The Viscosity of Synthetic and Natural Silicate Melts and Glasses at High Temperatures and 1 Bar (10^5 Pascals) Pressure and at Higher Pressures

U.S. GEOLOGICAL SURVEY BULLETIN 1764

Prepared in cooperation with the Hawaii Institute of Geophysics of the University of Hawaii, Honolulu, Hawaii

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By MICHAEL P. RYAN and JAMES Y.K. BLEVINS

Prepared in cooperation with the Hawaii Institute of Geophysics of the University of Hawaii, Honolulu, Hawaii

An extended compilation of viscosity data in tabular and graphic format

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SYMBOLS

A_n	First end correction function for the Couette viscometer
B_n	Second end correction function for the Couette viscometer
C_A	Coefficient of resistance in an infinite fluid medium
C_n	Integration constant
C_S	Coefficient of Stokes resistance (drag)
D	Cylinder diameter for the falling-sphere viscometer
E	Concise prefix signifying exponentiation to a power of 10
E^*	Activation energy for viscous flow
F	Wall proximity correction factor for the translation of a sphere falling axially in a right circular cylinder
F^P	Pressure drag component of the moving sphere
F^V	Viscous drag component of the moving sphere
F^T	Total drag of the moving sphere
Fx,Fy,Fz	Components of the gravitational force vector
$\vec{F}$	Body (gravitational) force vector
G	Gravitational acceleration constant
I_2	Modified Bessel function of the first kind and of the second order
K_n	n^{th} positive root of the equation $J_1\,(K_b)=0$
K_1	Wall-correction factor for the falling-sphere viscometer
L	Length of the inner cylinder of the Couette viscometer
L_o	Increment of length to be added to L to account for the end effect
L_w	Length of the wetted inner cylinder of the Couette viscometer
N_{Re}	The Reynolds number, based on sphere diameter for the falling-sphere viscometer
P	Pressure
P_s	Pressure distribution on the surface of a descending sphere
P_∞	Fluid pressure in melt before perturbation by a descending sphere
$\vec{P}$	Vector of surface tractions
Q	Instantaneous volumetric flow rate
R	Universal gas constant
Re	Reynolds number
R_i	Radius of the inner cylinder in the Couette configuration
R_o'	Cylinder radius for the falling-sphere viscometer
R_o	Radius of the outer cylinder in the Couette configuration
$\vec{R}$	Position vector with respect to the solid angles internal to descending spheres
T	Temperature
$\vec{T}$	Torque vector
U	Cartesian velocity component in X
U_∞	Terminal velocity of a descending sphere
$\vec{U}$	Local fluid velocity vector
V	Cartesian velocity component in Y
V_r	Radial velocity component (in cylindrical coordinates)
V_θ	Tangential velocity component (in cylindrical coordinates)
W	Cartesian velocity component in Z
$\vec{W}$	Velocity vector
X	Cartesian coordinate
Y	Cartesian coordinate
Z	Cartesian coordinate
a	Sphere radius for the falling-sphere viscometer
e_{ij}	Infinitesimal strain tensor
$\hat{i}$	Unit vector
$\hat{j}$	Unit vector
$\hat{k}$	Unit vector
r	Radial coordinate
t	Time
u	Fluid velocity in the x direction
$\vec{u}$	Local (microscopic) velocity of a fluid element
v	Fluid velocity in the y direction
w	Fluid velocity in the z direction
x	Cartesian reference direction
y	Cartesian reference direction
z	Cartesian reference direction
α	Ratio of the outer to inner cylinder radii in the Couette configuration
∇	Del (or nabla), the gradient operator
$\vec{\nabla}$	Hamiltonian nabla operator, $\hat{i}(\partial/\partial x)+\hat{j}(\partial/\partial y)+\hat{k}(\partial/\partial z)$, a vector quantity
γ	Shear strain
$\dot{\gamma}$	Shear strain rate
$\dot{\gamma}(r)$	Shear strain rate as a function of radial position
λ	"Second" (volumetric) coefficient of viscosity, as per Stokes' (1845) hypothesis
π	3.1415. . .
Ψ, ψ	Stream function
ρ	Melt density
ρ_m	Melt density (in contrast with ρ_s)
Ω_{ij}	Component of the vorticity tensor
$\vec{\Omega}$	Vorticity vector

Ω_θ	Tangential vorticity vector for secondary motions in the Couette configuration
Ω_r	r component of vorticity
Ω_x	x component of vorticity
Ω_y	y component of vorticity
Ω_z	Axial vorticity vector for primary melt motion in the Couette configuration
ω	Angular velocity
$\vec{\omega}$	Angular velocity vector
ω_i	Angular velocity of the inner cylinder
ω_o	Angular velocity of the outer cylinder
η	Melt (shear) viscosity
η_o	Preexponential constant in the Arrhenius relation for the temperature dependence of viscosity
ρ_s	Sphere density in the falling-sphere configuration
σ	Stress within the melt
σ_r	Radial component of stress
$\sigma_{(r)}$	Stress as a function of radial position
σ_{ii}	Normal stress components
σ_{ij}	Components of the second-rank stress tensor
θ	Spatial coordinate in the Couette configuration
θ'	Reference angle taken along a meridian plane of the sphere
Δ	Vertical separation of the bottom of the inner cylinder and the crucible base in the Couette configuration
Δ_{ij}	Rate-of-strain tensor
X	Operation of forming the cross product of two vector quantities
$\rightarrow$	Vector quantity
[ ]	Tensor quantity; when it encloses an array of nine elements, it symbolizes a second-rank tensorial quantity

Subscripts:

i	Directional index
j	Directional index
0	Initial value
r	Radial component
θ	Tangential component
x	Cartesian component
y	Cartesian component
z	Cartesian component

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By Michael P. Ryan[1] *and* James Y.K. Blevins[2]

Abstract

The Navier-Stokes equations of fluid motion are reviewed for isotropic incompressible Newtonian fluids. These equations have been applied to two primary viscometer configurations appropriate for the Earth and material sciences: the rotational Couette viscometer and the falling-sphere (Stokes flow) viscometer.

Viscosity data have been collated from widely distributed published sources and are presented in this volume in tabular and graphic formats that allow direct utilization of the original viscosity numbers, an efficient means of data intercomparison, and a means of evaluating the kinetics of viscous flow. The data fall into four groupings: synthetic oxide and SiO_2 systems, mineral systems, rock systems, and standard glasses.

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INTRODUCTION

Few physical properties of magmatic fluids play the profound role in the development of igneous systems and the evolution of their rocks that melt viscosity does, and few vary over such immense ranges in magnitude. We know now that η varies over 13 orders of magnitude for natural melts and over 15 orders of magnitude for their synthetic analogues.

This volume is intended as a handbook for those wishing essential viscosity data for multicomponent melts. It has been divided into two primary units: (1) introductory review material on the mechanics of certain classes of viscometers and (2) tabular material presenting viscosity-temperature-composition data for silicate melts.

Source material relevant to problems concerning the mechanics of silicate melts and melt-crystal mixtures includes the geologic reports of Bottinga and Weill (1972), McBirney and Murase (1984), Murase and McBirney (1973), Mysen (1981), Shaw and others (1968), and Shaw (1972). In addition, the Year Books of the Geophysical Laboratory of the Carnegie Institution of Washington contain regular reports on melt viscosity and melt density. Texts on the rheology of Newtonian and non-Newtonian fluids have been

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[2]Now at Mobil Oil Exploration and Producing, Inc., 1250 Poydras Street, New Orleans, LA 70113.

written by Bird and others (1977a, b) and Fredrickson (1964). Texts devoted exclusively to non-Newtonian flow are those of Coleman and others (1966), Harris (1977), and Schowalter (1978). Treatises on experimental technique and the theoretical analysis of experimental results have been presented by Bockris and others (1959), Van Wazer and others (1963), Walters (1975), and Whorlow (1980). In addition, two volumes emphasizing the particle-particle interactions of multiphase flow have been prepared by Clift and others (1978) and Happel and Brenner (1973). Journals containing regular reports on the mechanics of single-, two-, and three-phase flows are *Computers and Fluids* (John Wiley), *Journal of Colloid and Interface Science* (Academic Press), *Journal of Fluid Mechanics* (Cambridge University Press), *Journal of Multiphase Fluids* (John Wiley), *Journal of Non-Newtonian Fluid Mechanics* (Elsevier), *Journal of Physicochemical Hydrodynamics* (Pergamon Press), *Journal of Rheology* (Society of Rheology and John Wiley), and *Rheologica Acta* (Dietrich Steinkopff Verlag).

ORGANIZATION

Group I: Synthetic Oxide and SiO_2 Systems

Major-element oxide and SiO_2 systems have been arranged in order of increasing numbers of components, from binary through seven-component systems. Within each system, subsystems are defined generally by sequential variations of the weight percentages (mole fractions) of the constituents. This grouping contains 25 systems, 506 subsystems, and 2,383 discrete viscosity (η)-temperature (T)-composition (X) values. Each subsystem is represented by a table. Compositionally related neighboring subsystems are plotted on $\log_{10}\eta$ versus T (in degrees Celsius) and Arrhenius $\log_{10}\eta$ versus $10^4/T$ (per kelvin) graphs.

Group II: Mineral Systems

Single-component (monomineralic) and two- and three-component systems have been arranged in order of increasing numbers of components. This grouping contains 29 subsystems and 194 discrete η-T-X values. Graphs and tables follow the format used for group I.

Group III: Rock Systems

Basaltic, andesitic, and rhyolitic lithologies are the primary areas within this group. Subsystems are defined on the basis of (1) hand-sample lithology and major phenocryst assemblage; (2) H_2O content during the experimental run (as appropriate); and (3) pressure (P) (where applicable). This group contains 41 subsystems and 193 discrete η-P-T-X entries. Tables and graphs follow the format used for group I.

Group IV: Standard Glasses

National Bureau of Standards reference glasses are presented in this last grouping. The data have been evaluated at 1 atm and comprise 189 discrete η-T-X entries. Tables and graphs follow the format used for group I.

A guide to the use of the data, conversion factors, a list of data sources, symbol definitions, a number of indexes, and a reference list are also included in the volume.

MECHANICS OF THE ROTATIONAL (COUETTE) VISCOMETER

We begin by reviewing the relations for fluid deformation in terms of the spatial derivations of the (local) Cartesian components of velocity. The presentation draws on the work of Eskinazi (1967, 1975), Walters (1975), Darby (1976), and Bird and others (1977a). We assume the flow to be laminar, steady state, and Newtonian. Normal stress effects and transitions to Taylor flow regimes are either unwarranted or beyond the scope of this report.

The infinitesimal strain tensor is defined (Aris, 1962) as

$$e_{ij}=\left(\frac{\partial V_i}{\partial X_j}+\frac{\partial V_j}{\partial X_i}\right) \quad (1)$$

relative to Cartesian coordinates. In terms of the general expression for the rate of strain (cast in the form of "covariant" derivatives),

$$e_{ij}=-V_{i,j}+V_{j,i} \quad (2)$$

where the comma signifies differentiation with respect to the index that follows.

The rate of strain is

$$\Delta_{ij}=\frac{\partial e_{ij}}{\partial t}=\left(\frac{\partial V_i}{\partial X_j}+\frac{\partial V_j}{\partial X_i}\right) \quad (3)$$

which, in covariant form, becomes

$$\Delta_{ij}=\partial V_{i,j}+\partial V_{j,i} \quad (4)$$

These expressions (eqs. 1–4) are generalized for melt deformation irrespective of geometry. They are now to be specialized for a specific coordinate system.

The rotational viscometer (fig. 1) is constructed from coaxial cylinders that have differing radii and a continuously sheared fluid annulus between them. The appropriate coordinates are therefore cylindrical. Here the rate-of-strain tensor (Bird and others, 1977a) is

$$\Delta_{ij}=\begin{pmatrix} 2\frac{\partial V_r}{\partial r} & \frac{1}{r}\frac{\partial V_r}{\partial \theta}+\frac{r\,\partial}{\partial r}\frac{V_\theta}{r} & \frac{\partial V_r}{\partial Z}+\frac{\partial V_Z}{\partial r} \\ \frac{1}{r}\frac{\partial V_r}{\partial \theta}+\frac{r\,\partial}{\partial r}\frac{V_\theta}{r} & 2\frac{1}{r}\frac{\partial V_\theta}{\partial \theta}+\frac{V_r}{r} & \frac{\partial V}{\partial Z}+\frac{1}{r}\frac{\partial V_Z}{\partial \theta} \\ \frac{\partial V_r}{\partial Z}+\frac{\partial V_Z}{\partial r} & \frac{\partial V_\theta}{\partial Z}+\frac{1}{r}\frac{\partial V_Z}{\partial \theta} & 2\frac{\partial V_Z}{\partial Z} \end{pmatrix} \quad (5)$$

Because the flow velocity varies in the radial direction only, all of the generally realizable terms with a θ or a Z dependence become zero, and the new rate-of-strain tensor takes the following form:

$$\Delta_{ij}=\begin{pmatrix} 0 & r\frac{d\omega}{dr} & 0 \\ r\frac{d\omega}{dr} & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}=\dot{\gamma}\begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix} \quad (6)$$

This equation is a result of the shear strain rate definition

$$\dot{\gamma}=r\frac{d\omega}{dr} \quad (7)$$

and the realization of the directionality of flow, which produce the conditions

$$V_r=V_Z=0 \quad (8)$$

and

$$V_\theta(r)=r\omega(r) \quad (9)$$

Physically, this fluid movement in θ results from a lack of radial or axial flow after steady-state conditions have been achieved. At steady state, all fluid elements follow streamlines in θ only, and the velocity of these melt parcels is a function of r only (after the angular velocity ω_i has been established).

Melt Vorticity

A mutually orthogonal network of imaginary lines described on the surface of a crystal suspended in melt provides a means of monitoring the kinematics of the crystal as the aggregate is set in motion. If the distances between these lines, as well as their respective angles, do not change during fluid motion, the crystal behaves as a rigid body. Moreover, should the crystal begin to rotate, all points on a given surface would be expected to rotate at the same angular velocity—a state referred to as pure rotation. The surrounding melt, however, will be expected to respond in quite a different way when it is set in motion, for, in general, the distances between initially equidistant lines in our network will change continuously during flow, as will the angles formed by their intersections. Moreover, the rotation of the melt may vary continuously from point to point, because neighboring parcels have different angular veloc-

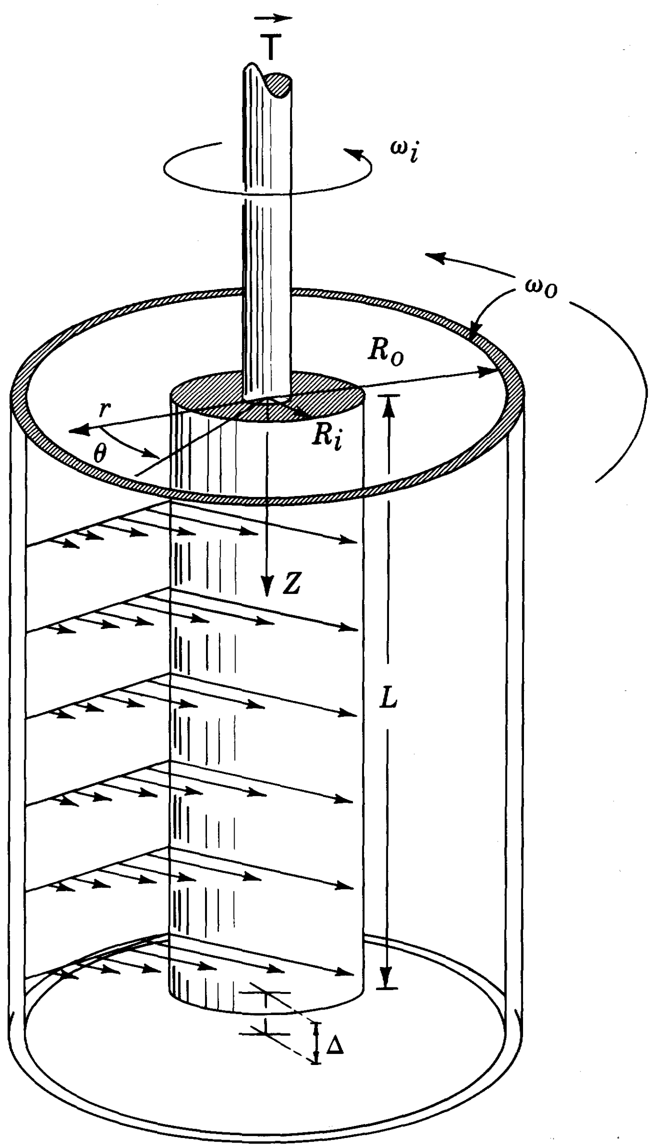
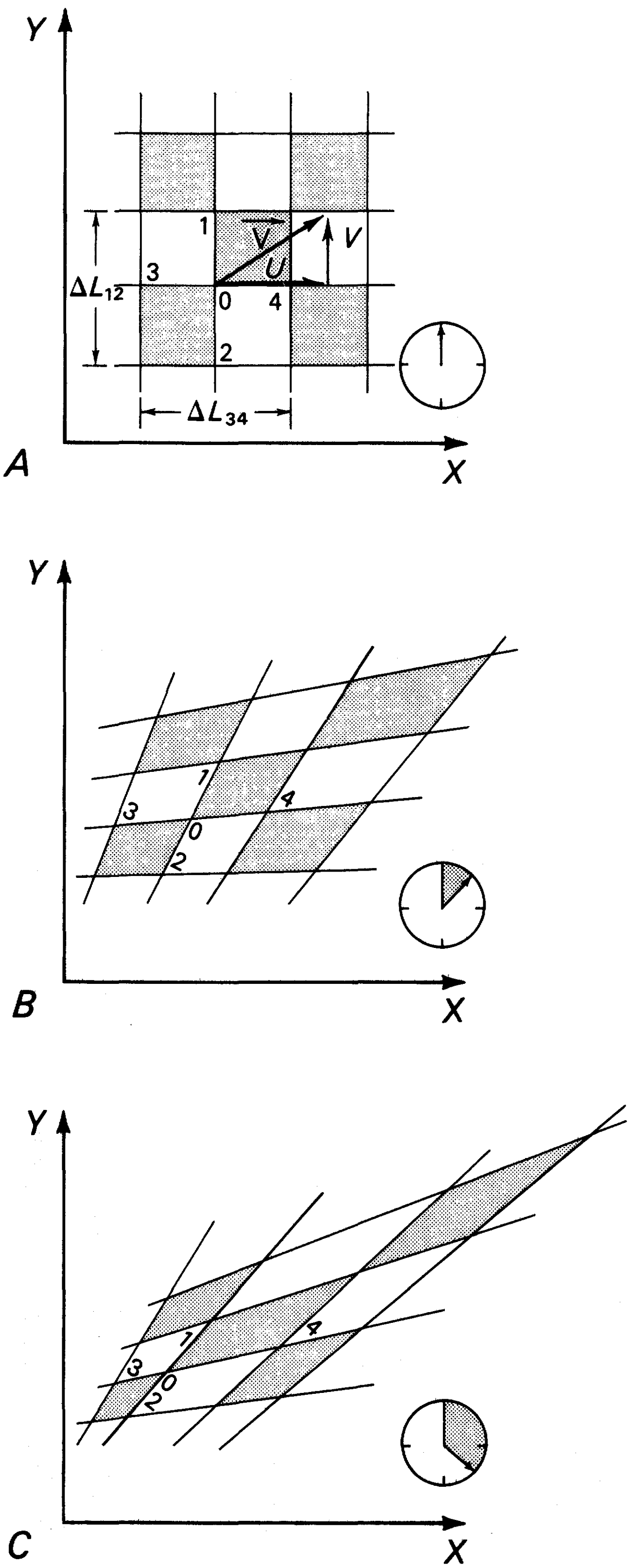


Figure 1. Three-dimensional cutaway section of the Couette flow developed in the fluid-filled annulus of a concentric cylinder viscometer. The inner cylinder is rotating at an angular velocity ω_i, and the outer cylinder rotates (in the most general treatment) at an angular velocity ω_o. Typically, ω_o for the outer cylinder is zero. The radii of the inner and outer cylinders are R_i and R_o, respectively. The torque on the inner cylinder axis is $\vec{T}$. The vertical separation between the base of the rotating cylinder and the bottom of the crucible is Δ. The overall length of the rotating inner cylinder is L; its wetted length L_w is the vertical contact distance between the cylinder and the silicate melt and determines the torque. Z, r, and θ are cylindrical coordinates.

ities. As a practical matter, then, the kinematic descriptions of the surrounding melt and the enclosed crystal proceed along differing lines, since melt parcels experience a progressive deformation as well as a translation and a rotation.



In this volume, we are concerned solely with the flow behavior of Newtonian single-phase melts. The rigid body movements of suspended crystals then illustrate the rotational motions of the fluid elements themselves. Such rotations can be considered by examining the progressive deformation of neighboring melt parcels, schematically illustrated in figure 2.

Figure 2 shows a microscopic patch of melt that has had its neighboring areas tagged by a superposed gridwork of imaginary lines forming a checkerboard pattern of alternating shaded parcels. This initial state (before motion) is indicated by the vertical sweephand of the clock at the lower right. The mutual boundaries of the four parcels adjacent to point 0 are delimited by the initially orthogonal line elements 1–0–2 and 3–0–4, respectively.

We now set the melt in motion by using a velocity vector $\vec{V}$ whose components are $U\ (X, Y)$ and $V\ (X, Y)$. Simultaneously, the clock is started, and the flowing melt progressively distorts the checkerboard, distending and rotating melt elements, as figures 2*B* and 2*C* show. To further fix ideas, we will assume that melt velocities increase in the direction of increasing coordinate directions. The rotation of the melt about the point 0 can then be examined by considering the motion of the line segments 1–0–2 and 3–0–4. For the segment 1–0–2, the endpoint velocities (Eskinazi, 1975) are

$$U_1 = U_0 + \left(\frac{\partial u}{\partial y}\right)_0 \cdot \left(\frac{\Delta L_{1-2}}{2}\right) + \ldots \qquad (10)$$

$$U_2 = U_0 + \left(\frac{\partial u}{\partial y}\right)_0 \cdot \left(\frac{\Delta L_{1-2}}{2}\right) - \ldots \qquad (11)$$

where $(\Delta L_{1-2})/2$ is the average distance between the element endpoint and the center of interest at point 0.

The realization that the melt element was infinitesimally small permitted an evaluation of the velocity field in the

◀**Figure 2.** Progressive deformation of adjacent fluid elements at the inception of flow. Time progression during flow is shown by the clock in the lower right-hand corner of each figure. The rotation of reference lines 1–0–2 and 3–0–4 yields an averaged angular rotation rate ω for the melt patch centered at point 0. From these averaged rates, the melt vorticity can be evaluated; it is numerically given by $\vec{\Omega} = 2\vec{\omega}$, where $\vec{\Omega}$ is the vorticity vector that is normal to the plane of the diagram and centered, in this example, at 0. Whether this "spin" vector points up at us or down below the plane of the diagram depends on whether the net sense of melt rotation is counterclockwise or clockwise, respectively. *A*, $\vec{V}$ is a velocity vector describing the motion of the fluid parcel at point 0 and has the components *U* and *V*. ΔL_{12} and ΔL_{34} are initial reference lengths of the undistorted fluid checkerboard before the inception of flow. *B* and *C*, Progressive development of the flow field. Reference parcels are distorted by fluid shear and stretch.

immediate neighborhood of point 0. Thus, the velocity has been expanded about U_0 as a Taylor series, the higher order terms being truncated. The quantity (U_1-U_2) is then the relative velocity of point 1 with respect to point 2, and its positive value suggests that both 1 and 2 are in relative motion. The sense of melt spin is clockwise, and the angular velocity is

$$\omega_{1-2}=\frac{U_1-U_2}{\Delta L_{1-2}}$$

$$=2\left(\frac{\partial u}{\partial y}\right)_0 \cdot \left(\frac{\Delta L_{1-2}/2}{\Delta L_{1-2}}\right) \tag{12}$$

or

$$\omega_{1-2}=\left(\frac{\partial u}{\partial y}\right)_0 \quad \text{(clockwise)} \tag{13}$$

By the right-hand rule convention, the rotation vector is directed downward, below the plane of the diagram, and away from the observer.

As the melt rotates and flows, the reference segment 3–0–4 experiences a counterclockwise spin, the result of the differential velocities of points 3 and 4 and the continued diminution of angles 1–0–4 and 3–0–2 during deformation. The velocities of the relevant points (Eskinazi, 1975) are

$$V_3=V_0-\left(\frac{\partial V}{\partial X}\right)_0 \cdot \left(\frac{\Delta L_{3-4}}{2}\right)-\ldots \tag{14}$$

and

$$V_4=V_0+\left(\frac{\partial V}{\partial X}\right)_0 \cdot \left(\frac{\Delta L_{3-4}}{2}\right)+\ldots \tag{15}$$

The angular velocity for this segment is then

$$\omega_{3-4}=\left(\frac{V_4-V_3}{\Delta L_{3-4}}\right)$$

$$=2\left(\frac{\partial V}{\partial X}\right)_0 \cdot \left(\frac{\Delta L_{3-4}/2}{\Delta L_{3-4}}\right) \tag{16}$$

or

$$\omega_{3-4}=\left(\frac{\partial V}{\partial X}\right)_0 \quad \text{(counterclockwise)} \tag{17}$$

The realization that the rotation vector is orthogonal to the $X-Y$ plane (acting in the Z direction) and the application of the right-hand rule yield a rotation vector pointing directly up at us, out of the plane of the diagram.

The net rotation of the melt element results from the weighted contributions of both the spin components, due consideration being given to their respective magnitudes and signs. Melt rotation is viewed as a locally averaged phenomenon, and the rotational resultant, acting in a specific direction, is formed as the average of the summed contributions. Hence, for example, the Z component of rotation is

$$\omega_z=\frac{1}{2}\left(\frac{\partial V}{\partial X}-\frac{\partial U}{\partial Y}\right) \tag{18}$$

The melt vorticity was defined by Helmholtz[3] (1858) as twice the angular velocity (for example, Batchelor, 1967):

$$\vec{\Omega}=2\,\vec{\omega} \tag{19}$$

so that, on a component basis,

$$\Omega_x=\left(\frac{\partial w}{\partial y}-\frac{\partial v}{\partial z}\right) \tag{20}$$

$$\Omega_y=\left(\frac{\partial u}{\partial z}-\frac{\partial w}{\partial x}\right) \tag{21}$$

$$\Omega_z=\left(\frac{\partial v}{\partial x}-\frac{\partial u}{\partial y}\right) \tag{22}$$

Since the total vorticity vector must equal the sum of its components, taken along the X, Y, and Z axes,

$$\vec{\Omega}=\hat{i}\Omega_x+\hat{j}\Omega_y+\hat{k}\Omega_z \tag{23}$$

or

$$\vec{\Omega}=\hat{i}\left(\frac{\partial w}{\partial y}-\frac{\partial v}{\partial z}\right)+\hat{j}\left(\frac{\partial u}{\partial z}-\frac{\partial w}{\partial x}\right)+\hat{k}\left(\frac{\partial v}{\partial x}-\frac{\partial u}{\partial y}\right) \tag{24}$$

Finally, the vorticity components developed in the more familiar Cartesian system above may now be specialized for the cylindrical system appropriate to Couette[4] viscometry.

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[3]Herman Von Helmholtz was born in Potsdam, Germany, on August 31, 1821. Financial constraints led him to the early study of medicine at the Friedrich-Wilhelms-Institute in Berlin; subsequently, he applied his growing interest in physics to problems in physiology. His work in hydrodynamics appears to have grown out of interests in the energetics of mechanical systems as well as the use of Green's theorem. His work on vorticity, which appeared in 1858, presented the systematics of rotary fluid motion, including the relevant vector mechanics, the theorems of vortex motion, the concept of the vortex line (Wirbellinie), and the geometrics of vortex tubes (Wirbelfaden). His writings on vorticity (Helmholtz, 1858) were translated into English by P.G. Tait in 1867. Helmholtz died in Berlin on September 8, 1894.

[4]Maurice Fréderic Alfred Couette was born on January 9, 1858, in Tours, France. His chief academic post was Professor of Physics in the Free Faculty of Sciences in Angers, Maine et Loire. His research centered on the viscosity of liquids, and his principal contribution was the development of the rotating concentric cylinder viscometer that bears his name (Couette, 1890).

This procedure involves taking the curl of the velocity vector and indicating the motion sense by their tangential, radial, and axial components.

$$\vec{\Omega} = \vec{\nabla} \times \vec{U} = \hat{i}\left(\frac{1}{r}\frac{\partial Vz}{\partial \theta} - \frac{\partial V_\Theta}{\partial z}\right) + \hat{j}\left(\frac{\partial Vr}{\partial z} - \frac{\partial Vz}{\partial r}\right) + \hat{k}\left(\frac{1}{r}\frac{\partial}{\partial r}(rV_\Theta) - \frac{\partial Vr}{\partial \theta}\right) \tag{25}$$

or

$$\vec{\Omega} = \hat{i}\Omega_r + \hat{j}\Omega_\theta + \hat{k}\Omega_z \tag{26}$$

The general form of the vorticity tensor for the cylindrical configuration (Bird and others, 1977a) is

$$\Omega_{ij} = \begin{pmatrix} 0 & \frac{1}{r}\left(\frac{\partial}{\partial r}(rV_\theta) - \frac{\partial V_r}{\partial \theta}\right) & \frac{\partial V_z}{\partial r} - \frac{\partial V_r}{\partial Z} \\ \frac{1}{r}\left(\frac{\partial V_r}{\partial \theta} - \frac{\partial}{\partial r}(rV_\theta)\right) & 0 & \frac{1}{r}\left(\frac{\partial V_z}{\partial \theta}\right) - \frac{\partial V_\theta}{\partial Z} \\ \frac{\partial V_r}{\partial Z} - \frac{\partial V_z}{\partial r} & \frac{\partial V_\theta}{\partial Z} - \frac{1}{r}\left(\frac{\partial V_z}{\partial \theta}\right) & 0 \end{pmatrix} \tag{27}$$

For the Couette configuration appropriate to the rotation of concentric coaxial cylinders (end effects, for the moment, being neglected), all velocity dependence on θ and Z vanishes (since $V(r)=r\omega(r)$ only), and the vorticity distribution for the concentric cylinder viscometer becomes

$$\Omega_{ij} = \begin{pmatrix} 0 & \frac{1}{r}\left(\frac{\partial}{\partial r}(rV_\theta)\right) & 0 \\ -\frac{1}{r}\left(\frac{\partial}{\partial r}(rV_\theta)\right) & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix} \tag{28}$$

After differentiation of the two elements, it becomes

$$\Omega_{ij} = \begin{pmatrix} 0 & \frac{\partial V_\theta}{\partial r} + \frac{V_\theta}{r} & 0 \\ -\frac{\partial V_\theta}{\partial r} + \frac{V_\theta}{r} & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix} \tag{29}$$

Note that the vorticity consists of just two terms: a gradient in tangential velocity with respect to r ($\partial V_\theta/\partial r$) and a ($V_\theta/r$) term.

The momentum equations for cylindrical coordinates for the three directional components in the general case are given below. In general, the radial component r is of the form

(melt density) (melt accelerations in r + directional velocity changes) + (directional changes in melt velocity) =

− (pressure changes) + (directional changes in surface stresses on a melt element) + (the gravitational force component)

or

$$\rho\left(\frac{\partial V_r}{\partial t} + V_r\frac{\partial V_r}{\partial r} + \frac{V_\theta}{r}\frac{\partial V_r}{\partial \theta} - \frac{V_\theta^2}{r} + V_Z\frac{\partial V_r}{\partial Z}\right) = -\frac{\partial P}{\partial r} + \left(\frac{1}{r}\frac{\partial(r\sigma_{rr})}{\partial r} + \frac{1}{r}\frac{\partial \sigma_r}{\partial \theta} - \frac{\sigma_{\theta\theta}}{r} + \frac{\partial \sigma_{rZ}}{\partial Z}\right) + \rho G_r \tag{30}$$

The tangential component θ is

$$\rho\left[\frac{\partial V_\theta}{\partial t} + V_r\frac{\partial V_\theta}{\partial r} + \frac{V_\theta}{r}\left(\frac{\partial V_\theta}{\partial \theta}\right) + \frac{V_r V_\theta}{r}\left(\frac{V_Z \partial V_\theta}{\partial Z}\right)\right] = -\frac{1}{r}\frac{\partial P}{\partial \theta} + \left[\frac{1}{r^2}\frac{\partial(r^2\sigma_{r\theta})}{\partial r} + \frac{1}{r}\left(\frac{\partial \sigma_{\theta\theta}}{\partial \theta}\right) + \frac{\partial \sigma_{\theta Z}}{\partial Z}\right] + \rho G_\theta \tag{31}$$

The axial component along Z is

$$\rho\left[\frac{\partial V_Z}{\partial t} + V_r\left(\frac{\partial V_Z}{\partial r}\right) + \frac{V_\theta}{r}\frac{\partial V_Z}{\partial \theta} + V_Z\left(\frac{\partial V_Z}{\partial Z}\right)\right] = -\frac{\partial P}{\partial Z} + \left[\frac{1}{r}\frac{\partial(r\sigma_{rz})}{\partial r} + \frac{1}{r}\left(\frac{\partial \sigma_{\theta Z}}{\partial Z}\right) + \frac{\partial \sigma_{zz}}{\partial Z}\right] + \rho G_Z \tag{32}$$

Because of the restrictions on nonaxial and nonradial flow in the viscometer and the radial dependence of tangential flow velocity—that is,

$$V_Z = 0 \tag{33}$$

$$V_r = 0 \tag{34}$$

$$V_\theta(r) = r\omega(r) \tag{35}$$

the momentum equations take on a simplified form. In the simplified momentum equations, (1) all accelerations have vanished (for example, $\partial V_r/\partial t$), since steady-state conditions have been achieved; (2) all θ and r components of ρG have vanished, since the cylinders are constrained to be perfectly plumb; (3) all velocity components in r and Z have vanished, owing to the confinement of the melt at the crucible boundaries; and (4) all shear stress components in the Z and r directions have vanished.

As a consequence of these simplifications, we are left with a considerably simplified set of relations. They retain the following characteristics: (1) velocity components in the melt change in r only; (2) pressures in the melt retain only a radial dependence; and (3) both normal ($\theta\theta$, rr) and shear ($r\theta$) stress components exhibit changes that depend on r only. The flow components during operation of the viscometer now become, for the *radial component r*,

$$\rho\frac{V_\theta{}^2}{r}=+\frac{\partial P}{\partial r}-\frac{1}{r}\left[\frac{\partial(r\sigma_{rr})}{\partial r}\right]+\frac{\sigma_{\theta\theta}}{r} \quad (36)$$

for the *tangential component* θ,

$$0=\frac{1}{r^2}\left[\frac{\partial(r^2\sigma_{r\theta})}{\partial r}\right] \quad (37)$$

and for the *axial component Z*,

$$0=-\frac{\partial P}{\partial Z}+\rho G_Z \quad (38)$$

If equation 37 is integrated, the dependence of the shear component σ_r on r is identified as

$$\sigma_{r\Theta}=\frac{C_1}{r^2} \quad (39)$$

where C_1 is a constant of integration. Here, shear stress is seen to fall off rapidly in the melt, in $1/r^2$ fashion. This fall off is a function of the velocity decay in the fluid as the distance from the moving inner cylinder increases.

The net applied torque required for rotation at a given angular velocity is the product of the force multiplied by the length of the lever arm through which it acts. This torque must be balanced by the shear force produced within the melt when steady state is achieved:

$$\vec{T}=\sigma_{r\theta}(2\pi rL)r \quad (40)$$

Notice that, while torque ($\vec{T}$) is directly proportional to the radial distance, the shear stress ($r\theta$) still falls off as $1/r^2$, so that most of the torque contribution comes from melt near the cylinder wall. Also, the term ($2\pi rL$) embodies the total surface area of the inner cylinder, and, since equation 40 holds for $R_i \leq r \leq R_o$, the torque will grow in proportion to the surface area of the inner cylinder. This relation holds for all radial points within the melt annulus or at the surface of the inner or outer cylinder—that is, for $R_i \leq r \leq R_o$.

Equating relations 39 and 40 and eliminating $\sigma_{r\theta}$ define the dependence of the constant C_1 on the torque and cylinder length—that is, $C_1=\vec{T}/(2\pi L)$. The $r\theta$ component of shear stress falls off as $1/r^2$ within the melt (fig. 1), and its dependence on the torque and viscometer geometry is

$$\sigma_{r\theta}=\vec{T}/2\pi Lr^2 \quad (41)$$

Through the rate-of-strain tensor, the relation between the shear stress in the melt and the angular velocity ω is linked by the fluid viscosity, such that

$$\sigma_{r\theta}=\eta r\frac{d}{dr}\left(\frac{V_\theta}{r}\right) \quad (42)$$

Combining equations 41 and 42 and integrating with respect to r provide the dependence of the θ component of velocity on the radial position:

$$V_\theta=C_2r-\frac{\vec{T}}{4\pi\eta Lr} \quad (43)$$

The velocity magnitudes in the melt are determined by the experimentalist. These magnitudes form a convenient set of boundary conditions on the tangential velocity component of the radial limits of the melt annulus. For the inner cylinder,

$$V_\theta=\omega_iR_i \qquad (\text{at } r=R_i) \quad (44)$$

and, for the outer cylinder,

$$V_\theta=\omega_oR_o \qquad (\text{at } r=R_o) \quad (45)$$

These fixed conditions at the rotating bob and crucible allow the two constants to be evaluated:

$$C_1=\frac{\vec{T}}{2\pi L}\left[\frac{2\eta(\omega_o-\omega_i)R_o^2}{(\alpha^2-1)}\right] \quad (46)$$

and

$$C_2=\omega_o+\left[\frac{(\omega_o-\omega_i)}{(\alpha^2-1)}\right] \quad (47)$$

where

$$\alpha=R_o/R_i \quad (48)$$

If equations 43, 46, and 47 are combined, the velocity distribution within the melt is

$$V_\theta=\frac{R_o^2}{r(\alpha^2-1)}\left\{\omega_o\left[\left(\frac{r^2}{R_i^2}\right)-1\right]\omega_i\left[\left(\frac{r^2}{R_o^2}\right)-1\right]\right\} \quad (49)$$

For the (hypothetical) case of a single cylinder rotating in a laterally large body of melt, $R_o=\infty$ and $\omega_o=0$, so that

$$V=\left[\frac{\omega_i R_i^2}{r}\right] \quad (50)$$

The final step is evaluating the dependence of the applied torque on the fluid viscosity. This torque may be related to the melt drag acting on both the bob and the crucible (inner and outer cylinders), and their respective dependences take the forms of:

$$\vec{T}=2\pi R_i L\sigma_{r\theta} \quad \Big|_{r=R_i}^{R_i} \quad (51)$$

for the inner cylinder and

$$\vec{T}=2\pi R_o L\sigma_{r\theta} \quad \Big|_{r=R_o}^{R_o} \quad (52)$$

for the outer cylinder.

Here, $\sigma_{r\theta}$ can be determined by relating the tangential component of melt velocity (V_θ) to the angular velocity (ω_o, ω_i), as equation 49 does, and introducing this term into equation 42. From the expression for torque

$$\vec{T}=\frac{4\pi\eta L(\omega_o-\omega_i)R_o^2}{(\alpha^2-1)} \quad (53)$$

and equation 41, the expression for the shear stress is

$$\sigma(r)=\frac{\vec{T}}{2\pi r^2 L} \quad (54)$$

and that for the shear rate is

$$\dot{\gamma}(r)=\frac{2R_o^2(\omega_o-\omega_i)}{r^2(\alpha^2-1)} \quad (55)$$

The viscosity of the melt in the annulus can now be evaluated from the ratio of the shear stress to shear strain rate. (This relation is embodied in Newton's hypothesis: "The resistance which arises from the lack of slipperiness originating in a fluid—other things being equal—is proportional to the velocity by which the parts of the fluid are being separated from each other" (Motte, 1946).)

Secondary Melt Motions

The primary flow developed in rotational Couette viscometry occurs in the θ direction. Melt confinement within crucible walls and a finite length to the inner rotating cylinder have the potential for superposing secondary melt motions on the primary flow field. The secondary motions are illustrated in figure 3, which focuses attention on the lowest section of the viscometer, and can be divided into radial and vertical effects.

Radial contribution—Frictional coupling between the melt and the inner cylinder wall—and the "no-slip" boundary condition at the outer cylinder wall—insures that all deformation occurs within the melt annulus itself and not along an interface. Vorticity is generated adjacent to the rotating inner cylinder by the melt-solid coupling at this moving interface. This primary (axial) vorticity component, designated Ω_Z in figure 3, diffuses radially outward during viscometer startup owing to the viscous coupling between adjacent melt parcels. The rotation in θ produces a tendency toward radial flow that must be counterbalanced by an inward-directed component of fluid pressure for equilibrium to be maintained. This component is directed back toward the axis of rotation, and, at equilibrium, centripetal and centrifugal forces just balance.

Vertical contribution.—The adherence of melt to the crucible base generates a viscous basal boundary layer, in which centrifugal flow components die out. Since the centripetal force component is independent of Z, the inward-directed force overbalances the outward-directed component, and an inward-directed motion results along the base. Conservation of mass requires that the resulting melt deficit be made up by downward-directed melt motion along the crucible wall. The result is a counterclockwise secondary rotation set up in a subvertical plane, as the large arrows in figure 3 illustrate. The resultant secondary vorticity component in θ has been designated $\vec{\Omega}_\theta$ in figure 3.

A familiar example of these secondary fluid motions is the motion of tea leaves in a cup during moderate stirring. The leaves move radially inward along the bottom and collect in the center of the cup. Becuase they lack the neutral buoyancy to ride the secondary current for a full cycle, they are fated to lie on the bottom. In silicate melts, the strength of these secondary motions is expected to be a strong function of the melt viscosity and viscometer rotation rate—hence, composition and temperature. As a practical note, nonviscometric motions may be handled by application of end-effect corrections, discussed below.

The earlier discussion that led to expressing the shear rate as a function of the cylinder radii (R_o, R_i) and the angular velocities (ω_o, ω_i) (eq. 55) implicitly assumed that the end of the inner cylinder was at a large distance from the bottom of the outer cylinder. Note here that r is used as a distance measure and not as a radial coordinate per se. In practice, this separation of cylinders is rarely "large," and the proxim-

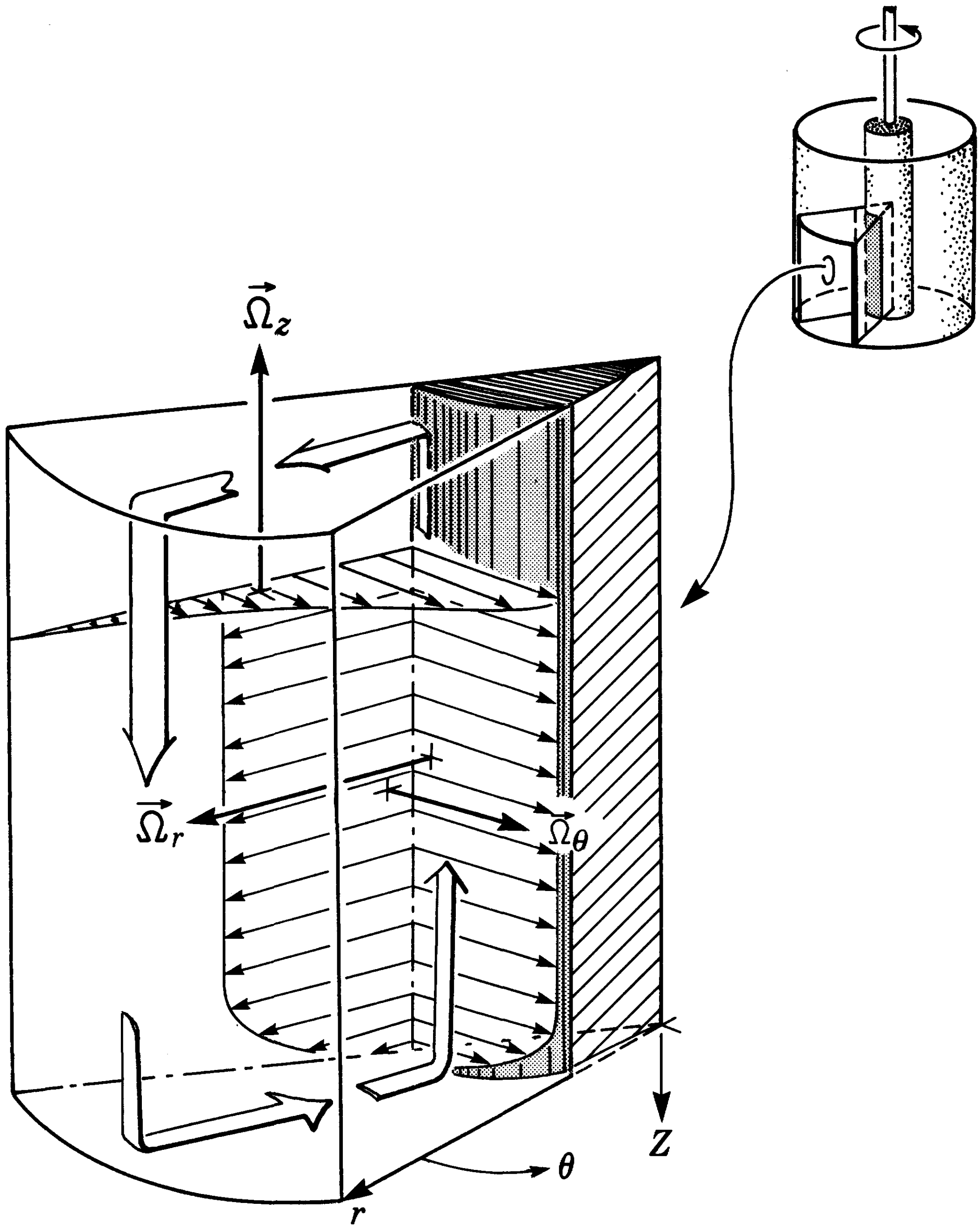

Figure 3. Primary and secondary melt motions induced during rotational Couette flow. Superposed on the primary viscometric flow developed in θ is the tendency for motion to be developed along the path defined by the large arrows. This motion, in turn, produces a secondary vorticity ($\vec{\Omega}_\theta$) component superposed on the primary vorticity ($\vec{\Omega}_z$). Z, r, and θ are cylindrical vorticity coordinates. The shaded section of the cylinder wall is a volume element of the inner rotating cylinder. $\vec{\Omega}_r$ is a relatively minor component of vorticity that may arise because of the viscous drag induced by the "no-slip" boundary condition associated with the crucible base.

ity of the rotating bob to the base of the crucible produces an additional "instrumental" drag component. Physically, this drag arises from the immobilization of melt at the solid-liquid interface and the additional viscous coupling in those melt elements that form the fluid gap between what we think of as the no-slip interfaces. This drag is the "end" equivalent, in a broad qualitative fashion, of the wall effect experienced in falling-sphere viscometry, to be discussed shortly.

Corrections for the end effect developed by Oka (1960) satisfy the Navier-Stokes[5,6] equations for flow:

$$\frac{L_o}{R_i}=\left\{\frac{R_i}{8\Delta}\left[1-\left(\frac{R_i}{R_o}\right)^2\right]\right\}\left\{1+\left(\frac{4\Delta}{R_i}\right)\sum_{n=1}^{\alpha}A_nI_2\left(\frac{n\pi R_i}{\Delta}\right)\right.$$

$$\left.+\left(\frac{8\Delta}{\pi R_i}\right)\sum_{n=1}^{\alpha}B_n[\sinh(K_nL)]/K_nR_i\right\} \tag{56}$$

where R_i and R_o have been defined above, Δ is the clearance between the bottom of the inner cylinder and the crucible base, L_o is an extra "effective" length increment to be added to the inner cylinder length L to account for the lower end effect, A_n and B_n are functional forms of the viscometer geometry (that is, functions of R_i/R_o, L_w/R_o, and Δ/R_o), I_2 is a modified Bessel function (of the first kind and of the second order) (Van Wazer and others, 1963), and K_n is the nth positive root of the relation $\rho=(K_b)=0$, from the Navier-Stokes relations.

MECHANICS OF THE FALLING-SPHERE (STOKES FLOW) VISCOMETER

Newton's Second Law assures us that the sum of the forces acting in and on a melt element is balanced by the product of the element's mass and acceleration. This statement provides the basis for developing the equations of fluid motion. In vector form, this equation (Schlichting, 1968) is

$$\rho\frac{D\vec{W}}{Dt}=\vec{F}+\vec{P} \tag{57}$$

where ρ is the melt density, $D\vec{W}/Dt$ is the substantial derivative of the velocity vector $\vec{W}$, $\vec{F}$ is the body (gravitational) force vector, and $\vec{P}$ is the vector of surface tractions.

Surface forces can be explicitly written as the contribution of nine scalar quantities, each referenced to a local ($\hat{i}$, $\hat{j}$, $\hat{k}$) unit vector:

$$\vec{P}_x=\hat{i}\sigma_{xx}+\hat{j}\sigma_{xy}+\hat{k}\sigma_{xz} \tag{58}$$

$$\vec{P}_y=\hat{i}\sigma_{yx}+\hat{j}\sigma_{yy}+\hat{k}\sigma_{yz} \tag{59}$$

$$\vec{P}_z=\hat{i}\sigma_{zx}+\hat{j}\sigma_{zy}+\hat{k}\sigma_{zz} \tag{60}$$

These nine components then form the elements of a second-order stress tensor:

$$\sigma_{ij}=\begin{bmatrix}\sigma_{xx} & \sigma_{xy} & \sigma_{xz}\\ \sigma_{yx} & \sigma_{yy} & \sigma_{yz}\\ \sigma_{zx} & \sigma_{zy} & \sigma_{zz}\end{bmatrix} \tag{61}$$

where the first component (i) of the i,j double subscript orients the face of a reference melt element (in a local Cartesian coordinate system) and the second (j) component orients the direction in which that stress component acts.

If a balance of the net force components on the six sides of a reference elemental volume is formed, the resulting surface force per unit volume is

$$\vec{P}=\left[\frac{\partial\vec{P}_x}{\partial x}+\frac{\partial\vec{P}_y}{\partial y}+\frac{\partial\vec{P}_z}{\partial z}\right] \tag{62}$$

In terms of the nine tensor components discussed above, this surface traction becomes

$$\vec{P}=\hat{i}\left[\frac{\partial\sigma_{xx}}{\partial x}+\frac{\partial\sigma_{xy}}{\partial y}+\frac{\partial\sigma_{xz}}{\partial z}\right] \tag{63}$$

$$+\hat{j}\left[\frac{\partial\sigma_{yx}}{\partial x}+\frac{\partial\sigma_{yy}}{\partial y}+\frac{\partial\sigma_{yz}}{\partial z}\right] \tag{64}$$

$$+\hat{k}\left[\frac{\partial\sigma_{zx}}{\partial x}+\frac{\partial\sigma_{zy}}{\partial y}+\frac{\partial\sigma_{zz}}{\partial z}\right] \tag{65}$$

Surface tractions can now be fit into the formulation of the balance of forces and accelerations, to yield

[5]Claude-Louis-Marie-Henri Navier was born in Dijon, France, on February 10, 1785. The son of a lawyer for the Legislative Assembly at Paris, he attended the École Polytechnique, where he was influenced by Fourier, his professor of analysis. From 1819, he taught analytical engineering mechanics at the École des Ponts et Chaussées (The School of Bridges and Highways=the College of Civil Engineering). His research contributions include the application of analytic mechanics to bridge design, the development of the mechanical concept of work, and the development of a force-balance approach to the hydrodynamic interaction of solid bodies and fluids. His analyses of fluid-solid interactions, derived without using shear stress components, made use of his theory of "fluid" particle attraction–repulsion." Navier died in Paris on August 21, 1836.

[6]George Gabriel Stokes was born at Skreen in County Sligo, Ireland, on August 13, 1819. The son of a parish rector, he attended Pembroke College, Cambridge, studying mathematics under William Hopkins. It was Hopkins who encouraged Stokes to pursue the study of hydrodynamics. In 1842, he began his investigations with an analysis of the steady motion of an incompressible fluid in two dimensions. Stokes' hydrodynamics work in the 1840's was largely given over to the study of internal friction in fluids. His research resulted in an 1842 report on what was later to become known as viscosity and culminated in his paper on the hydrodynamics of pendulums in 1850. In 1849, he was appointed to the Lucasian professorship at Cambridge (the chair once held by Newton). Most noted for his work in fluid mechanics, he also contributed to other branches of physics (the elasticity of solids, optics, and the defraction of light, as well as acoustics). He died at Cambridge on February 1, 1903.

$$\rho \frac{Du}{Dt} = F_x + \left(\frac{\partial \sigma_{xx}}{\partial x} + \frac{\partial \sigma_{xy}}{\partial y} + \frac{\partial \sigma_{xz}}{\partial z} \right) \tag{66}$$

$$\rho \frac{Dv}{Dt} = F_y + \left(\frac{\partial \sigma_{yx}}{\partial x} + \frac{\partial \sigma_{yy}}{\partial y} + \frac{\partial \sigma_{yz}}{\partial z} \right) \tag{67}$$

$$\rho \frac{Dw}{Dt} = F_z + \left(\frac{\partial \sigma_{zx}}{\partial x} + \frac{\partial \sigma_{zy}}{\partial y} + \frac{\partial \sigma_{zz}}{\partial z} \right) \tag{68}$$

Stated explicitly, these equations tell us that the following balance has been achieved within the melt:

$$\begin{pmatrix}\text{fluid}\\ \text{density}\end{pmatrix}\begin{pmatrix}\text{local and}\\ \text{convected}\\ \text{acceleration}\end{pmatrix} = \begin{pmatrix}\text{melt}\\ \text{body force}\\ \text{components}\end{pmatrix} + \begin{pmatrix}\text{normal and}\\ \text{shear stress}\\ \text{gradients}\end{pmatrix}$$

For an inviscid fluid, each shear stress component on the right-hand sides of equations 66, 67, and 68 would vanish and leave only the normal stress components.

The relation between stress components in the melt and the resulting rate of strain requires three assumptions:

1. The components of stress are linear functions of the components of strain rates. This assumption is reasonable for the infinitesimally small deformation increments considered.
2. The relations established between the stress and deformation rate components must be invariant for coordinate transformations involving mirror reflections or rotations of the axes. This assumption provides for a physical "rule" for the flow process and a measure of independence about how a deforming reference melt element is viewed.
3. The stresses must recover the hydrostatic pressure of the melt when velocity gradients go to zero. This condition provides for melt continuity when the fluid is at rest.

The derivation of this relation involves expressing individual stress components in terms of linear combinations of component strains, defining the constant coefficients of these strains, introducing velocity gradients in terms of strain components, and then simplifying the final expressions. These involved steps have been well presented by Yuan (1967, p. 97–99).

The sequence of steps relating stress and strain rate components leads to the identification of two connecting coefficients of viscosity: η, the (shear) viscosity, and λ, the "second" coefficient of viscosity. By Stokes' (1845) hypothesis, we assume that

$$3\lambda + 2\eta = 0 \tag{69}$$

or

$$\lambda = -\frac{2}{3}\eta \tag{70}$$

The second coefficient of viscosity, referred to as the dilatational viscosity, is generally associated with dilational deformation modes and, hence, with fluid compressibility. Although the value of λ in terms of η has been confirmed through experimentation, its theoretical justification and precise physical implications have been the subject of some debate (Rosenhead, 1954; Davies, 1954).

The constitutive relations for an isotropic Newtonian fluid (recalling the assumption above of a linear relation between shear stress and shear strain rate components) are now (Schlichting, 1968, p. 58)

$$\sigma_{xx} = -P - \frac{2}{3}\eta \operatorname{div} \vec{W} + 2\eta \frac{\partial u}{\partial x} \tag{71}$$

$$\sigma_{yy} = -P - \frac{2}{3}\eta \operatorname{div} \vec{W} + 2\eta \frac{\partial v}{\partial y} \tag{72}$$

$$\sigma_{zz} = -P - \frac{2}{3}\eta \operatorname{div} \vec{W} + 2\eta \frac{\partial w}{\partial z} \tag{73}$$

$$\sigma_{xy} = \sigma_{yx} = \eta \left(\frac{\partial v}{\partial x} + \frac{\partial u}{\partial y} \right) \tag{74}$$

$$\sigma_{yz} = \sigma_{zy} = \eta \left(\frac{\partial w}{\partial y} + \frac{\partial v}{\partial z} \right) \tag{75}$$

$$\sigma_{zx} = \sigma_{xz} = \eta \left(\frac{\partial u}{\partial z} + \frac{\partial w}{\partial x} \right) \tag{76}$$

Melt isotropy has been maintained by requiring the principal axes of the stress tensor to coincide with the principal axes of the rate of strain tensor.

Note particularly that, in equations 74, 75, and 76, the shear stress is balanced by the shear strain rate acting through the coefficient of viscosity η. This coefficient has been the principal object of our attention in this compilation.

By introducing the constitutive relations (eqs. 71–76) into the surface force expressions (eqs. 63–65) per unit volume and then using the relations for the deviatoric normal stress components,

$$\sigma_{xx}' = \sigma_{xx} + P \tag{77}$$

$$\sigma_{yy}' = \sigma_{yy} + P \tag{78}$$

$$\sigma_{zz}' = \sigma_{zz} + P \tag{79}$$

nonviscous pressure terms, the normal components of deviatoric stress, and two sets of viscous pressure terms appear as separate groupings in the equations of motion. The hydrostatic and thermodynamic pressure is formed from the trace of the stress tensor and is given by

$$P=-(\sigma_{xx}+\sigma_{yy}+\sigma_{zz})/3 \tag{80}$$

where the minus sign denotes compression. It is appropriate for the melt at rest. The intermediate step is the development of the constitutive relations (eqs. 71–76). After simplifications generated by considering only incompressible fluids have been made, the equations of motion for an isotropic Newtonian melt become

$$\rho\left(\frac{\partial u}{\partial t}+\frac{u\partial u}{\partial x}+\frac{v\partial u}{\partial y}+\frac{w\partial u}{\partial z}\right)$$

$$=F_x-\frac{\partial P}{\partial x}\eta\left(\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}\right) \tag{81}$$

$$\rho\left(\frac{\partial v}{\partial t}+\frac{u\partial v}{\partial x}+\frac{v\partial v}{\partial y}+\frac{w\partial v}{\partial z}\right)$$

$$=F_y-\frac{\partial p}{\partial y}+\eta\left(\frac{\partial^2 v}{\partial x^2}+\frac{\partial^2 v}{\partial y^2}+\frac{\partial^2 v}{\partial z^2}\right) \tag{82}$$

$$\rho\left(\frac{\partial w}{\partial t}+\frac{u\partial w}{\partial x}+\frac{v\partial w}{\partial y}+\frac{w\partial w}{\partial z}\right)$$

$$=F_z-\frac{\partial P}{\partial Z}+\eta\left(\frac{\partial^2 w}{\partial x^2}+\frac{\partial^2 w}{\partial y^2}+\frac{\partial^2 w}{\partial z^2}\right) \tag{83}$$

These equations are the Navier-Stokes equations of fluid motion.

The Navier-Stokes equations (developed above for Cartesian coordinates) can be generalized by writing them in vector form:

$$\rho\frac{D\vec{W}}{Dt}=\vec{F}-grad\ P+\eta\nabla^2\vec{W} \tag{84}$$

where the Laplacian operator is ∇^2 and $\nabla^2=(\partial^2/\partial x^2)+(\partial^2/\partial y^2)+(\partial^2/\partial z^2)$.

In the falling-sphere viscometer (fig. 4), the axial motion of the descending sphere through the melt is expected to be very slow. Thus, to good approximation, the inertial terms can be eliminated in the Navier-Stokes equations developed above (eq. 84). Thus, the further simplified relations become

$$\text{grad } P=\eta\nabla^2\vec{W} \tag{85}$$

and the equation of continuity for incompressible flow becomes

$$\text{div } \vec{W}=0 \tag{86}$$

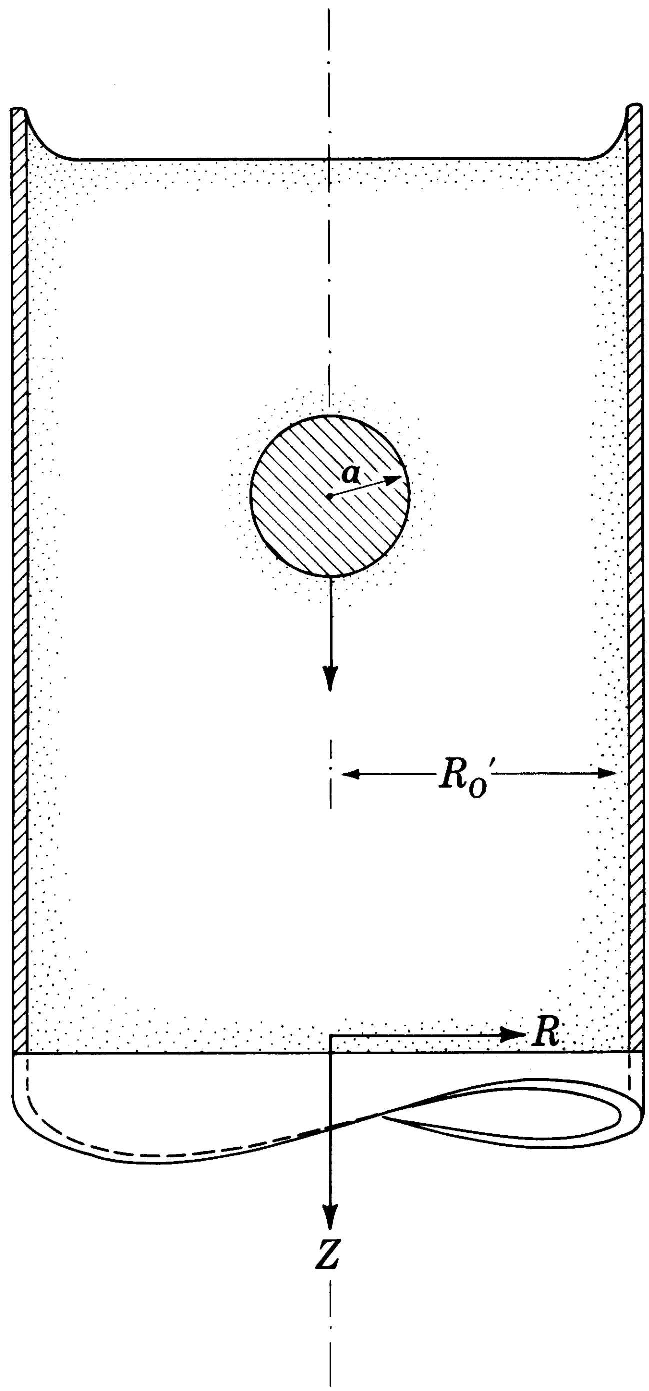

Figure 4. Falling-sphere (Stokes flow) viscometer. Cross-sectional slices taken through the cylinder wall and descending sphere have a hachured pattern. The melt-solid interfacial regions are shown by stippling. *R* and *Z* are coordinates for the cylinder.

The results of Stokes' (1851) analysis of this creeping motion of fluid past a sphere take the form of the sphere velocity, plus the pressure developed at the front- and rear-center positions (see Bird and others (1977a, ch. 1):

$$U = U_\infty \left\{ \left[1 - \frac{3}{4}\left(\frac{a}{r}\right) - \frac{1}{4}\left(\frac{a}{r}\right)^3 \right] - \frac{3}{4}\left(U_\infty \cdot \delta_r \delta_r\right) \left[\left(\frac{a}{r}\right) - \left(\frac{a}{r}\right)^3 \right] \right\} \quad (87)$$

$$P_s - P = -\frac{3}{2} \frac{\eta U_\infty ax}{r^3} \quad (88)$$

where a is the radius of the sphere, r is a radial coordinate, $r^2 = x^2 + y^2 + z^2$, and U_∞ is the terminal velocity.

As the sphere descends, the maximum and minimum pressures developed on the surface are found at points 1 and 2, respectively, on the pressure-distance graph in figure 5. These points correspond to the stagnation points of melt motion on the surface. Numerically, their values are

$$P_s^{1,2} = P_\infty \pm \frac{3}{2} \frac{\eta U_\infty}{a} \quad (89)$$

where the superscripts 1 and 2 refer to the leading and trailing pole positions (fig. 5), respectively, which are cases, specialized for the condition $x/r = \pm 1$, of the more general relation for the surface pressure distribution on the sphere,

$$P_s = P - \frac{3}{2} \frac{\eta X U_\infty}{r^2} \quad (90)$$

Here, the pressure P in equations 88, 89, and 90 is the hydrostatic pressure developed in the standing column of melt at rest and is formed from the trace of the stress tensor.

Descent of the Sphere

Consider, for a moment, the following thought experiment involving the movement of a sphere descending in a silicate melt that is initially at rest and free of any crystalline or discrete gas phase. We will position ourselves inside the sphere, at the origin of the coordinate system, and observe and record the changing flow conditions in the melt during this downward travel.

During our descent, fluid adheres to the sphere surface and is effectively immobilized. This adherence produces, on the outer surface, a no-slip boundary condition that is physically equivalent to requiring that all flow must occur within the melt itself, not along the melt-solid interface. These conditions are $V_n = 0$ and $V_t = 0$ along the walls, where the subscripts n and t refer to the normal and tangential components of the velocity. Their specification is required to solve the Navier-Stokes equations of motion discussed above (eqs. 81–83). Effectively, the surface of the sphere is acting as a source of melt shearing motion and angular momentum.

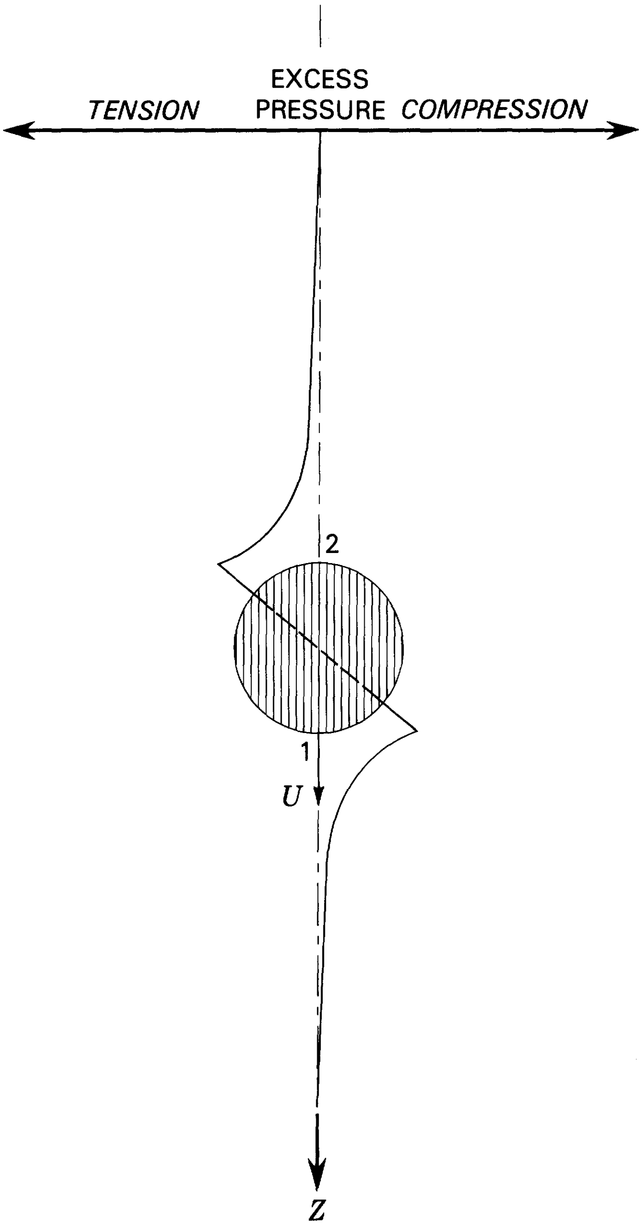

Figure 5. Pressure distribution around a sphere descending through quiescent melt. The pressure is hydrostatic and is formed as the average of the trace of the stress tensor. This hydrostatic pressure is the "zero datum" indicated by the asymptotes of the solid curve as they approach the long dash-short dash Z axis along the center line of descent. In the near field of the sphere, transient "pressures" are built up and then relaxed during melt flow. These pressures have been plotted as "excess pressure" and can be either above mean hydrostatic (compressive) or below mean hydrostatic (tensile), depending on whether we are stationed on the front pole (1) or the rear pole (2) of the sphere. They contribute to the pressure component of the total drag. The downward axial velocity is U.

We further fix ideas by noting that small, equally spaced spherical fluid elements have been temporarily dyed with a marker, so that we can monitor the kinematic effects of our passage by observing how these elements translate, rotate, and deform. Figure 6 illustrates the sphere and the flowing marker elements during a point frozen in time.

Ahead of the sphere, the melt is at rest—immobile and undeformed. As the sphere moves closer, the elements begin to spread radially away from the front pole trajectory. In the two-dimensional section of figure 6, this spreading takes the form of a lateral flow away from the nose. In terms of the Navier-Stokes equation describing incompressible creeping flow (grad $P = \eta \nabla^2 \vec{W}$), the u, v, and w velocity components have begun to take on finite values, effectively "turning on" the viscous term on the right-hand side.

As the sphere approaches close to a fluid element, the local pressure difference rises abruptly, reaches a maximum value at the sphere pole, and then declines as the melt element deforms, rotates, and accelerates laterally off to the side. Along a meridian, this local pressure reduction will continue in a linear fashion, as equation 89 and figure 5 show, and reach a zero (that is, ambient hydrostatic) value at the equator. The minimum local differential pressure is achieved at the rear pole (point 2 in fig. 5) and contributes to the pressure component of the total drag. The pressure in the near-field wake is below hydrostatic, and an annular suction field centered at the rear pole has developed in three dimensions. Farther out in the wake, the pressure rises, climbing back to ambient hydrostatic values, given by $-1/3$ the trace of the stress tensor (eq. 80) and thus signaling our passage farther downstream.

In the path of advance, as melt elements are perturbed by the sphere's close approach and begin to move, they rotate as well as translate and deform. The rotation is imparted by the viscous coupling of adjacent fluid elements (inviscid fluids are irrotational). The magnitude of this rotation, as well as its sense, is specified by the angular velocity vector $\vec{\omega}$ and is related to the fluid vorticity $(\vec{\Omega})$ through the curl of the local velocity $\vec{U}$:

$$\vec{\Omega} = \nabla \times \vec{U} = 2\vec{\omega} \quad (91)$$

This equation is a measure of the instantaneous rotation of the orthogonal material lines that pass through the element center. Close to the sphere, in the disturbed adjacent layers, vorticity increases as the wall of the sphere is approached and dies out rapidly as the radial distance increases along a given azimuth. Beyond the disturbed near-field region, in the melt at rest, $\vec{\Omega}=0$, and the fluid is irrotational.

Flow-Field Visualization

If one had the means of attaching neutrally buoyant bright particles to transparent fluid parcels, the flow fields set up in the fluid during the passage of solid objects could be monitored by tracking the motion of the particles themselves. This process exemplifies the flow visualization techniques that have been used for about 20 years in experimental studies of fluid motion (see Van Dyke's (1982) presentation for a recent compilation of studies).

Coutanceau and Thizon (1981) used this technique in conducting a series of experiments designed to determine the wall effects of spherical bubbles rising axially in cylindrical tubes. Their experiments are particularly relevant to visualizing the flow field developed in the falling-sphere viscometer during the creeping passage of the sphere, and we will summarize certain of the points brought out by their work. Their focus was on rising bubbles, whereas ours is on descending spheres. However, the essential first-order effects of the near-field flow of one system may be applied to the other. (Minor differences show up in the deformation of the two-phase interface, such as certain inertial and surface tension effects as well as the value of traction components at the interface itself. These are not of immediate concern.) Coutanceau and Thizon's (1981, figs. 11, 12) original plates have been modified to produce our figures 7 and 9. The plates have been inverted, and a circular white disk has been centered on the bubble. A circular, vertically ruled pattern has been superposed to suggest a vertical cross section through the descending sphere.

Coutanceau and Thizon (1981) used silicone oil (300 poise at 20°C) as the fluid medium in their experiments. Visualization of the flow patterns was accomplished by shining an electric-arc projector beam through a meridian section of the tube after fine (<20 μm) magnesium flakes were uniformly dispersed within the liquid. The particle paths then portrayed the kinematics of flow during the moment of transit of the spherical body. Photographs were taken with a fixed camera and with a traveling camera. In both cases, the terminal velocity of the sphere had been reached before exposure, to insure that the flow field developed was steady and not transient. Thus, it corresponded to the Stokes flow discussed in this volume.

In the moving frame of reference (fig. 7), the trajectories of the particles describe a pattern that closely duplicates the flow field calculated in figure 8, complete with stagnation points (very short lines) at the front and rear poles of the sphere. The flow is symmetrical about the equatorial plane, as well as being symmetrical along meridian planes.

In the fixed frame of reference (fig. 9), the lines of magnesium particles describe a pattern of closed streamlines, resolving the extent of the fluid region disturbed by the passage of the sphere. The white lines or streaks thus track the fluid paths during the exposure interval. Their length, therefore, is directly proportional to their instantaneous velocity; this relative velocity environment can be appreciated by comparing the streak length as a function of radial distance (along a given azimuth or along a given meridian, from pole to pole).

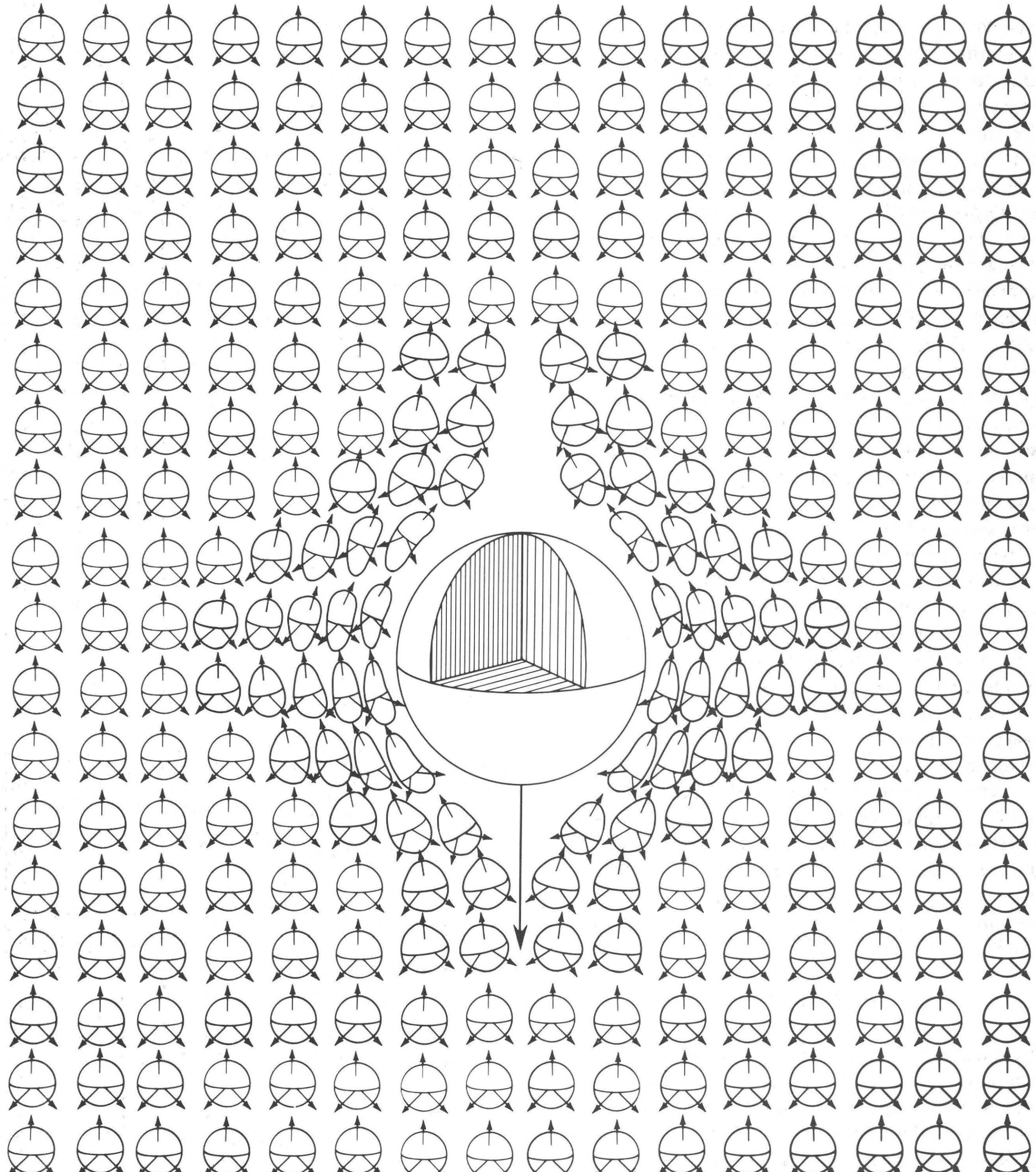

Figure 6. Schematic melt deformation field produced by the descent of a sphere. Melt marker elements are arrayed on a 16 × 20 field and are comprised of tiny spheres. Each marker sphere has three initially orthogonal references axes, two of which project out at us from the equatorial plane. These elements are translated, rotated, and stretched during the passage of the falling sphere. Their rigid body movements and their deformation track the kinematics of melt motion. Such deformation comprises the skin friction component of the total drag. (Not illustrated are the more subtle contributions of the axisymmetric compression and rarefaction fields near the front and rear poles, respectively.)

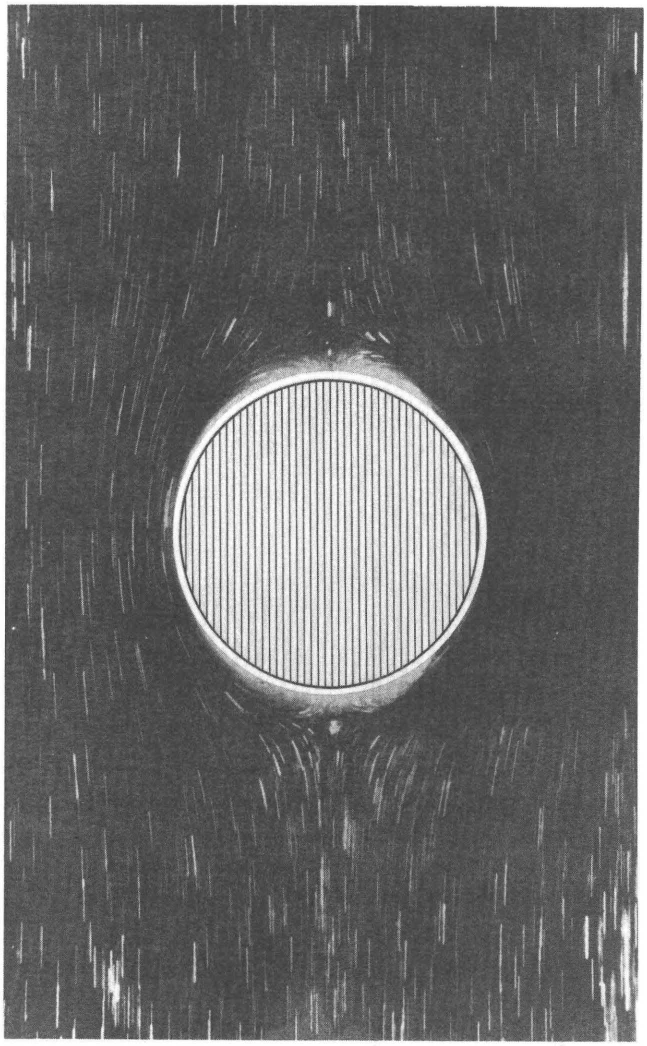

Figure 7. Creeping flow field developed by the axial passage of a sphere in a circular cylinder containing a viscous fluid. The camera is moving downward with the sphere. (Modified after Coutanceau and Thizon, 1981.)

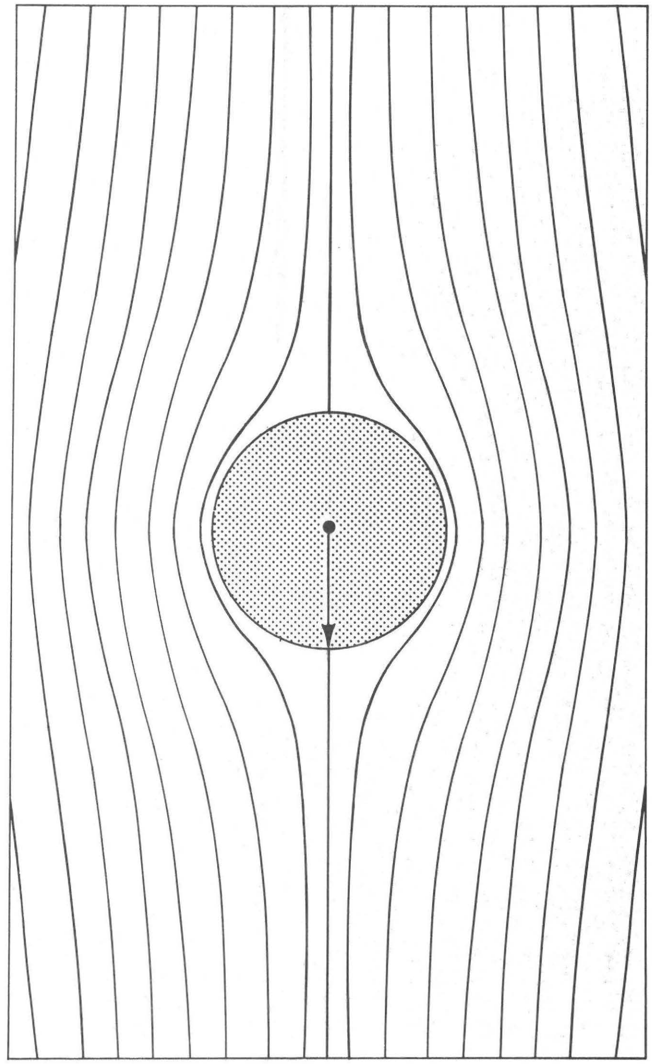

Figure 8. Flow field developed around a sphere descending at constant velocity through a Newtonian melt. The arrow at the center of the sphere denotes the direction of motion.

Direct-Observation Falling-Sphere Viscometry

Sandia National Laboratories, supported by the U.S. Department of Energy, has developed an approach for the direct observation of descending spheres in natural silicate melts (Wemple and others, 1980) that is a refinement of a surprisingly old technique. Hunter (1934) used stacked two-coil electromagnetic loops, in tandem with a shortwave receiver and an oscillograph, to record the time of flight of the descending 0.80 platinum—0.20 rhodium sphere. Figure 10 shows a generalized schematic layout of the experimental configuration. Figure 11 provides an X radiograph of the internal structure of the falling-sphere viscometer used, and figure 12 provides X radiographs of the descent of a sphere as recorded at temperatures just above the 1-atm liquidus for Hawaiian olivine tholeiite.

Attainment of Terminal Velocity

For a solid sphere moving at a constant velocity through an unbounded melt that is at rest, Stokes' (1851) stream function formulation can be used to evaluate the components of drag or the resistance to translation. For the axisymmetric flow under consideration, the stream function at a radial position vector $\vec{R}$ is defined (Happel and Brenner, 1973) by

$$\psi = \psi\,(\vec{R};t) = \frac{Q}{2\Pi} \qquad (92)$$

where t is time, Q is the instantaneous volumetric flow rate and ψ is the stream function. For a sphere of radius a and velocity U traveling in the $+z$ direction, the appropriate

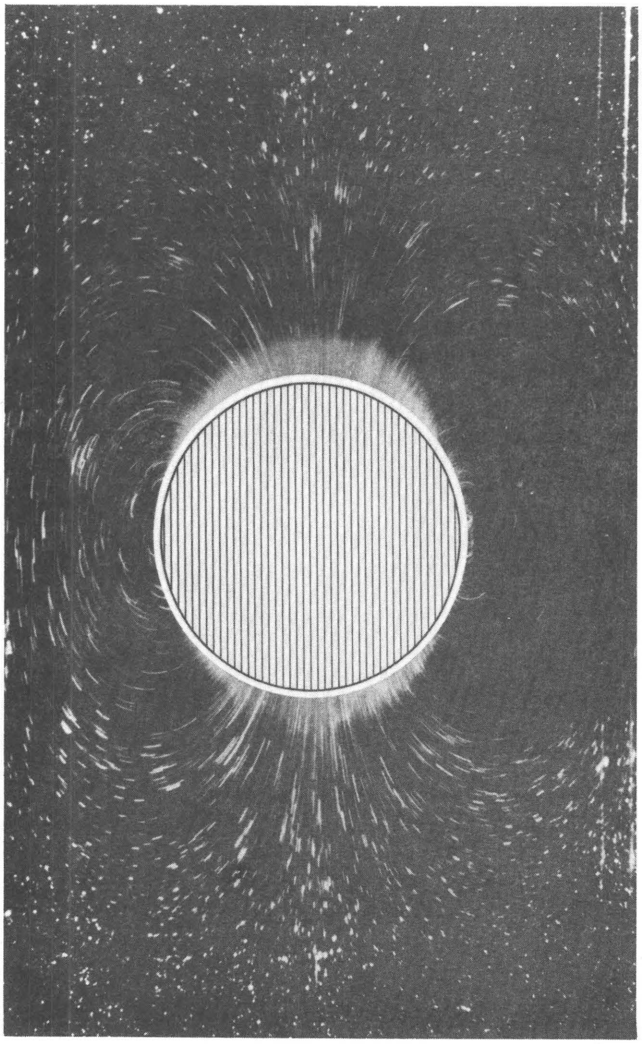

Figure 9. Creeping flow field produced by the axial passage of a sphere in a circular cylinder containing a transparent viscous fluid. The position of the camera (observer) is stationary. (Modified after Coutanceau and Thizon, 1981.)

boundary conditions on the sphere's surface ($r=a$) become

$$\psi \Big|_{r=a} = -\frac{1}{2} Ua^2 \sin^2 \theta \tag{93}$$

$$\frac{\partial\psi}{\partial r} \Big|_{r=a} = -Ua \sin^2 \theta' \tag{94}$$

where the reference angle θ' is taken along a meridian plane and begins at the front pole facing in the $+z$ direction.

The stream function is biharmonic and satisfies the differential equation

$$E^4 \psi=0 \tag{95}$$

where, for spherical coordinates,

$$E^2=\frac{\partial}{\partial r}+\frac{\sin \theta'}{r^2}\frac{\partial}{\partial \theta'}\left(\frac{1}{\sin \theta'}\frac{\partial}{\partial \theta'}\right) \tag{96}$$

The successive use of final trial functions of the form $\psi=\sin^2 \theta' F(r)$ and a subsequent evaluation of the constant coefficients of r (Stokes, 1851; Happel and Brenner, 1973) by application of the boundary conditions lead to the stream function

$$\psi=\frac{1}{4}Ur^2 \sin^2 \theta'\left[\left(\frac{a}{r}\right)^3-3\left(\frac{a}{r}\right)\right] \tag{97}$$

The corresponding radial and tangential velocity components for this flow field are

$$V_r=\frac{1}{r^2 \sin \theta'}\left(\frac{\partial\psi}{\partial\theta'}\right) \tag{98}$$

or

$$V_r=-\frac{1}{2} U \cos \theta' \left(\frac{a}{r}\right)^2\left(\frac{a}{r}-\frac{3r}{a}\right) \tag{99}$$

and

$$V_\theta=\frac{1}{r \sin \theta'}\left(\frac{\partial\psi}{\partial r}\right) \tag{100}$$

or

$$V_\theta=-\frac{1}{4} U \sin \theta' \left(\frac{a}{r}\right)\left[\left(\frac{a}{r}\right)^2+3\right] \tag{101}$$

Changes in differential pressure over small patches of the sphere's surface can be cast in terms of the fluid viscosity and the normal derivative of $E^2 \psi$ (Happel and Brenner, 1973). Thus, the total force exerted on the sphere by the fluid can be computed by integrations taken along the meridian planes.

For the pressure drag component, this procedure leads to

$$F_Z^P=-2\pi\eta aU \tag{102}$$

For the viscous drag produced by the tangential stresses along the sphere skin, the procedure produces

$$F_Z^V=-4\pi\eta aU \tag{103}$$

The total drag is now formed from the sum of the pressure and viscous components

$$F_Z^T=F_Z^P+F_Z^V \tag{104}$$

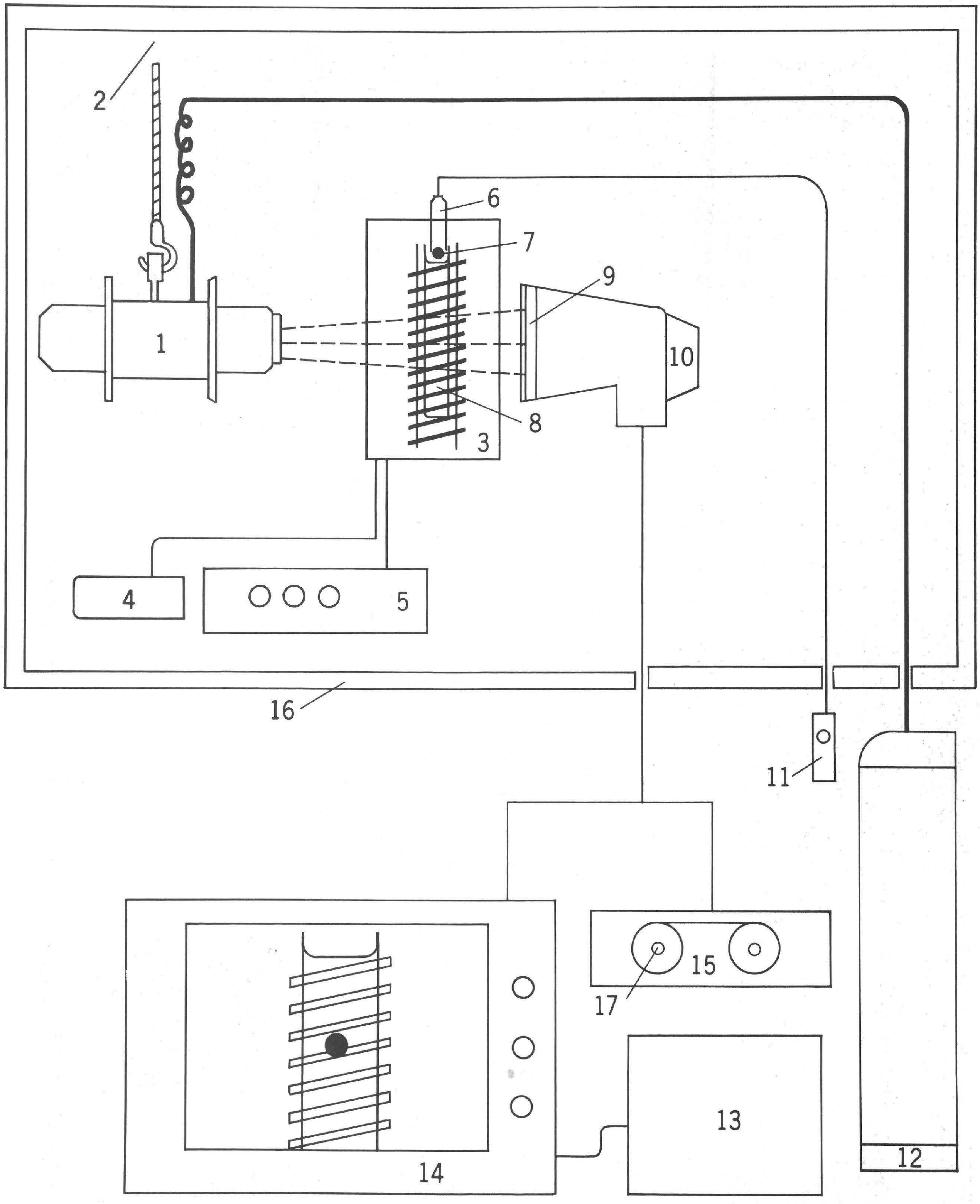

Figure 10. Direct-observation falling-sphere viscometer for silicate melts. Principal components are (1) X-ray transmission unit; (2) traveling overhead crane for support and positioning; (3) Kanthal-wound furnace; (4) digital temperature indicator; (5) temperature controller; (6) sphere-release mechanism; (7) sphere; (8) crucible; (9) fluorescent screen; (10) television camera; (11) remote-linkage sphere-release terminal; (12) X-ray generation unit; (13) image-enhancement unit; (14) video monitor; (15) videotape recorder; (16) lead- and concrete shielded inner laboratory; (17) videotape cartridge and drive.

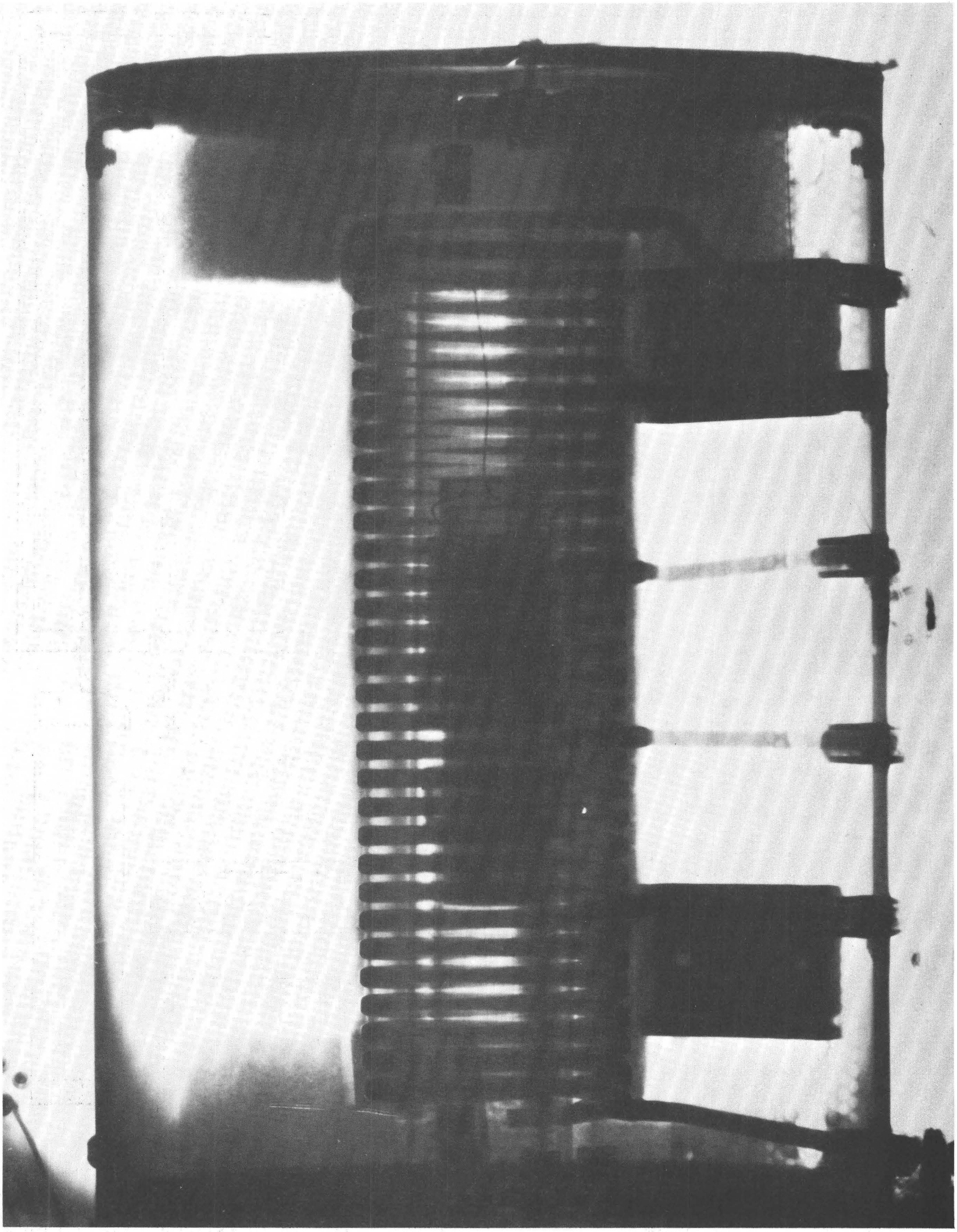

Figure 11. X radiograph of a real-time 1-atm falling-sphere viscometer assembly. Kanthal windings and the vertical cylindrical crucible occupy the center of the field of view. (Photograph by Sandia National Laboratories.)

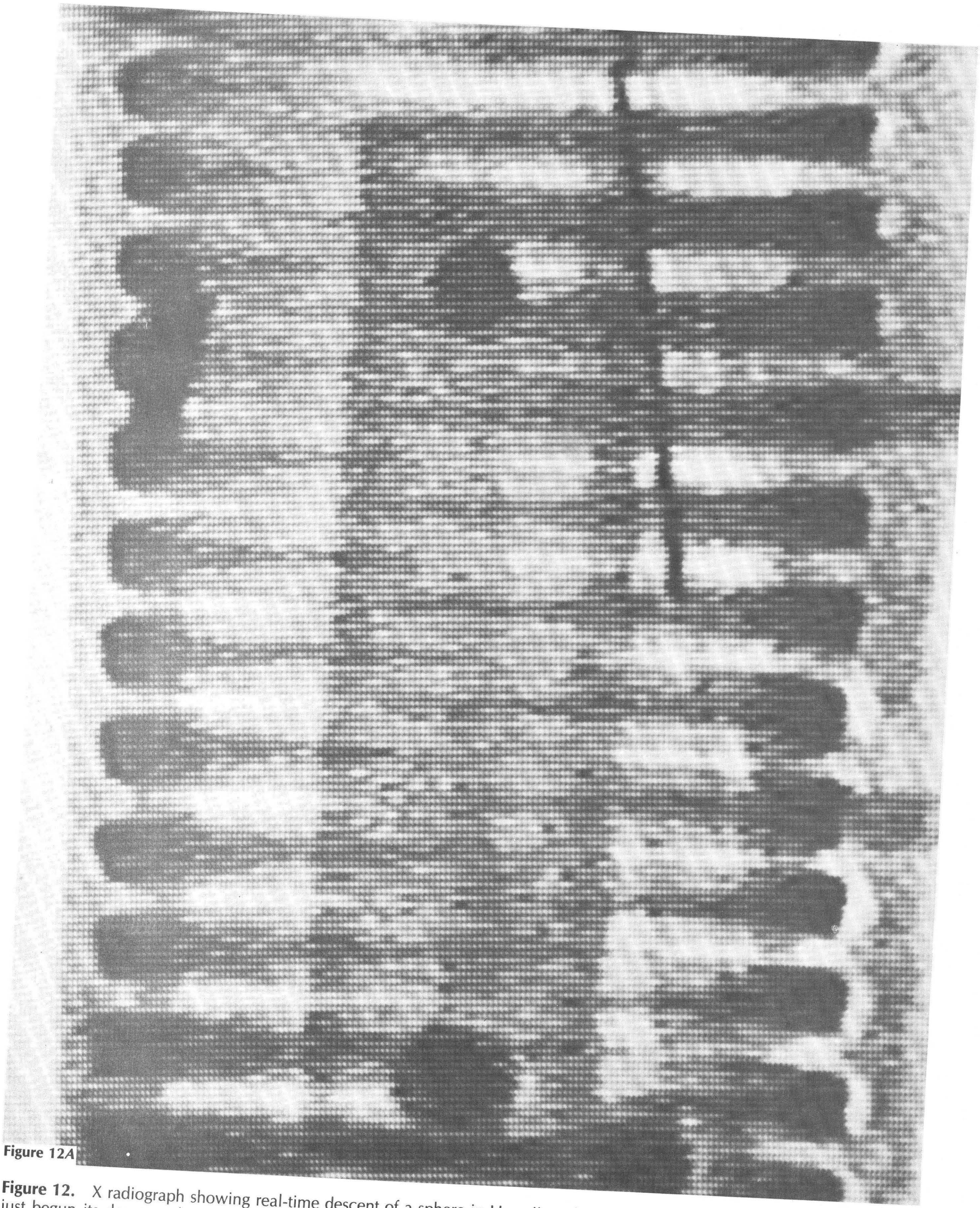

Figure 12A

Figure 12. X radiograph showing real-time descent of a sphere in Hawaiian olivine tholeiite melt at 1,244 °C. The sphere has just begun its downward travel; a sphere that had descended earlier rests on the crucible bottom. (Photographs by Sandia National Laboratories.)

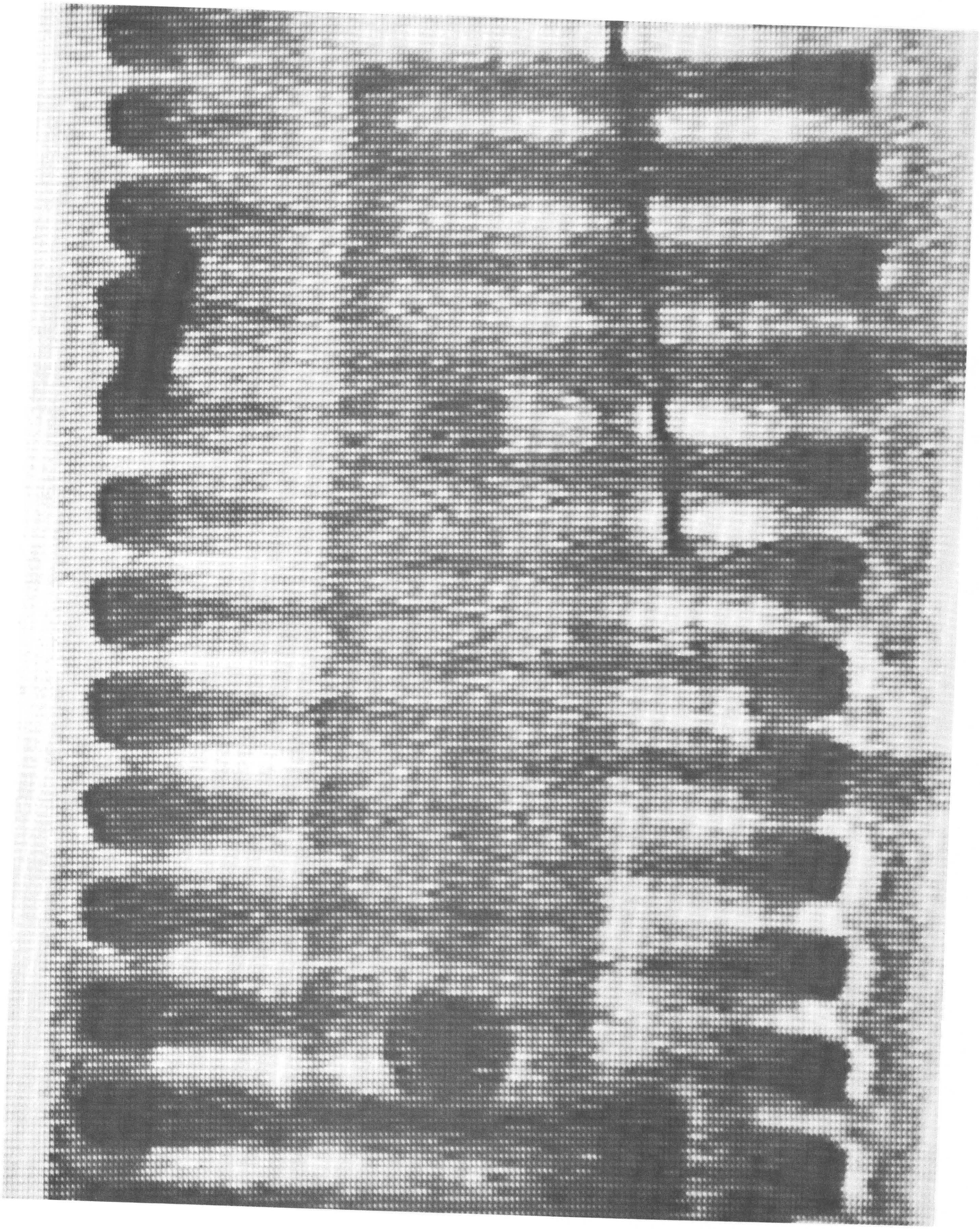

Figure 12*B*

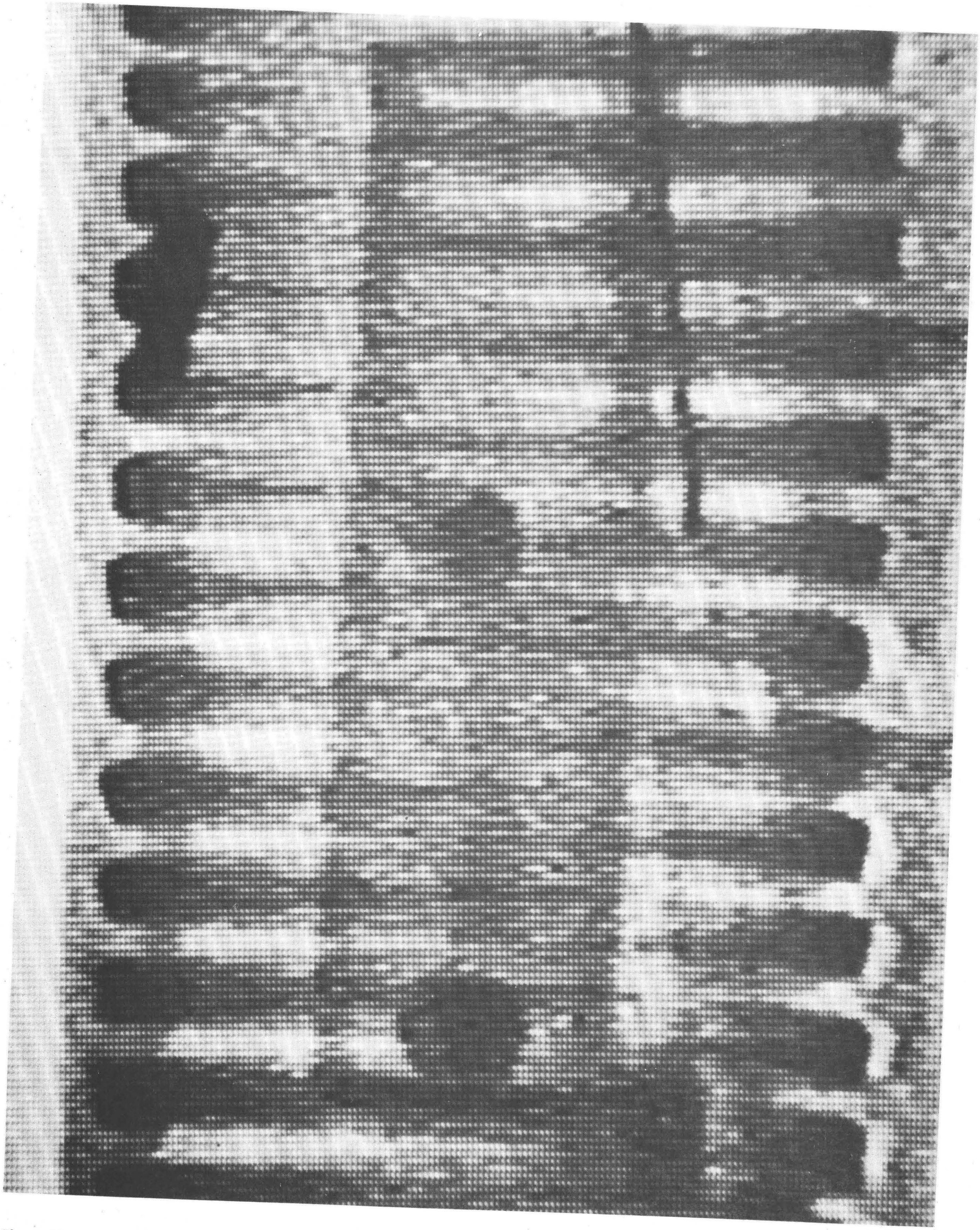

Figure 12*C*

or

$$F_Z^T = -6\pi\eta a U \qquad (105)$$

This equation is the Stokes resistance law of hydrodynamics, which has become known simply as Stokes law. The reader may also see Bird and others' (1977a, b) volumes for additional discussion. The negative sign for the pressure resistance component and for the viscous traction component (as well as the total F_Z^T) suggests that the force exerted by the fluid opposes the motion of the sphere. Under the driving force of gravity, the downward-directed force on the sphere is

$$F = (\rho_s - \rho_m) G \frac{4}{3} \pi a^3 \qquad (106)$$

where the buoyancy of the surrounding melt has been considered by taking the effective density of the sphere as the density contrast between the sphere (ρ_s) and the melt (ρ_m).

Ultimately, the velocity of the sphere will approach a value where the downward-directed gravitational force is just balanced by the total resistance of the pressure drag and the viscous surface traction drag components of the total Stokes resistance. The value of U at which this balance occurs is referred to as the terminal velocity, U_∞. The terminal velocity can be related to the driving and resisting force components of sphere motion by striking a balance between equations 105 and 106:

$$U_\infty = \frac{2}{9}(\rho_s - \rho_m)\frac{Ga^2}{\eta} \qquad (107)$$

This important relation has been the object of our attention in this section, for its rearrangement leads to a means for evaluating melt viscosity through a knowledge of density contrasts, sphere sizes, and terminal velocities:

$$\eta = \frac{2}{9}(\rho_s - \rho_m)\frac{Ga^2}{U_\infty} \qquad (108)$$

In practice, the presence of the cylinder walls exerts a retarding motion on the downward translation of the sphere. This retardation arises from the viscous coupling between melt elements and the sphere surface and wall surface and is a direct result of the immobility of melt at these fluid-solid contacts. Mathematically, it is a consequence of the condition $\vec{V}=0$ along these boundaries, where all shear and normal velocity components must vanish. We might imagine, then, an additional coefficient added to the Stokes resistance expression (eq. 105) to suggest the retarding effect of the wall. Wall-correction factors appear in table 1.

Expressions providing such "wall coefficients" are given by Happel and Brenner (1973) for translation along the axis of a cylinder. One such expression (Fayon and Happel, 1960) is as follows:

Table 1. Wall-correction factors (K_1) for rigid spheres translating in quiescent melt along the axis of a circular cylinder
[a, sphere radius; R_o, cylinder radius; —, not determined. After Happel and Brenner (1973)]

	K_1	
a/R_o	Haberman approximation (Happel and Brenner, 1973)	Bohlin (1960) approximation (eq. 115)
0.0	1.000	1.000
.1	1.263	1.263
.2	1.680	1.680
.3	2.370	2.370
.4	3.582	3.588
.5	5.871	5.923
.6	10.591	11.057
.7	21.406	36.598
.8	48.985	—

$$\frac{F}{6\pi\eta ua} = \frac{1}{1 - 2.104\left(\frac{a}{R_o}\right) + 2.087\left(\frac{a}{R_o}\right)^3} + \left(\frac{C_a}{C_s} - 1\right) \qquad (109)$$

Here, the actual coefficient of resistance in an infinite fluid medium is given by C_a, and C_s is the Stokes resistance drag, $24/N_{\mathrm{Re}}$ (based on the sphere diameter). Therefore, $(C_A/C_s) - 1$ is a measure of the fractional departure from the resistance computed by considering Stokes law alone. Figure 13 presents Fayon and Happel's (1960) curve as well as the comparative curves of Faxen (1923), Oseen (1927), and Bohlin (1960). For Reynolds numbers over the range 0.1 to 1.0, the curves are essentially coincident.

Another such expression is

$$\frac{F}{6\pi\eta ua} = \frac{1}{\left(1 - \frac{3}{16} N_{\mathrm{Re}}\right) - \left(\frac{d}{D}\right) 2.104 + 2.09\left(\frac{d}{D}\right)^3} \qquad (110)$$

(Faxen (1923) cited by Oseen (1927)), where N_{Re} is the Reynolds number based on the sphere diameter, d is the sphere diameter, and D is the cylinder diameter. (The coefficient 2.104 was evaluated for $N_{\mathrm{Re}}=0$.)

A third expression is

$$\vec{F} = -i_Z 6\pi\eta a U K_1 \qquad (111)$$

(Bohlin, 1960), where

$$K_1 = 1/\left[1 - 2.10443\left(\frac{a}{R_o}\right) + 2.08877\left(\frac{a}{R_o}\right)^3 - 0.94813\left(\frac{a}{R_o}\right)^5 - 1.372\left(\frac{a}{R_o}\right)^6 + 3.87\left(\frac{a}{R_o}\right)^8 + \ldots\right] \qquad (112)$$

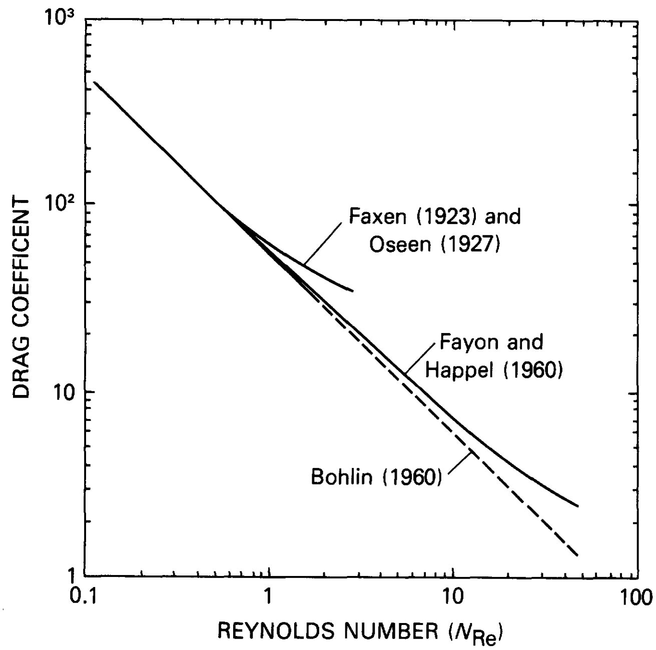

Figure 13. Drag on a sphere falling axially in a circular cylinder. The convergence of computed drag at low particle–Reynolds number is evident.

Figure 14 presents wall-correction factors for the axial motion of a rigid sphere as a function of the melt annulus thickness *(a/R_o)*, defined as the ratio of the sphere diameter to the cylinder diameter. It is based on the "exact" curve presented by Happel and Brenner (1973, p. 319).

ORGANIZATION OF THE TABLES

A standard format has been selected for the tabulation of data. Each table begins with a heading. For multicomponent synthetic systems, the heading is comprised of two parts: the system name and the subsystem number. System names are combinations of the first letters of each major oxide component. For example, the four-component system Al_2O_3-CaO-MgO-SiO_2 is referenced as ACMgS. Subsystems are defined by sequential variations in the mole fractions (and weight percentages) of major oxides. Thus, ACMgS–147 indicates the one hundred and forty seventh subsystem within this overall composition.

For standard glasses, minerals, or rocks, the system-name equivalent in the table title is the standard glass number, the mineral name, or the lithologic name, respectively. Multicomponent mineral systems also may have subsystem divisions, which delimit the proportions of each component over a systematic range of compositions. For example, Di-Al-An-5 is the fifth subsystem within the compositional group diopside-albite-anorthite. Rocks also have been divided into subsystems; the subsystem number denotes a restricted lithologic variant or, for that matter, a change in

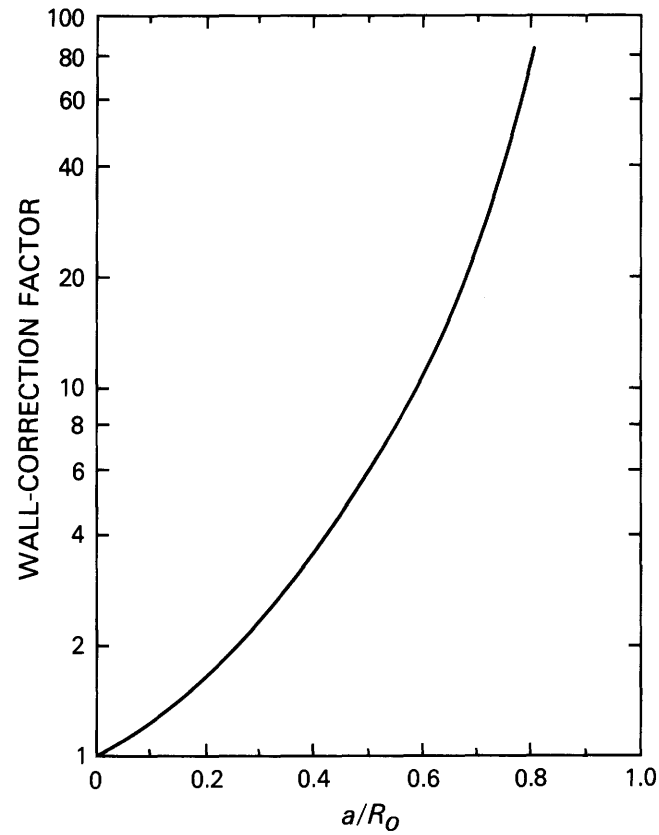

Figure 14. Wall-correction factors for a rigid sphere falling axially in a circular cylinder. The ratio a/R_o is formed by the radius of the sphere and the cylinder.

water pressure during the experimental run. An example of the latter is R-5 for rhyolithic glass at a P_{H_2O} of 20.7 bars. Symbols, units, and conversions used in compiling the viscosity data are listed in table 2.

Table 2. Symbols, units, and conversions used in compiling viscosity data

Symbol	Definition
K	Boltzmann's constant
P	Pressure, in atmospheres (atm) and bars (1 bar=10^6 dyn cm^{-2}=10^5 Pa; 1 std. atm=101,325 Pa[1]).
R	Universal gas constant[2] (commonly 8.314(3)±0.0008 $J{\cdot}K^{-1}$ mol^{-1}).
T	Temperature, in degrees Celsius (°C) and kelvins (K).
Z	Function 10,000.0/*T* in K^{-1}
η	Apparent viscosity, in poises
log	Common (or Briggsian) logarithm, to the base 10.
ln	Natural (or Napierian) logarithm, to the base *e*=2.718(2).

[1] Recommended by CODATA (Committee on Data for Science and Technology).

[2] CODATA Task Group on Key Values for Thermodynamics (1976).

Beneath the table title, in the upper left-hand corner, are the weight percentages and mole fractions of each major oxide within a synthetic system. Mole proportions have been computed by using the atomic weights presented in table 3. For rocks and multicomponent mineral systems, this section of each viscosity table gives the sample locality, including, where possible, the district as well as the country.

The upper right-hand corner of each table gives the names of the investigators and the year in which their results were published. Information about the original paper can be found in the reference list.

The measurement method is given in the left-central portion of the table (for example, "rotating cylinder viscometer").

The data source within the original reference is given in the right-central portion of the table under the heading "Derived from." This source will almost always be a table presented in the original paper.

Table 3. Atomic weights of the elements
[Recommended for 1975 (Commission on Atomic Weights, 1976)]

Element	Symbol	Atomic weight
Actinium	Ac	227.0278
Silver	Ag	107.868
Aluminum	Al	26.9815
Americium	Am	(243).
Argon	Ar	39.948
Arsenic	As	74.9216
Astatine	At	(210).
Gold	Au	196.9665
Boron	B	10.811
Barium	Ba	137.33
Beryllium	Be	9.0121
Bismuth	Bi	208.9804
Bromine	Br	79.904
Carbon	C	12.0111
Calcium	Ca	40.08
Cadmium	Cd	112.41
Cerium	Ce	140.12
Chlorine	Cl	35.453
Cobalt	Co	58.9332
Chromium	Cr	51.996
Cesium	Cs	132.905
Copper	Cu	63.546
Dysprosium	Dy	162.50
Erbium	Er	167.26
Europium	Eu	151.96
Fluorine	F	18.998
Iron	Fe	55.847
Francium	Fr	(223).
Gallium	Ga	69.72
Gadolinium	Gd	157.25
Germanium	Ge	72.59
Hydrogen	H	1.0079
Helium	He	4.0026
Hafnium	Hf	178.49
Mercury	Hg	200.59
Holmium	Ho	164.930
Iodine	I	126.904
Indium	In	114.82
Iridium	Ir	192.22
Potassium	K	39.098
Krypton	Kr	83.80
Lanthanum	La	138.905
Lithium	Li	6.939
Lutetium	Lu	174.97
Magnesium	Mg	24.305
Manganese	Mn	54.938
Molybdenum	Mo	95.94
Nitrogen	N	14.0067
Sodium	Na	22.9897
Niobium	Nb	92.9064
Neodymium	Nd	144.24
Neon	Ne	20.179
Nickel	Ni	58.70
Neptunium	Np^{237}	237.0482
Oxygen	O	15.9994
Osmium	Os	190.2
Phosphorus	P	30.9737
Protactinium	Pa	231.0359
Lead	Pb	207.2
Palladium	Pd	106.4
Polonium	Po	(209).
Promethium	Pm	(145).
Praseodymium	Pr	140.9077
Platinum	Pt	195.09
Plutonium	Pu	(244).
Radium	Ra	226.0254
Rubidium	Rb	85.467
Rhenium	Re	186.207
Rhodium	Rh	102.9055
Radon	Rn	(222).
Ruthenium	Ru	101.07
Sulfur	S	32.06
Antimony	Sb	121.75
Scandium	Sc	44.955
Selenium	Se	78.96
Silicon	Si	28.085
Samarium	S	150.4
Tin	Sn	118.69
Strontium	Sr	87.62
Tantalum	Ta	180.947
Terbium	Tb	158.925
Technetium	Tc	(97).
Tellurium	Te	127.60
Thorium	Th	232.038
Titanium	Ti	47.90
Thallium	Tl	204.37
Thulium	Tm	168.934
Uranium	U	238.029
Vanadium	V	50.941
Tungsten	W	183.85
Xenon	Xe	131.30
Yttrium	Y	88.905
Ytterbium	Yb	173.04
Zinc	Zn	65.38

The units of viscosity, temperature, and pressure are set out in the central portion of the table.

The data have been organized in a five-column format. Starting on the left-hand side and moving across the table, the columns are temperature (in degrees Celsius), function [10,000/*T*], ln (η), $\log_{10}$ (η), and viscosity (η).

For systems having low viscosity, the η entry in column 5 will be a real number (for example, η=277.0) (ACMgS-147, at 1,250 °C and 1 atm). For systems having high viscosities, the entry will be cast in exponential notation (for example, $\eta=2.04\times10^{10}$) (National Bureau of Standards reference glass no. 711, at 510 °C and 1 atm), which is read "2.04 * 10E10." Finally, for convenience, interconversions of the units of viscosity are presented in table 4, and the units of length, time, force, and mass are set out in table 5 for internal consistency.

Table 4. Units of viscosity

[CGS unit of viscosity is poise (P), where 1 $P=10^{-1}$ Pa·s. SI unit of dynamic viscosity is pascal·second (Pa·s), where 1 Pa·s=1 $N\cdot s\cdot M^{-2}=1$ $kg\cdot(m\cdot s)^{-1}$. Interconversions from Bird and others (1960, p. 752)]

	$g\cdot cm^{-1}\cdot s^{-1}$	$kg\cdot m^{-1}\cdot s^{-1}$	CP
$g\cdot cm^{-1}\cdot s^{-1}$	1	10^{-1}	10^2
$kg\cdot m^{-1}\cdot s^{-1}$	10	1	10^3
CP	10	10	1

Table 5. International System (SI) units having special names

[From McGlashan (1973, p. 62)]

Physical quantity	Unit	Symbol	Definition
Length	meter	m	
Mass	kilogram	kg	
Time	second	s	
Thermodynamic temperature.	kelvin	K	
Amount of substance	mole	mol	
Frequency	hertz	Hz	s^{-1}
Energy	joule	J	$m^2\cdot kg\cdot s^{-2}$
Force	newton	N	$m\cdot kg\cdot s^{-2}=J\cdot m^{-1}$
Pressure	pascal	Pa	$m^{-1}\cdot kg\cdot s^{-2}=N\cdot m^{-2}$ $=J\cdot m^{-3}$

SOURCES OF TABULATED DATA

Data have been compiled from the following sources:

Carnegie Institution of Washington (Geophysical Laboratory) Year Book
Faraday Society of London Transactions
Geological Society of America Bulletin
Geological Society of America Special Papers
Glastechnische Berichte
Imperial Academy of Japan Proceedings
Journal of the American Ceramic Society
Journal of Geophysical Research
Journal of the Iron and Steel Institute (London)
Journal of Petrology
Journal of Research of the U.S. National Bureau of Standards, Series A—Physics and Chemistry
Proceedings of the Royal Society of London
Revue Internationale des Hautes Temperatures et des Refractories
Revue de Metallurgie
Science
Society of Glass Technology Journal (London)
Stahl und Eisen
Tectonophysics
Transactions of the American Geophysical Union
U.S. National Bureau of Standards Miscellaneous Publications
U.S. National Bureau of Standards Publications Series
U.S. National Bureau of Standards Special Publications
Zeitschrift für Erzbergbau and Metallhüttenwesen

ORGANIZATION OF THE GRAPHS

Two types of graphs are presented: plots of $\log_{10}\eta$ (poise) versus temperature (degrees Celsius) and plots of $\log_{10}\eta$ versus 10,000/*T* (per kelvin). The graphs are presented in pairs, the $\log_{10}\eta\times T$ plot appearing first. Both graphs immediately follow the tabulated data on which they are based and provide a rapid means of summarizing the trends within a subsystem as well as of making comparisons between neighboring subsystems.

The primary purpose of the $\log_{10}\eta$ versus *T* graphs is the assessment of the temperature dependence of the data. The $\log_{10}\eta$ versus 10,000/*T* plots provide a graphic means of evaluating the activation energy for viscous flow.

Within an individual graph, the data have been organized on the basis of compositionally neighboring subsystems; this method of presentation reflects the subsystem ordering within the tables, especially for the multicomponent synthetic systems. Individual graphs, then, typically contain multiple plots; each suite of data points represents one subsystem and is labeled within its subsystem number.

The temperature dependence of the viscosity of silicate melts is adequately decribed by the Arrhenius relation

$$\log\eta=\eta_o+E^*/2.302RT$$

where η_o is a (preexponential) constant, E^* is the activation energy for viscous flow, R is the gas constant, and T is the absolute temperature.

Activation energies are frequently presented in two formats; for convenience, both have been incorporated in table 6. In addition, it is not uncommon to find viscosity values cast in terms of natural logarithms to the base *e* (in addition

Table 6. Activation energies

Variable	Definition
Format 1 (in electron volts per atom): $\eta=\eta_o \exp-(E^*/KT)$	
K	Boltzmann's constant
E^*	Activation energy for viscous flow (in electron volts per atom).
T	Temperature (in kelvins)
η_o	Preexponential constant
Format 2 (in calories per mole): $\eta=\eta \exp-(E^*/RT)$	
R	Gas constant
E	Activation energy for viscous flow (in calories per mole).
T	Temperature (in kelvins)

to the base 10). A summary for conversions from one system to another follows. The relations between the logarithms of a number N to different bases a and b are given by

$$\log_a N=\frac{\log_b \mathrm{N}}{\log_b a}$$

so that

$$\log_e N=\ln N=2.302585 \log_{10} N$$

and

$$\log_{10} N=\log N=0.434 \log_e N$$

(Selby and Girling, 1965, p. 14).

Finally, interconversions in the units of energy (calories, joules, ergs, and electron volts) alter the numerical value of the gas constant; these conversions are considered in table 7. Activation energies for given subsystems can be conveniently estimated by evaluating the line slopes in the log η versus $10^4/T$ plot series.

Table 7. Units of R

[R=energy/(temperature×mole). All temperatures in kelvins, all moles in grams. Conversions from Rosenberger (1979, p. 494)]

Energy	R
Calories	1.987
Joules	8.314(3)
Ergs	$8.314(3)\times10^7$
Electron volts	$5.189(2)\times10^{19}$

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Two-Component Systems

SYSTEM

BAO(15.4),SIO2(84.6) (X)
BAO(31.7),SIO2(68.3) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR

BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

BS-1

T	Z	LN(N)	LOG(N)	N
1650.00	5.200	5.700	2.476	299.
1700.00	5.068	5.273	2.290	195.
1750.00	4.943	4.905	2.130	135.
1800.00	4.824	4.605	2.000	100.

SYSTEM
BAO(25.1),SIO2(74.9) (X)
BAO(46.1),SIO2(53.9) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

BS-2

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	4.701	2.041	110.
1550.00	5.485	4.191	1.820	66.1
1600.00	5.339	3.777	1.641	43.7
1650.00	5.200	3.408	1.480	30.2
1700.00	5.068	3.063	1.330	21.4
1750.00	4.943	2.773	1.204	16.0
1800.00	4.824	2.526	1.097	12.5

SYSTEM
BAO(30.7),SIO2(69.3) (X)
BAO(53.1),SIO2(46.9) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

BS-3

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	3.478	1.511	32.4
1550.00	5.485	3.110	1.350	22.4
1600.00	5.339	2.766	1.201	15.9
1650.00	5.200	2.468	1.072	11.8
1700.00	5.068	2.141	0.930	8.51
1750.00	4.943	1.899	0.825	6.68
1800.00	4.824	1.670	0.725	5.31

SYSTEM
BAO(33.5),SIO2(66.5) (X)
BAO(56.3),SIO2(43.7) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

BS-4

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	3.270	1.420	26.3
1550.00	5.485	2.901	1.260	18.2
1600.00	5.339	2.559	1.111	12.9
1650.00	5.200	2.268	0.985	9.66
1700.00	5.068	1.974	0.857	7.20
1750.00	4.943	1.758	0.763	5.80
1800.00	4.824	1.504	0.653	4.50

SYSTEM
BAO(40.2),SIO2(59.8) (X)
BAO(63.2),SIO2(36.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

BS-5

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	2.833	1.231	17.0
1550.00	5.485	2.468	1.071	11.8
1600.00	5.339	2.180	0.947	8.85
1650.00	5.200	1.900	0.825	6.68
1700.00	5.068	1.681	0.730	5.37
1750.00	4.943	1.520	0.660	4.57
1800.00	4.824	1.381	0.600	3.92

SYSTEM
BAO(42.0),SIO2(58.0) (X)
BAO(65.0),SIO2(35.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

BS-6

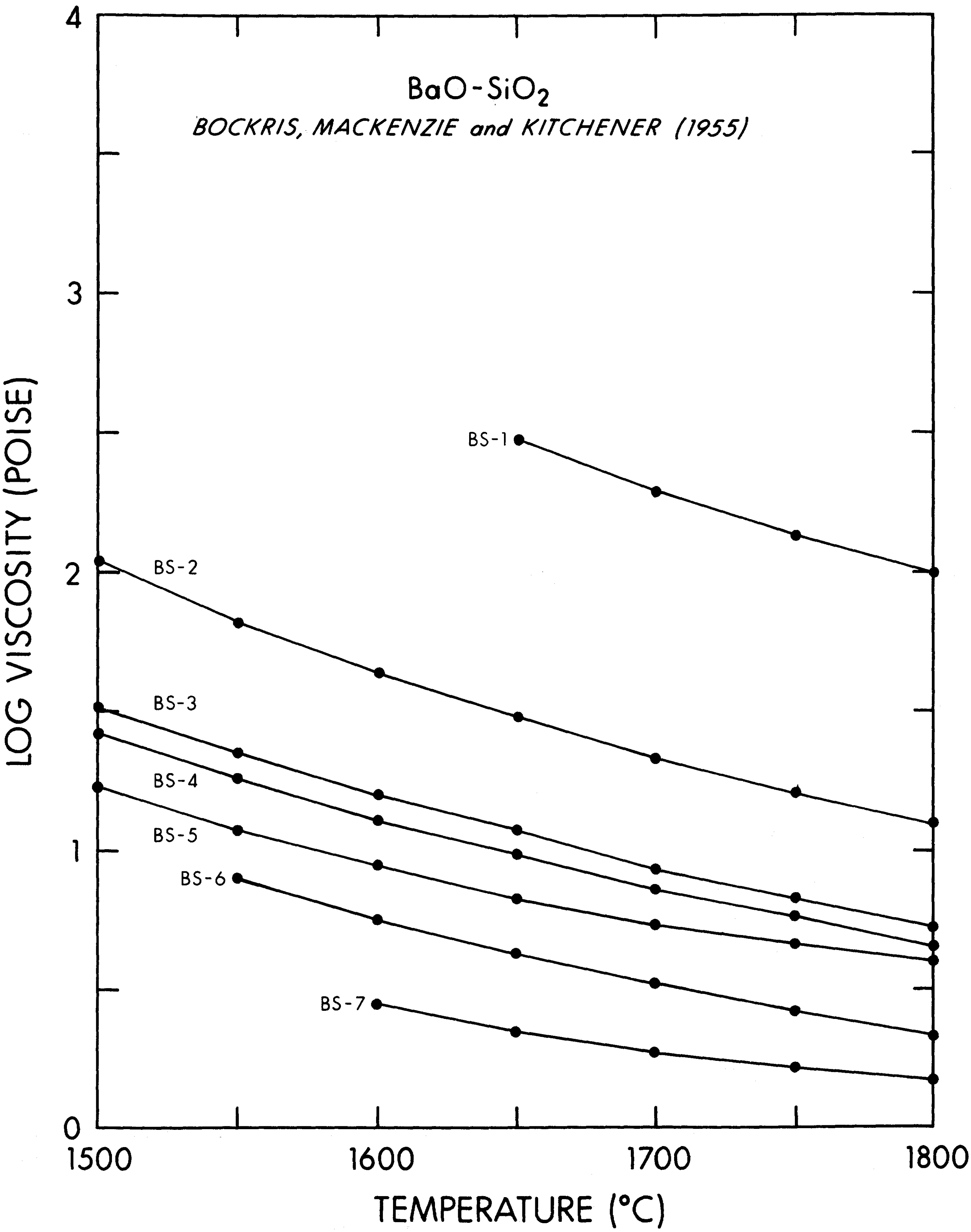
T	Z	LN(N)	LOG(N)	N
1550.00	5.485	2.072	0.900	7.94
1600.00	5.339	1.726	0.725	5.62
1650.00	5.200	1.447	0.628	4.25
1700.00	5.068	1.197	0.529	3.31
1750.00	4.943	0.963	0.418	2.62
1800.00	4.824	0.766	0.332	2.15

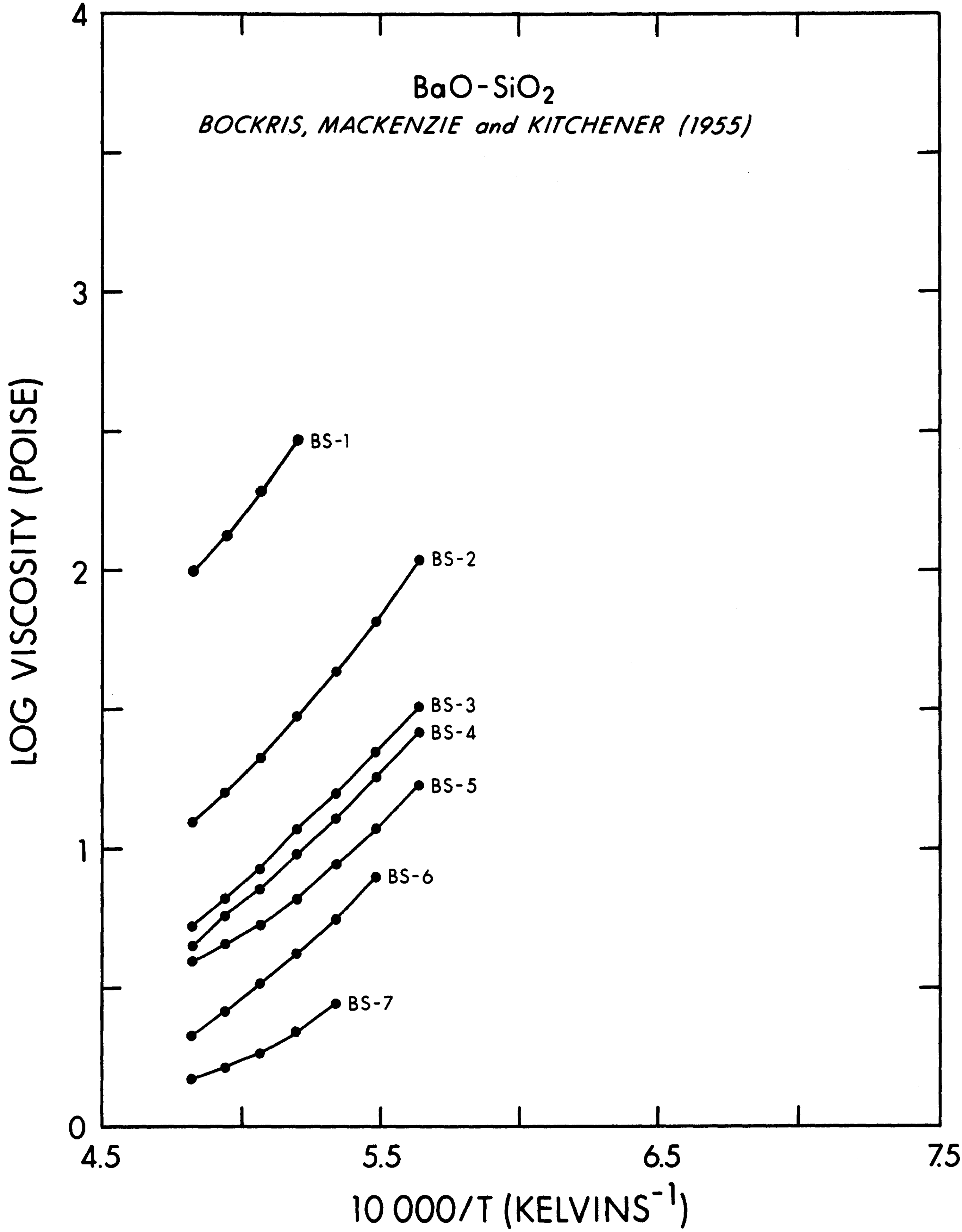
SYSTEM
BAO(49.8),SIO2(50.2) (X)
BAO(71.7),SIO2(28.3) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

BS-7

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	1.030	0.447	2.80
1650.00	5.200	0.798	0.346	2.22
1700.00	5.068	0.621	0.270	1.86
1750.00	4.943	0.495	0.215	1.64
1800.00	4.824	0.406	0.176	1.50


BaO-SiO2
BOCKRIS, MACKENZIE and KITCHENER (1955)
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
BS-1
BS-2
BS-3
BS-4
BS-5
BS-6
BS-7
0
1
2
3
4
1500
1600
1700
1800



BaO-SiO_2
BOCKRIS, MACKENZIE and KITCHENER (1955)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5
BS-1
BS-2
BS-3
BS-4
BS-5
BS-6
BS-7

SYSTEM
CAO(30.5),SIO2(69.5) (X)
CAO(29.0),SIO2(71.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-1

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	2.610	1.134	13.4
1750.00	4.943	2.342	1.017	10.4
1800.00	4.824	2.140	0.929	8.5

SYSTEM
CAO(34.6),SIO2(65.4) (X)
CAO(33.0),SIO2(67.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-2

T	Z	LN(N)	LOG(N)	N
1650.00	5.200	2.303	1.000	10.0
1700.00	5.068	2.054	0.892	7.8
1750.00	4.943	1.800	0.782	6.05
1800.00	4.824	1.504	0.653	4.5

SYSTEM
CAO(38.8),SIO2(61.2) (X)
CAO(37.2),SIO2(62.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-3

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	3.049	1.324	21.1
1500.00	5.640	2.667	1.158	14.4
1550.00	5.485	2.322	1.009	10.2
1600.00	5.339	1.988	0.863	7.30
1650.00	5.200	1.658	0.720	5.25
1700.00	5.068	1.366	0.593	3.92
1750.00	4.943	1.131	0.491	3.10

SYSTEM
CAO(38.8),SIO2(61.2) (X)
CAO(37.2),SIO2(62.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-4

T	Z	LN(N)	LOG(N)	N
1450.00	5,804	3,039	1.316	20.7
1500.00	5.640	2.639	1.146	14.0
1550.00	5.485	2.282	0.991	9.8
1600.00	5.339	1.960	0.851	7.10
1650.00	5.200	1.635	0.710	5.13
1700.00	5.068	1.369	0.594	3.93
1750.00	4.943	1.099	0.477	3.00
1800.00	4.824	0.916	0.398	2.5

SYSTEM
CAO(38.8),SIO2(61.2) (X)
CAO(37.2),SIO2(62.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-5

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	3.054	1.326	21.2
1500.00	5.640	2.639	1.146	14.0
1550.00	5.485	2.272	0.987	9.7
1600.00	5.339	1.960	0.851	7.10
1650.00	5.200	1.658	0.720	5.25
1700.00	5.068	1.361	0.591	3.90
1750.00	4.943	1.147	0.498	3.15

SYSTEM
CAO(41.6),SIO2(58.4) (X)
CAO(40.0),SIO2(60.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-6

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	2.235	0.971	9.35
1550.00	5.485	1.869	0.812	6.48
1600.00	5.339	1.543	0.670	4.68
1650.00	5.200	1.273	0.553	3.57
1700.00	5.068	1.012	0.439	2.75
1750.00	4.943	0.770	0.334	2.16
1800.00	4.824	0.588	0.255	1.8

SYSTEM
CAO(43.7),SIO2(56.3) (X)
CAO(47.0),SIO2(53.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-7

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	2.035	0.884	7.65
1550.00	5.485	1.723	0.748	5.60
1600.00	5.339	1.399	0.607	4.05
1650.00	5.200	1.082	0.470	2.95
1700.00	5.068	0.854	0.371	2.35
1750.00	4.943	0.668	0.290	1.95
1800.00	4.824	0.405	0.176	1.5

SYSTEM
CAO(48.7),SIO2(51.3) (X)
CAO(47.0),SIO2(53.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-8

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	1.470	0.638	4.35
1550.00	5.485	1.154	0.501	3.17
1600.00	5.339	0.880	0.382	2.41
1650.00	5.200	0.642	0.279	1.90
1700.00	5.068	0.405	0.176	1.50
1750.00	4.943	0.182	0.079	1.20
1800.00	4.824	-0.010	-0.004	0.99

SYSTEM
CAO(49.7),SIO2(50.3) (X)
CAO(48.0),SIO2(52.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-9

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	1.058	0.459	2.88
1600.00	5.339	0.779	0.338	2.18
1650.00	5.200	0.519	0.225	1.68
1700.00	5.068	0.285	0.124	1.33
1750.00	4.943	0.058	0.025	1.06
1800.00	4.824	-0.128	-0.056	0.88

SYSTEM
CAO(50.7),SIO2(49.3) (X)
CAO(49.0),SIO2(51.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-10

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	0.993	0.431	2.70
1600.00	5.339	0.703	0.301	2.00
1650.00	5.200	0.419	0.182	1.52
1700.00	5.068	0.174	0.076	1.19
1750.00	4.943	-0.030	-0.013	0.97
1800.00	4.824	-0.223	-0.097	0.8

SYSTEM
CAO(51.7),SIO2(48.3) (X)
CAO(50.0),SIO2(50.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-11

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	0.888	0.386	2.43
1600.00	5.339	0.593	0.258	1.81
1650.00	5.200	0.329	0.143	1.39
1700.00	5.068	0.104	0.045	1.11
1750.00	4.943	-0.105	-0.046	0.90
1800.00	4.824	-0.208	-0.125	0.75

SYSTEM
CAO(52.7),SIO2(47.3) (X)
CAO(51.0),SIO2(49.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

C S - 1 2

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	1.109	0.481	3.03
1550.00	5.485	0.788	0.342	2.20
1600.00	5.339	0.507	0.220	1.66
1650.00	5.200	0.247	0.107	1.28
1700.00	5.068	0.010	0.004	1.01
1750.00	4.943	-0.186	-0.081	0.83
1800.00	4.824	-0.329	-0.143	0.72

SYSTEM
CAO(53.7),SIO2(46.3) (X)
CAO(52.0),SIO2(48.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

C S-13

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	1.058	0.459	2.88
1550.00	5.485	0.747	0.324	2.11
1600.00	5.339	0.451	0.196	1.57
1650.00	5.200	0.182	0.079	1.20
1700.00	5.068	-0.041	-0.018	0.96
1750.00	4.943	-0.236	-0.102	0.79
1800.00	4.824	-0.416	-0.180	0.66

SYSTEM
CAO(54.7),SIO2(45.3) (X)
CAO(53.0),SIO2(47.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-14

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	0.944	0.410	2.57
1550.00	5.485	0.329	0.143	1.39
1600.00	5.339	0.336	0.146	1.40
1650.00	5.200	0.095	0.041	1.10
1700.00	5.068	-0.105	-0.046	0.90
1750.00	4.943	-0.288	-0.125	0.75
1800.00	4.824	-0.416	-0.180	0.66

SYSTEM
CAO(56.1),SIO2(43.9) (X)
CAO(54.5),SIO2(45.5) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-15

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	1.197	0.529	3.31
1500.00	5.640	0.871	0.378	2.39
1550.00	5.485	0.588	0.255	1.80
1600.00	5.339	0.329	0.143	1.39
1650.00	5.200	0.049	0.021	1.05
1700.00	5.068	-0.211	-0.092	0.81
1750.00	4.943	-0.386	-0.167	0.68
1800.00	4.824	-0.511	-0.222	0.60

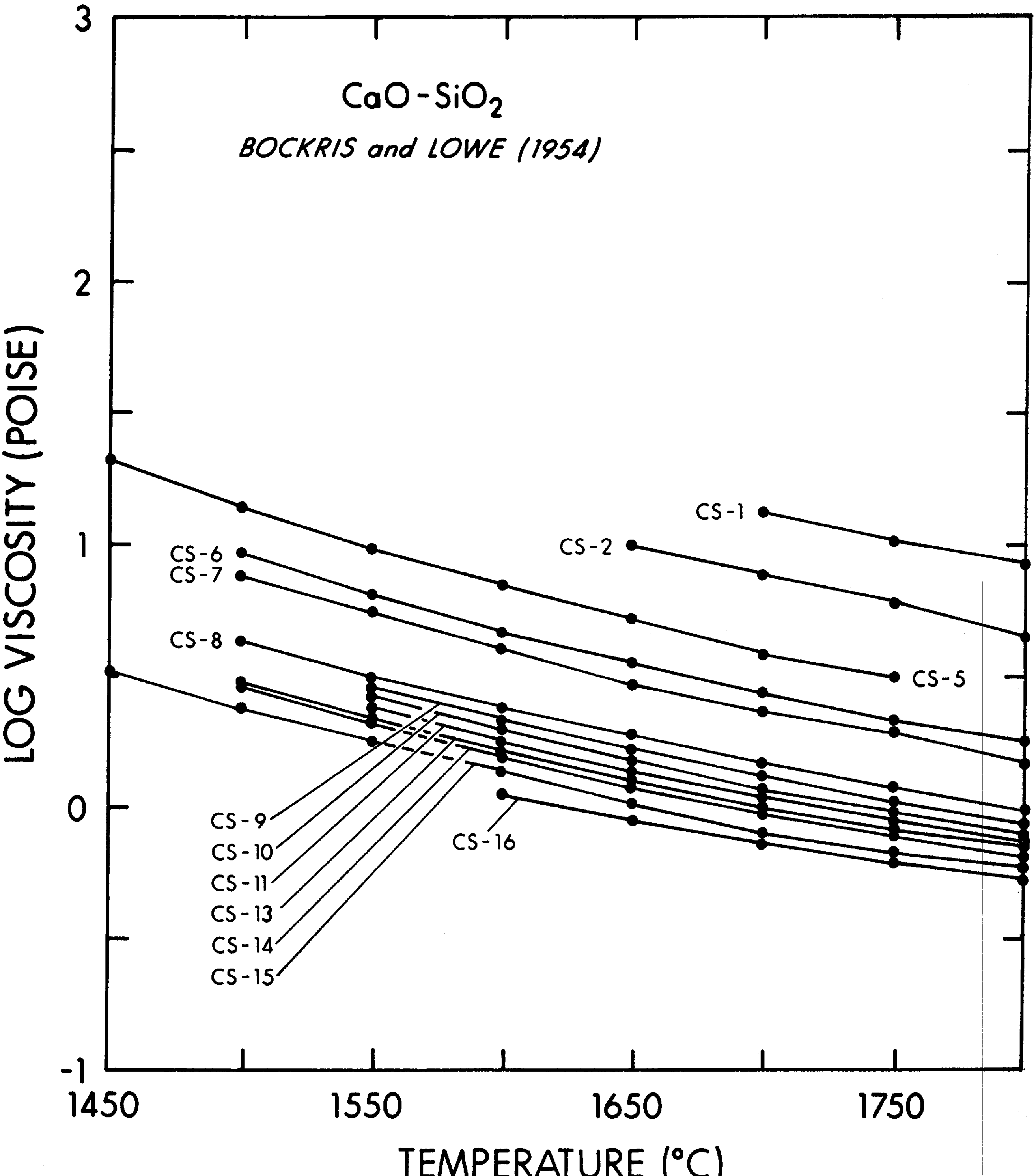
SYSTEM
CAO(57.6),SIO2(42.4) (X)
CAO(56.0),SIO2(44.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

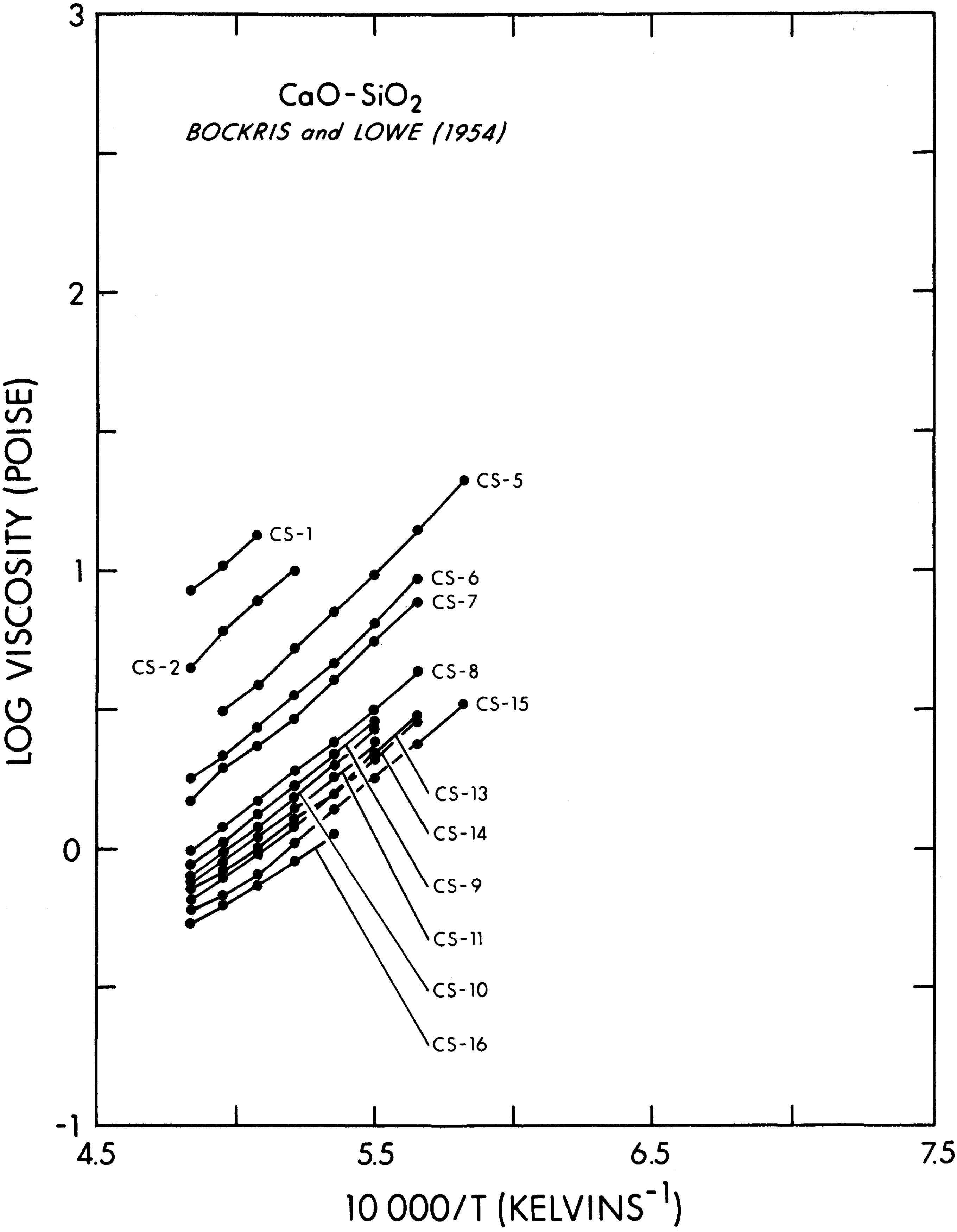
AUTHOR
BOCKRIS AND LOWE (1954)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-16

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	0.122	0.053	1.13
1650.00	5.200	-0.105	-0.046	0.90
1700.00	5.068	-0.301	-0.131	0.74
1750.00	4.943	-0.478	-0.208	0.62
1800.00	4.824	-0.616	-0.268	0.54


CaO-SiO2
BOCKRIS and LOWE (1954)
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
3
2
1
0
-1
1450
1550
1650
1750
CS-1
CS-2
CS-5
CS-6
CS-7
CS-8
CS-9
CS-10
CS-11
CS-13
CS-14
CS-15
CS-16


CaO-SiO2
BOCKRIS and LOWE (1954)
LOG VISCOSITY (POISE)
10 000/T (KELVINS-1)
3
2
1
0
-1
4.5
5.5
6.5
7.5
CS-1
CS-2
CS-5
CS-6
CS-7
CS-8
CS-15
CS-13
CS-14
CS-9
CS-11
CS-10
CS-16

SYSTEM
CAO(36.58),SIO2(63.42) (X)
CAO(35.0),SIO2(65.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-17

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	3.063	1.330	21.4

SYSTEM
CAO(42.0),SIO2(58.0) (X)
CAO(40.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-18

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.667	1.158	14.4
1500.00	5.640	2.196	0.954	8.99

SYSTEM
CAO(56.71),SIO2(43.29) (X)
CAO(55.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CS-19

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	0.846	0.367	2.33

SYSTEM
FEO(55.5),SIO2(44.5) (X)
FEO(59.9),SIO2(40.1) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-1

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	1.649	0.716	5.2
1250.00	6.566	1.065	0.462	2.9
1300.00	6.357	0.405	0.176	1.5
1350.00	6.161	0.336	0.146	1.4
1400.00	5.977	0.262	0.114	1.3
1450.00	5.804	0.182	0.079	1.2

SYSTEM
FEO(56.9),SIO2(43.1) (X)
FEO(61.2),SIO2(38.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-2

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	1.308	0.568	3.7
1250.00	6.566	0.742	0.322	2.1
1300.00	6.357	-0.105	-0.046	0.9
1350.00	6.161	-1.609	-0.699	0.2

SYSTEM
FEO(59.4),SIO2(40.6) (X)
FEO(63.6),SIO2(36.4) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-3

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	0.642	0.279	1.9
1300.00	6.357	0.095	0.041	1.1

SYSTEM
FEO(60.8),SIO2(39.2) (X)
FEO(65.0),SIO2(35.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-4

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	1.749	0.760	5.75
1250.00	6.566	0.588	0.255	1.8
1300.00	6.357	0.470	0.204	1.6
1350.00	6.161	0.336	0.146	1.4

SYSTEM
FEO(61.0),SIO2(39.0) (X)
FEO(65.2),SIO2(34.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-5

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	0.405	0.176	1.5
1400.00	5.977	0.000	0.000	1.0

SYSTEM
FEO(61.0),SIO2(39.0) (X)
FEO(65.2),SIO2(34.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-6

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	0.182	0.079	1.2
1300.00	6.357	0.095	0.041	1.1
1350.00	6.161	0.095	0.041	1.1
1400.00	5.977	0.000	0.000	1.0
1450.00	5.804	-0.105	-0.046	0.9

SYSTEM
FEO(62.0),SIO2(38.0) (X)
FEO(66.1),SIO2(33.9) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-7

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	0.405	0.176	1.5
1250.00	6.566	0.262	0.114	1.3
1300.00	6.357	0.182	0.079	1.2
1350.00	6.161	0.000	0.000	1.0
1400.00	5.977	-0.105	-0.046	0.9
1450.00	5.804	-0.223	-0.097	0.8

SYSTEM
FEO(63.0),SIO2(37.0) (X)
FEO(67.1),SIO2(32.9) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-8

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	-0.223	-0.097	0.8
1250.00	6.566	-0.357	-0.155	0.7
1300.00	6.357	-0.511	-0.222	0.6
1350.00	6.161	-0.511	-0.222	0.6
1400.00	5.977	-0.693	-0.301	0.5
1450.00	5.804	-0.916	-0.398	0.4

SYSTEM
FEO(65.5),SIO2(34.5) (X)
FEO(69.6),SIO2(30.4) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-9

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	-0.357	-0.155	0.7
1400.00	5.977	-0.916	-0.398	0.4

SYSTEM
FEO(65.5),SIO2(34.5) (X)
FEO(69.6),SIO2(30.4) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-10

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	-0.105	-0.046	0.9
1250.00	6.566	-0.223	-0.097	0.8
1300.00	6.357	-0.357	-0.155	0.7
1350.00	6.161	-0.511	-0.222	0.6
1400.00	5.977	-0.511	-0.222	0.6
1450.00	5.804	-0.693	-0.301	0.5

SYSTEM
FEO(66.1),SIO2(33.9) (X)
FEO(70.0),SIO2(30.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-11

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	0.875	0.380	2.4
1250.00	6.566	0.668	0.290	1.95
1300.00	6.357	0.262	0.114	1.3

SYSTEM
FEO(66.8),SIO2(33.2) (X)
FEO(70.6),SIO2(29.4) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-12

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	1.856	0.806	6.4
1250.00	6.566	0.916	0.398	2.5
1300.00	6.357	0.742	0.322	2.1
1350.00	6.161	0.588	0.255	1.8

SYSTEM
FEO(68.5),SIO2(31.5) (X)
FEO(72.2),SIO2(27.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-13

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	-0.105	-0.046	0.9
1300.00	6.357	-0.105	-0.046	0.9
1350.00	6.161	-0.223	-0.097	0.8
1400.00	5.977	-0.357	-0.155	0.7
1450.00	5.804	-0.357	-0.155	0.7

SYSTEM
FEO(70.0),SIO2(30.0) (X)
FEO(73.6),SIO2(26.4) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-14

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	0.336	0.146	1.4
1400.00	5.977	-0.357	-0.155	0.7

SYSTEM
FEO(71.5),SIO2(28.5) (X)
FEO(75.0),SIO2(25.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-15

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	0.113	0.049	1.12
1250.00	6.566	0.000	0.000	1.00
1300.00	6.357	-0.357	-0.155	0.7
1350.00	6.161	-0.799	-0.347	0.45

SYSTEM
FEO(71.5),SIO2(28.5) (X)
FEO(75.0),SIO2(25.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND KAMMEL (1956)
DERIVED FROM TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-16

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	-0.105	-0.046	0.9
1250.00	6.566	-0.223	-0.097	0.8
1300.00	6.357	-0.511	-0.222	0.6
1350.00	6.161	-0.693	-0.301	0.5
1400.00	5.977	-0.916	-0.398	0.4
1450.00	5.804	-1.204	-0.523	0.3

SYSTEM
FEO(73.0),SIO2(27.0) (X)
FEO(76.4),SIO2(23.6) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND
KAMMEL (1956)
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-17

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	-0.223	-0.097	0.8
1400.00	5.977	-0.511	-0.222	0.6

SYSTEM
FEO(77.5),SIO2(22.5) (X)
FEO(80.5),SIO2(19.5) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND
KAMMEL (1956)
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-18

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	-0.693	-0.301	0.5
1400.00	5.977	-0.916	-0.398	0.4

SYSTEM
FEO(79.5),SIO2(20.5) (X)
FEO(82.3),SIO2(17.7) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND
KAMMEL (1956)
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

FS-19

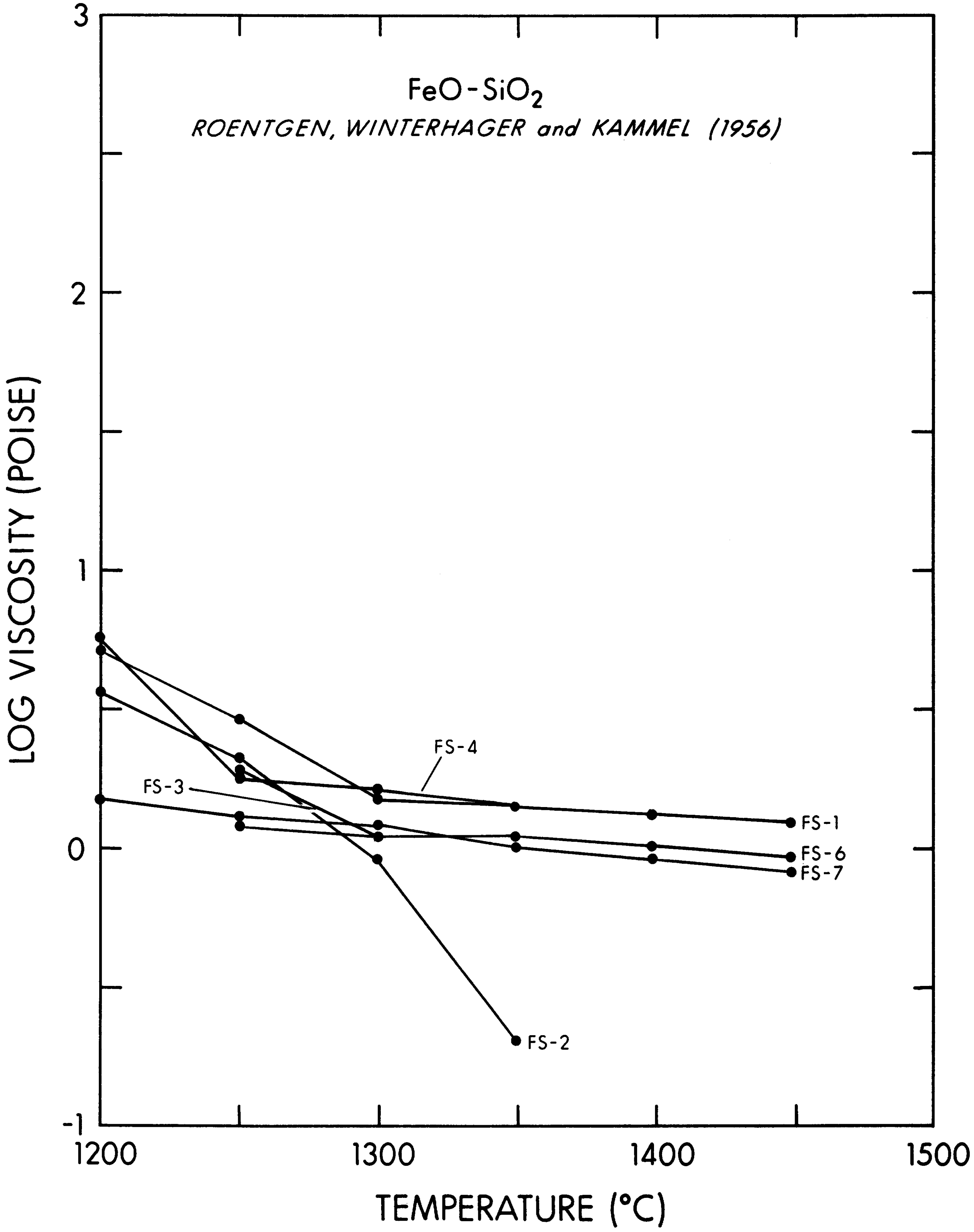
T	Z	LN(N)	LOG(N)	N
1250.00	6.566	-0.693	-0.301	0.5
1300.00	6.357	-0.916	-0.398	0.4
1350.00	6.161	-0.916	-0.398	0.4
1400.00	5.977	-1.204	-0.523	0.3
1450.00	5.804	-1.609	-0.699	0.2

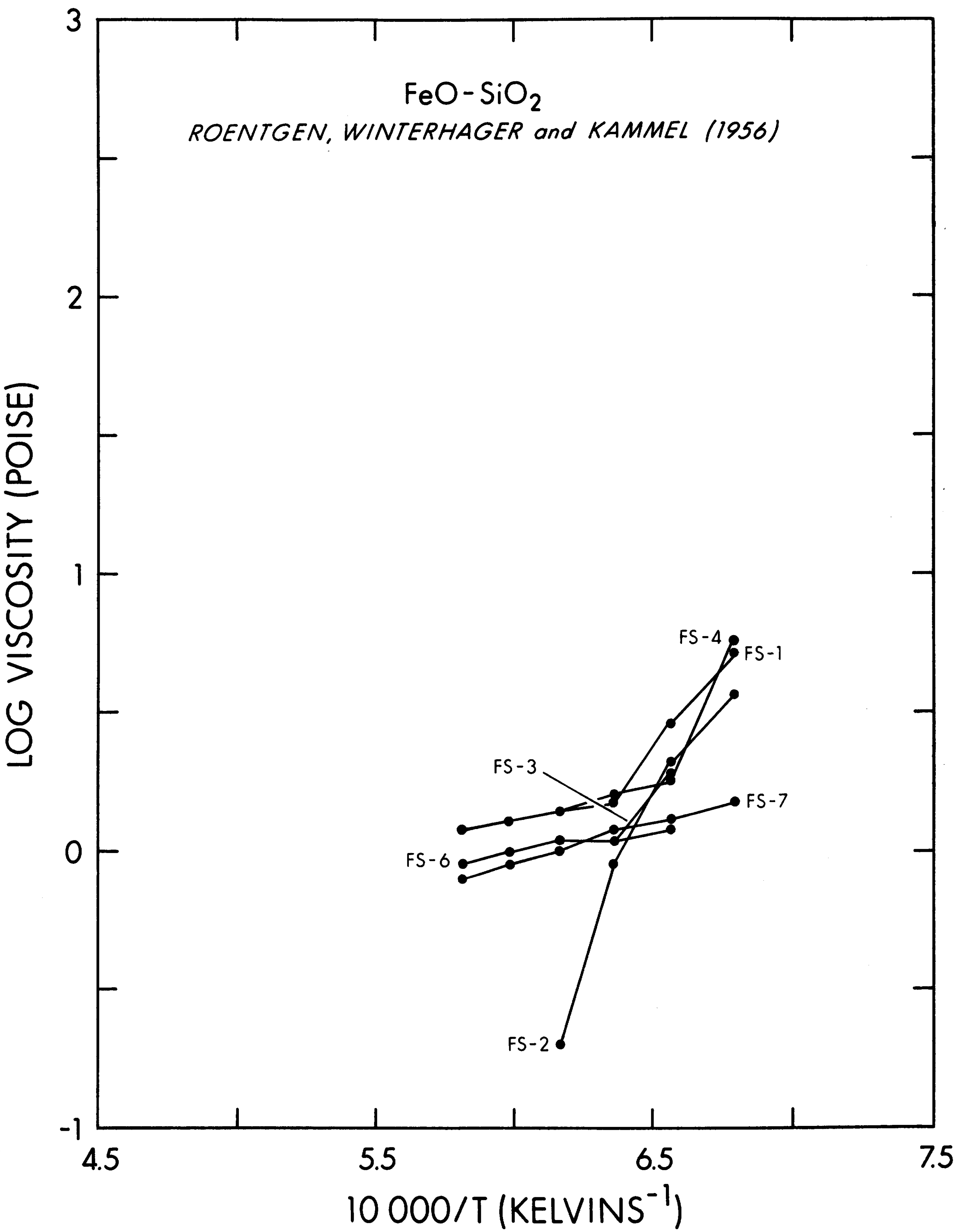
SYSTEM
FEO(91.0),SIO2(9.0) (X)
FEO(92.4),SIO2(7.6) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
ROENTGEN, WINTERHAGER AND
KAMMEL (1956)
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

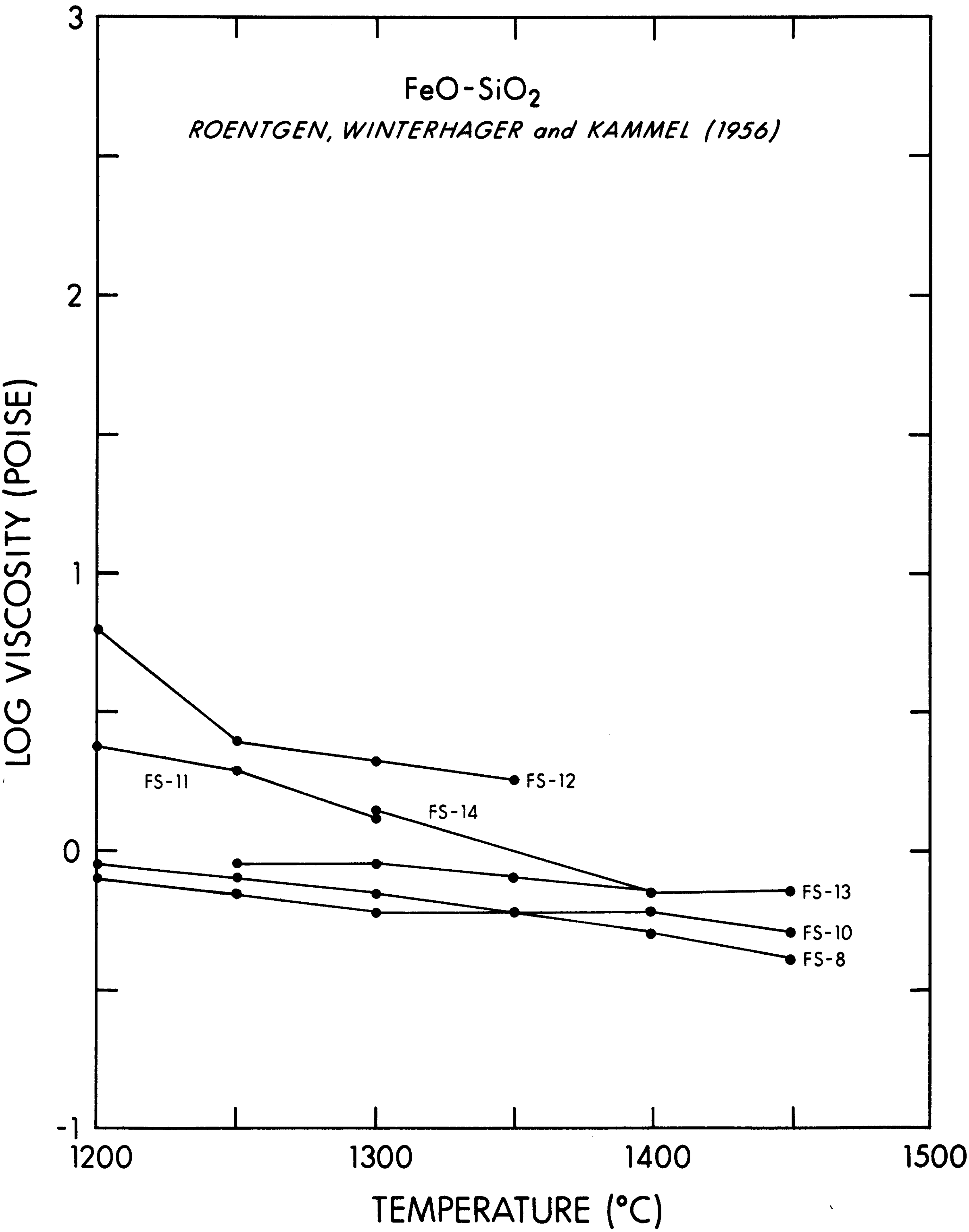
FS-20

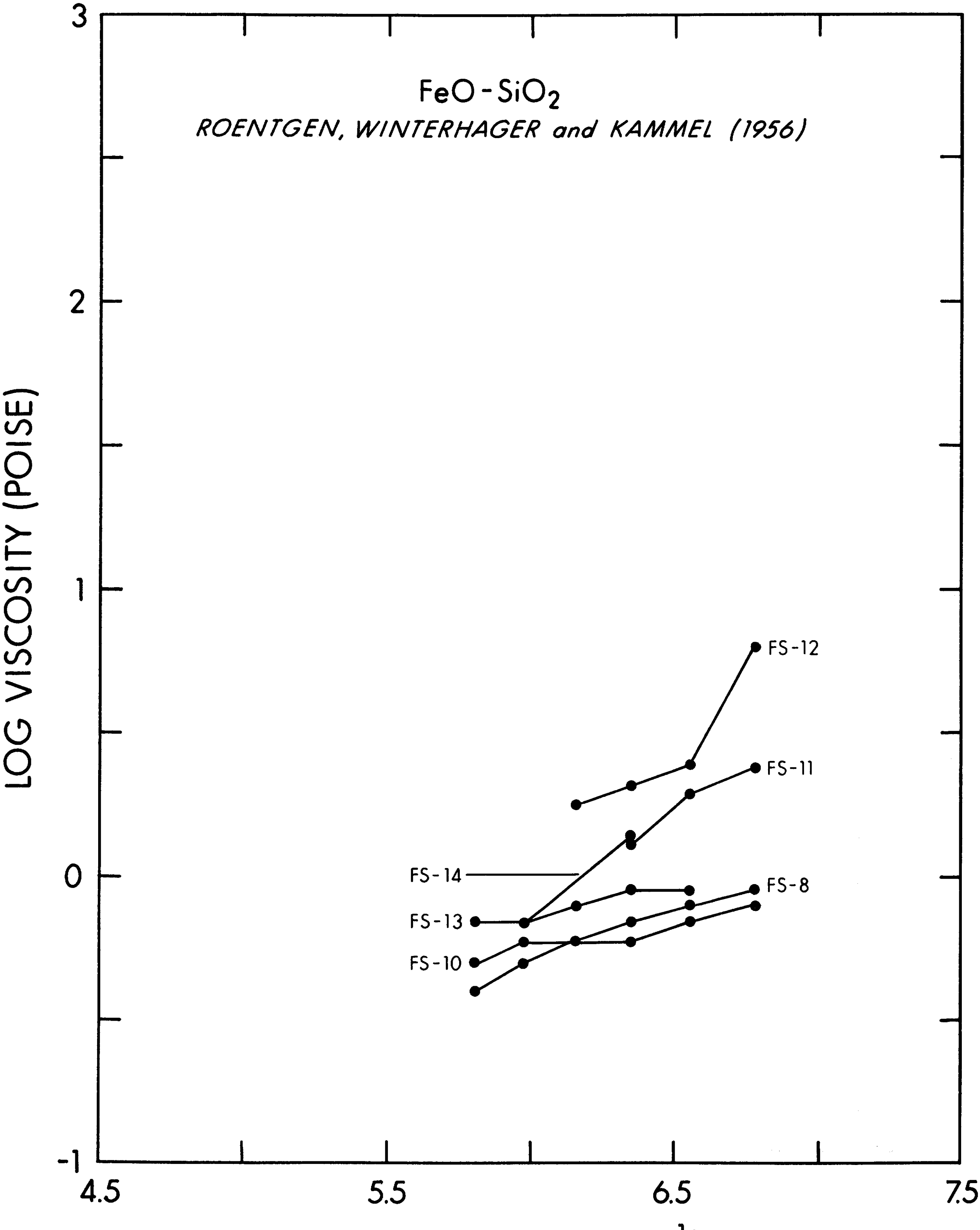
T	Z	LN(N)	LOG(N)	N
1200.00	6.789	2.477	1.076	11.9
1250.00	6.566	-0.916	-0.398	0.4
1300.00	6.357	-0.916	-0.398	0.4
1350.00	6.161	-1.204	-0.523	0.3
1400.00	5.977	-1.609	-0.699	0.2
1450.00	5.804	-2.303	-1.000	0.1

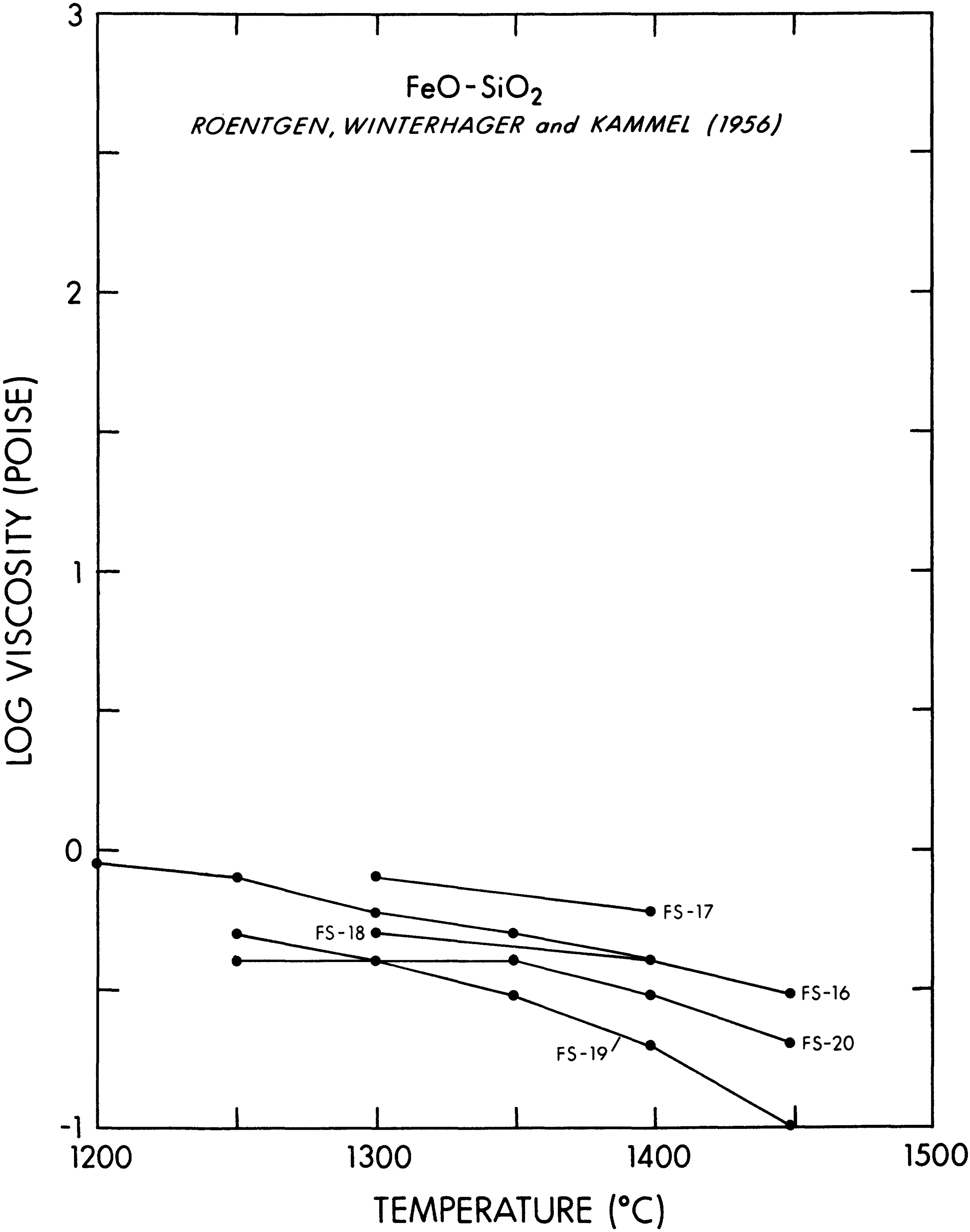

FeO-SiO2
ROENTGEN, WINTERHAGER and KAMMEL (1956)
LOG VISCOSITY (POISE)
3
2
1
0
-1
1200
1300
1400
1500
TEMPERATURE (°C)
FS-4
FS-3
FS-1
FS-6
FS-7
FS-2



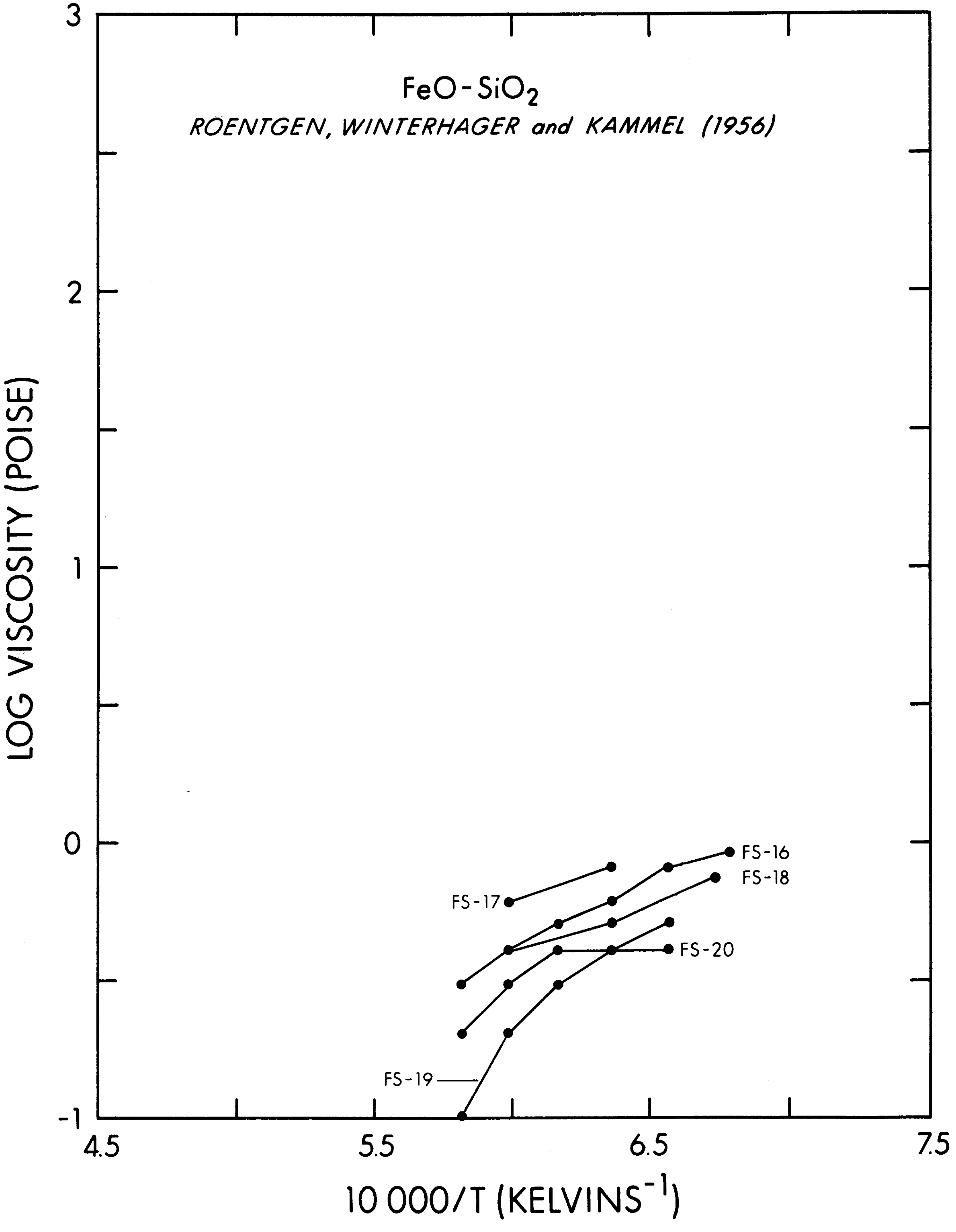
FeO - SiO2
ROENTGEN, WINTERHAGER and KAMMEL (1956)
LOG VISCOSITY (POISE)
10 000/T (KELVINS-1)
3
2
1
0
-1
4.5
5.5
6.5
7.5
FS-4
FS-1
FS-3
FS-7
FS-6
FS-2


FeO-SiO2
ROENTGEN, WINTERHAGER and KAMMEL (1956)
LOG VISCOSITY (POISE)
3
2
1
0
-1
FS-11
FS-12
FS-14
FS-13
FS-10
FS-8
1200
1300
1400
1500
TEMPERATURE (°C)


FeO - SiO2
ROENTGEN, WINTERHAGER and KAMMEL (1956)
FS-12
FS-11
FS-14
FS-8
FS-13
FS-10
LOG VISCOSITY (POISE)
3
2
1
0
-1
4.5
5.5
6.5
7.5
10 000/T KELVINS-1)



FeO - SiO2
ROENTGEN, WINTERHAGER and KAMMEL (1956)
3
2
1
0
-1
LOG VISCOSITY (POISE)
1200
1300
1400
1500
TEMPERATURE (°C)
FS-17
FS-18
FS-16
FS-20
FS-19


FeO-SiO2
ROENTGEN, WINTERHAGER and KAMMEL (1956)
LOG VISCOSITY (POISE)
3
2
1
0
-1
4.5
5.5
6.5
7.5
10 000/T (KELVINS-1)
FS-16
FS-18
FS-17
FS-20
FS-19

SYSTEM
K2O(2.5),SIO2(97.5) (X)
K2O(3.9),SIO2(96.1) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

KS-1

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	8.451	3.670	4680.
1650.00	5.200	7.897	3.430	2690.
1700.00	5.068	7.484	3.250	1780.
1750.00	4.943	7.140	3.100	1260.

SYSTEM
K2O(6.3),SIO2(93.7) (X)
K2O(9.5),SIO2(90.5) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

KS-2

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	8.152	3.540	3470.
1550.00	5.485	7.438	3.230	1700.
1600.00	5.339	6.976	3.029	1070.
1650.00	5.200	6.585	2.860	724.
1700.00	5.068	6.286	2.730	537.

SYSTEM
K2O(10.8),SIO2(89.2) (X)
K2O(15.9),SIO2(84.1) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

KS-3

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	7.528	3.270	1860.
1400.00	5.977	7.073	3.072	1180.
1450.00	5.804	6.632	2.880	759.
1500.00	5.604	6.263	2.720	525.
1550.00	5.485	5.849	2.540	347.
1600.00	5.339	5.481	2.380	240.

SYSTEM
K2O(16.9),SIO2(83.1) (X)
K2O(24.2),SIO2(75.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

KS-4

T	Z	LN(N)	LOG(N)	N
1100.00	7.283	8.865	3.850	7080.
1150.00	7.027	8.474	3.680	4790.
1200.00	6.789	7.714	3.350	2240.
1250.00	6.566	7.230	3.140	1380.
1300.00	6.357	6.724	2.92	832.
1350.00	6.161	6.562	2.850	708.
1400.00	5.977	5.872	2.550	355.

SYSTEM
K2O(22.3),SIO2(77.7) (X)
K2O(31.1),SIO2(68.9) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

KS-5

T	Z	LN(N)	LOG(N)	N
1100.00	7.293	8.383	3.641	4370.
1150.00	7.027	7.808	3.391	2460.
1200.00	6.789	7.251	3.149	1410.
1250.00	6.566	6.746	2.930	851.
1300.00	6.357	6.286	2.730	537.
1350.00	6.161	5.826	2.530	339.
1400.00	5.977	5.434	2.360	229.

SYSTEM
K2O(25.6),SIO2(74.4) (X)
K2O(35.2),SIO2(64.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

KS-6

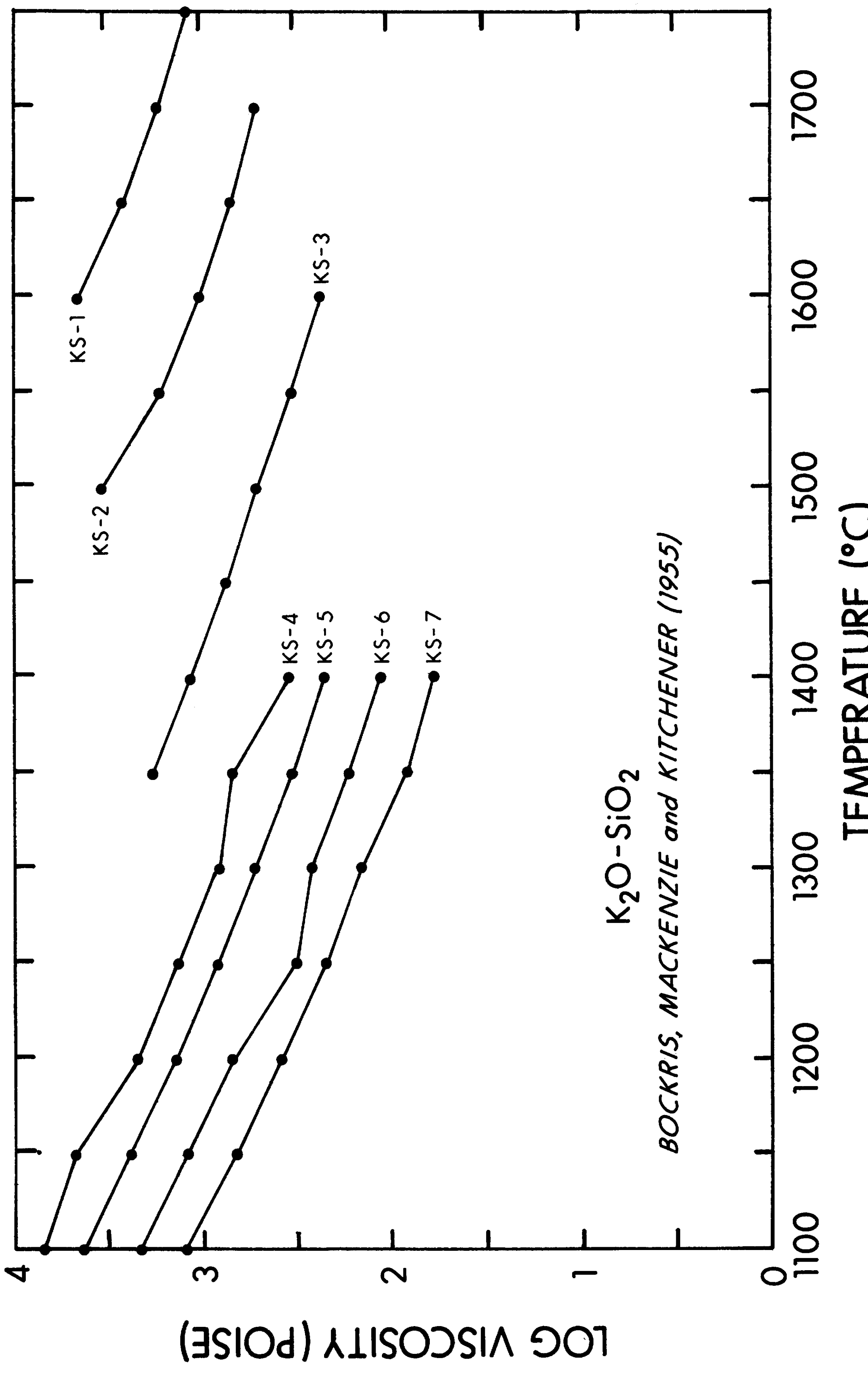
T	Z	LN(N)	LOG(N)	N
1100.00	7.283	7.692	3.340	2190.
1150.00	7.027	7.115	3.090	1230.
1200.00	6.789	6.562	2.850	708.
1250.00	6.566	5.781	2.511	324.
1300.00	6.357	5.595	2.430	269.
1350.00	6.161	5.136	2.231	170.
1400.00	5.977	4.745	2.061	115.

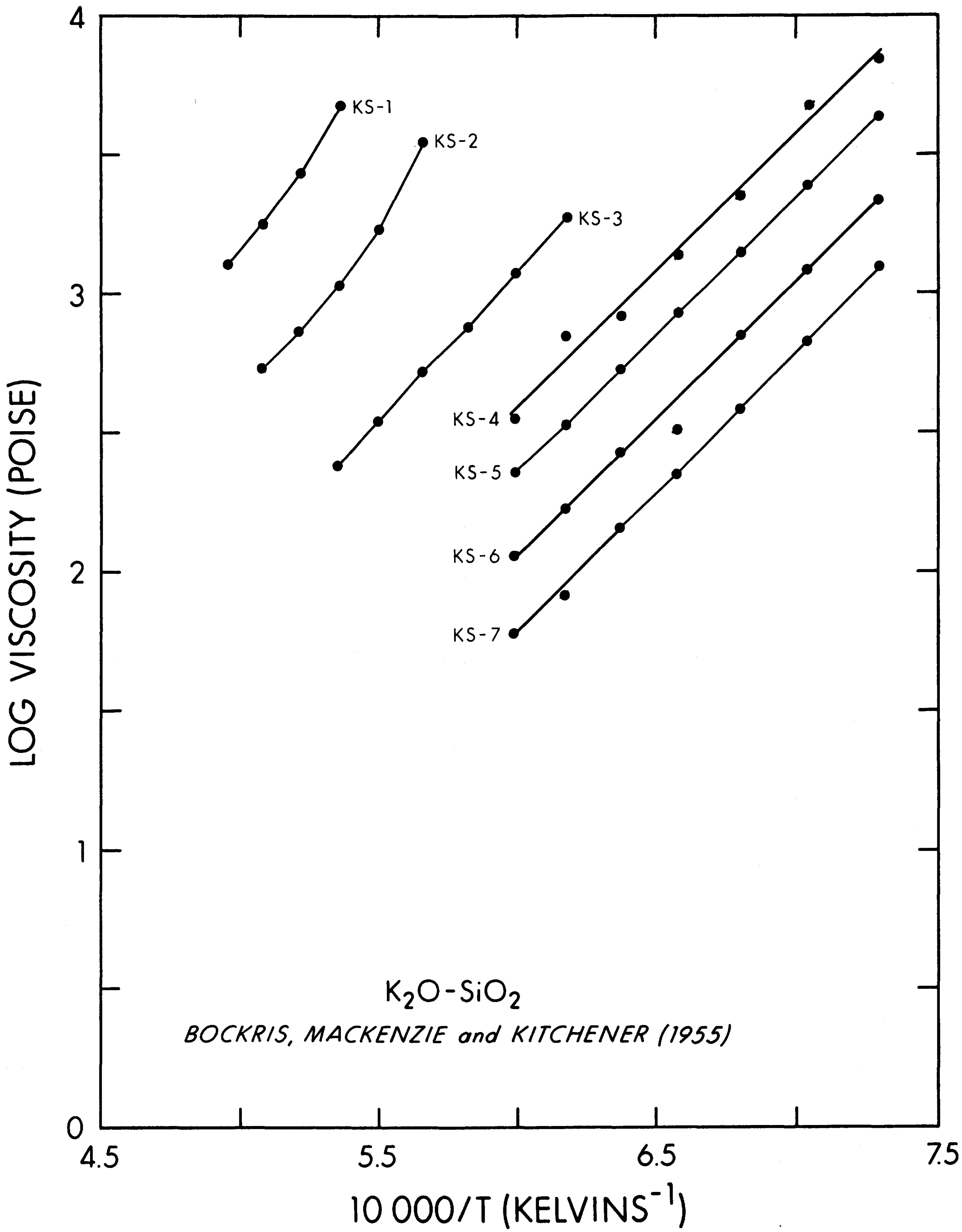
SYSTEM
K2O(33.4),SIO2(66.6) (X)
K2O(48.0),SIO2(56.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

KS-7

T	Z	LN(N)	LOG(N)	N
1100.00	7.283	7.139	3.100	1260.
1150.00	7.027	6.516	2.830	676.
1200.00	6.789	5.966	2.591	390.
1250.00	6.566	5.412	2.350	224.
1300.00	6.357	4.077	2.161	145.
1350.00	6.161	4.421	1.920	83.2
1400.00	5.977	4.099	1.780	60.3


K$_2$O-SiO$_2$
BOCKRIS, MACKENZIE and KITCHENER (1955)
KS-1
KS-2
KS-3
KS-4
KS-5
KS-6
KS-7
TEMPERATURE (°C)
LOG VISCOSITY (POISE)
1100
1200
1300
1400
1500
1600
1700
0
1
2
3
4



4
3
2
1
0
4.5
5.5
6.5
7.5
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
KS-1
KS-2
KS-3
KS-4
KS-5
KS-6
KS-7
K_2O-SiO_2
BOCKRIS, MACKENZIE and KITCHENER (1955)

SYSTEM
LI2O(20.0),SIO2(80.0) (X)
LI2O(11.0),SIO2(89.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-1

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	5.25	2.28	191.
1450.00	5.804	4.88	2.12	132.
1500.00	5.640	4.54	1.97	93.3
1550.00	5.485	4.28	1.86	72.4
1600.00	5.339	3.89	1.69	49.0
1650.00	5.200	3.59	1.56	36.3
1700.00	5.068	3.31	1.44	27.3

SYSTEM
LI2O(25.0),SIO2(75.0) (X)
LI2O(14.2),SIO2(85.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-2

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	4.77	2.07	118.
1400.00	5.977	4.40	1.91	81.3
1450.00	5.804	4.03	1.75	56.2
1500.00	5.640	3.68	1.60	39.8
1550.00	5.485	3.36	1.47	28.8
1600.00	5.339	3.06	1.33	21.4

SYSTEM
LI2O(30.0),SIO2(70.0) (X)
LI2O(17.6),SIO2(82.4) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-3

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	4.745	2.061	115.
1250.00	6.566	4.352	1.890	77.6
1300.00	6.357	4.007	1.740	55.0
1350.00	6.161	3.661	1.590	38.9
1400.00	5.977	3.339	1.450	28.2
1450.00	5.804	3.040	1.320	20.9
1500.00	5.640	2.766	1.201	15.9

SYSTEM
LI2O(33.0),SIO2(67.0) (X)
LI2O(19.1),SIO2(80.9) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-4

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	4.812	2.090	123.
1200.00	6.789	4.398	1.910	81.3
1250.00	6.566	4.007	1.740	55.
1300.00	6.357	3.661	1.590	38.9
1350.00	6.161	3.314	1.439	27.5
1400.00	5.977	2.996	1.301	20.0
1450.00	5.804	2.715	1.179	15.1

SYSTEM
LI2O(35.0),SIO2(65.0) (X)
LI2O(21.1),SIO2(78.9) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-5

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	4.282	1.860	72.4
1200.00	6.789	3.892	1.690	49.0
1250.00	6.566	3.523	1.530	33.9
1300.00	6.357	3.203	1.391	24.6
1350.00	6.161	2.901	1.260	18.2
1400.00	5.977	2.603	1.130	13.5
1450.00	5.804	2.322	1.009	10.2
1500.00	5.640	2.063	0.896	7.87

SYSTEM
LI2O(40.0),SIO2(60.0) (X)
LI2O(25.0),SIO2(75.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-6

T	Z	LN(N)	LOG(N)	N
1150.00	7.028	3.570	1.550	35.5
1200.00	6.789	3.292	1.430	26.9
1250.00	6.566	2.996	1.301	20.0
1300.00	6.357	2.741	1.190	15.5
1350.00	6.161	2.510	1.090	12.3
1400.00	5.977	2.257	0.980	9.55
1450.00	5.804	2.049	0.890	7.76
1500.00	5.640	1.866	0.810	6.46

SYSTEM
LI2O(45.0),SIO2(55.0) (X)
LI2O(28.9),SIO2(71.1) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-7

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	2.187	0.950	8.91
1250.00	6.566	1.889	0.820	6.61
1300.00	6.357	1.635	0.710	5.13
1350.00	6.161	1.381	0.600	3.98
1400.00	5.977	1.128	0.490	3.09
1450.00	5.804	0.920	0.400	2.51
1500.00	5.640	0.693	0.301	2.00

SYSTEM
LI2O(50.0),SIO2(50.0) (X)
LI2O(33.2),SIO2(66.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-8

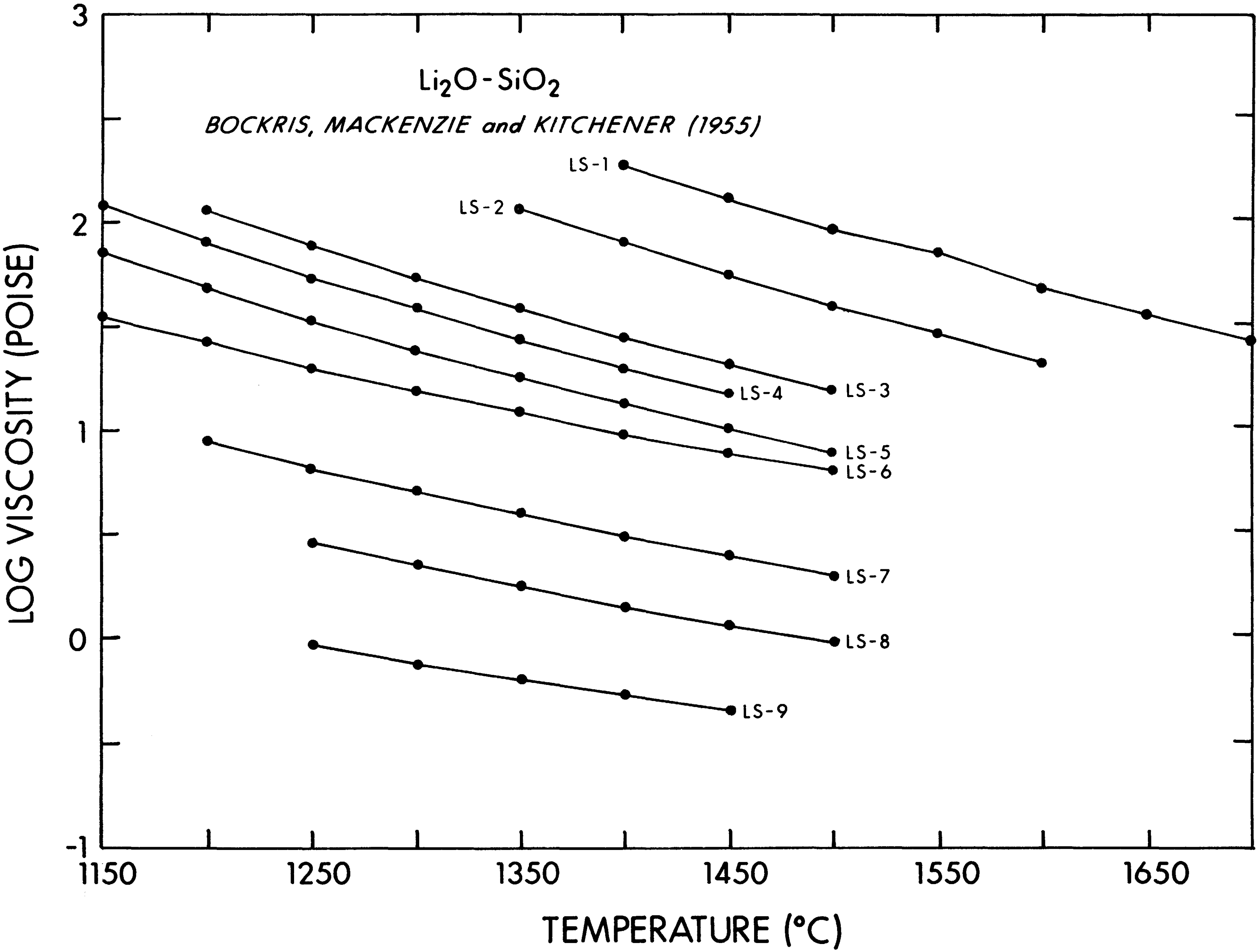
T	Z	LN(N)	LOG(N)	N
1250.00	6.566	1.058	0.459	2.88
1300.00	6.357	0.807	0.350	2.24
1350.00	6.161	0.577	0.250	1.78
1400.00	5.977	0.344	0.149	1.41
1450.00	5.804	0.140	0.061	1.15
1500.00	5.640	-0.041	-0.018	0.96

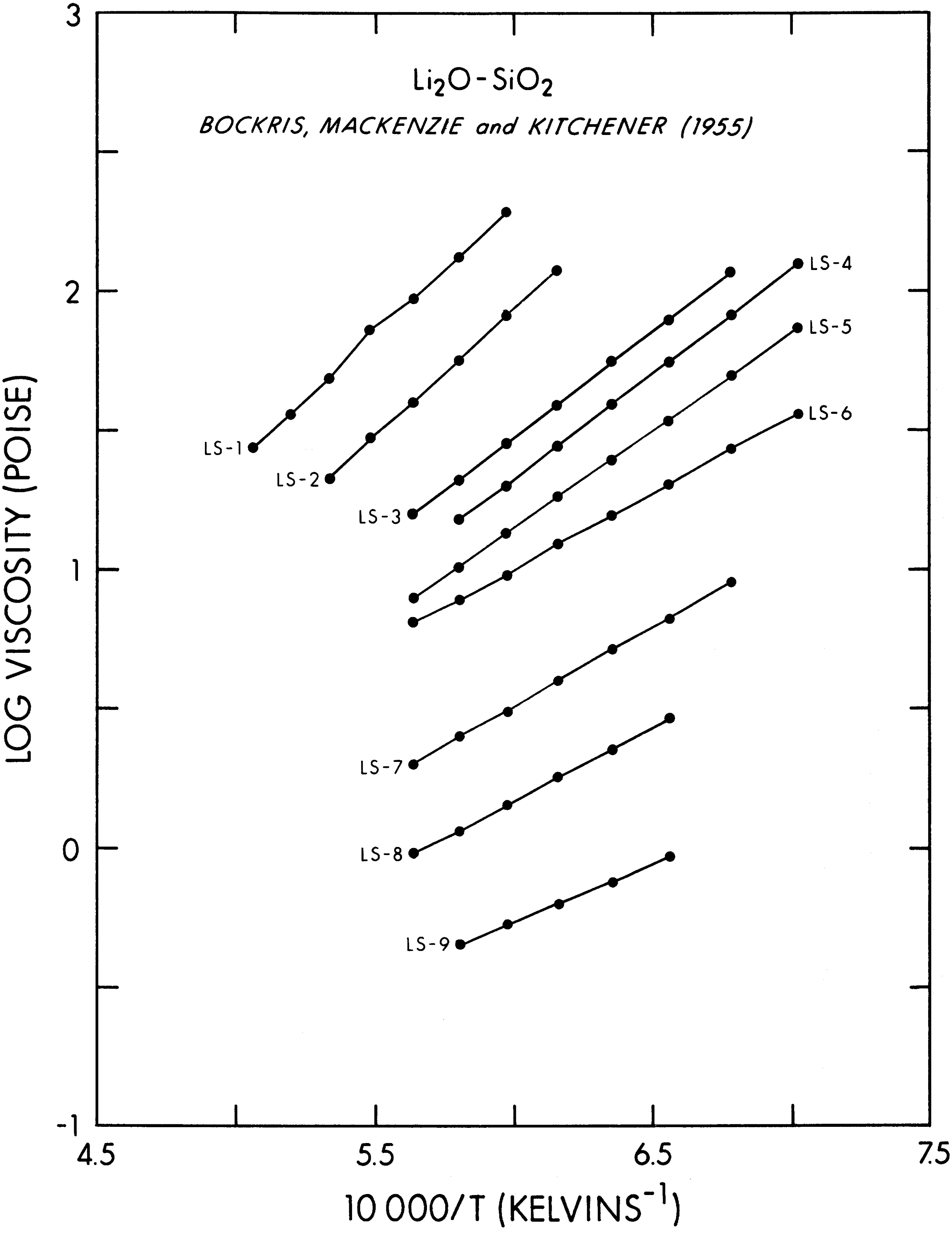
SYSTEM
LI2O(55.0),SIO2(45.0) (X)
LI2O(37.9),SIO2(62.1) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-9

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	-0.083	-0.036	0.92
1300.00	6.357	-0.288	-0.125	0.75
1350.00	6.161	-0.462	-0.201	0.63
1400.00	5.977	-0.635	-0.276	0.53
1450.00	5.804	-0.799	-0.347	0.45


Li2O-SiO2
BOCKRIS, MACKENZIE and KITCHENER (1955)
LS-1
LS-2
LS-3
LS-4
LS-5
LS-6
LS-7
LS-8
LS-9
LOG VISCOSITY (POISE)
3
2
1
0
-1
1150
1250
1350
1450
1550
1650
TEMPERATURE (°C)


Li$_2$O-SiO$_2$
BOCKRIS, MACKENZIE and KITCHENER (1955)
LS-1
LS-2
LS-3
LS-4
LS-5
LS-6
LS-7
LS-8
LS-9
LOG VISCOSITY (POISE)
3
2
1
0
-1
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})

SYSTEM
LI2O(21.5) - SIO2(78.5)
N (POISES)
T (DEGREES C)

AUTHOR
SHARTSIS, SPINNER AND CAPPS(1952)
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-10

T	Z	LN(N)	LOG(N)	N
1390.00	6.013	5.245	2.278	189.7
1347.00	6.173	5.600	2.431	269.8

SYSTEM
LI2O(22.9) - SIO2(77.1)
N (POISES)
T (DEGREES C)

AUTHOR
SHARTSIS, SPINNER AND CAPPS(1952)
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-11

T	Z	LN(N)	LOG(N)	N
1403.00	5.967	4.769	2.071	117.8
1300.00	6.238	5.588	2.427	267.3

SYSTEM
LI2O(28.6),SIO2(71.4) (X)
LI2O(12.0),SIO2(88.0) (%)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
SHARTSIS, SPINNER AND CAPPS (1952)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-12

T	Z	LN(N)	LOG(N)	N
1099.00	7.289	6.203	2.694	494.3
1200.00	6.789	5.305	2.304	201.4
1296.00	6.373	4.442	1.929	84.92
1400.00	5.977	3.652	1.586	38.55

SYSTEM
LI2O(30.3),SIO2(69.7) (X)
LI2O(17.8),SIO2(82.2) (%)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
SHARTSIS, SPINNER AND CAPPS (1952)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-13

T	Z	LN(N)	LOG(N)	N
1000.00	7.856	6.754	2.933	857.0
1048.00	7.570	6.208	2.696	496.6
1094.00	7.315	5.809	2.523	333.4
1143.00	7.062	5.420	2.354	225.9
1242.00	6.601	4.479	1.945	88.11
1288.00	6.406	4.066	1.766	58.35
1391.00	6.010	3.293	1.430	26.92

SYSTEM
LI2O(32.6),SIO2(67.4) (X)
LI2O(19.4),SIO2(80.6) (%)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
SHARTSIS, SPINNER AND CAPPS (1952)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-14

T	Z	LN(N)	LOG(N)	N
1102.00	7.273	5.358	2.327	212.3
1202.00	6.780	4.419	1.919	82.99
1302.00	6.350	3.675	1.596	39.45
1402.00	5.970	2.991	1.299	19.91

SYSTEM
LI2O(33.4),SIO2(66.6) (X)
LI2O(20.0),SIO2(80.0) (%)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
SHARTSIS, SPINNER AND CAPPS (1952)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-15

T	Z	LN(N)	LOG(N)	N
1109.00	7.236	5.181	2.250	177.8
1193.00	6.821	4.444	1.930	85.11
1290.00	6.398	3.643	1.582	38.19
1390.00	6.013	3.095	1.344	22.08

SYSTEM
LI2O(35.9),SIO2(64.1) (X)
LI2O(21.8),SIO2(78.2) (%()
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
SHARTSIS, SPINNER AND CAPPS (1952)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-16

T	Z	LN(N)	LOG(N)	N
1110.00	7.231	4.679	2.032	107.7
1204.00	6.771	3.827	1.662	45.92
1307.00	6.329	3.019	1.311	20.46
1401.00	5.074	2.480	1.077	11.94

SYSTEM
LI2O(38.7),SIO2(61.3) (X)
LI2O(23.9),SIO2(76.1) (%)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
SHARTSIS, SPINNER AND CAPPS (1952)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-17

T	Z	LN(N)	LOG(N)	N
1099.00	7.310	3.832	1.664	65.77
1195.00	6.812	3.581	1.555	35.89
1295.00	6.378	3.081	1.338	21.78
1386.00	6.028	2.056	0.893	7.816

SYSTEM
LI2O(41.3),SIO2(58.7) (X)
LI2O(27.8),SIO2(72.2) (%)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
SHARTSIS, SPINNER AND CAPPS (1952)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

LS-18

T	Z	LN(N)	LOG(N)	N
1095.00	7.310	3.832	1.664	46.13
1200.00	6.789	2.991	1.299	19.91
1296.00	6.374	2.342	1.017	10.40
1393.00	6.002	1.826	0.793	6.209

SYSTEM
MGO(44.3),SIO2(55.7) (X)
MGO(34.8),SIO2(65.2) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

MgS-1

T	Z	LN(N)	LOG(N)	N
1650.00	5.200	1.805	0.784	6.08
1700.00	5.068	1.533	0.666	4.63
1750.00	4.943	1.281	0.556	3.60
1800.00	4.824	1.040	0.452	2.83

SYSTEM
MGO(45.1),SIO2(54.9) (X)
MGO(35.5),SIO2(64.5) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

MgS-2

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	2.119	0.920	8.32
1600.00	5.339	1.780	0.780	6.03
1650.00	5.200	1.520	0.660	4.57
1700.00	5.068	1.308	0.568	3.7
1750.00	4.943	0.990	0.430	2.69
1800.00	4.824	0.737	0.320	2.09

SYSTEM
MGO(45.8),SIO2(54.2) (X)
MGO(36.2),SIO2(63.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

MgS-3

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	1.866	0.810	6.46
1600.00	5.339	1.558	0.677	4.75
1650.00	5.200	1.267	0.550	3.55
1700.00	5.068	0.967	0.420	2.63
1750.00	4.943	0.718	0.312	2.05
1800.00	4.824	0.588	0.255	1.80

SYSTEM
MGO(50.0),SIO2(50.0) (X)
MGO(40.1),SIO2(59.9) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Mg S- 4

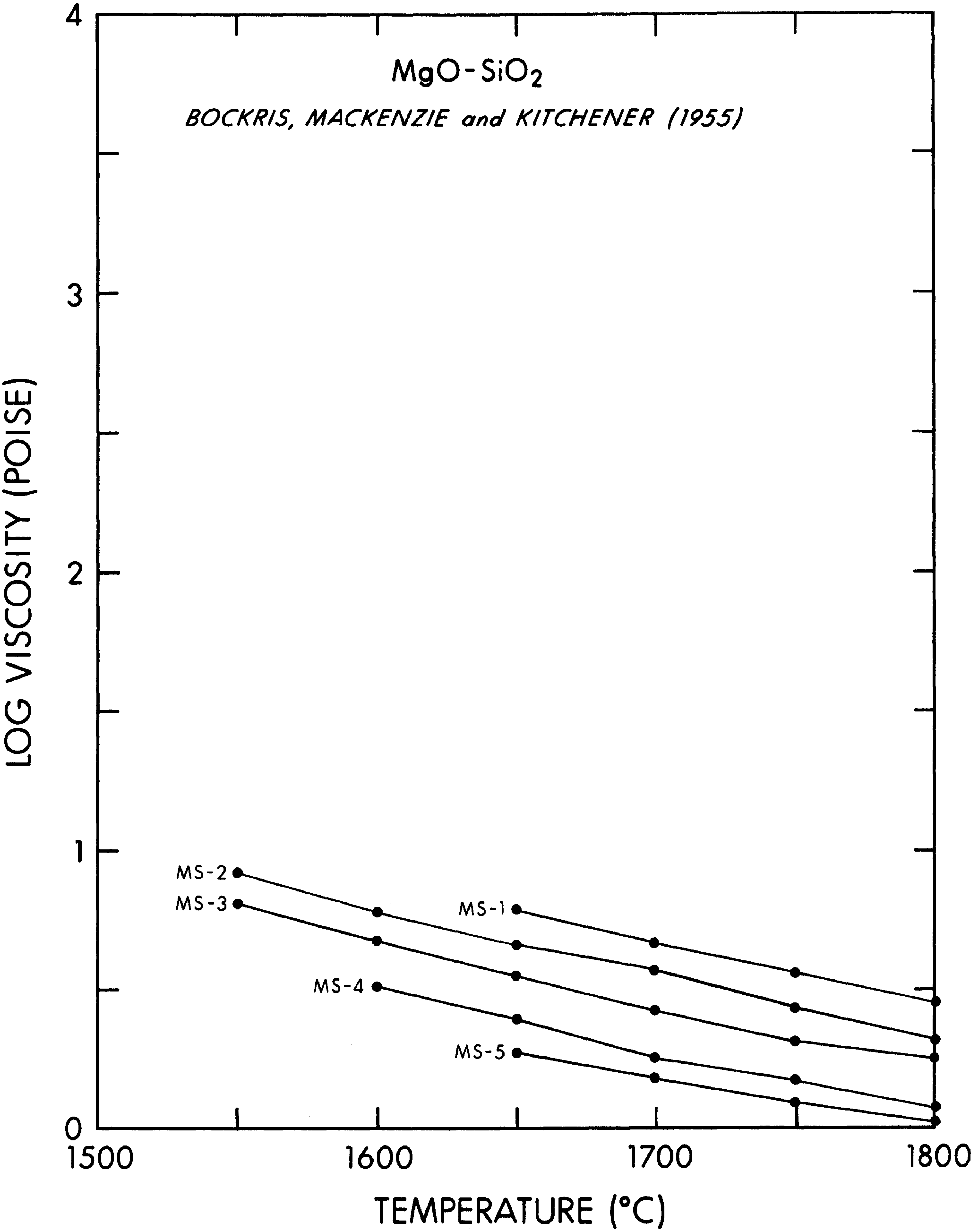
T	Z	LN(N)	LOG(N)	N
1600.00	5.339	1.151	0.509	3.16
1650.00	5.200	0.900	0.391	2.46
1700.00	5.068	0.582	0.253	1.79
1750.00	4.943	0.399	0.173	1.49
1800.00	4.824	0.166	0.072	1.18

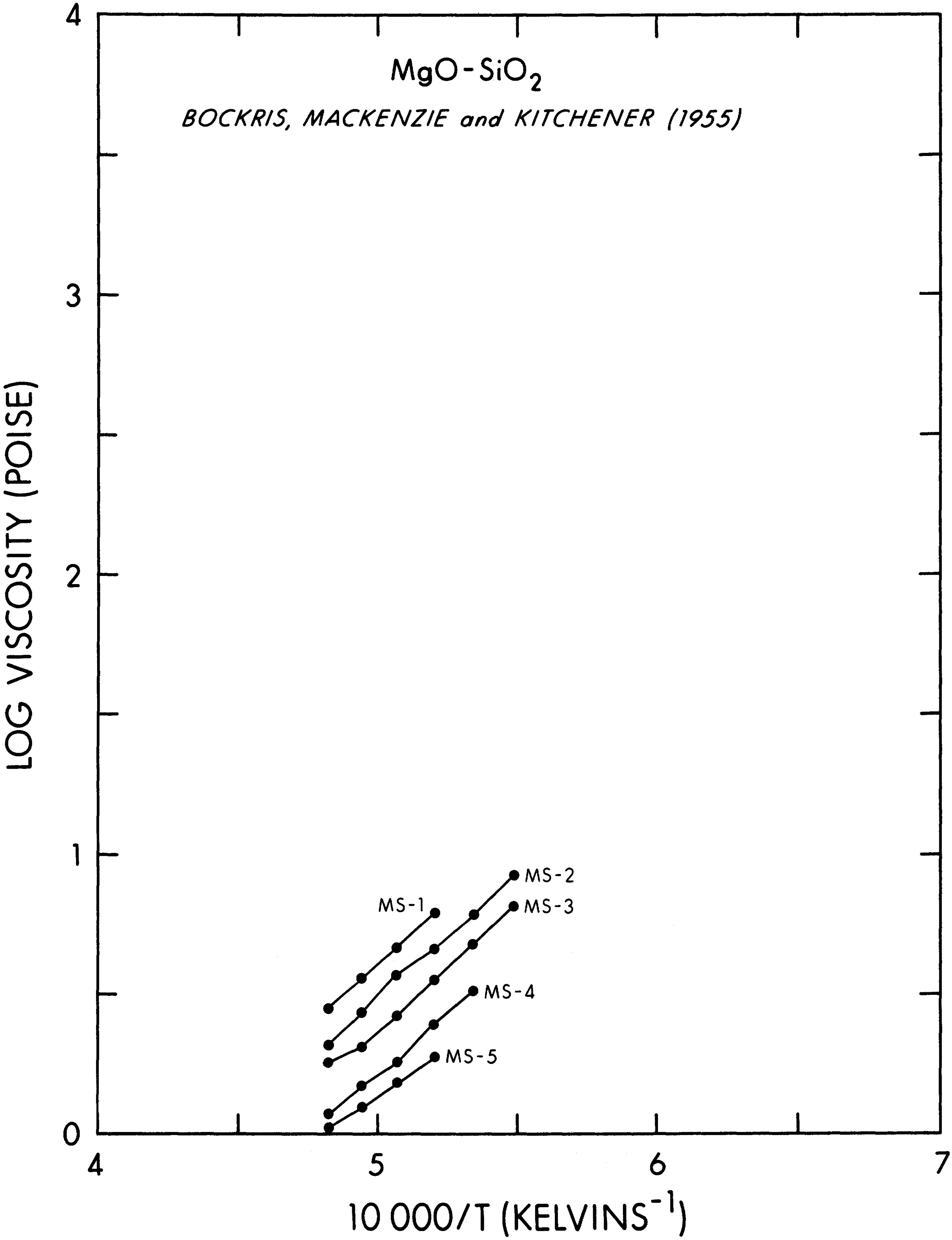
SYSTEM
MGO(51.4),SIO2(48.6) (X)
MGO(41.4),SIO2(58.6) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Mg S – 5

T	Z	LN(N)	LOG(N)	N
1650.00	5.200	0.631	0.274	1.88
1700.00	5.068	0.412	0.179	1.51
1750.00	4.943	0.215	0.093	1.24
1800.00	4.824	0.068	0.024	1.07


MgO-SiO2
BOCKRIS, MACKENZIE and KITCHENER (1955)
4
3
2
1
0
LOG VISCOSITY (POISE)
MS-1
MS-2
MS-3
MS-4
MS-5
1500
1600
1700
1800
TEMPERATURE (°C)


MgO - SiO2
BOCKRIS, MACKENZIE and KITCHENER (1955)
MS-1
MS-2
MS-3
MS-4
MS-5
LOG VISCOSITY (POISE)
10 000/T (KELVINS-1)
0
1
2
3
4
4
5
6
7

SYSTEM
MGO(50.0),SIO2(50.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
RIEBLING (1964)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

MgS-6

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	1.154	0.501	3.17

SYSTEM
NA2O(10.0),SIO2(90.0) (X)
NA2O(10.3),SIO2(89.7) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-1

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	6.06	2.63	427.
1600.00	5.339	5.62	2.44	275.
1650.00	5.200	5.20	2.26	182.
1700.00	5.068	4.81	2.10	123.
1750.00	4.943	4.44	1.93	85.1

SYSTEM
NA2O(15.0),SIO2(85.0) (X)
NA2O(15.4),SIO2(84.6) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-2

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	6.35	2.76	575.
1400.00	5.977	5.89	2.56	363.
1450.00	5.804	5.48	2.38	240.
1500.00	5.640	5.09	2.21	162.
1550.00	5.485	4.79	2.08	120.
1600.00	5.339	4.35	1.89	77.6

SYSTEM
NA2O(20.0),SIO2(80.0) (X)
NA2O(20.5),SIO2(79.5) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-3

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.87	2.55	355.
1300.00	6.357	5.41	2.35	224.
1350.00	6.161	5.02	2.18	151.
1400.00	5.977	4.61	2.00	100.
1450.00	5.804	4.26	1.85	70.8
1500.00	5.640	3.89	1.69	49.0

SYSTEM
NA2O(25.0),SIO2(75.0) (X)
NA2O(25.6),SIO2(74.4) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-4

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	6.38	2.77	589.
1200.00	6.789	5.919	2.571	372.
1250.00	6.566	5.481	2.380	240.
1300.00	6.357	5.069	2.201	159.
1350.00	6.161	4.673	2.029	107.
1400.00	5.977	4.352	1.890	77.6
1450.00	5.804	3.983	1.730	53.7
1500.00	5.680	3.661	1.590	38.9

SYSTEM
NA2O(27.0),SIO2(73.0) (X)
NA2O(27.6),SIO2(72.4) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-5

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	6.080	2.641	437.
1200.00	6.789	5.617	2.439	275.
1250.00	6.566	5.226	2.270	186.
1300.00	6.357	4.836	2.100	126.
1350.00	6.161	4.490	1.950	89.1
1400.00	5.977	4.122	1.790	61.7
1450.00	5.804	3.822	1.660	45.7
1500.00	5.640	3.523	1.530	33.9

SYSTEM
NA2O(30.0),SIO2(70.0) (X)
NA2O(30.7),SIO2(69.3) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-6

T	Z	LN(N)	LOG(N)	N
1100.00	7.283	6.240	2.710	513.
1150.00	7.027	5.756	2.500	316.
1200.00	6.789	5.298	2.301	200.
1250.00	6.566	4.860	2.111	129.
1300.00	6.357	4.467	1.940	87.1
1350.00	6.161	4.076	1.770	58.9
1400.00	5.977	3.731	1.620	41.7
1450.00	5.804	3.384	1.470	29.5

SYSTEM
NA2O(33.0),SIO2(67.0) (X)
NA2O(33.7),SIO2(66.3) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-7

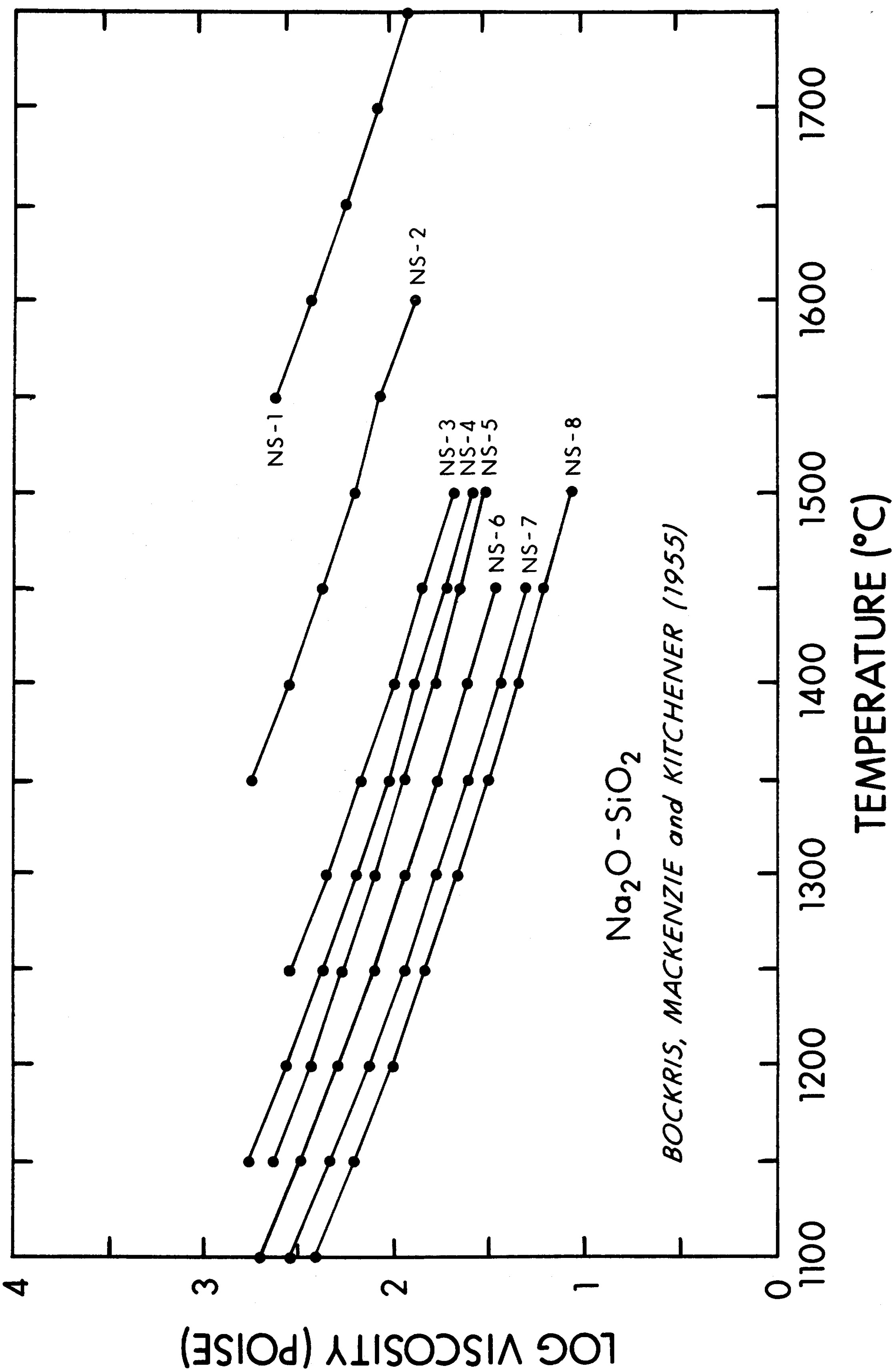
T	Z	LN(N)	LOG(N)	N
1100.00	7.283	5.869	2.549	354.
1150.00	7.027	5.389	2.340	219.
1200.00	6.789	4.905	2.130	135.
1250.00	6.566	4.467	1.940	87.1
1300.00	6.357	4.099	1.780	60.3
1350.00	6.161	3.706	1.610	40.7
1400.00	5.977	3.339	1.450	28.2
1450.00	5.804	1.310	3.016	20.4

SYSTEM
NA2O(35.0),SIO2(65.0) (X)
NA2O(35.8),SIO2(64.2) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

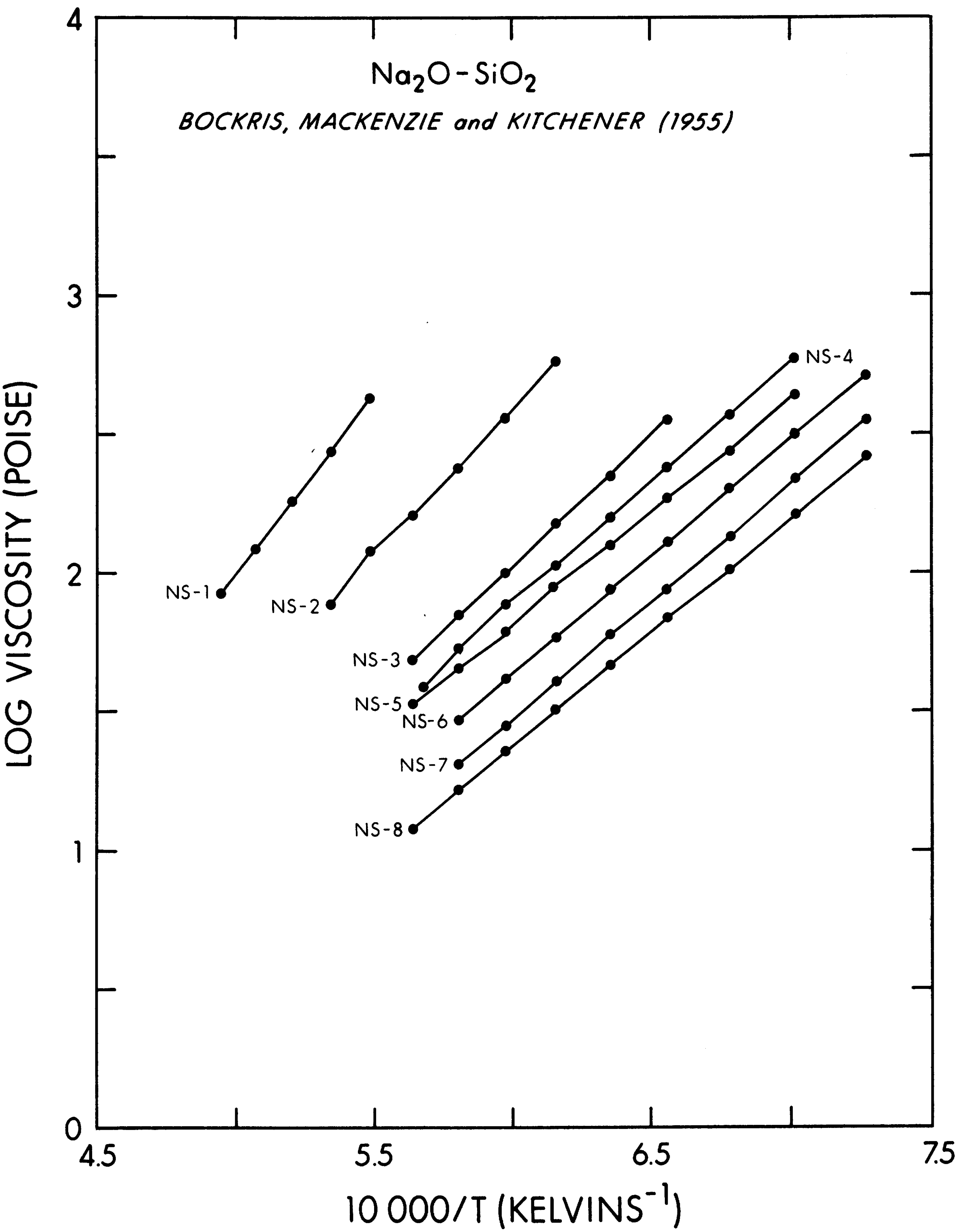
AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-8

T	Z	LN(N)	LOG(N)	N
1100.00	7.283	5.572	2.420	263.
1150.00	7.027	5.088	2.210	162.
1200.00	6.789	4.625	2.009	102.
1250.00	6.566	4.237	1.840	69.2
1300.00	6.357	3.846	1.670	46.8
1350.00	6.161	3.478	1.511	32.4
1400.00	5.977	3.131	1.360	22.9
1450.00	5.804	2.809	1.220	16.6
1500.00	5.640	2.485	1.079	12.0



Na_2O-SiO_2
BOCKRIS, MACKENZIE and KITCHENER (1955)
NS-1
NS-2
NS-3
NS-4
NS-5
NS-6
NS-7
NS-8
TEMPERATURE (°C)
1100
1200
1300
1400
1500
1600
1700
LOG VISCOSITY (POISE)
0
1
2
3
4


Na_2O-SiO_2
BOCKRIS, MACKENZIE and KITCHENER (1955)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
4.5
5.5
6.5
7.5
NS-1
NS-2
NS-3
NS-4
NS-5
NS-6
NS-7
NS-8

SYSTEM
NA2O(21.38),SIO2(78.62) (X)
NA2O(21.91),SIO2(78.09) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-9

T	Z	LN(N)	LOG(N)	N
850.00	8.905	11.439	4.968	92900.
927.00	8.333	9.991	4.339	21800.
1003.00	7.837	8.777	3.812	6486.34
1078.00	7.402	7.794	3.385	2426.61
1155.00	7.003	6.942	3.015	1035.14
1207.00	6.757	6.417	2.787	612.35
1258.00	6.532	5.966	2.591	389.94
1309.00	6.321	5.540	2.406	254.68
1360.00	6.124	5.158	2.240	173.78
1406.00	5.956	4.817	2.092	123.59

SYSTEM
NA2O(24.31),SIO2(75.69) (X)
NA2O(24.89),SIO2(75.11) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-10

T	Z	LN(N)	LOG(N)	N
820.00	9.149	11.453	4.974	94200.
893.00	8.576	10.014	4.349	22300.
970.00	8.045	8.752	3.801	6324.12
1046.00	7.582	7.730	3.357	2275.10
1119.00	7.184	6.876	2.986	968.28
1206.00	6.761	6.017	2.613	410.20
1256.00	6.540	5.586	2.426	266.69
1305.00	6.337	5.183	2.251	178.24
1357.00	6.135	4.805	2.087	122.18
1404.00	5.963	4.476	1.944	87.90

SYSTEM
NA2O(25.19),SIO2(74.81) (X)
NA2O(25.78),SIO2(74.22) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-11

T	Z	LN(N)	LOG(N)	N
800.00	9.320	11.762	5.108	1.28*10E 5
904.00	8.496	9.664	4.197	1.57*10E 4
1003.00	7.837	8.140	3.535	3427.68
1104.00	7.262	6.915	3.003	1006.93
1152.00	7.018	6.397	2.778	599.79
1201.00	6.784	5.922	2.572	373.25
1254.00	6.549	5.496	2.387	243.78
1307.00	6.329	5.070	2.202	159.22
1356.00	6.139	4.688	2.036	108.64
1403.00	5.967	4.380	1.902	79.80

--

SYSTEM
NA2O(25.97),SIO2(74.03) (X)
NA2O(26.57),SIO2(73.43) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-12

T	Z	LN(N)	LOG(N)	N
800.00	9.320	11.709	5.085	1.22*10E 5
840.00	8.985	10.818	4.698	4.99*10E 4
910.00	8.453	9.507	4.129	1.35*10E 4
990.00	7.918	8.248	3.582	3819.44
1091.00	7.331	6.986	3.034	1081.43
1189.00	6.840	5.996	2.604	401.79
1230.00	6.653	5.616	2.439	274.79
1270.00	6.481	5.287	2.296	197.70
1311.00	6.313	4.962	2.155	142.89
1354.00	6.146	4.665	2.026	106.17
1395.00	5.995	4.375	1.900	79.43

--

SYSTEM
NA2O(26.18),SIO2(73.82) (X)
NA2O(26.79),SIO2(73.21) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-13

T	Z	LN(N)	LOG(N)	N
802.00	9.302	11.561	5.021	1.05*10E5
903.00	8.503	9.537	4.142	1.39*10E4
1002.00	7.843	8.004	3.476	2992.26
1102.00	7.273	6.816	2.960	912.01
1180.00	6.882	6.024	2.616	413.05
1232.00	6.645	5.554	2.412	258.23
1282.00	6.431	5.135	2.230	169.82
1324.00	6.262	4.817	2.092	123.59
1361.00	6.120	4.545	1.974	94.19
1403.00	5.967	4.264	1.852	71.12

--

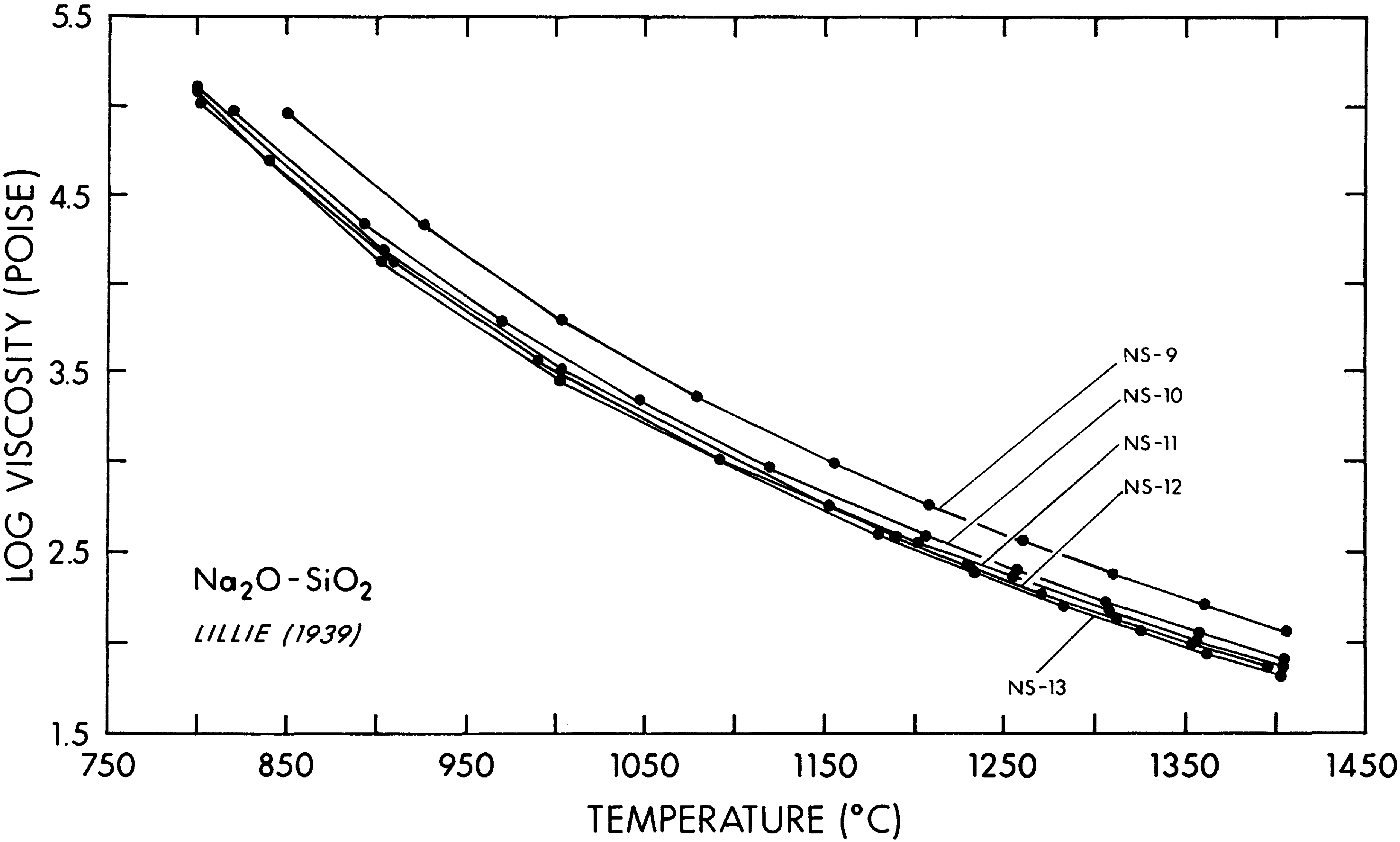
SYSTEM
NA2O(27.83),SIO2(72.17) (X)
NA2O(28.46),SIO2(71.54) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)

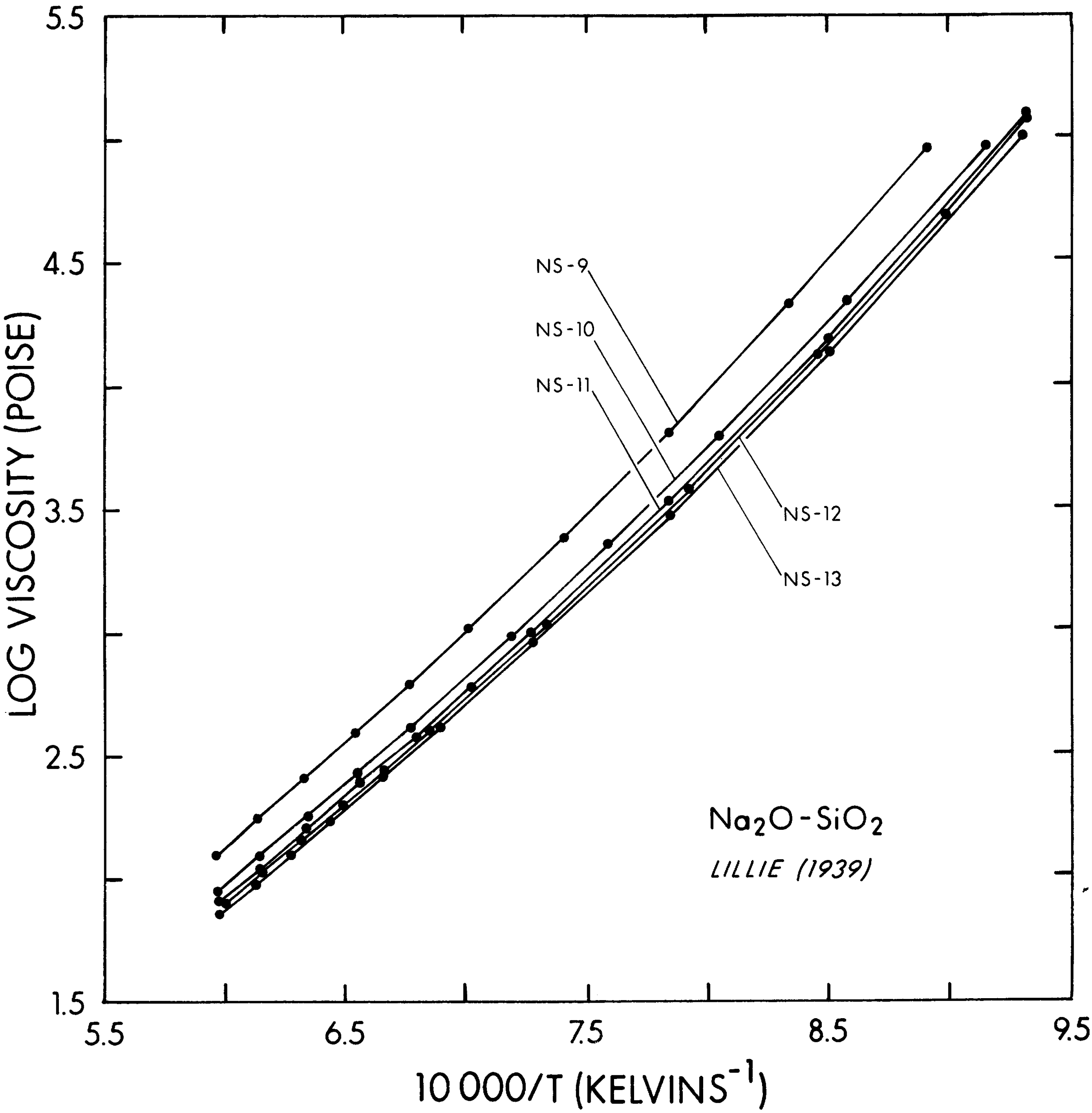
DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-14

T	Z	LN(N)	LOG(N)	N
801.00	9.311	13.343	4.926	8.43*10E4
903.00	8.503	9.307	4.042	1.10*10E4
1003.00	7.837	7.808	3.391	2460.37
1103.00	7.267	6.641	2.884	765.60
1152.00	7.018	6.123	2.659	456.04
1201.00	6.784	5.653	2.455	285.10
1253.00	6.553	5.172	2.246	176.20
1302.00	6.349	4.849	2.106	127.64
1354.00	6.146	4.444	1.930	85.11
1403.00	5.967	4.103	1.782	60.53



5.5
4.5
3.5
2.5
1.5
LOG VISCOSITY (POISE)
750
850
950
1050
1150
1250
1350
1450
TEMPERATURE (°C)
NS-9
NS-10
NS-11
NS-12
NS-13
Na2O-SiO2
LILLIE (1939)



LOG VISCOSITY (POISE)
5.5
4.5
3.5
2.5
1.5
5.5
6.5
7.5
8.5
9.5
10 000/T (KELVINS^{-1})
NS-9
NS-10
NS-11
NS-12
NS-13
Na_2O-SiO_2
LILLIE (1939)

-

SYSTEM
NA2O(29.14),SIO2(70.86) (X)
NA2O(29.79),SIO2(70.21) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)
DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-15

T	Z	LN(N)	LOG(N)	N
851.00	8.897	10.065	4.371	23500.
899.00	8.532	9.176	3.985	9660.51
951.00	8.170	8.356	3.629	4255.98
1001.00	7.849	7.633	3.315	2065.38
1098.00	7.294	6.498	2.822	663.74
1199.00	6.793	5.515	2.395	248.31
1240.00	6.609	5.162	2.242	174.58
1282.00	6.431	4.829	2.097	125.03
1317.00	6.289	4.515	1.961	91.41
1361.00	6.120	4.241	1.842	69.50
1402.00	5.970	3.958	1.719	52.36

--

SYSTEM
NA2O(31.07),SIO2(68.93) (X)
NA2O(31.74),SIO2(68.26) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)
DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-16

T	Z	LN(N)	LOG(N)	N
848.00	8.921	9.770	4.243	17500.
889.00	8.606	9.017	3.916	8241.38
949.00	8.183	8.084	3.511	3243.40
1009.00	7.800	7.262	3.154	1425.61
1079.00	7.396	6.459	2.805	638.26
1176.00	6.901	5.466	2.374	236.59
1220.00	6.698	5.096	2.213	163.31
1260.00	6.523	4.757	2.066	116.41
1301.00	6.353	4.444	1.930	85.11
1399.00	5.981	3.744	1.626	42.27

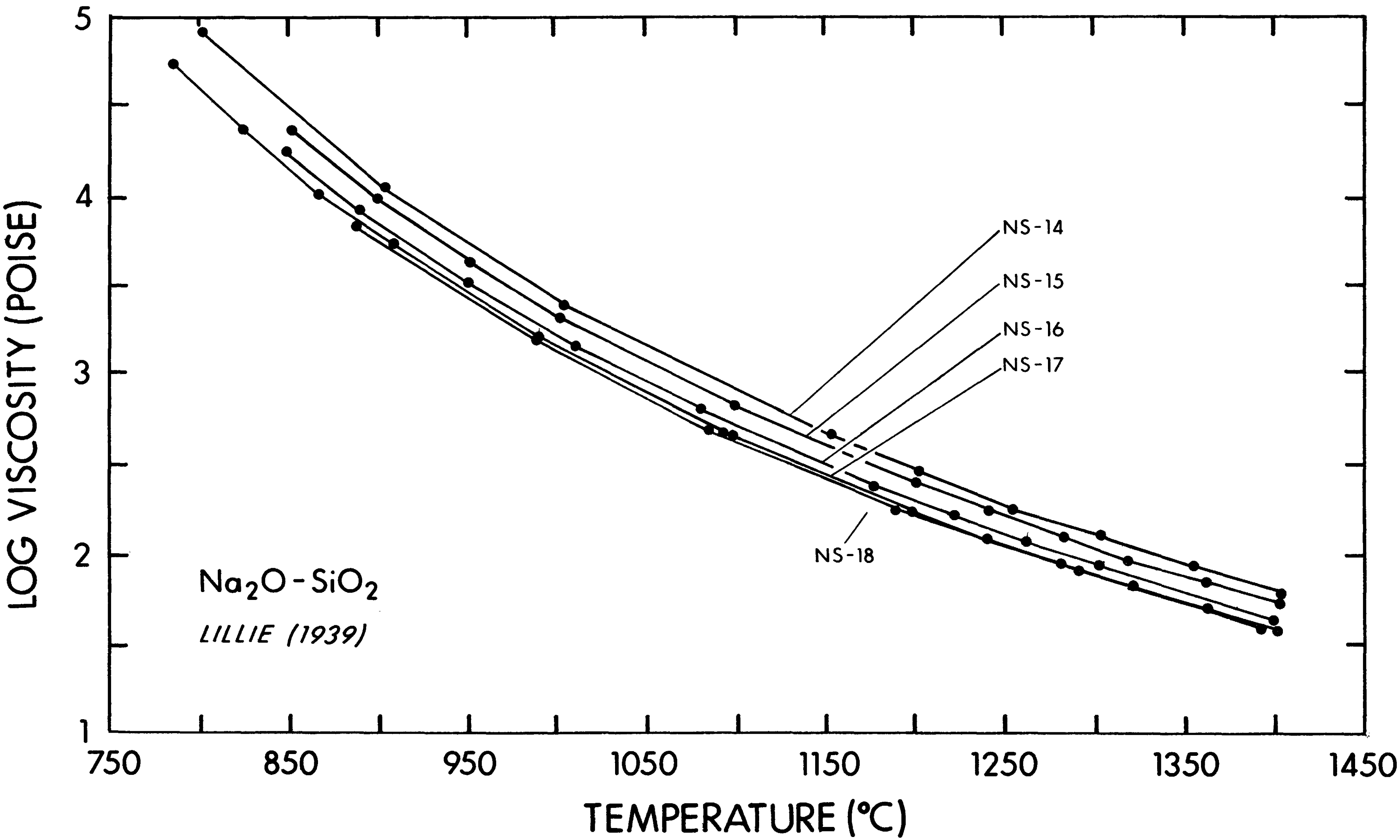
--

SYSTEM
NA2O(32.23),SIO2(67.77) (X)
NA2O(32.91),SIO2(67.09) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

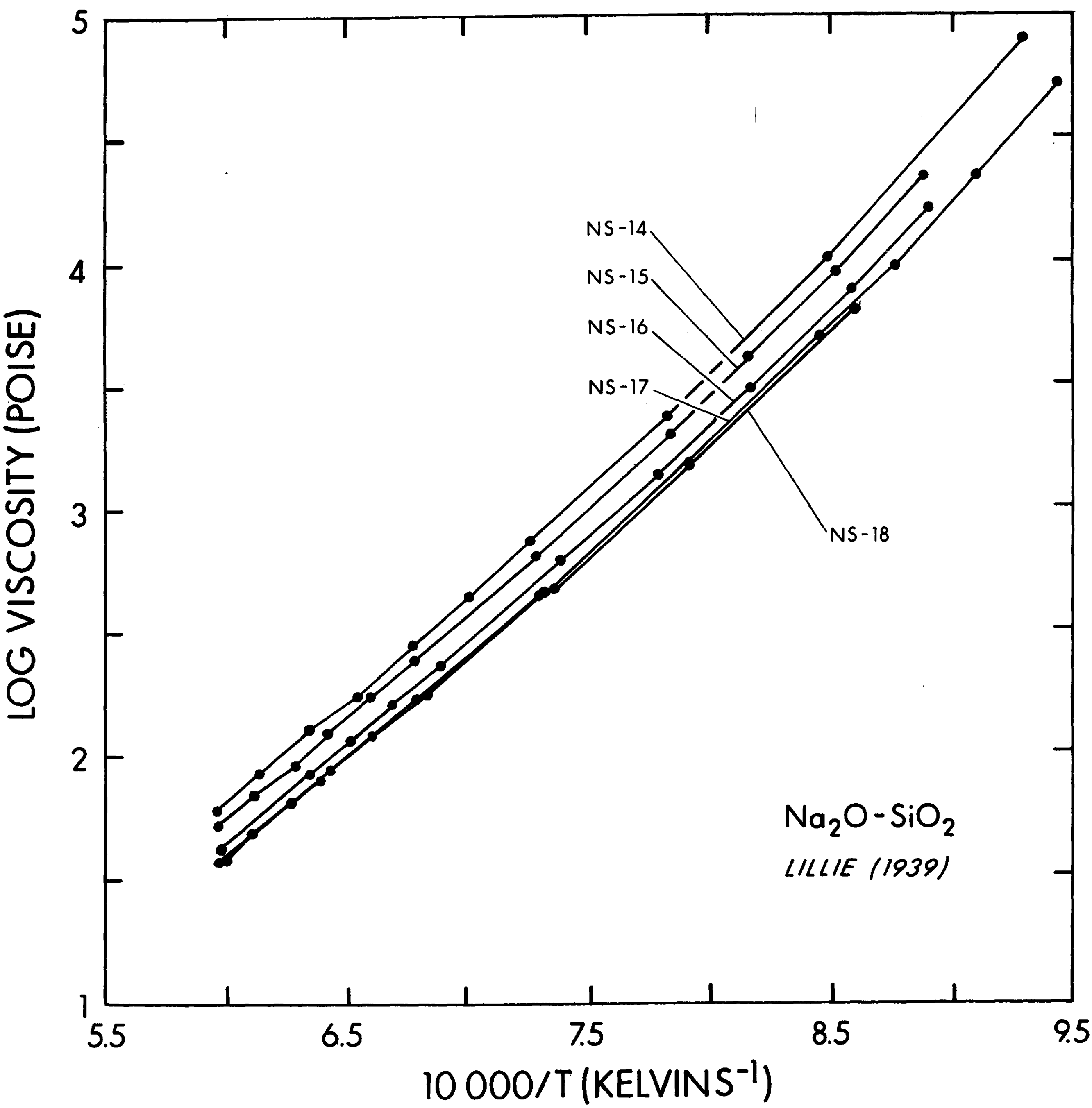
AUTHOR
LILLIE (1939)
DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-17

T	Z	LN(N)	LOG(N)	N
785.00	9.452	10.926	4.745	55600.
824.00	9.116	10.074	4.375	23700.
866.00	8.780	9.236	4.011	10300.
908.00	8.467	8.573	3.723	5284.45
989.00	7.924	7.375	3.203	1595.88
1091.00	7.331	6.157	2.674	472.06
1096.00	7.305	6.123	2.659	456.04
1197.00	6.803	5.149	2.236	172.19
1239.00	6.614	4.801	2.085	121.19
1280.00	6.439	4.476	1.944	87.90
1320.00	6.277	4.181	1.816	65.46
1362.00	6.116	3.887	1.688	48.75
1401.00	5.974	3.622	1.573	37.41



LOG VISCOSITY (POISE)
5
4
3
2
1
750
850
950
1050
1150
1250
1350
1450
TEMPERATURE (°C)
NS-14
NS-15
NS-16
NS-17
NS-18
Na2O-SiO2
LILLIE (1939)


LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
5
4
3
2
1
5.5
6.5
7.5
8.5
9.5
NS-14
NS-15
NS-16
NS-17
NS-18
Na_2O-SiO_2
LILLIE (1939)

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SYSTEM
NA2O(32.55),SIO2(67.45) (X)
NA2O(33.24),SIO2(66.76) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-18

T	Z	LN(N)	LOG(N)	N
888.00	8.613	8.805	3.824	6668.07
988.00	7.930	7.345	3.190	1548.82
1084.00	7.369	6.192	2.689	488.65
1188.00	6.845	5.188	2.253	179.06
1290.00	6.398	4.386	1.905	80.35
1392.00	6.006	3.650	1.585	38.46

--

SYSTEM
NA2O(33.08),SIO2(66.92) (X)
NA2O(33.77),SIO2(66.23) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-19

T	Z	LN(N)	LOG(N)	N
787.00	9.434	10.705	4.649	44600.
827.00	9.091	9.853	4.279	19000.
869.00	8.757	9.054	3.932	8550.67
911.00	8.446	8.372	3.636	4325.14
992.00	7.905	7.200	3.127	1339.68
1094.00	7.315	6.024	2.616	413.05
1199.00	6.793	5.024	2.182	152.05
1240.00	6.609	4.681	2.033	107.89
1282.00	6.431	4.361	1.894	78.34
1323.00	6.266	4.094	1.778	59.98
1365.00	6.105	3.760	1.633	42.95
1404.00	5.963	3.484	1.513	32.58

--

SYSTEM
NA2O(33.57),SIO2(66.43) (X)
NA2O(34.27),SIO2(65.73) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-20

T	Z	LN(N)	LOG(N)	N
831.00	9.058	9.735	4.228	16900.
871.00	8.741	9.001	3.909	8109.61
912.00	8.439	8.340	3.622	4187.94
992.00	7.905	7.200	3.127	1339.68
1092.00	7.326	6.028	2.618	414.95
1192.00	6.826	5.061	2.198	157.76
1231.00	6.649	4.711	2.046	111.17
1269.00	6.485	4.430	1.924	83.95
1312.00	6.309	4.115	1.787	61.24
1352.00	6.154	3.829	1.663	46.03
1393.00	6.002	3.557	1.545	35.08

--

SYSTEM
NA2O(34.22),SIO2(65.78) (X)
NA2O(34.92),SIO2(65.08) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-21

T	Z	LN(N)	LOG(N)	N
785.00	9.452	10.682	4.639	43600.
828.00	9.083	9.733	4.227	16900.
867.00	8,772	8.989	3.904	8016.78
911.00	8.446	8.275	3.594	3926.45
1044.00	7.593	6.479	2.814	651.63
1157.00	6.993	5.296	2.300	199.53
1197.00	6.803	4.930	2.141	138.36
1236.00	6.627	4.589	1.993	98.40
1281.00	6.435	4.285	1.861	72.61
1322.00	6.270	3.963	1.721	52.60
1363.00	6.112	3.675	1.596	39.45
1405.00	5.959	3.401	1.477	29.99

--

SYSTEM
NA2O(36.01),SIO2(63.99) (X)
NA2O(36.73),SIO2(63.27) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-22

T	Z	LN(N)	LOG(N)	N
831.00	9.058	9.429	4.095	12400.
907.00	8.475	8.096	3.516	3280.95
983.00	7.962	7.000	3.040	1096.48
1058.00	7.513	6.120	2.658	454.99
1132.00	7.117	5.333	2.316	207.01
1209.00	6.748	4.628	2.010	102.33
1259.00	6.527	4.241	1.842	69.50
1311.00	6.313	3.852	1.673	47.10
1361.00	6.120	3.491	1.516	32.81
1410.00	5.942	3.136	1.362	23.01

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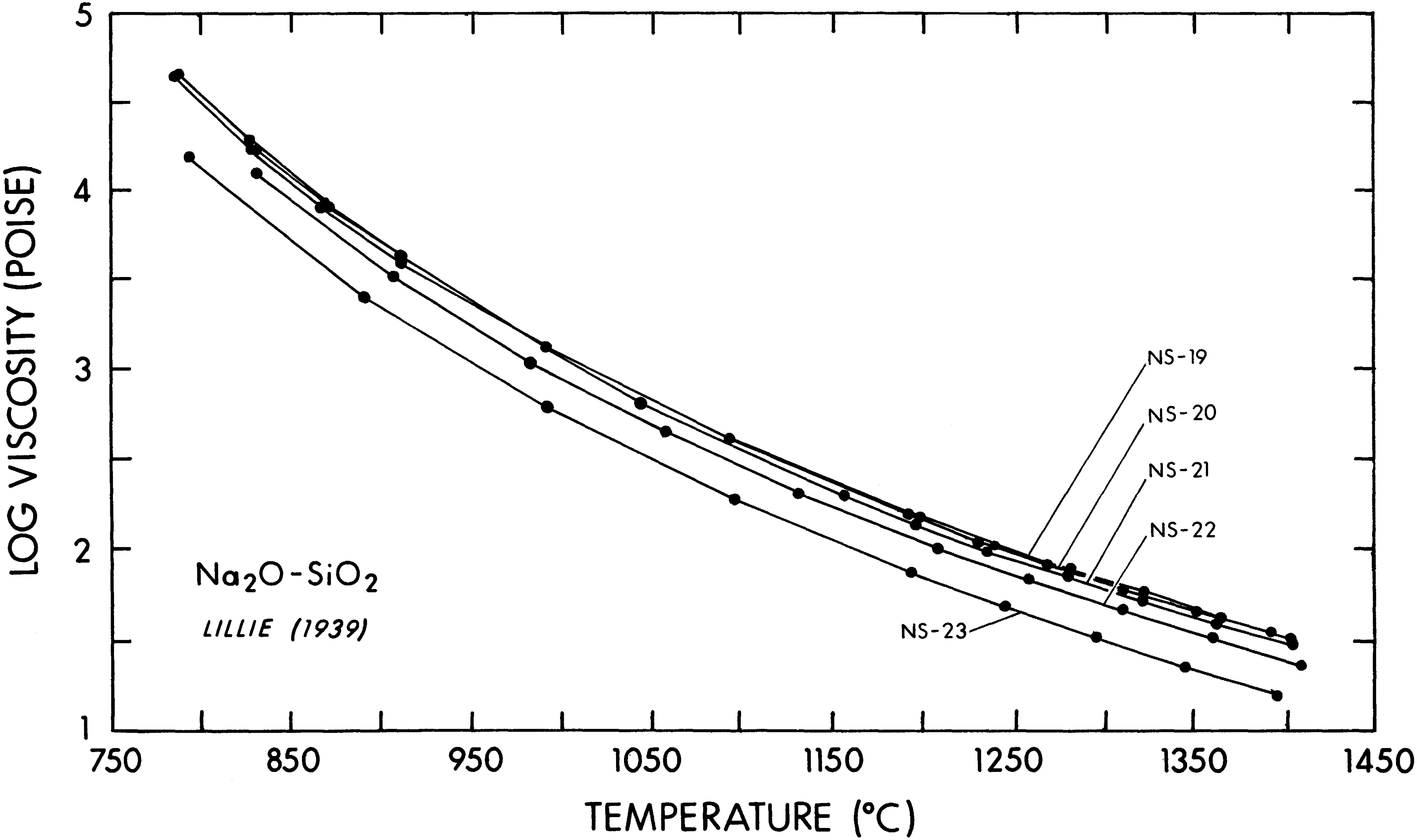
SYSTEM
NA2O(39.00),SIO2(61.00) (X)
NA2O(39.74),SIO2(60.26) (%)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1939)

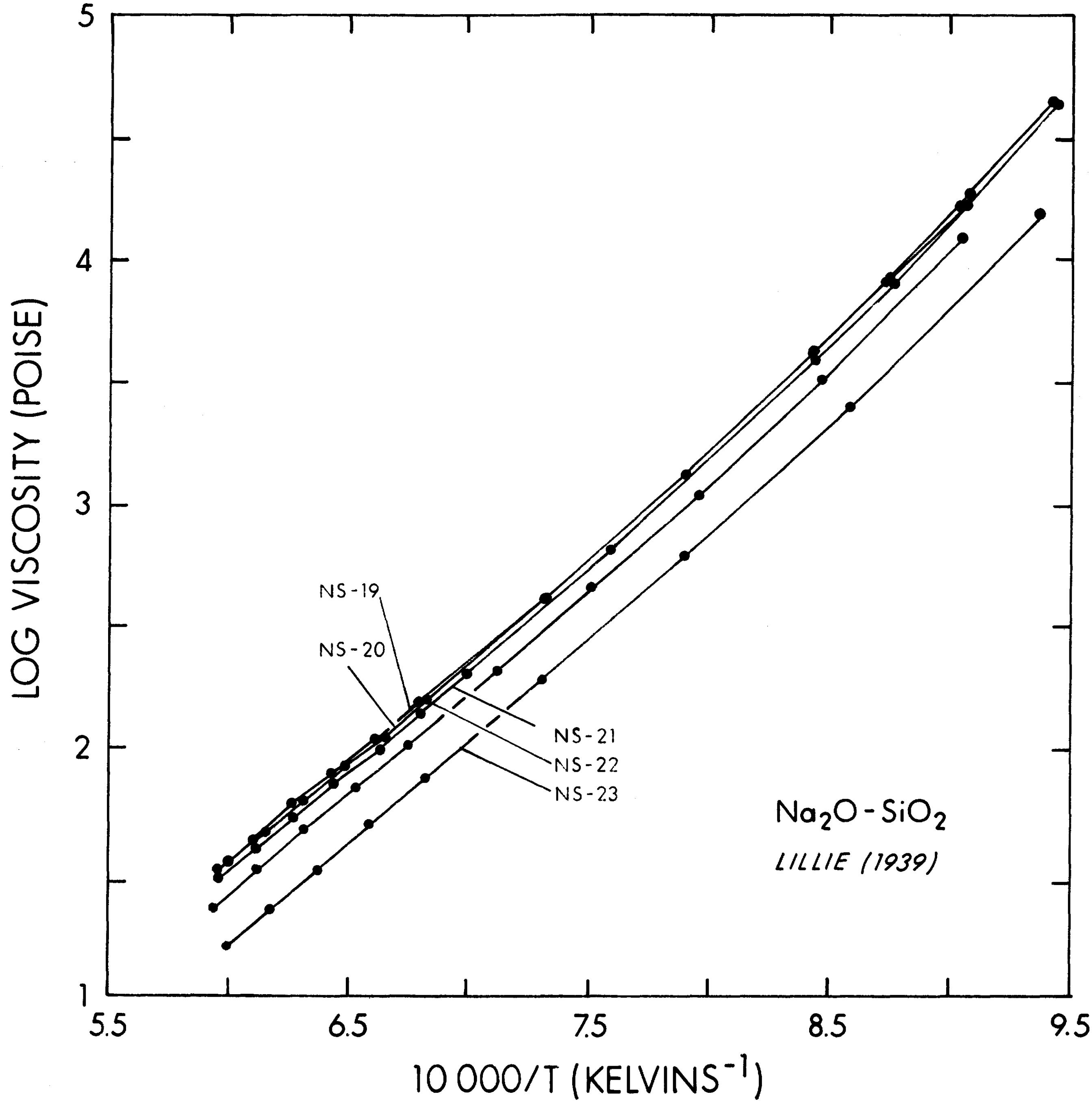
DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NS-23

T	Z	LN(N)	LOG(N)	N
793.00	9.381	9.643	4.188	15400.
891.00	8.591	7.833	3.402	2523.48
992.00	7.905	6.431	2.793	620.87
1096.00	7.305	5.250	2.280	190.55
1194.00	6.817	4.322	1.877	75.34
1246.00	6.583	3.889	1.689	48.87
1297.00	6.369	3.484	1.513	32.58
1346.00	6.177	3.122	1.356	22.70
1397.00	5.988	2.768	1.202	15.92



5
4
3
2
1
750
850
950
1050
1150
1250
1350
1450
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
NS-19
NS-20
NS-21
NS-22
NS-23
Na2O-SiO2
LILLIE (1939)



5
4
3
2
1
LOG VISCOSITY (POISE)
5.5
6.5
7.5
8.5
9.5
10 000/T (KELVINS^{-1})
NS-19
NS-20
NS-21
NS-22
NS-23
Na_2O-SiO_2
LILLIE (1939)

SYSTEM
SRO(20.1),SIO2(79.9) (X)
SRO(30.3),SIO2(69.7) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

SS-1

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	4.387	1.905	80.4
1750.00	4.943	4.064	1.765	58.2
1800.00	4.824	3.764	1.634	43.1

SYSTEM
SRO(25.4),SIO2(74.6) (X)
SRO(37.1),SIO2(62.9) (%0)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

SS-2

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	4.127	1.792	62.0
1650.00	5.200	3.742	1.625	42.2
1700.00	5.068	3.332	1.447	28.0
1750.00	4.943	3.109	1.350	22.4
1800.00	4.824	2.809	1.220	16.6

SYSTEM
SRO(29.7),SIO2(70.3) (X)
SRO(42.2),SIO2(57.8) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

SS-3

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	3.292	1.430	26.9
1600.00	5.339	2.923	1.270	18.6
1650.00	5.200	2.625	1.140	13.8
1700.00	5.068	2.322	1.009	10.2
1750.00	4.943	2.049	0.890	7.76
1800.00	4.824	1.754	0.762	5.78

SYSTEM
SRO(40.5),SIO2(59.5) (X)
SRO(54.0),SIO2(46.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

SS-4

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	2.443	1.061	11.5
1600.00	5.339	2.086	0.906	8.05
1650.00	5.200	1.823	0.792	6.19
1700.00	5.068	1.567	0.680	4.79
1750.00	4.943	1.316	0.572	3.73
1800.00	4.824	1.082	0.470	2.95

SYSTEM
SRO(44.4),SIO2(55.6) (X)
SRO(58.0),SIO2(42.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

SS-5

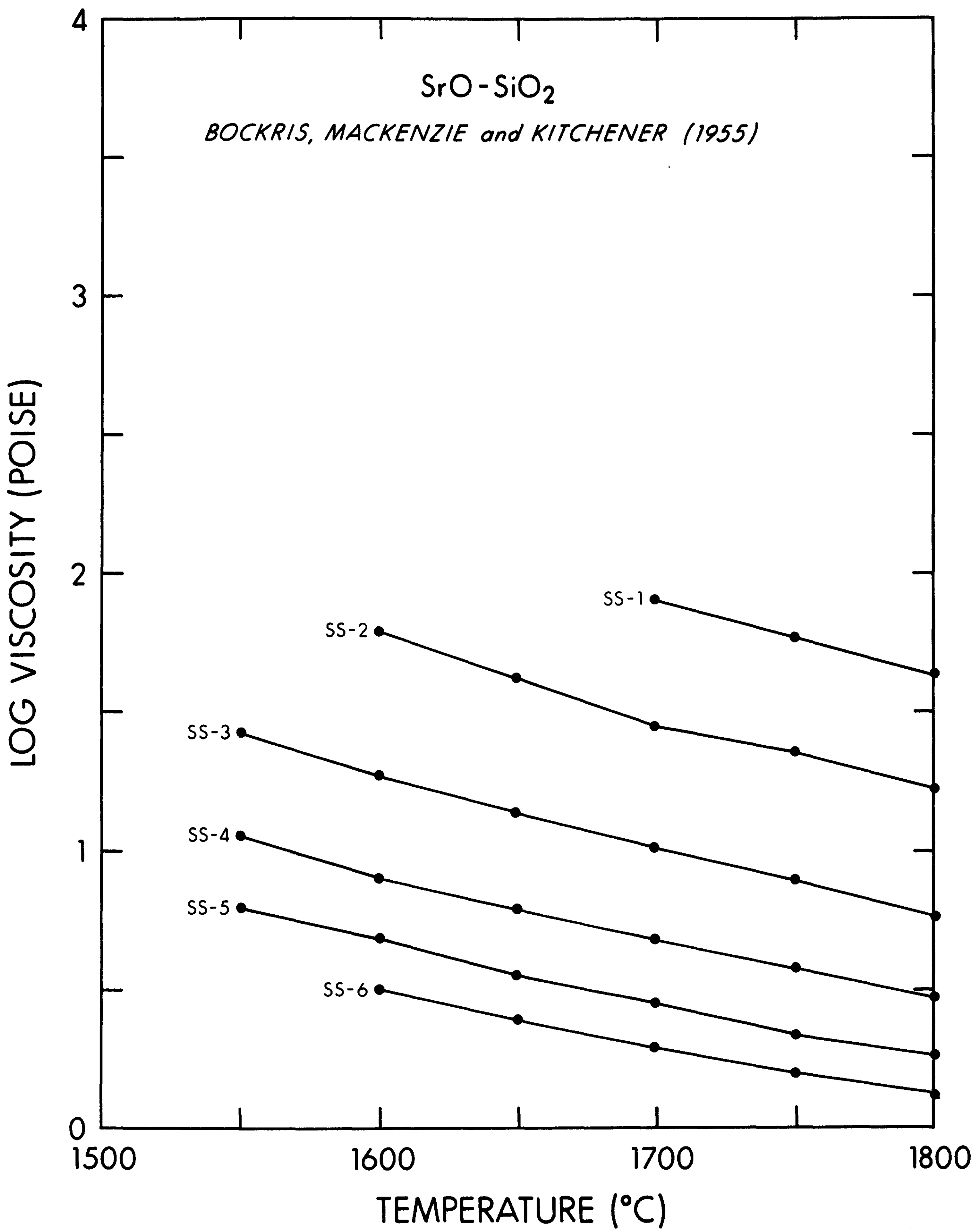
T	Z	LN(N)	LOG(N)	N
1550.00	5.485	1.841	0.799	6.30
1600.00	5.339	1.585	0.688	4.88
1650.00	5.200	1.275	0.554	3.58
1700.00	5.068	1.033	0.449	2.81
1750.00	4.943	0.761	0.330	2.14
1800.00	4.824	0.599	0.260	1.82

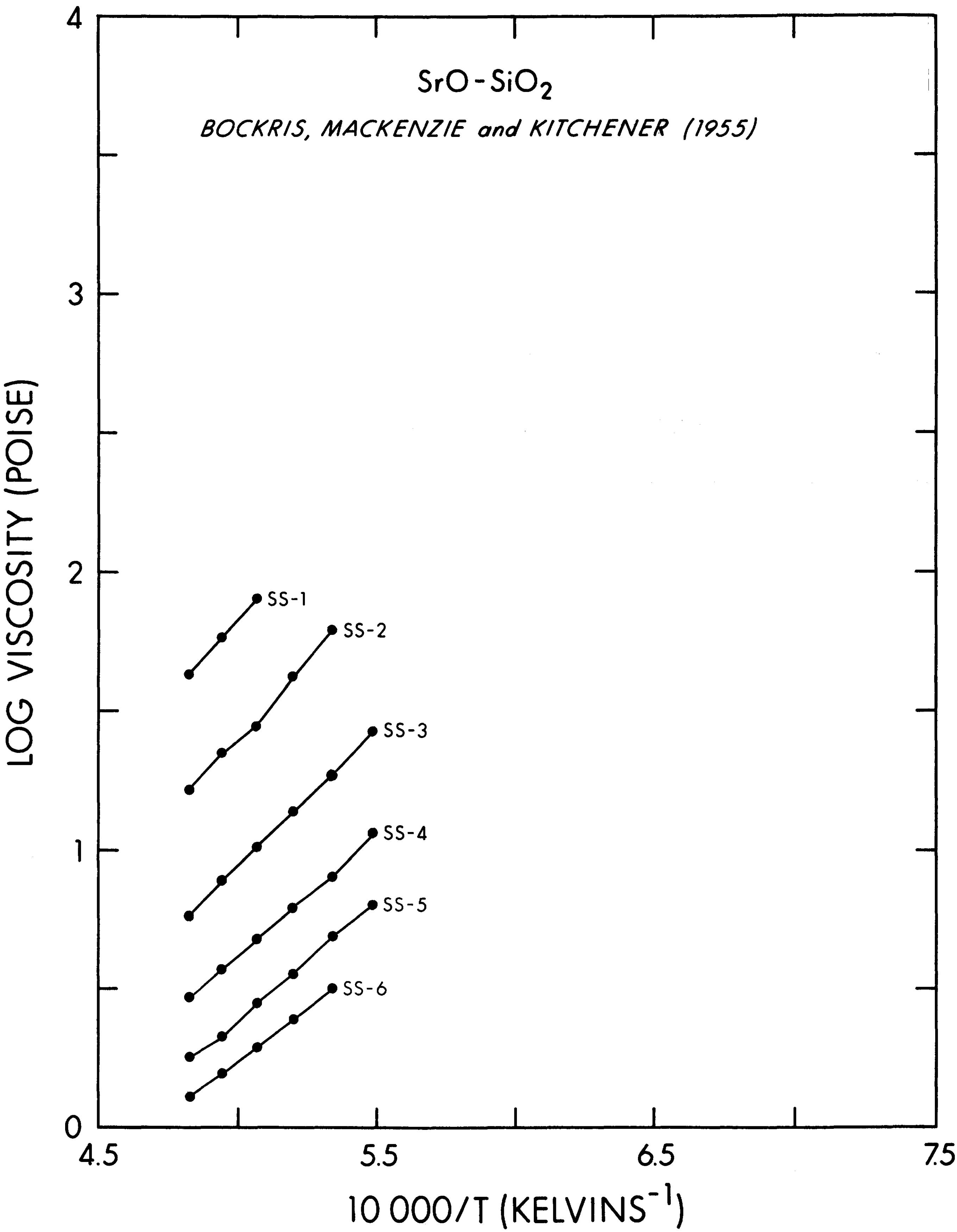
SYSTEM
SRO(50.3),SIO2(49.7) (X)
SRO(63.6),SIO2(36.4) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
BOCKRIS, MACKENZIE AND KITCHENER
(1955)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

SS-6

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	1.157	0.502	3.18
1650.00	5.200	-0.755	-0.328	0.47
1700.00	5.068	0.668	0.290	1.95
1750.00	4.943	0.451	0.196	1.57
1800.00	4.824	0.262	0.134	1.30


SrO - SiO2
BOCKRIS, MACKENZIE and KITCHENER (1955)
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
SS-1
SS-2
SS-3
SS-4
SS-5
SS-6
0
1
2
3
4
1500
1600
1700
1800



SrO - SiO2
BOCKRIS, MACKENZIE and KITCHENER (1955)
SS-1
SS-2
SS-3
SS-4
SS-5
SS-6
LOG VISCOSITY (POISE)
0
1
2
3
4
4.5
5.5
6.5
7.5
10 000/T (KELVINS-1)

Three-Component Systems

SYSTEM				AUTHOR
AL2O3(9.1),CAO(38.9),SIO2(52.0) (X)				BILLS (1963)
MEASUREMENT METHOD				DERIVED FROM
RESTRAINED SPHERE				TABLE
N (POISES)				P = 1.0 ATM.
T (DEGREES C)				Z = 10000.0/T(K) (1/K)

ACS-1

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.641	2.45	281.8
1300.00	6.357	4.835	2.10	125.9
1350.00	6.161	4.329	1.88	75.86
1400.00	5.977	3.753	1.63	42.66
1450.00	5.804	3.224	1.40	25.12
1500.00	5.640	2.878	1.25	17.78

SYSTEM				AUTHOR
AL2O3(12.4),CAO(45.2),SIO2(42.3) (X)				BILLS (1963)
MEASUREMENT METHOD				DERIVED FROM
RESTRAINED SPHERE				TABLE
N (POISES)				P = 1.0 ATM.
T (DEGREES C)				Z = 10000.0/T(K) (1/K)

ACS-2

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.971	2.17	147.9
1300.00	6.357	4.122	1.79	61.66
1350.00	6.161	3.569	1.55	35.48
1400.00	5.977	3.062	1.33	21.38
1450.00	5.804	2.613	1.135	13.65
1500.00	5.640	2.118	0.92	8.318

SYSTEM				AUTHOR
AL2O3(10.96),CAO(18.12), SIO2(70.92) (X) AL2O3(17.6),CAO(16.0), SIO2(67.1) (%)				JOHANNSEN AND BRUNION (1959)
MEASUREMENT METHOD				DERIVED FROM
ROTATIONAL VISCOMETER				TABLE 4
N (POISES)				P = 1.0 ATM.
T (DEGREES C)				Z = 10000.0/T(K) (1/K)

ACS-3

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	9.582	4.161	14500.
1350.00	6.161	8.941	3.883	7640.
1400.00	5.977	8.232	3.575	3760.
1450.00	5.804	7.512	3.262	1830.

SYSTEM				AUTHOR
AL2O3(15.43),CAO(18.31), SIO2(66.27) (X) AL2O3(23.9),CAO(15.6), SIO2(60.5) (%)				JOHANNSEN AND BRUNION (1959)
MEASUREMENT METHOD				DERIVED FROM
ROTATIONAL VISCOMETER				TABLE 4
N (POISES)				P = 1.0 ATM.
T (DEGREES C)				Z = 10000.0/T(K) (1/K)

ACS-4

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	9.547	4.146	14000.
1350.00	6.161	8.759	3.804	6370.
1400.00	5.977	8.016	3.481	3030.
1450.00	5.804	7.272	3.158	1440.

SYSTEM
AL2O3(17.78),CAO(18.57),
SIO2(63.64) (X)
AL2O3(27.5),CAO(15.8),
SIO2(58.0) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-5

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	7.601	3.301	2000.
1450.00	5.804	6.846	2.973	940.

SYSTEM
AL2O3(12.65),CAO(20.94),
SIO2(66.42) (X)
AL2O3(20.1),CAO(18.3),
SIO2(62.2) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-6

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	9.629	4.182	15200.
1300.00	6.357	8.825	3.833	6800.
1350.00	6.161	8.036	3.490	3090.
1400.00	5.977	7.320	3.179	1510.
1450.00	5.804	6.659	2.892	780.

SYSTEM
AL2O3(17.74),CAO(22.81),
SIO2(59.45) (X)
AL2O3(27.3),CAO(19.3),
SIO2(53.9) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-7

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	6.721	2.919	830.
1450.00	5.804	5.858	2.544	350.

SYSTEM
AL2O3(14.16),CAO(24.26),
SIO2(61.58) (X)
AL2O3(22.4),CAO(21.1),
SIO2(57.4) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-8

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	8.810	3.826	6700.
1300.00	6.357	7.886	3.425	2660.
1350.00	6.161	7.107	3.086	1220.
1400.00	5.977	6.380	2.771	590.
1450.00	5.804	5.753	2.498	315.

SYSTEM
AL2O3(10.43),CAO(24.63),
SIO2(64.94) (X)
AL2O3(16.7),CAO(21.7),
SIO2(61.3) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-9

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	9.449	4.104	12700.
1250.00	6.566	8.560	3.718	5220.
1300.00	6.357	7.701	3.344	2210.
1350.00	6.161	6.947	3.017	1040.
1400.00	5.977	6.273	2.724	530.
1450.00	5.804	5.670	2.462	290.

SYSTEM
AL2O3(7.54),CAO(26.11),
SIO2(66.35) (X)
AL2O3(12.5),CAO(23.8),
SIO2(64.8) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-10

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	9.185	3.989	9750.
1250.00	6.566	8.221	3.571	3720.
1300.00	6.357	7.384	3.207	1610.
1350.00	6.161	6.659	2.892	780.
1400.00	5.977	6.040	2.623	420.
1450.00	5.804	5.481	2.380	240.

SYSTEM
AL2O3(13.80),CAO(37.49),
SIO2(48.71) (X)
AL2O3(25.1),CAO(23.7),
SIO2(52.2) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-11

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	7.056	3.064	1160.
1350.00	6.161	6.254	2.716	520.
1400.00	5.977	5.598	2.431	270.
1450.00	5.804	4.977	2.161	145.

SYSTEM
AL2O3(10.57),CAO(29.05),
SIO2(60.38) (X)
AL2O3(17.2),CAO(26.0),
SIO2(57.9) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-12

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	8.366	3.633	4300.
1250.00	6.566	7.450	3.236	1720.
1300.00	6.357	6.579	2.857	720.
1350.00	6.161	5.829	2.531	340.
1400.00	5.977	5.193	2.255	180.
1450.00	5.804	4.787	2.079	120.

SYSTEM
AL2O3(11.77),CAO(37.43),
SIO2(50.80) (X)
AL2O3(21.2),CAO(25.4),
SIO2(53.9) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-13

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	8.319	3.613	4100.
1250.00	6.566	7.320	3.179	1510.
1300.00	6.357	6.492	2.820	660.
1350.00	6.161	5.814	2.525	335.
1400.00	5.977	5.273	2.290	195.
1450.00	5.804	4.745	2.061	115.

SYSTEM
AL2O3(6.75),CAO(34.31),
SIO2(58.94) (X)
AL2O3(11.2),CAO(31.3),
SIO2(57.6) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-14

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	5.598	2.431	270.
1350.00	6.161	5.011	2.176	150.
1400.00	5.977	4.605	2.000	100.
1450.00	5.804	3.912	1.699	50.0

SYSTEM
AL2O3(12.40),CAO(34.32),
SIO2(53.28) (X)
AL2O3(19.9),CAO(30.3),
SIO2(50.4) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

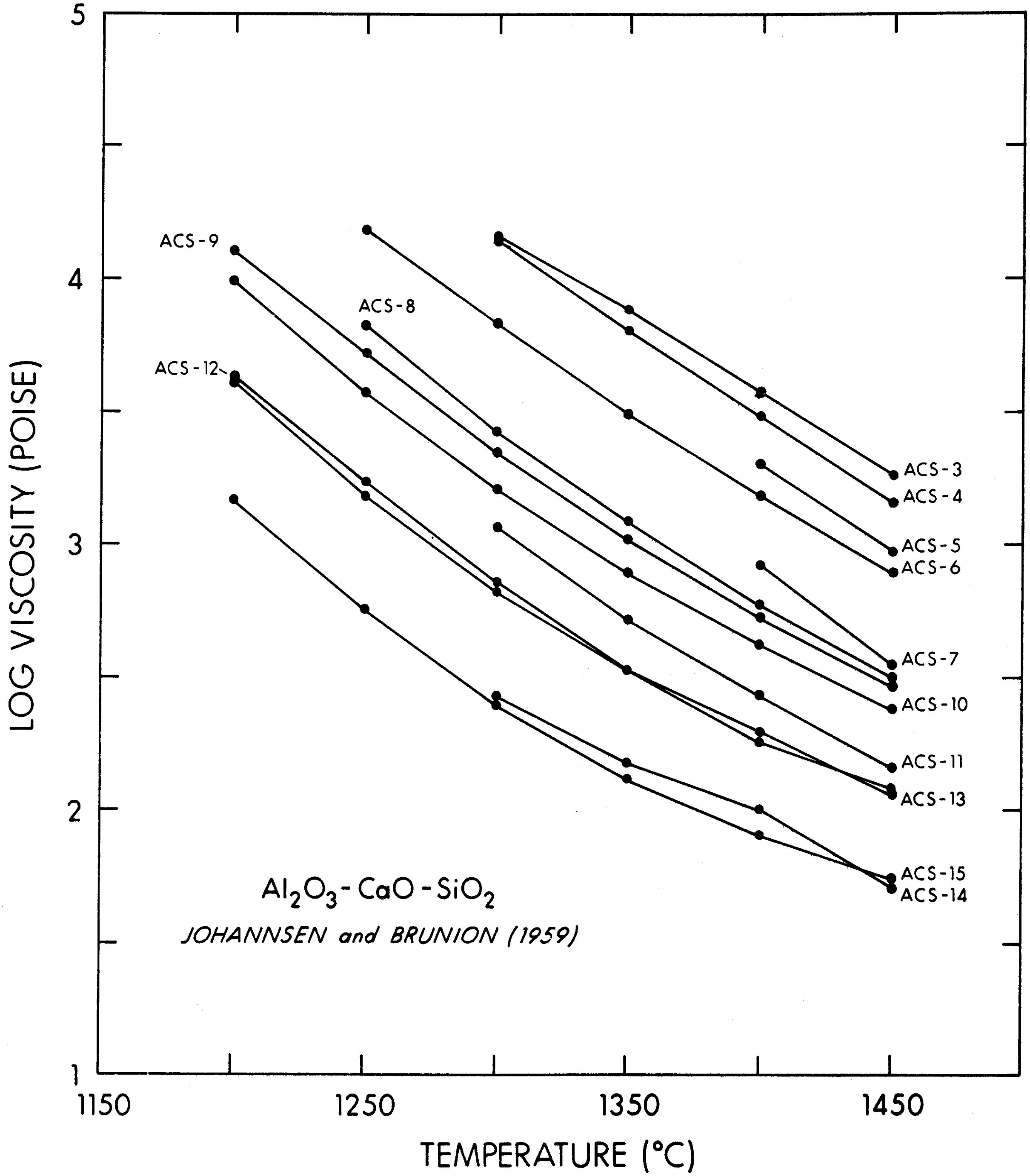
DERIVED FROM
TABLE 4

N (POISES)
T (DEGREES C)

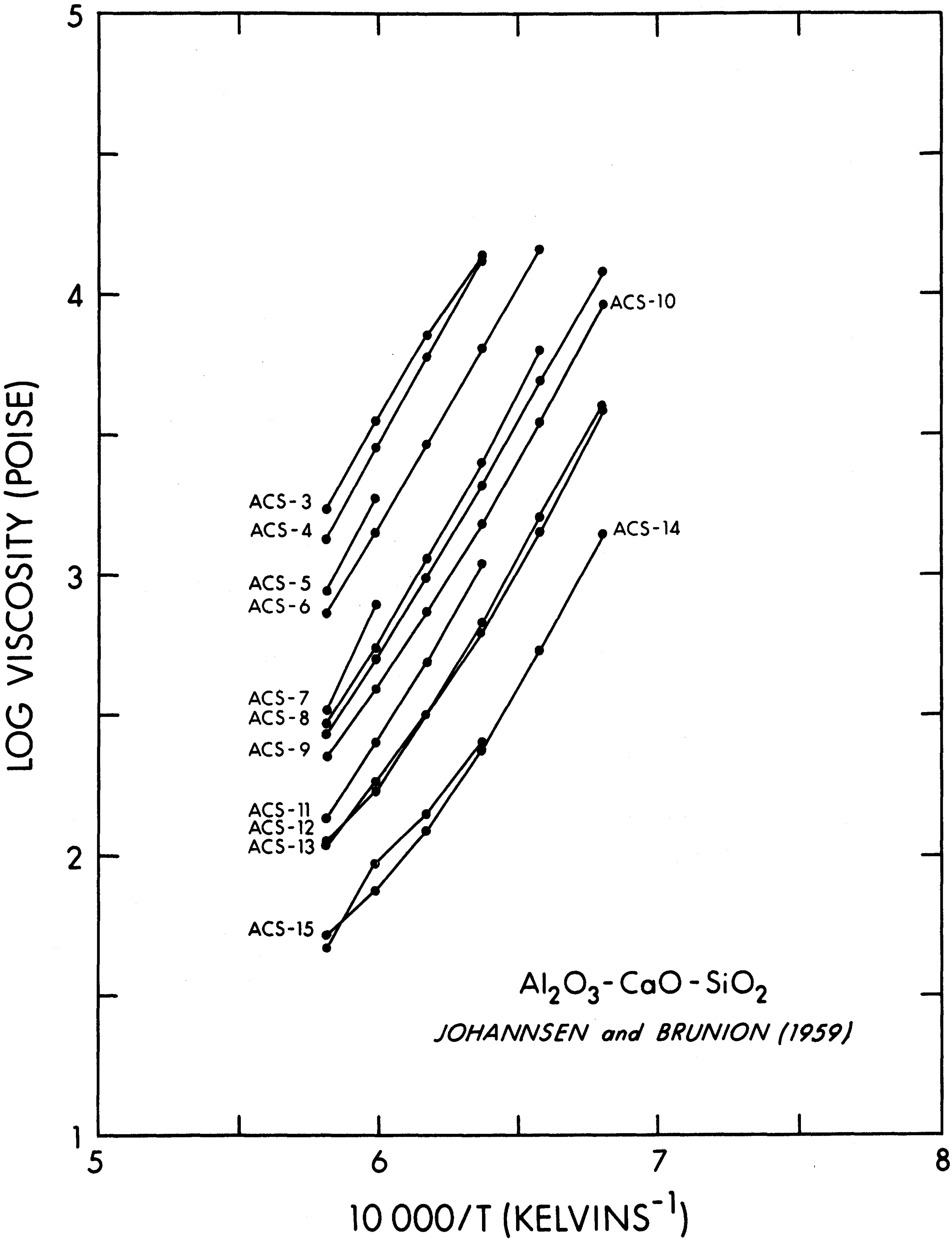
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-15

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	7.293	3.167	1470.
1250.00	6.566	6.346	2.756	570.
1300.00	6.357	5.521	2.398	250.
1350.00	6.161	4.868	2.114	130.
1400.00	5.977	4.382	1.903	80.
1450.00	5.804	4.007	1.740	55.



LOG VISCOSITY (POISE)
5
4
3
2
1
1150
1250
1350
1450
TEMPERATURE (°C)
ACS-9
ACS-8
ACS-12
ACS-3
ACS-4
ACS-5
ACS-6
ACS-7
ACS-10
ACS-11
ACS-13
ACS-15
ACS-14
Al2O3-CaO-SiO2
JOHANNSEN and BRUNION (1959)



LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
5
4
3
2
1
5
6
7
8
ACS-3
ACS-4
ACS-5
ACS-6
ACS-7
ACS-8
ACS-9
ACS-10
ACS-11
ACS-12
ACS-13
ACS-14
ACS-15
Al_2O_3-CaO-SiO_2
JOHANNSEN and BRUNION (1959)

SYSTEM
AL2O3(26.83),CAO(73.17),
SIO2(0.0) (X)
AL2O3(40.0),CAO(60.0),
SIO2(0.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-16

T	Z	LN(N)	LOG(N)	N
1650.00	5.200	0.095	0.041	1.1
1700.00	5.068	-0.223	-0.097	0.8
1750.00	4.943	-0.357	-0.155	0.7
1800.00	4.824	-0.511	-0.222	0.6
1900.00	4.602	-0.693	-0.301	0.5

SYSTEM
AL2O3(35.48),CAO(64.52),
SIO2(0.0) (X)
AL2O3(50.0),CAO(50.0),
SIO2(0.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-17

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.163	0.940	8.7
1500.00	5.640	1.740	0.756	5.7
1550.00	5.485	1.253	0.544	3.5
1600.00	5.339	0.833	0.362	2.3
1650.00	5.200	0.470	0.204	1.6
1700.00	5.068	0.182	0.079	1.2
1750.00	4.943	0.953	0.041	1.1
1800.00	4.824	0.000	0.000	1.0

SYSTEM
AL2O3(39.23),CAO(60.77) (X)
SIO2(0.0) (X)
AL2O3(54.0),CAO(46.0),
SIO2(0.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-18

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	1.792	0.778	6.0
1550.00	5.485	1.386	0.602	4.0
1600.00	5.339	0.993	0.431	2.7
1650.00	5.200	0.693	0.301	2.0
1700.00	5.068	0.405	0.176	1.5
1750.00	4.943	0.182	0.079	1.2

--

SYSTEM
AL2O3(45.21),CAO(54.79),
SIO2(0.0) (X)
AL2O3(60.0),CAO(40.0),
SIO2(0.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

ACS-19

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	1.629	0.708	5.1
1600.00	5.339	1.194	0.519	3.3
1650.00	5.200	0.833	0.362	2.3
1700.00	5.068	0.531	0.230	1.7
1750.00	4.943	0.262	0.114	1.3
1800.00	4.824	0.095	0.041	1.1

--

SYSTEM
AL2O3(56.20),CAO(43.80),
SIO2(0.0) (X)
AL2O3(70.0),CAO(30.0),
SIO2(0.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES) P = 1.0 ATM.

T (DEGREES C) Z = 10000.0/T(K) (1/K)

ACS-20

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	0.588	0.255	1.8
1750.00	4.943	0.336	0.146	1.4
1800.00	4.824	0.095	0.041	1.1

SYSTEM
AL2O3(68.75),CAO(31.25),
SIO2(0.0) (X)
AL2O3(80.0),CAO(20.0),
SIO2(0.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

ACS-21

T	Z	LN(N)	LOG(N)	N
1800.00	4.824	0.095	0.041	1.1
1850.00	4.710	-0.105	-0.046	0.9
1900.00	4.602	-0.357	-0.155	0.7
1950.00	4.498	-0.511	-0.222	0.6
2000.00	4.399	-0.511	-0.222	0.6

--

SYSTEM
AL2O3(100.0),CAO(0.0),
SIO2(0.0) (X)
AL2O3(100.0),CAO(0.0),
SIO2(0.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

ACS-22

T	Z	LN(N)	LOG(N)	N
2050.00	4.305	-0.511	-0.222	0.6
2100.00	4.214	-0.693	-0.301	0.5

SYSTEM
AL2O3(19.22),CAO(69.91),
SIO2(10.87) (X)
AL2O3(30.0),CAO(60.0),
SIO2(10.0) (%)
MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZAKEVITCH (1960)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-23

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	0.788	0.342	2.2
1600.00	5.339	0.262	0.114	1.3
1650.00	5.200	0.000	0.000	1.0
1700.00	5.068	-0.223	-0.097	0.8
1750.00	4.943	-0.357	-0.155	0.7
1800.00	4.824	-0.511	-0.222	0.6
1850.00	4.710	-0.693	-0.301	0.5
1900.00	4.602	-0.916	-0.398	0.4

SYSTEM
AL2O3(27.05),CAO(61.48),
SIO2(11.47) (X)
AL2O3(40.0),CAO(50.0),
SIO2(10.0) (%)
MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZAKEVITCH (1960)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-24

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.041	0.886	7.7
1500.00	5.640	1.609	0.699	5.0
1550.00	5.485	1.194	0.519	3.3
1600.00	5.339	0.833	0.362	2.3
1650.00	5.200	0.531	0.230	1.7
1700.00	5.068	0.405	0.176	1.5
1750.00	4.943	0.182	0.079	1.2
1800.00	4.824	0.000	0.000	1.0
1850.00	4.710	-0.105	-0.046	0.9
1900.00	4.602	-0.223	-0.097	0.8

SYSTEM
AL2O3(35.79),CAO(52.06),
SIO2(12.15) (X)
AL2O3(50.0),CAO(40.0),
SIO2(10.0) (%)
MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZAKEVITCH (1960)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-25

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	1.649	0.716	5.2
1600.00	5.339	1.224	0.531	3.4
1650.00	5.200	0.833	0.362	2.3
1700.00	5.068	0.531	0.230	1.7
1750.00	4.943	0.336	0.146	1.4
1800.00	4.824	0.182	0.079	1.2
1850.00	4.710	0.000	0.000	1.0
1900.00	4.602	0.000	0.000	1.0

SYSTEM
AL2O3(40.56),CAO(46.93),
SIO2(12.51) (X)
AL2O3(55.0),CAO(35.0),
SIO2(10.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-26

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	1.361	0.591	3.9
1650.00	5.200	0.956	0.415	2.6
1700.00	5.068	0.642	0.279	1.9
1750.00	4.943	0.470	0.204	1.6
1800.00	4.824	0.336	0.146	1.4

SYSTEM
AL2O3(51.01),CAO(35.67),
SIO2(13.32) (X)
AL2O3(65.0),CAO(25.0),
SIO2(10.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-27

T	Z	LN(N)	LOG(N)	N
1650.00	5.200	0.788	0.342	2.2
1700.00	5.068	0.531	0.230	1.7
1750.00	4.943	0.336	0.146	1.4
1800.00	4.824	0.182	0.079	1.2

SYSTEM
AL2O3(19.37),CAO(58.71),
SIO2(21.92) (X)
AL2O3(30.0),CAO(50.0),
SIO2(20.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-28

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	0.875	0.380	2.4
1650.00	5.200	0.588	0.255	1.8
1700.00	5.068	0.336	0.146	1.4
1750.00	4.943	0.182	0.079	1.2
1800.00	4.824	0.000	0.000	1.0
1850.00	4.710	-0.223	-0.097	0.8
1900.00	4.602	-0.357	-0.155	0.7
2000.00	4.399	-0.511	-0.222	0.6

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SYSTEM
AL2O3(27.27),CAO(49.59),
SIO2(23.14) (X)
AL2O3(40.0),CAO(40.0),
SIO2(20.0) (%)
MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZAKEVITCH (1960)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-29

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	1.841	0.799	6.3
1600.00	5.339	1.386	0.602	4.0
1650.00	5.200	0.993	0.431	2.7
1700.00	5.068	0.693	0.301	2.0
1750.00	4.943	0.405	0.176	1.5
1800.00	4.824	0.262	0.114	1.3
1850.00	4.710	0.095	0.041	1.1
1900.00	4.602	-0.105	-0.046	0.9

SYSTEM
AL2O3(36.10),CAO(39.39),
SIO2(24.51) (X)
AL2O3(50.0),CAO(30.0),
SIO2(20.0) (%)
MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZAKEVITCH (1960)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-30

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	2.442	1.061	11.5
1550.00	5.485	2.001	0.869	7.4
1600.00	5.339	1.548	0.672	4.7
1650.00	5.200	1.194	0.519	3.3
1700.00	5.068	0.916	0.398	2.5
1750.00	4.943	0.642	0.279	1.9
1800.00	4.824	0.405	0.176	1.5
1850.00	4.710	0.262	0.114	1.3
1900.00	4.602	0.182	0.079	1.2
1950.00	4.498	0.095	0.041	1.1
2000.00	4.399	0.000	0.000	1.0

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SYSTEM
AL2O3(46.05),CAO(27.90),
SIO2(26.05) (X)
AL2O3(60.0),CAO(20.0),
SIO2(20.0) (%)
MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZAKEVITCH (1960)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-31

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	0.993	0.431	2.7
1750.00	4.943	0.693	0.301	2.0
1800.00	4.824	0.470	0.204	1.6
1850.00	4.710	0.336	0.146	1.4
1900.00	4.602	0.262	0.114	1.3

SYSTEM
AL2O3(70.21),CAO(0.0),
SIO2(29.79) (X)
AL2O3(80.0),CAO(0.0),
SIO2(20.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-32

T	Z	LN(N)	LOG(N)	N
1950.00	4.498	-0.105	-0.046	0.9
2000.00	4.399	-0.223	-0.097	0.8
2050.00	4.305	-0.357	-0.155	0.7
2100.00	4.214	-0.511	-0.222	0.6

SYSTEM
AL2O3(12.36),CAO(56.18),
SIO2(31.46) (X)
AL2O3(20.0),CAO(50.0),
SIO2(30.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-33

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	0.916	0.398	2.5
1650.00	5.200	0.588	0.255	1.8
1700.00	5.068	0.336	0.146	1.4
1750.00	4.943	0.095	0.041	1.1
1800.00	4.824	-0.105	-0.046	0.9
1850.00	4.710	-0.223	-0.097	0.8
1900.00	4.602	-0.357	-0.155	0.7
2000.00	4.399	-0.511	-0.222	0.6

SYSTEM
AL2O3(19.52),CAO(47.34),
SIO2(33.14) (X)
AL2O3(30.0),CAO(40.0),
SIO2(30.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-34

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	2.219	0.964	9.2
1550.00	5.485	1.808	0.785	6.1
1600.00	5.339	1.482	0.643	4.4
1650.00	5.200	1.194	0.519	3.3
1700.00	5.068	0.875	0.380	2.4
1750.00	4.943	0.642	0.279	1.9
1800.00	4.824	0.405	0.176	1.5
1850.00	4.710	0.336	0.146	1.4
1900.00	4.602	0.262	0.114	1.3
1950.00	4.498	0.182	0.079	1.2
2000.00	4.399	0.095	0.041	1.1

SYSTEM
AL2O3(27.50),CAO(37.50),
SIO2(35.0) (X)
AL2O3(40.0),CAO(30.0),
SIO2(30.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-35

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	3.408	1.480	30.2
1500.00	5.640	2.890	1.255	18.0
1550.00	5.485	2.434	1.057	11.4
1600.00	5.339	2.054	0.892	7.8
1650.00	5.200	1.758	0.763	5.8
1700.00	5.068	1.482	0.643	4.4
1750.00	4.943	1.163	0.505	3.2
1800.00	4.824	0.875	0.380	2.4
1850.00	4.710	0.642	0.279	1.9
1900.00	4.602	0.531	0.230	1.7
1950.00	4.498	0.336	0.146	1.4
2000.00	4.399	0.182	0.079	1.2

SYSTEM
AL2O3(36.43),CAO(26.49),
SIO2(37.09) (X)
AL2O3(50.0),CAO(20.0),
SIO2(30.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-36

T	Z	LN(N)	LOG(N)	N
1650.00	5.200	1.887	0.820	6.6
1700.00	5.068	1.609	0.699	5.0
1750.00	4.943	1.361	0.591	3.9
1800.00	4.824	1.099	0.477	3.0
1850.00	4.710	0.833	0.362	2.3
1900.00	4.602	0.588	0.255	1.8
1950.00	4.498	0.405	0.176	1.5
2000.00	4.399	0.182	0.079	1.2

SYSTEM
AL2O3(46.48),CAO(14.08),
SIO2(39.44) (X)
AL2O3(60.0),CAO(10.0),
SIO2(30.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-37

T	Z	LN(N)	LOG(N)	N
1900.00	4.602	0.642	0.279	1.9
1950.00	4.498	0.405	0.176	1.5
2000.00	4.399	0.182	0.079	1.2

SYSTEM
AL2O3(5.92),CAO(53.86),
SIO2(40.21) (X)
AL2O3(10.0),CAO(50.0),
SIO2(40.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-38

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	1.668	0.724	5.3
1500.00	5.640	1.361	0.591	3.9
1550.00	5.485	1.030	0.447	2.8
1600.00	5.339	0.742	0.322	2.1
1650.00	5.200	0.470	0.204	1.6
1700.00	5.068	0.262	0.114	1.3
1750.00	4.943	0.095	0.041	1.1
1800.00	4.824	0.000	0.000	1.0
1850.00	4.710	-0.105	-0.046	0.9
1900.00	4.602	-0.223	-0.097	0.8
1950.00	4.498	-0.357	-0.155	0.7
2000.00	4.399	-0.511	-0.222	0.6

SYSTEM
AL2O3(12.46),CAO(45.28),
SIO2(42.26) (X)
AL2O3(20.0),CAO(40.0),
SIO2(40.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-39

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.688	1.167	14.7
1500.00	5.640	2.219	0.964	9.2
1550.00	5.485	1.825	0.792	6.2
1600.00	5.339	1.459	0.633	4.3
1650.00	5.200	1.099	0.477	3.0
1700.00	5.068	0.788	0.342	2.2
1750.00	4.943	0.693	0.301	2.0
1800.00	4.824	0.588	0.255	1.8
1850.00	4.710	0.470	0.204	1.6
1900.00	4.602	0.336	0.146	1.4
1950.00	4.498	0.262	0.114	1.3
2000.00	4.399	0.182	0.079	1.2

SYSTEM
AL2O3(19.68),CAO(35.79),
SIO2(44.53) (X)
AL2O3(30.0),CAO(30.0),
SIO2(40.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-40

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	3.669	1.593	39.2
1500.00	5.640	3.246	1.410	25.7
1550.00	5.485	2.821	1.225	16.8
1600.00	5.339	2.398	1.041	11.0
1650.00	5.200	2.028	0.881	7.6
1700.00	5.068	1.668	0.724	5.3
1750.00	4.943	1.335	0.580	3.8
1800.00	4.824	1.030	0.447	2.8
1850.00	4.710	0.833	0.362	2.3
1900.00	4.602	0.693	0.301	2.0
1950.00	4.498	0.588	0.255	1.8
2000.00	4.399	0.470	0.204	1.6

SYSTEM
AL2O3(27.73),CAO(25.21),
SIO2(47.06) (X)
AL2O3(40.0),CAO(20.0),
SIO2(40.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-41

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	2.991	1.299	19.9
1650.00	5.200	2.632	1.143	13.9
1700.00	5.068	2.262	0.982	9.6
1750.00	4.943	1.960	0.851	7.1
1800.00	4.824	1.668	0.724	5.3
1850.00	4.710	1.411	0.613	4.1
1900.00	4.602	1.131	0.491	3.1

SYSTEM
AL2O3(46.92),CAO(0.0),
SIO2(53.08) (X)
AL2O3(60.0),CAO(0.0),
SIO2(40.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-42

T	Z	LN(N)	LOG(N)	N
1850.00	4.710	1.194	0.519	3.3
1900.00	4.602	0.875	0.380	2.4
1950.00	4.498	0.588	0.255	1.8
2000.00	4.399	0.405	0.176	1.5
2050.00	4.305	0.262	0.114	1.3
2100.00	4.214	0.182	0.079	1.2

SYSTEM
AL2O3(24.96),CAO(25.05),
SIO2(49.99) (X)
AL2O3(36.6),CAO(20.2),
SIO2(43.2) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-43

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	3.235	1.405	25.4
1650.00	5.200	2.809	1.220	16.6
1700.00	5.068	2.370	1.029	10.7
1750.00	4.943	1.988	0.863	7.3
1800.00	4.824	1.723	0.748	5.6

SYSTEM
AL2O3(0.0),CAO(51.72),
SIO2(48.28) (X)
AL2O3(0.0),CAO(50.0),
SIO2(50.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-44

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	0.875	0.380	2.4
1600.00	5.339	0.588	0.255	1.8
1650.00	5.200	0.336	0.146	1.4
1700.00	5.068	0.095	0.041	1.1
1750.00	4.943	-0.105	-0.046	0.9
1800.00	4.824	-0.223	-0.097	0.8
1900.00	4.602	-0.223	-0.097	0.8
2000.00	4.399	-0.357	-0.155	0.7

SYSTEM
AL2O3(5.97),CAO(43.40),
SIO2(50.63) (X)
AL2O3(10.0),CAO(40.0),
SIO2(50.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-45

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.510	1.090	12.3
1500.00	5.640	2.152	0.934	8.6
1550.00	5.485	1.825	0.792	6.2
1600.00	5.339	1.504	0.653	4.5
1650.00	5.200	1.224	0.531	3.4
1700.00	5.068	0.956	0.415	2.6
1750.00	4.943	0.693	0.301	2.0
1800.00	4.824	0.588	0.255	1.8
1850.00	4.710	0.470	0.204	1.6
1900.00	4.602	0.336	0.146	1.4
1950.00	4.498	0.182	0.079	1.2
2000.00	4.399	0.000	0.000	1.0

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SYSTEM
AL2O3(12.55),CAO(34.22),
SIO2(53.23) (X)
AL2O3(20.0),CAO(30.0),
SIO2(50.0) (%)
MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZAKEVITCH (1960)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-46

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	3.747	1.627	42.4
1500.00	5.640	3.472	1.508	32.2
1550.00	5.485	3.096	1.344	22.1
1600.00	5.339	2.760	1.199	15.8
1650.00	5.200	2.451	1.064	11.6
1700.00	5.068	2.128	0.924	8.4
1750.00	4.943	1.775	0.771	5.9
1800.00	4.824	1.482	0.643	4.4
1850.00	4.710	1.253	0.544	3.5
1900.00	4.602	1.099	0.477	3.0
1950.00	4.498	0.993	0.431	2.7
2000.00	4.399	0.916	0.398	2.5

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SYSTEM
AL2O3(19.84),CAO(24.05),
SIO2(56.12) (X)
AL2O3(30.0),CAO(20.0),
SIO2(50.0) (%)
MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZAKEVITCH (1960)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-47

T	Z	LN(N)	LOG(N)	N
1650.00	5.200	3.509	1.524	33.4
1700.00	5.068	3.105	1.348	22.3
1750.00	4.943	2.688	1.167	14.7
1800.00	4.824	2.370	1.029	10.7
1850.00	4.710	2.079	0.903	8.0
1900.00	4.602	1.792	0.778	6.0
1950.00	4.498	1.526	0.663	4.6
2000.00	4.399	1.335	0.580	3.8

--

SYSTEM
AL2O3(27.97),CAO(12.71),
SIO2(59.32) (X)
AL2O3(40.0),CAO(10.0),
SIO2(50.0) (%)
MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZAKEVITCH (1960)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-48

T	Z	LN(N)	LOG(N)	N
1750.00	4.943	2.862	1.243	17.5
1800.00	4.824	2.518	1.093	12.4
1850.00	4.710	2.152	0.934	8.6
1900.00	4.602	1.808	0.785	6.1
1950.00	4.498	1.482	0.643	4.4
2000.00	4.399	1.308	0.568	3.7

SYSTEM
AL2O3(37.08),CAO(0.0),
SIO2(62.92) (X)
AL2O3(50.0),CAO(0.0),
SIO2(50.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-49

T	Z	LN(N)	LOG(N)	N
1850.00	4.710	1.758	0.763	5.8
1900.00	4.602	1.411	0.613	4.1
1950.00	4.498	1.131	0.491	3.1
2000.00	4.399	0.916	0.398	2.5
2050.00	4.305	0.788	0.342	2.2
2100.00	4.214	0.642	0.279	1.9

SYSTEM
AL2O3(0.0),CAO(41.67),
SIO2(58.33) (X)
AL2O3(0.0),CAO(40.0),
SIO2(60.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-50

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	2.230	0.968	9.3
1550.00	5.485	1.872	0.813	6.5
1600.00	5.339	1.548	0.672	4.7
1650.00	5.200	1.281	0.556	3.6
1700.00	5.068	0.993	0.431	2.7
1750.00	4.943	0.788	0.342	2.2
1800.00	4.824	0.588	0.255	1.8
1850.00	4.710	0.405	0.176	1.5
1900.00	4.602	0.262	0.114	1.3
1950.00	4.498	0.095	0.041	1.1
2000.00	4.399	0.000	0.000	1.0

SYSTEM
AL2O3(6.01),CAO(32.79),
SIO2(61.20) (X)
AL2O3(10.0),CAO(30.0),
SIO2(60.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-51

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	2.885	1.253	17.9
1650.00	5.200	2.518	1.093	12.4
1700.00	5.608	2.186	0.949	8.9
1750.00	4.943	1.887	0.820	6.6
1800.00	4.824	1.609	0.699	5.0
1850.00	4.710	1.361	0.591	3.9
1900.00	4.602	1.099	0.477	3.0

--

SYSTEM
AL2O3(12.65),CAO(22.99),
SIO2(64.37) (X)
AL2O3(20.0),CAO(20.0),
SIO2(60.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-52

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	3.638	1.580	38.0
1750.00	4.943	3.300	1.433	27.1
1800.00	4.824	2.929	1.272	18.7
1850.00	4.710	2.580	1.121	13.2
1900.00	4.602	2.313	1.004	10.1
1950.00	4.498	2.128	0.924	8.4
2000.00	4.399	1.988	0.863	7.3

--

SYSTEM
AL2O3(20.00),CAO(12.12),
SIO2(67.88) (X)
AL2O3(30.0),CAO(10.0),
SIO2(60.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-53

T	Z	LN(N)	LOG(N)	N
1800.00	4.824	3.239	1.407	25.5
1850.00	4.710	2.821	1.225	16.8
1900.00	4.602	2.518	1.093	12.4
1950.00	4.498	2.282	0.991	9.8

--

SYSTEM
AL2O3(0.0),CAO(31.47),
SIO2(68.53) (X)
AL2O3(0.0),CAO(30.0),
SIO2(70.0) (%)

AUTHOR
KOZAKEVITCH (1960)

MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER

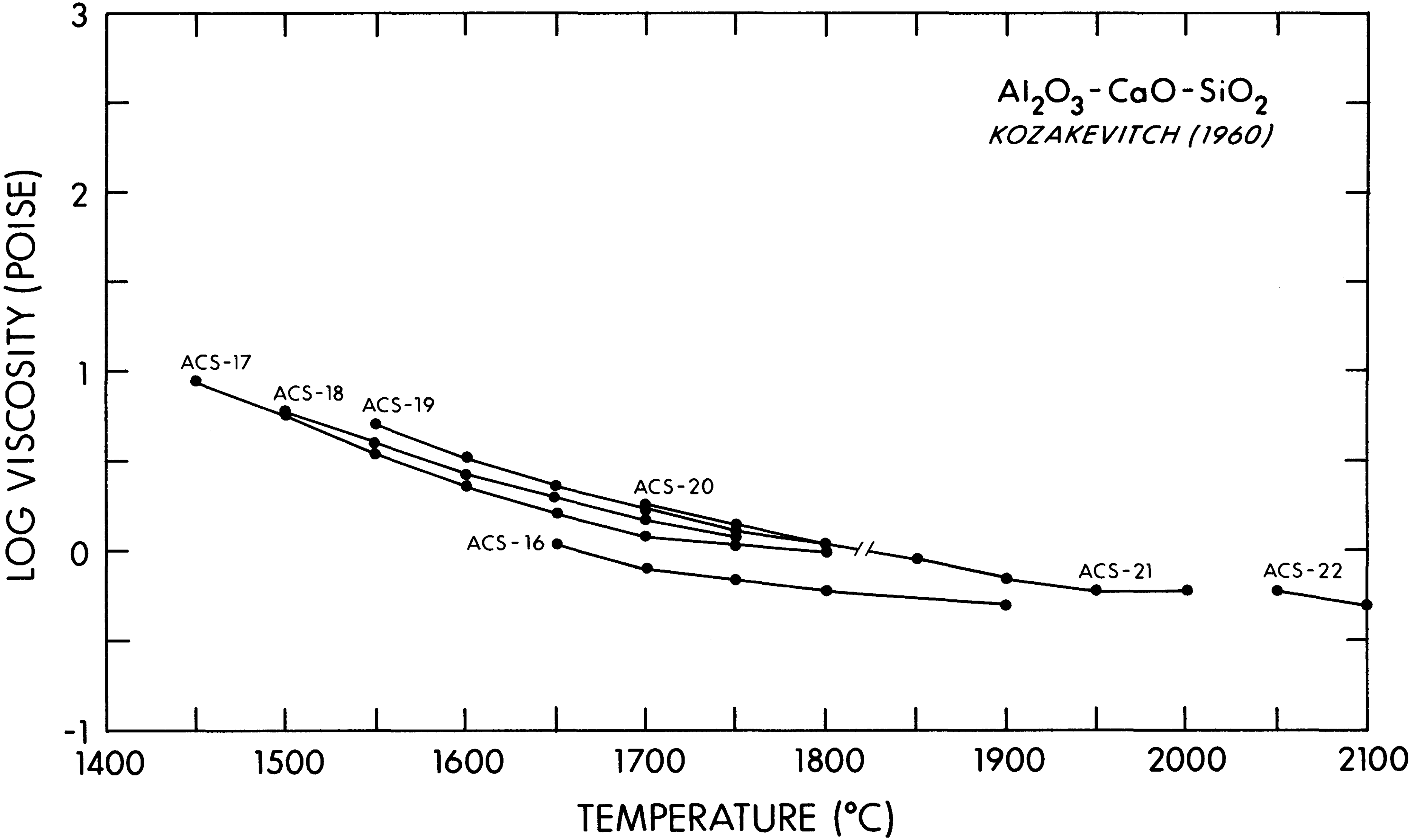
DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

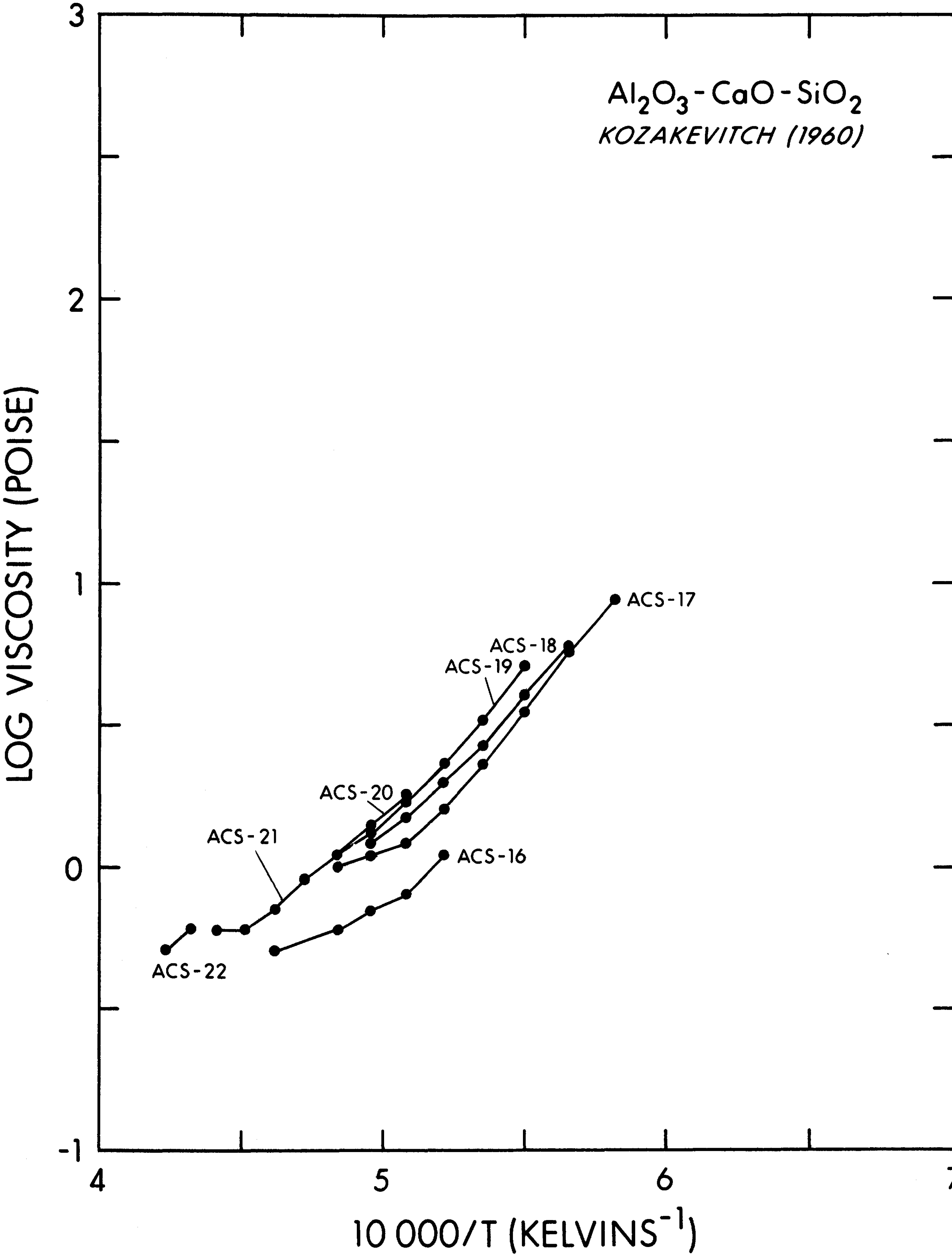
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-54

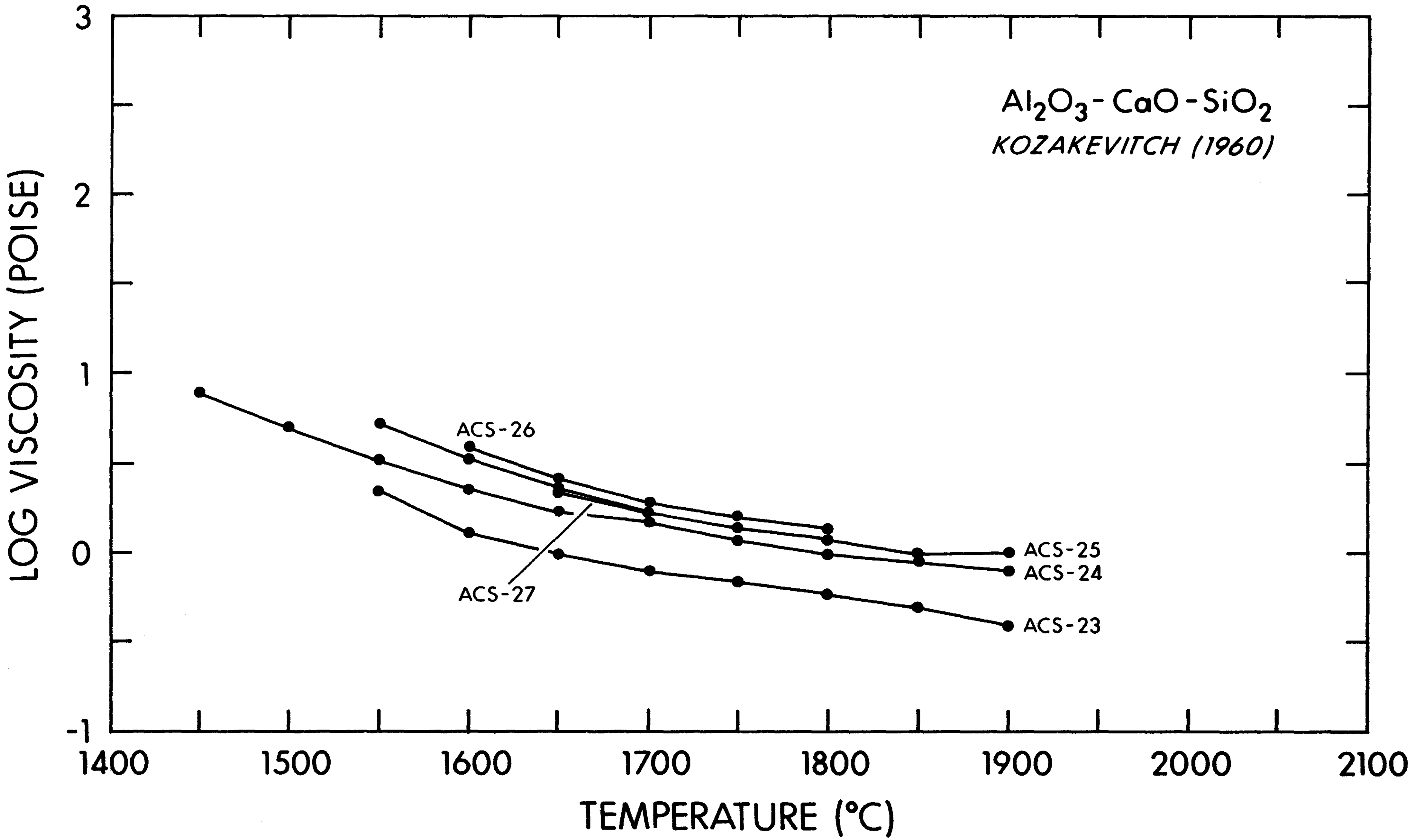
T	Z	LN(N)	LOG(N)	N
1700.00	5.068	2.510	1.090	12.3
1750.00	4.943	2.230	0.968	9.3
1800.00	4.824	2.001	0.869	7.4
1850.00	4.710	1.825	0.792	6.2
1900.00	4.602	1.686	0.732	5.4



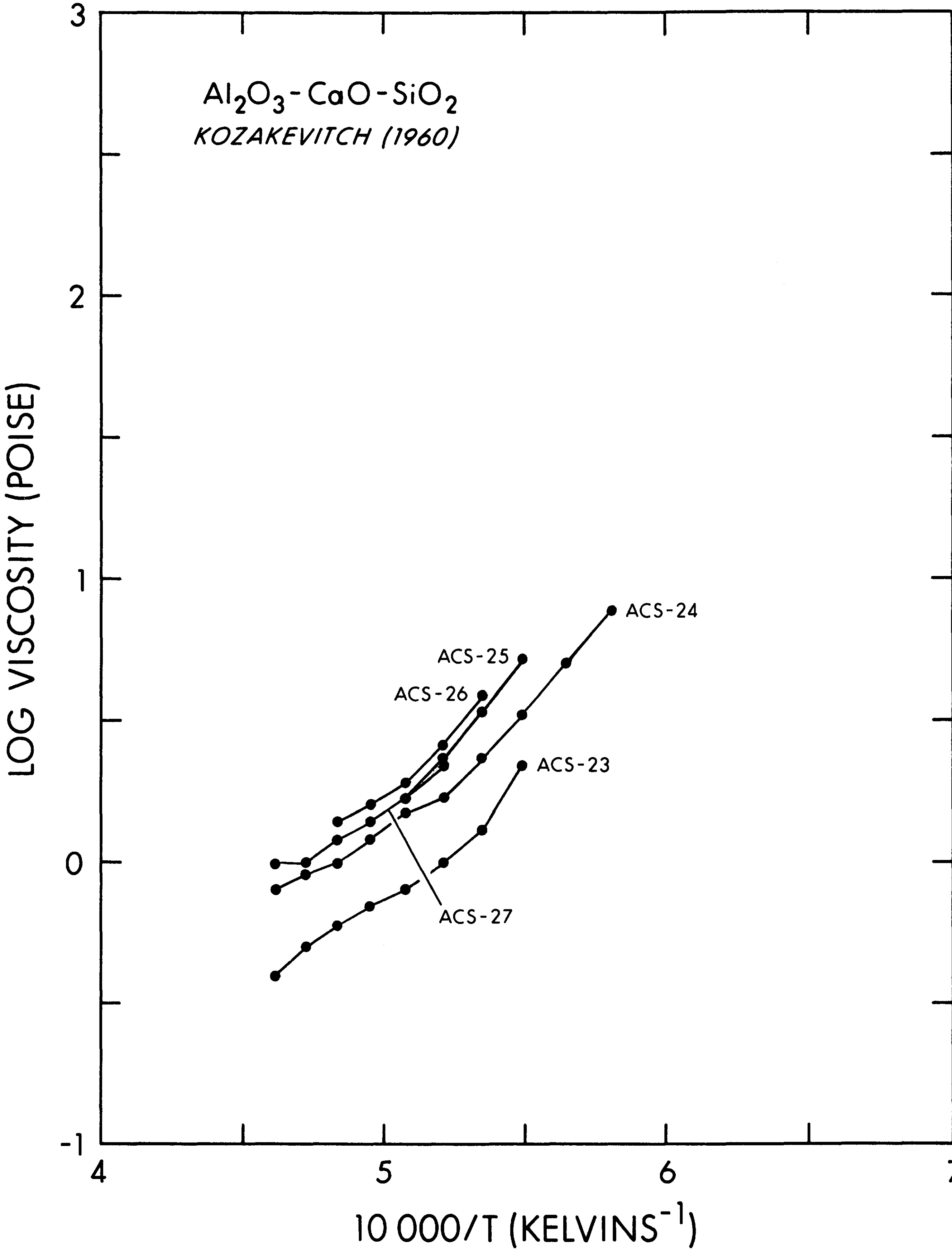
$Al_2O_3 - CaO - SiO_2$
KOZAKEVITCH (1960)
ACS-17
ACS-18
ACS-19
ACS-20
ACS-16
ACS-21
ACS-22
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
3
2
1
0
-1
1400
1500
1600
1700
1800
1900
2000
2100



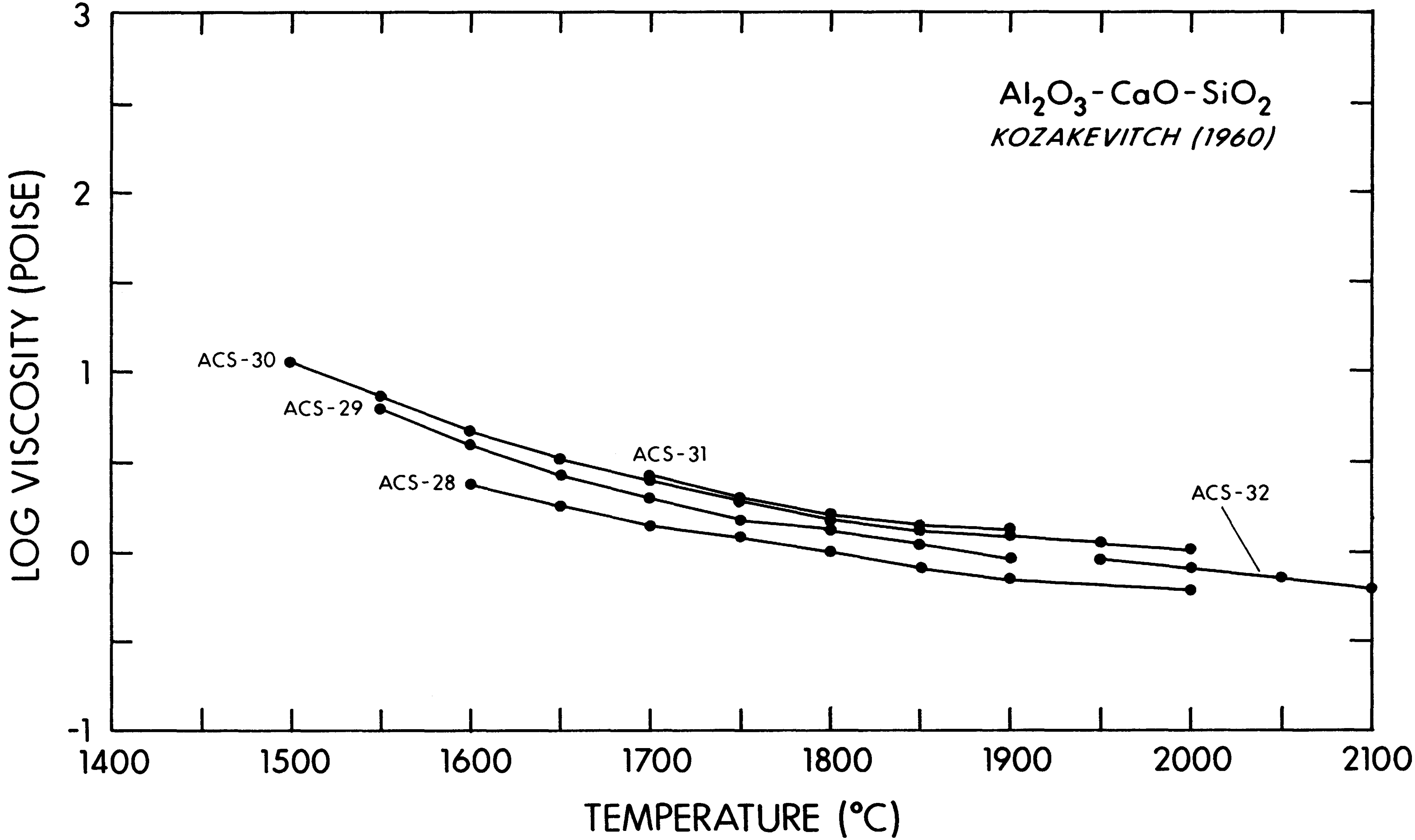
Al_2O_3 - CaO - SiO_2
KOZAKEVITCH (1960)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
ACS-17
ACS-18
ACS-19
ACS-20
ACS-21
ACS-16
ACS-22
3
2
1
0
-1
4
5
6
7



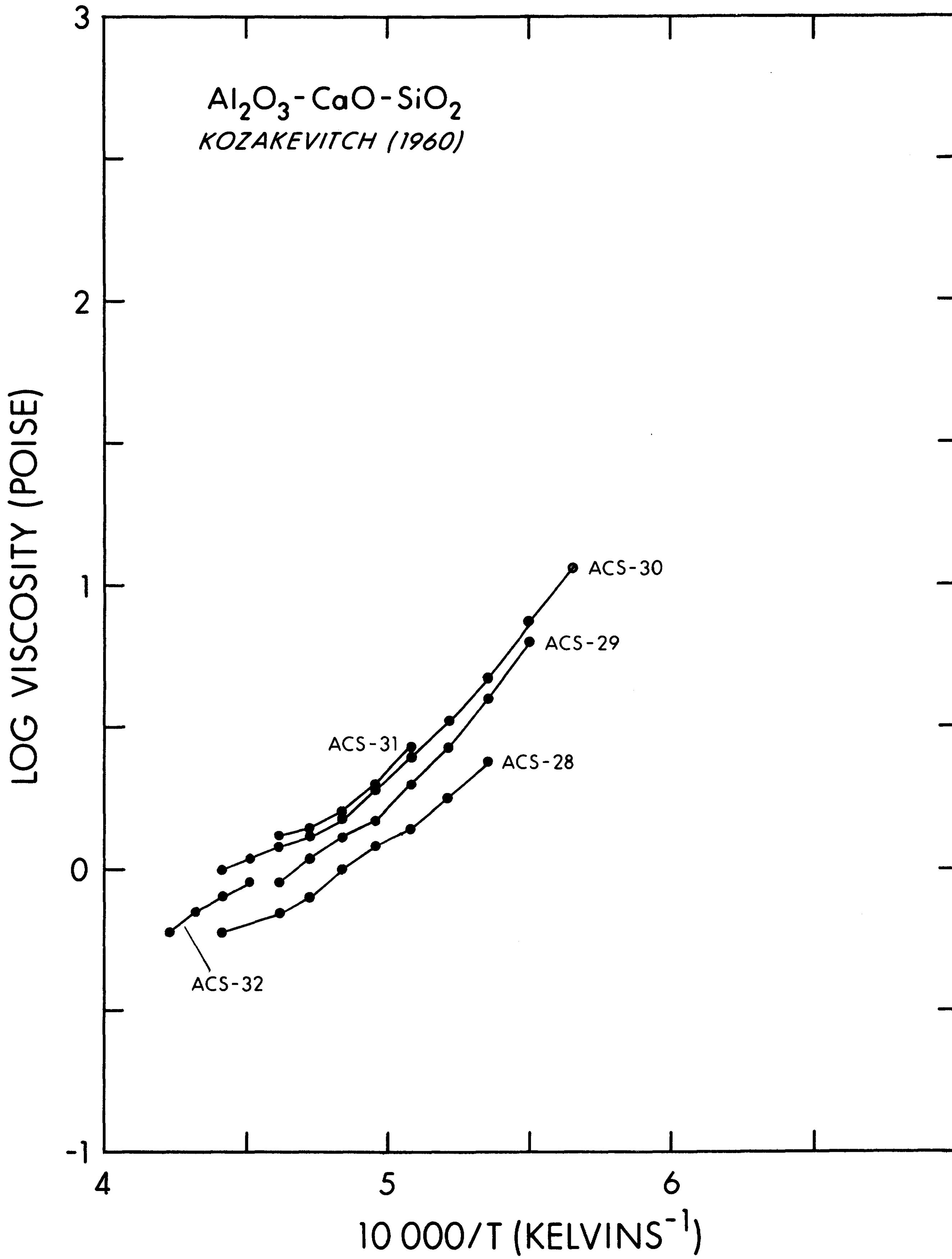
Al_2O_3 - CaO - SiO_2
KOZAKEVITCH (1960)
ACS-26
ACS-27
ACS-25
ACS-24
ACS-23
3
2
1
0
-1
LOG VISCOSITY (POISE)
1400
1500
1600
1700
1800
1900
2000
2100
TEMPERATURE (°C)

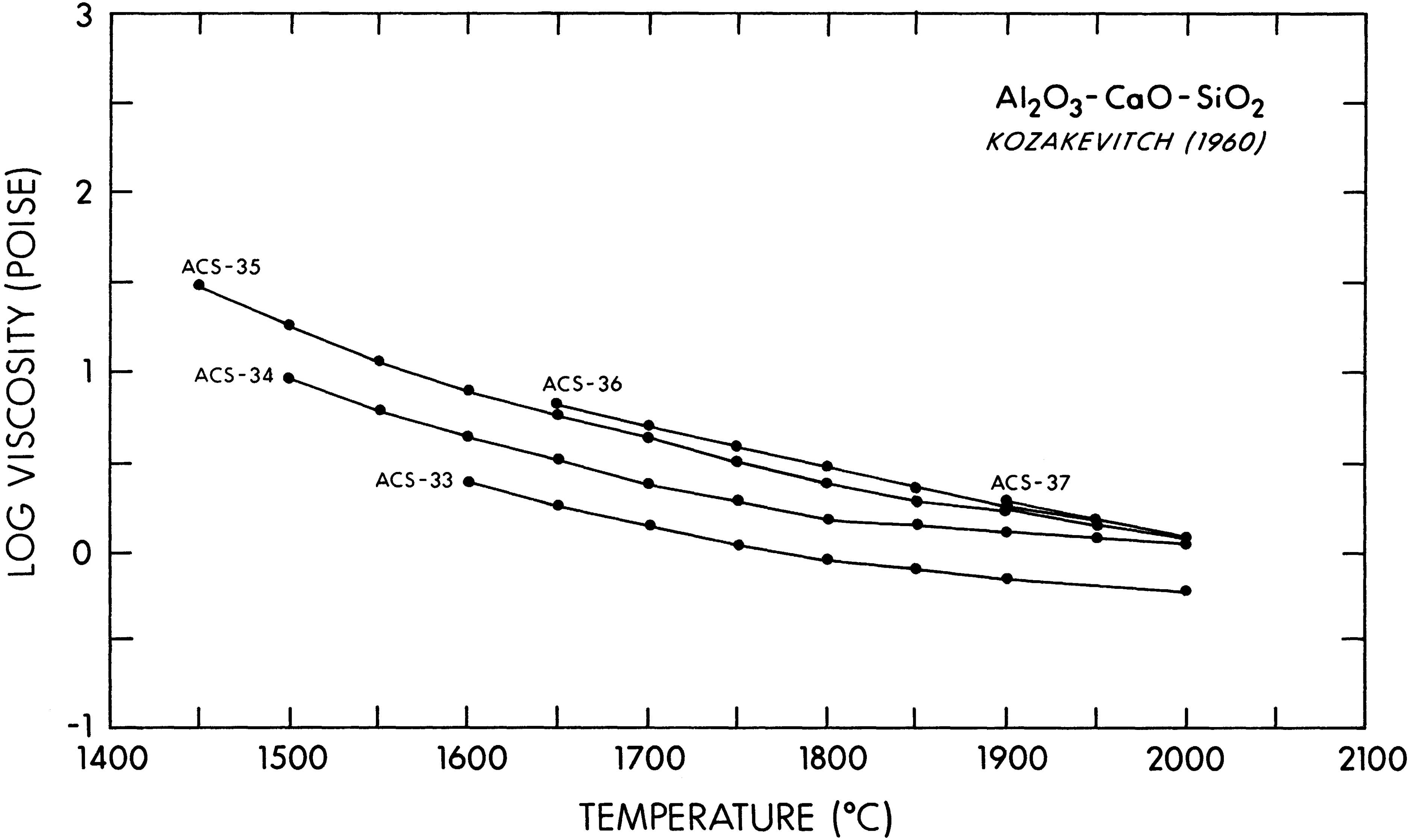


Al_2O_3-CaO-SiO_2
KOZAKEVITCH (1960)
ACS-24
ACS-25
ACS-26
ACS-23
ACS-27
LOG VISCOSITY (POISE)
3
2
1
0
-1
4
5
6
7
10 000/T (KELVINS^{-1})

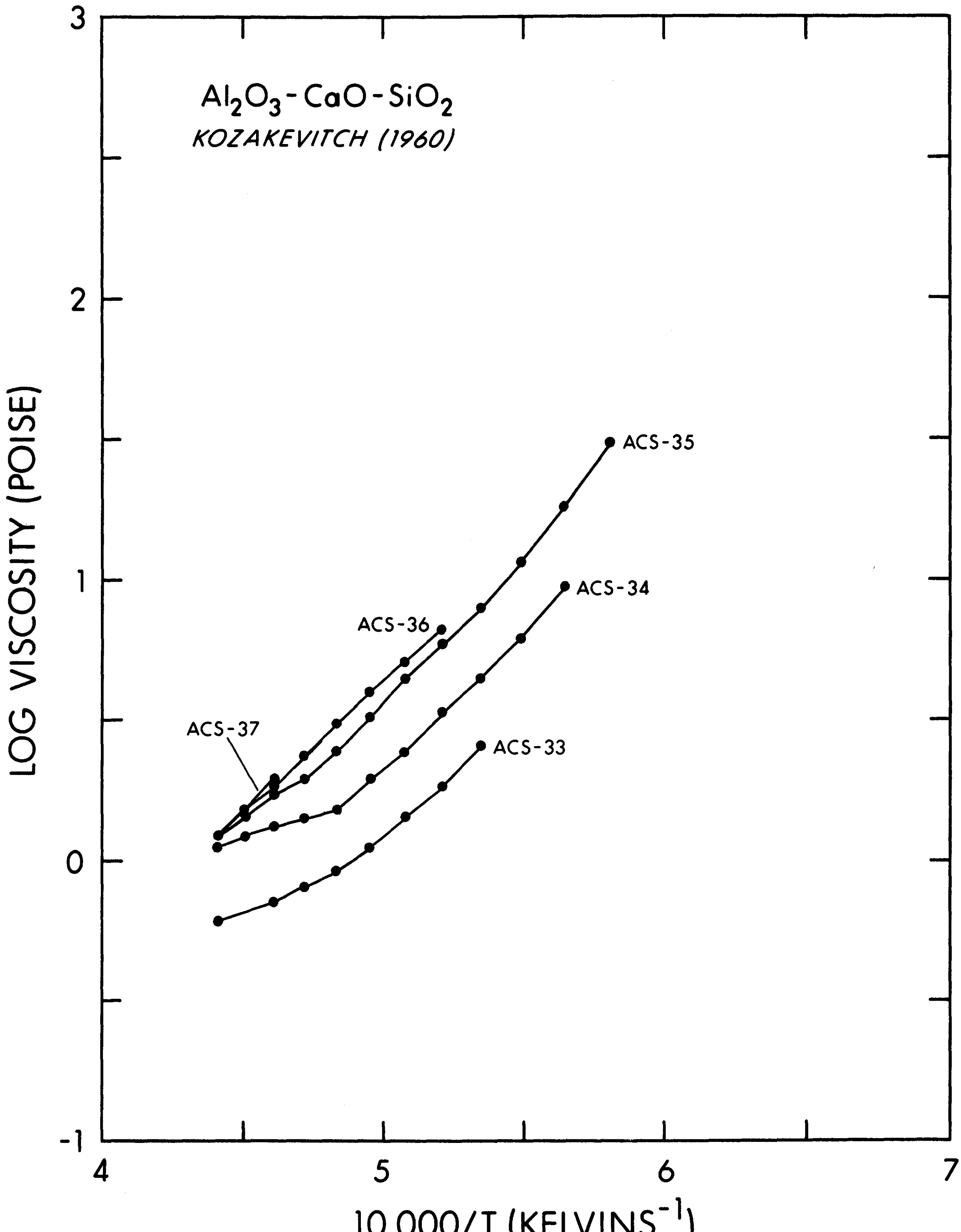


$Al_2O_3 - CaO - SiO_2$
KOZAKEVITCH (1960)
ACS-30
ACS-29
ACS-28
ACS-31
ACS-32
LOG VISCOSITY (POISE)
3
2
1
0
-1
1400
1500
1600
1700
1800
1900
2000
2100
TEMPERATURE (°C)

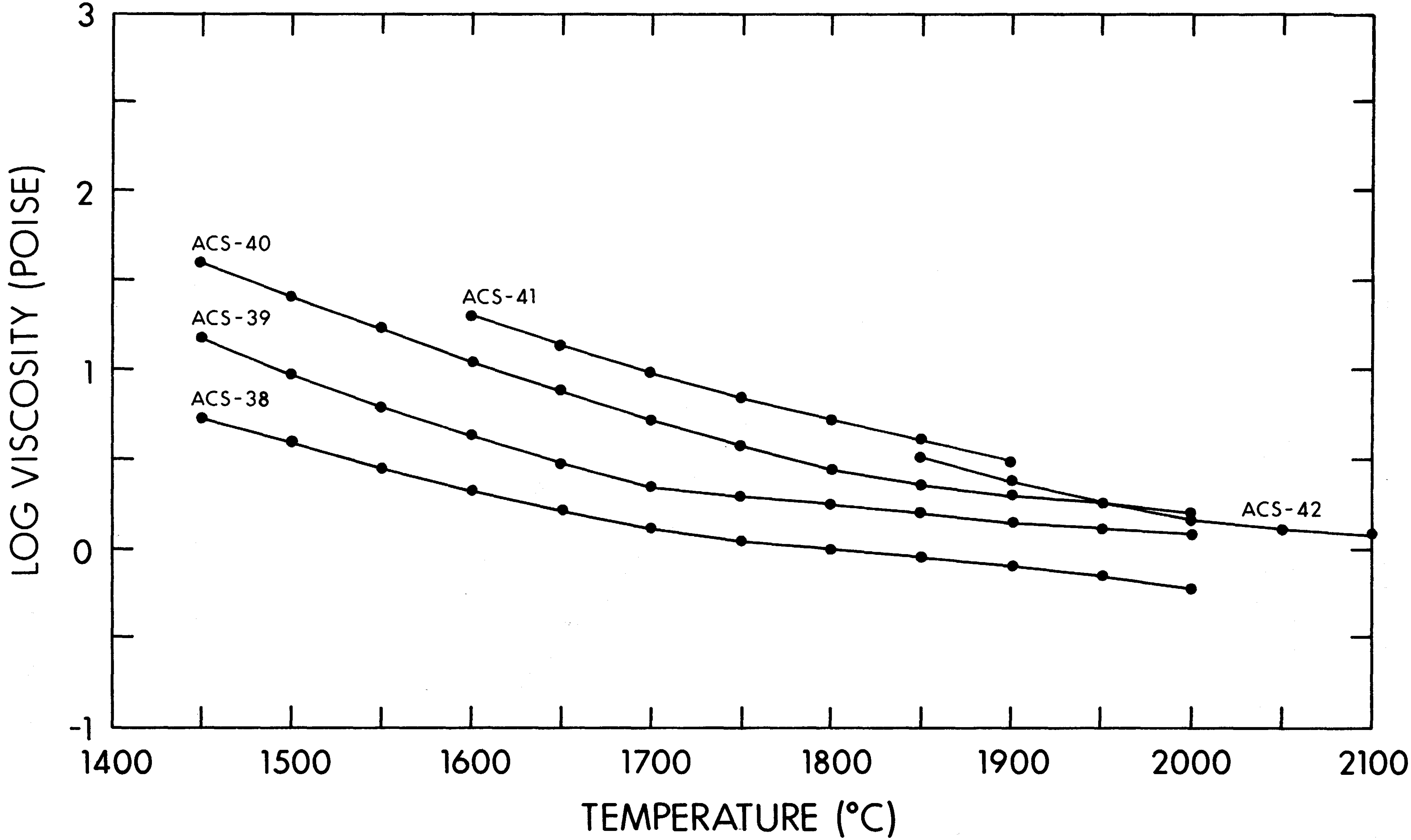

Al_2O_3-CaO-SiO_2
KOZAKEVITCH (1960)
ACS-30
ACS-29
ACS-31
ACS-28
ACS-32
LOG VISCOSITY (POISE)
3
2
1
0
-1
4
5
6
7
10 000/T (KELVINS^{-1})



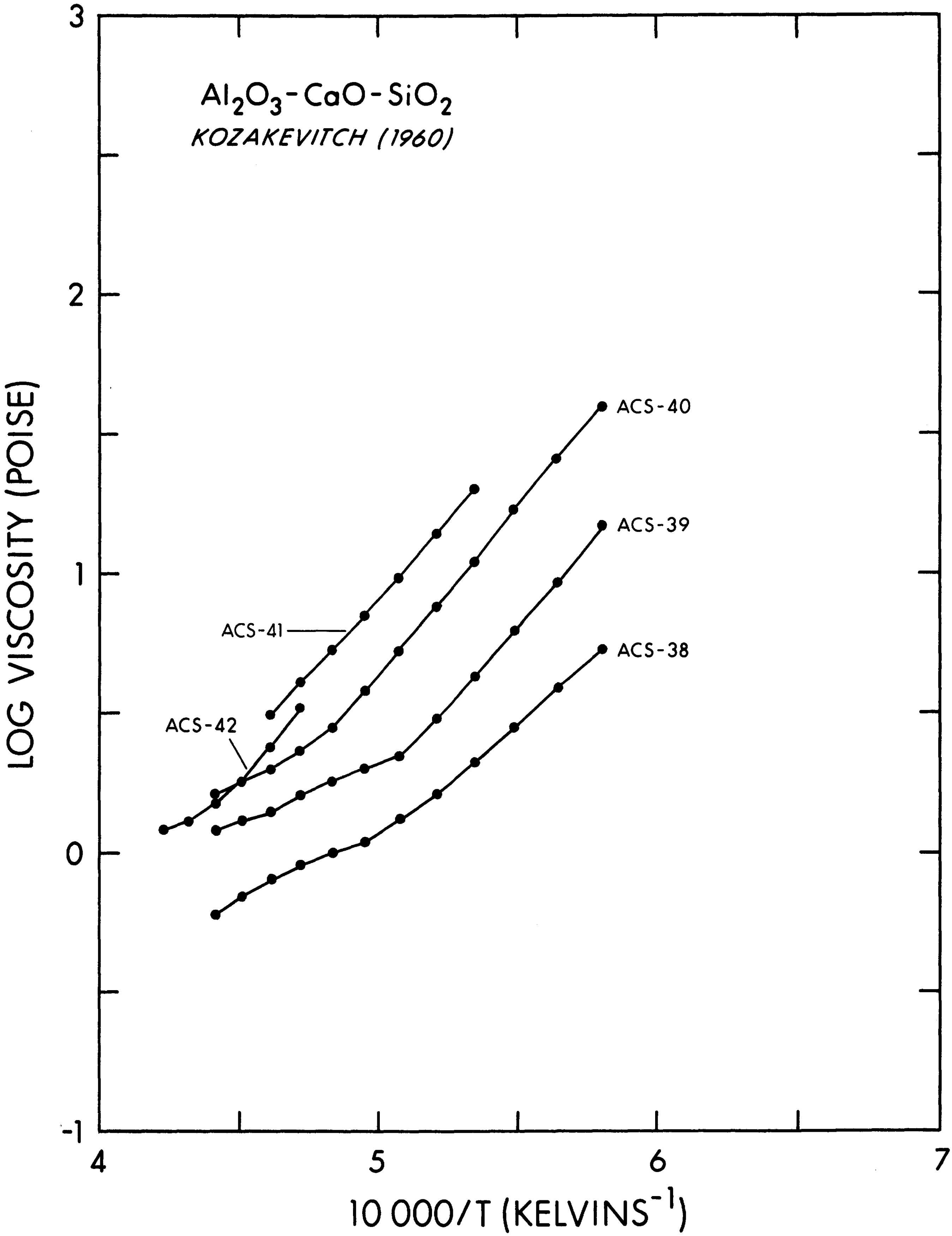
Al_2O_3 - CaO - SiO_2
KOZAKEVITCH (1960)
ACS-35
ACS-34
ACS-36
ACS-33
ACS-37
LOG VISCOSITY (POISE)
3
2
1
0
-1
1400
1500
1600
1700
1800
1900
2000
2100
TEMPERATURE (°C)



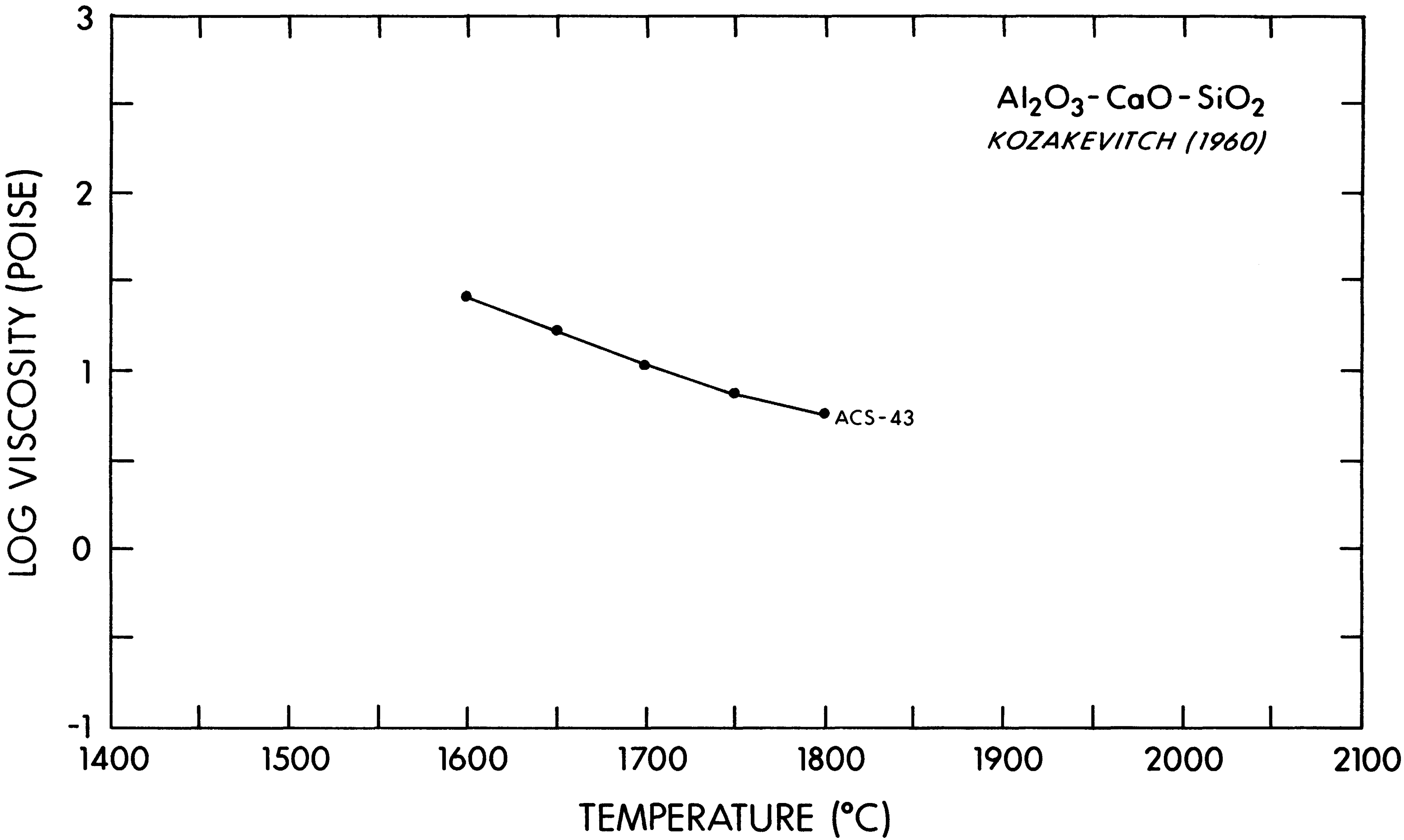
Al_2O_3 - CaO - SiO_2
KOZAKEVITCH (1960)
ACS-35
ACS-34
ACS-36
ACS-37
ACS-33
3
2
1
0
-1
4
5
6
7
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})



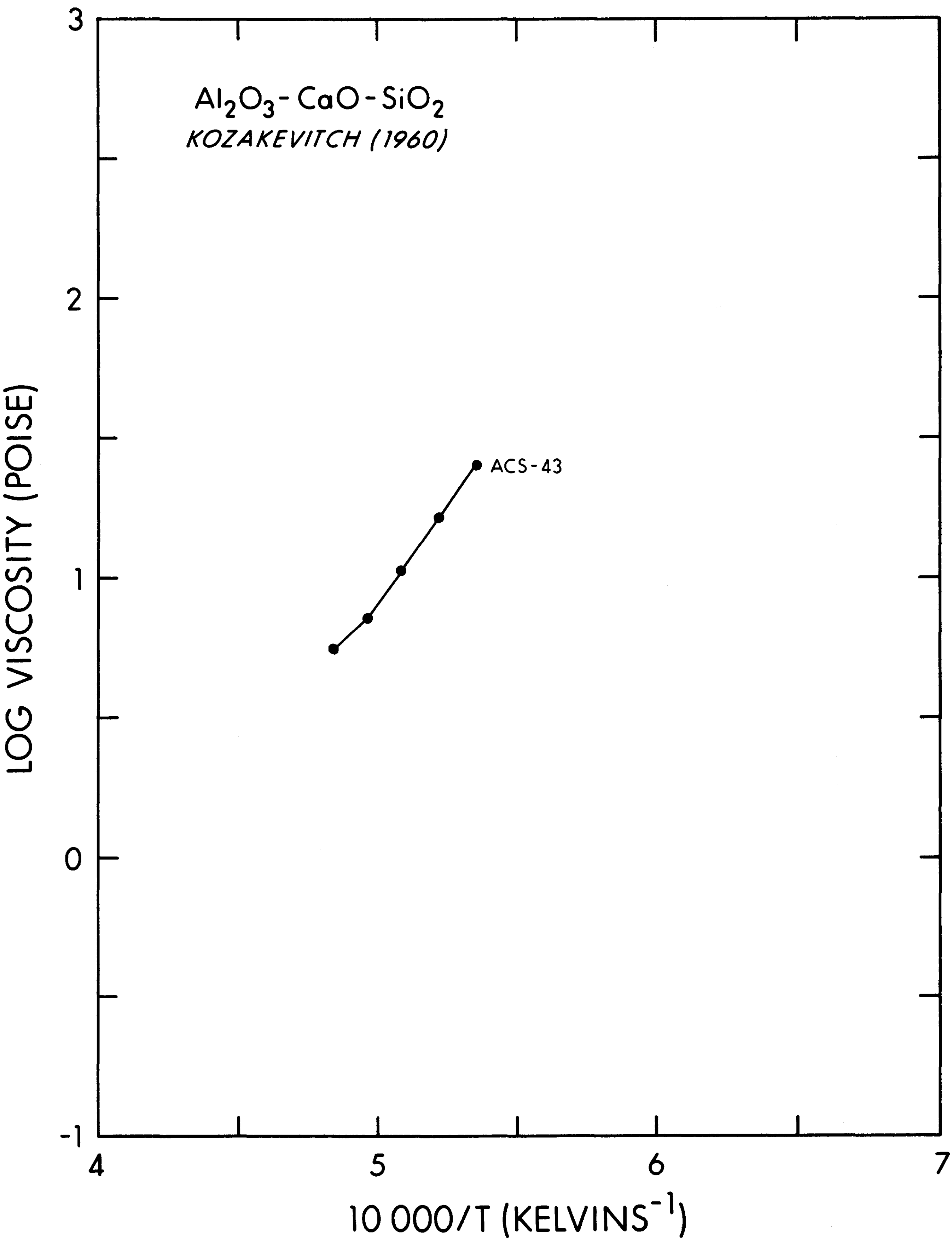
LOG VISCOSITY (POISE)
3
2
1
0
-1
1400
1500
1600
1700
1800
1900
2000
2100
TEMPERATURE (°C)
ACS-40
ACS-39
ACS-38
ACS-41
ACS-42



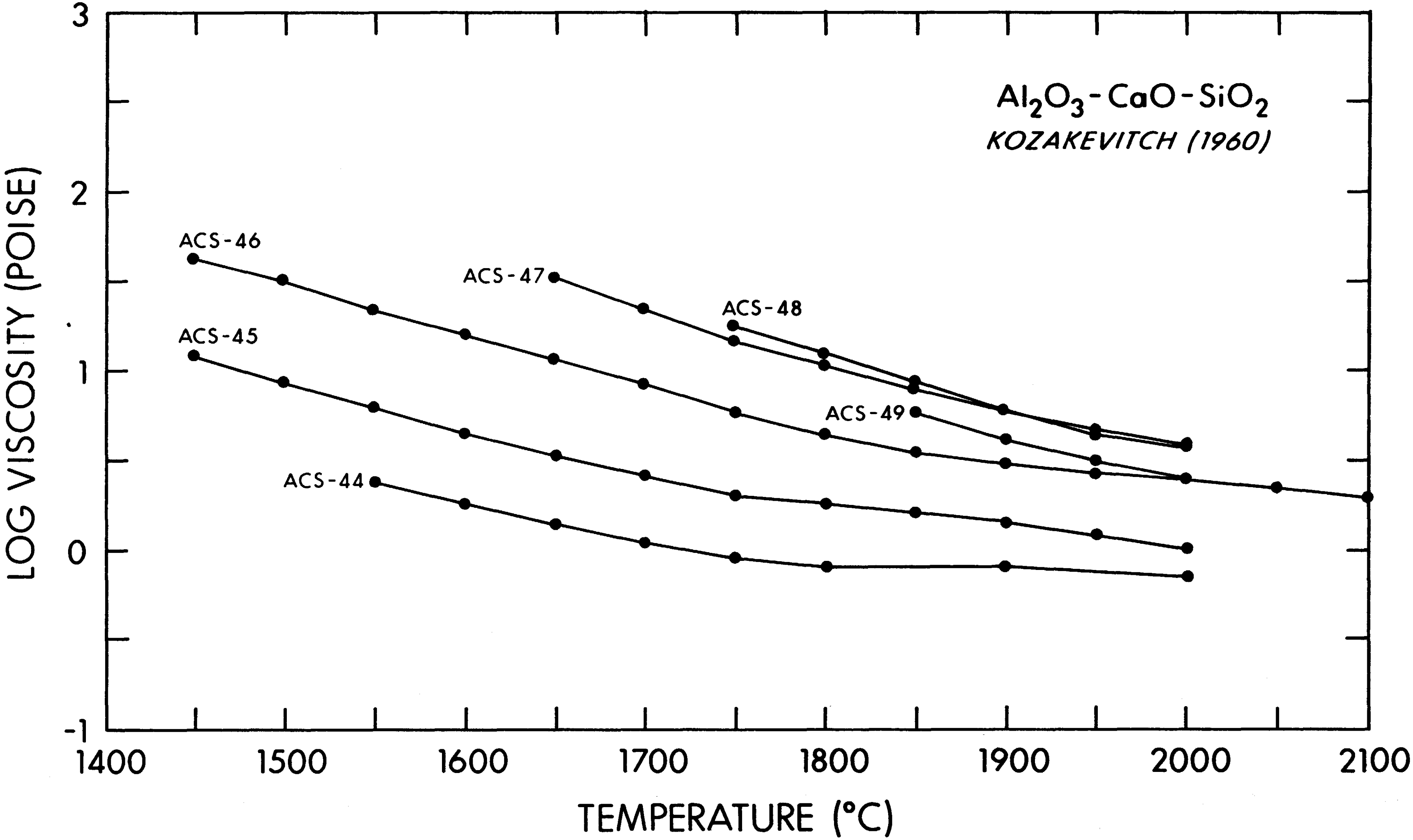
Al_2O_3-CaO-SiO_2
KOZAKEVITCH (1960)
ACS-40
ACS-39
ACS-38
ACS-41
ACS-42
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
3
2
1
0
-1
4
5
6
7



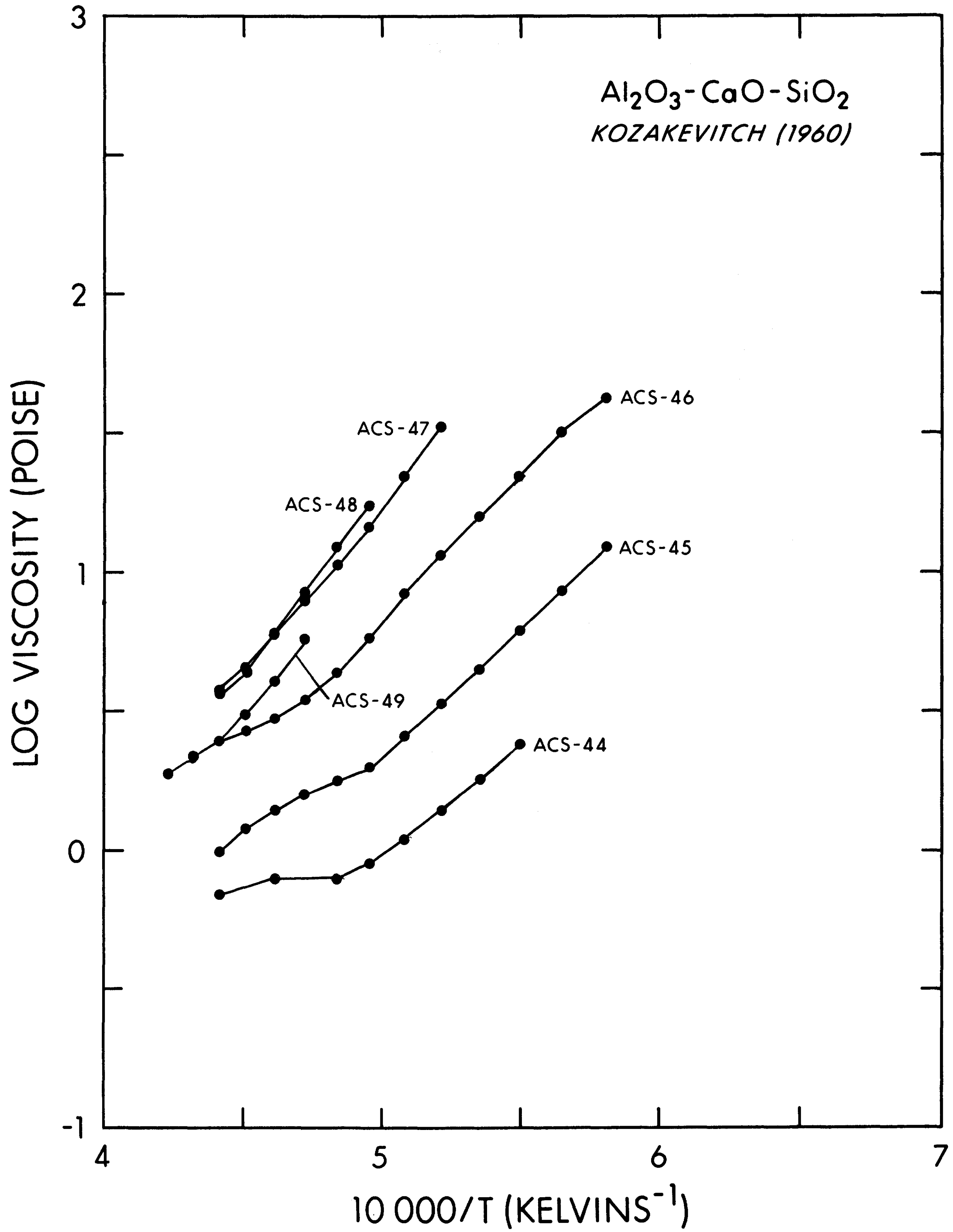
Al2O3 - CaO - SiO2
KOZAKEVITCH (1960)
ACS-43
LOG VISCOSITY (POISE)
3
2
1
0
-1
1400
1500
1600
1700
1800
1900
2000
2100
TEMPERATURE (°C)



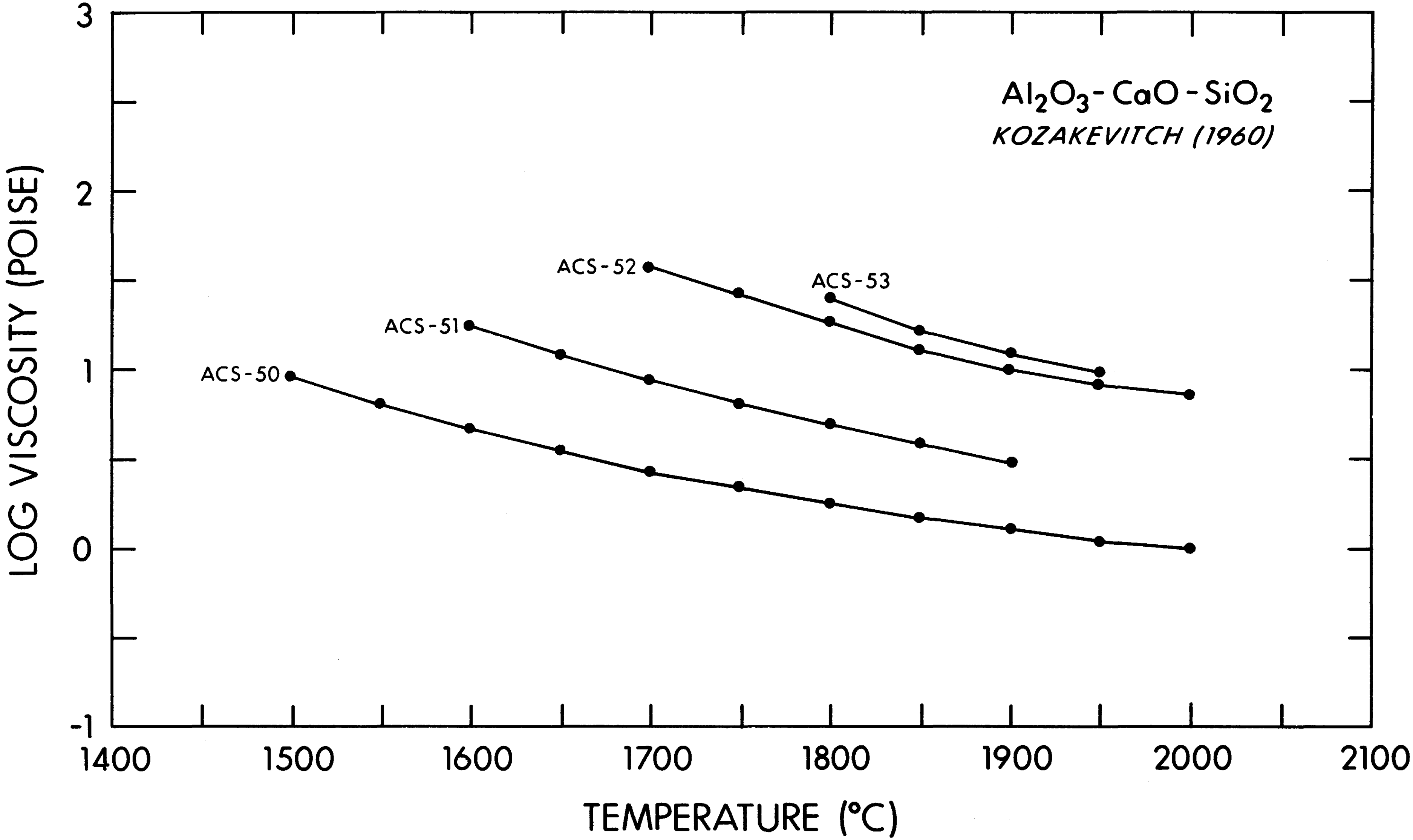
Al_2O_3 - CaO - SiO_2
KOZAKEVITCH (1960)
ACS-43
LOG VISCOSITY (POISE)
3
2
1
0
-1
4
5
6
7
10 000/T (KELVINS^{-1})



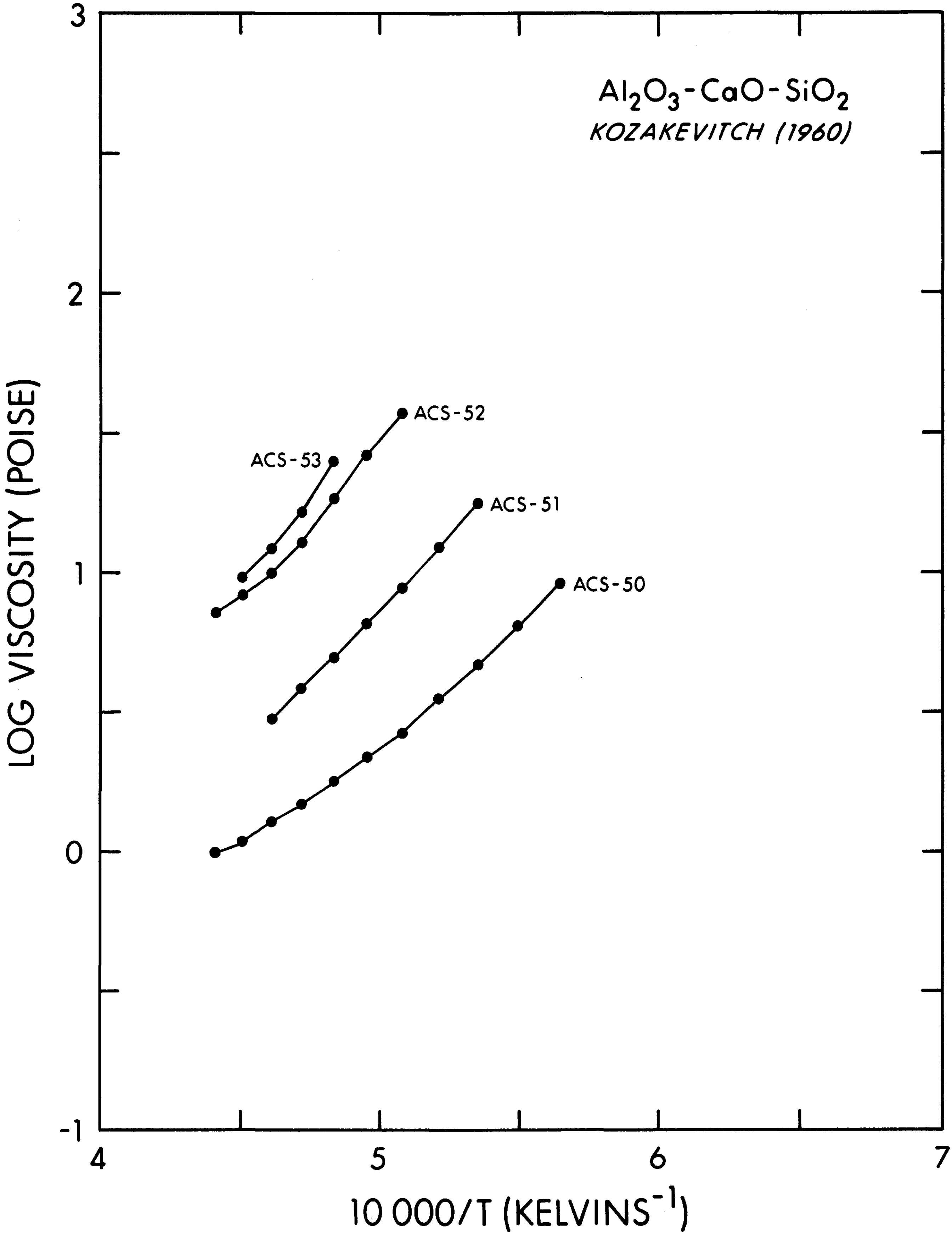
Al_2O_3 - CaO - SiO_2
KOZAKEVITCH (1960)
ACS-46
ACS-47
ACS-48
ACS-45
ACS-49
ACS-44
LOG VISCOSITY (POISE)
3
2
1
0
-1
1400
1500
1600
1700
1800
1900
2000
2100
TEMPERATURE (°C)

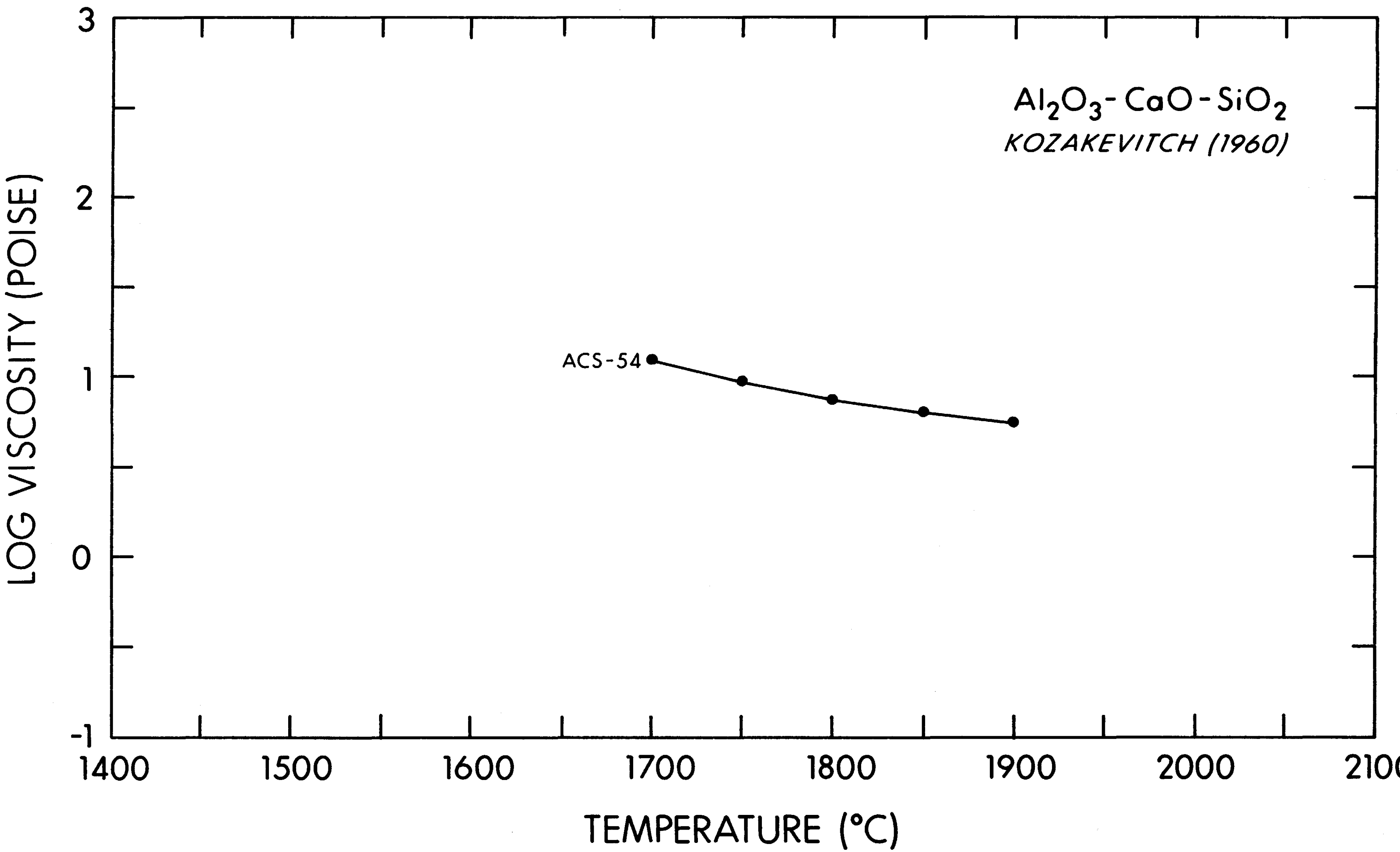


Al_2O_3-CaO-SiO_2
KOZAKEVITCH (1960)
ACS-47
ACS-48
ACS-46
ACS-45
ACS-49
ACS-44
3
2
1
0
-1
4
5
6
7
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})

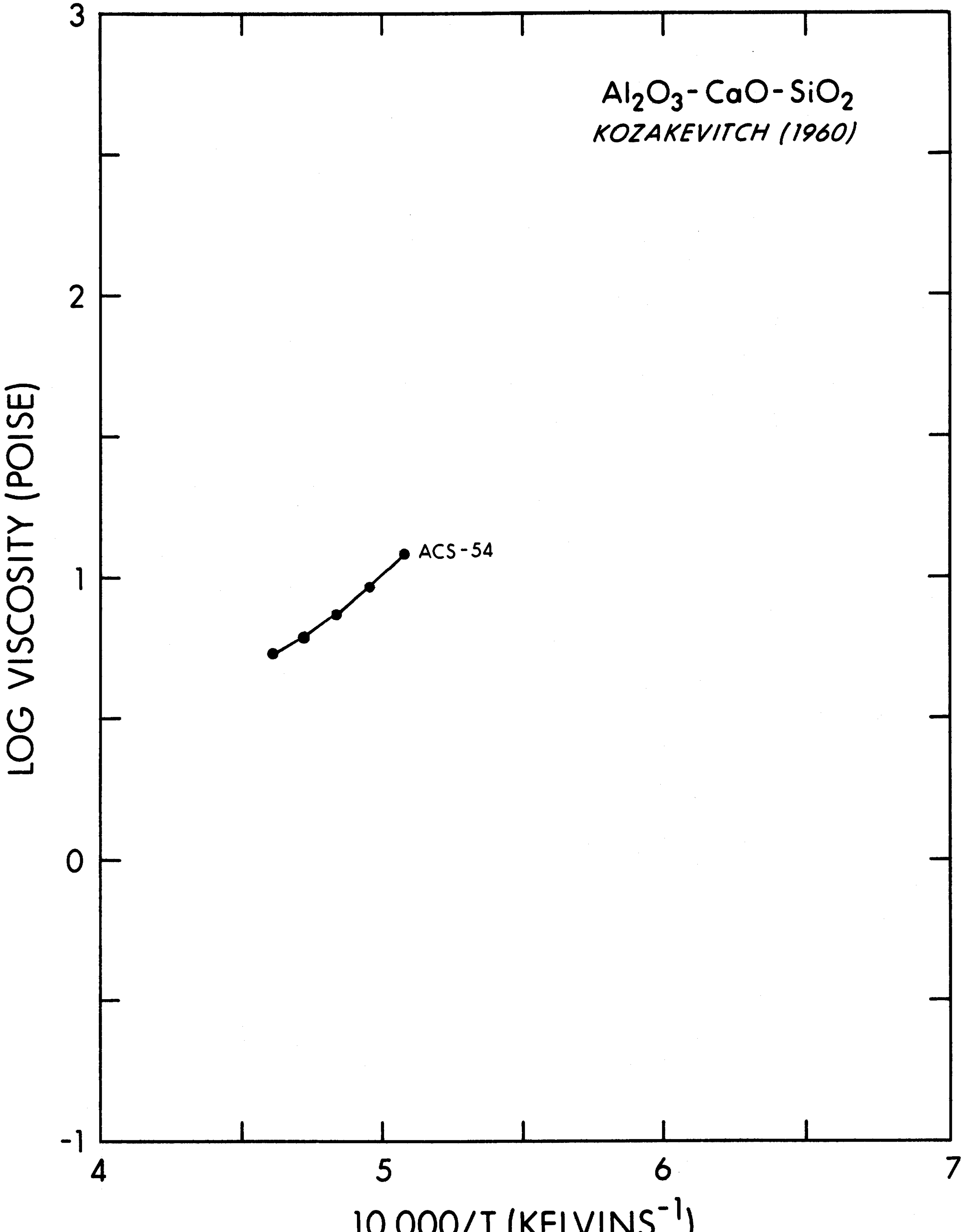


Al_2O_3 - CaO - SiO_2
KOZAKEVITCH (1960)
ACS-50
ACS-51
ACS-52
ACS-53
LOG VISCOSITY (POISE)
3
2
1
0
-1
1400
1500
1600
1700
1800
1900
2000
2100
TEMPERATURE (°C)


Al_2O_3-CaO-SiO_2
KOZAKEVITCH (1960)
ACS-53
ACS-52
ACS-51
ACS-50
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
3
2
1
0
-1
4
5
6
7



Al_2O_3 - CaO - SiO_2
KOZAKEVITCH (1960)
ACS-54
LOG VISCOSITY (POISE)
3
2
1
0
-1
1400
1500
1600
1700
1800
1900
2000
2100
TEMPERATURE (°C)


3
2
1
0
-1
4
5
6
7
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
Al_2O_3-CaO-SiO_2
KOZAKEVITCH (1960)
ACS-54

SYSTEM AUTHOR

AL2O3(5.92),CAO(53.86),SIO2(40.22) (X) MACHIN AND HANNA (1945)
AL2O3(10.0),CAO(50.0),SIO2(40.0) (%)

MEASUREMENT METHOD DERIVED FROM
OSCILLATING-CYC. VISCOMETER TABLE
N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

ACS-55

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.120	0.921	8.33
1450.00	5.804	1.654	0.719	5.23
1500.00	5.640	1.389	0.603	4.01

SYSTEM AUTHOR
AL2O3(9.10),CAO(49.66),SIO2(41.24) (X) MACHIN AND HANNA (1945)
AL2O3(15.0),CAO(45.0),SIO2(40.0) (%)

MEASUREMENT METHOD DERIVED FROM
OSCILLATING-CYC. VISCOMETER TABLE
N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

ACS-56

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.452	1.933	85.8
1300.00	6.357	3.696	1.605	40.27
1350.00	6.161	3.099	1.346	22.18
1400.00	5.977	2.582	1.122	13.23
1450.00	5.804	2.107	0.915	8.22
1500.00	5.640	1.641	0.713	5.16

SYSTEM AUTHOR
AL2O3(12.44),CAO(45.27), MACHIN AND HANNA (1945)
SIO2(42.29) (X)
AL2O3(20.0),CAO(40.0),
SIO2(40.0) (%)

MEASUREMENT METHOD DERIVED FROM
OSCILLATING-CYC. VISCOMETER TABLE
N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

ACS-57

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.997	2.170	147.9
1300.00	6.357	4.213	1.830	67.56
1350.00	6.161	3.557	1.545	35.07
1400.00	5.977	3.067	1.332	21.48
1450.00	5.804	2.617	1.136	13.69
1500.00	5.640	2.119	0.920	8.32

SYSTEM AUTHOR
AL2O3(15.96),CAO(40.65), MACHIN AND HANNA (1945)

SIO2(43.39) (X)
AL2O3(25.0),CAO(35.0),
SIO2(40.0) (%)

MEASUREMENT METHOD DERIVED FROM
OSCILLATING-CYC. VISCOMETER TABLE
N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

ACS-58

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.645	2.452	283.
1300.00	6.357	4.854	2.108	128.3
1350.00	6.161	4.157	1.806	63.90
1400.00	5.977	3.554	1.543	34.94
1450.00	5.804	3.077	1.337	21.70
1500.00	5.640	2.663	1.157	14.34

SYSTEM
AL2O3(19.67),CAO(35.78),
SIO2(44.55) (X)
AL2O3(30.0),CAO(30.0),
SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA (1945)

ACS-59

MEASUREMENT METHOD

OSCILLATING-CYC. VISCOMETER

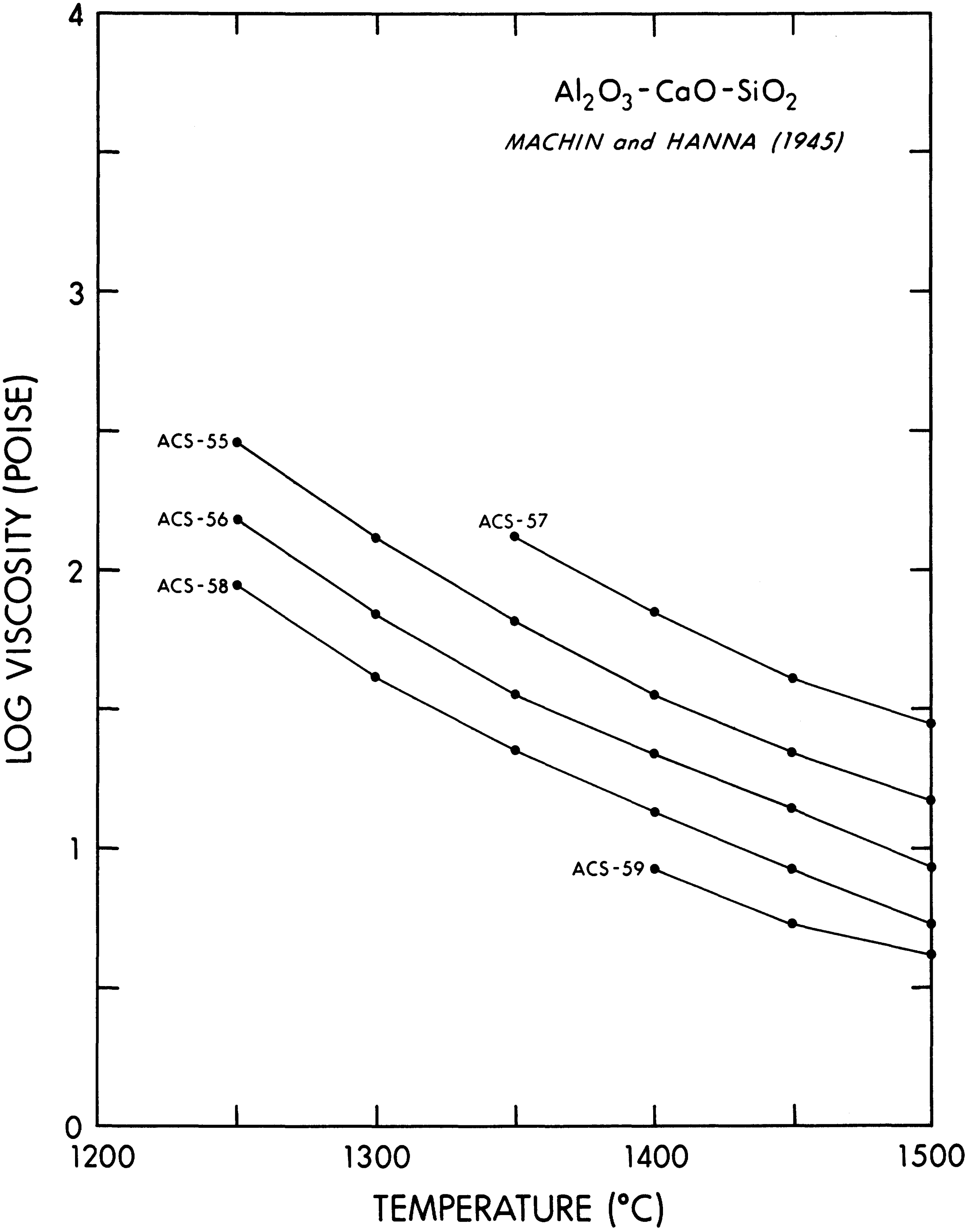
DERIVED FROM

TABLE

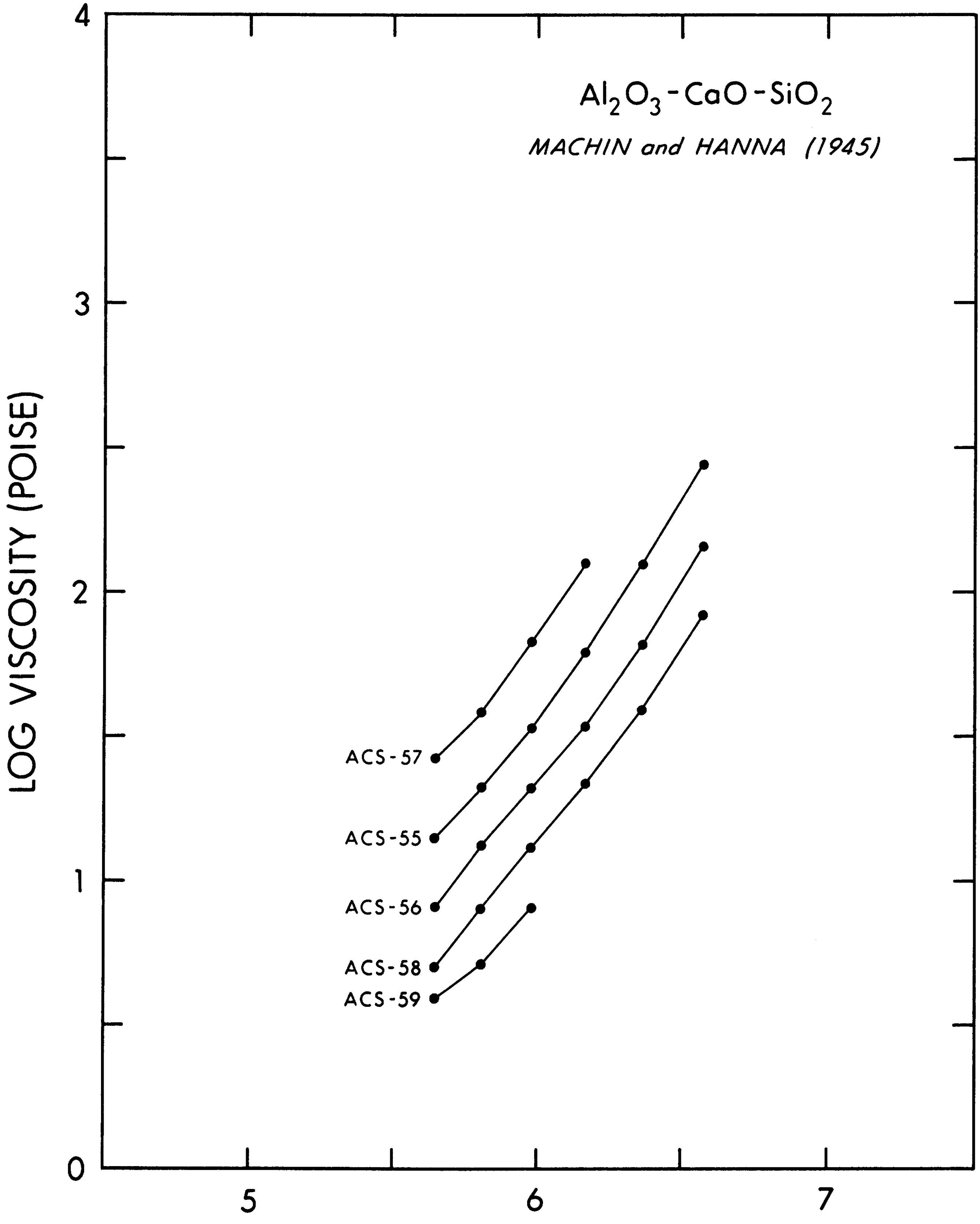
N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	4.864	2.112	129.5
1400.00	5.977	4.240	1.841	69.39
1450.00	5.804	3.676	1.597	39.50
1500.00	5.640	3.301	1.434	27.14



Al_2O_3-CaO-SiO_2
MACHIN and HANNA (1945)
ACS-55
ACS-56
ACS-57
ACS-58
ACS-59
LOG VISCOSITY (POISE)
4
3
2
1
0
1200
1300
1400
1500
TEMPERATURE (°C)



Al_2O_3 - CaO - SiO_2
MACHIN and HANNA (1945)
ACS-57
ACS-55
ACS-56
ACS-58
ACS-59
LOG VISCOSITY (POISE)
4
3
2
1
0
5
6
7
10 000/T (KELVINS^{-1})

SYSTEM
AL2O3(23.41),CAO(42.55),
SIO2(34.04) (X)
AL2O3(35.0),CAO(35.0),
SIO2(30.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-60

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	2.322	1.009	10.2

SYSTEM
AL2O3(12.41),CAO(50.75),
SIO2(36.84) (X)
AL2O3(20.0),CAO(45.0),
SIO2(35.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-61

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.610	1.134	13.6
1450.00	5.804	2.028	0.881	7.60
1500.00	5.640	1.601	0.695	4.96

SYSTEM
AL2O3(15.91),CAO(46.29),
SIO2(37.80) (X)
AL2O3(25.0),CAO(40.0),
SIO2(35.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-62

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.991	1.299	19.9
1450.00	5.804	2.477	1.076	11.9
1500.00	5.640	2.019	0.877	7.53

SYSTEM
AL2O3(19.60),CAO(41.58),
SIO2(38.81) (X)
AL2O3(30.0),CAO(35.0),
SIO2(35.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-63

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	3.456	1.501	31.7
1450.00	5.804	2.939	1.276	18.9
1500.00	5.640	2.451	1.064	11.6

SYSTEM
AL2O3(23.50),CAO(36.62),
SIO2(39.88) (X)
AL2O3(35.0),CAO(30.0),
SIO2(35.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-64

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	5.513	2.394	248.
1350.00	6.161	4.691	2.037	109.
1400.00	5.977	4.002	1.738	54.7
1450.00	5.804	3.447	1.497	31.4
1500.00	5.640	2.944	1.279	19.0

SYSTEM
AL2O3(27.62),CAO(31.38),
SIO2(41.00) (X)
AL2O3(40.0),CAO(25.0),
SIO2(35.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-65

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	3.711	1.612	40.9
1500.00	5.640	3.215	1.396	24.9

SYSTEM
AL2O3(5.92),CAO(53.86),
SIO2(40.2) (X)
AL2O3(10.0),CAO(50.0),
SIO2(40.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-66

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.120	0.921	8.33
1450.00	5.804	1.654	0.719	5.23
1500.00	5.640	1.389	0.603	4.01

SYSTEM
AL2O3(9.11),CAO(49.68),
SIO2(41.21) (X)
AL2O3(15.0),CAO(45.0),
SIO2(40.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-67

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.452	1.933	85.8
1300.00	6.357	3.696	1.605	40.3
1350.00	6.161	3.100	1.346	22.2
1400.00	5.977	2.580	1.121	13.2
1450.00	5.804	2.107	0.915	8.22
1500.00	5.640	1.641	0.713	5.16

SYSTEM
AL2O3(12.46),CAO(45.28),
SIO2(42.26) (X)
AL2O3(20.0),CAO(40.0),
SIO2(40.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-68

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.977	2.170	148.
1300.00	6.357	4.214	1.830	67.6
1350.00	6.161	3.558	1.545	35.1
1400.00	5.977	3.068	1.332	21.5
1450.00	5.804	2.617	1.137	13.7
1500.00	5.640	2.119	0.920	8.32

SYSTEM
AL2O3(15.97),CAO(40.66),
SIO2(43.37) (X)
AL2O3(25.0),CAO(35.0),
SIO2(40.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-69

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.645	2.452	283.
1300.00	6.357	4.852	2.107	128.
1350.00	6.161	4.157	1.806	63.9
1400.00	5.977	3.552	1.542	34.9
1450.00	5.804	3.077	1.336	21.7
1500.00	5.640	2.660	1.155	14.3

SYSTEM
AL2O3(19.68),CAO(35.79),
SIO2(44.53) (X)
AL2O3(30.0),CAO(30.0),
SIO2(40.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-70

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	4.860	2.111	129.
1400.00	5.977	4.240	1.841	69.4
1450.00	5.804	3.676	1.597	39.5
1500.00	5.640	3.300	1.433	27.1

SYSTEM
AL2O3(0.0),CAO(56.70),
SIO2(43.30) (X)
AL2O3(0.0),CAO(55.0),
SIO2(45.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-71

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	0.846	0.367	2.33

SYSTEM
AL2O3(2.90),CAO(52.77),
SIO2(44.33) (X)
AL2O3(5.0),CAO(50.0),
SIO2(45.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-72

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	1.569	0.681	4.80
1500.00	5.640	1.227	0.533	3.41

SYSTEM
AL2O3(5.95),CAO(48.65),
SIO2(45.40) (X)
AL2O3(10.0),CAO(45.0),
SIO2(45.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-73

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.451	1.064	11.6
1450.00	5.804	2.024	0.879	7.57
1500.00	5.640	1.585	0.688	4.88

SYSTEM
AL2O3(9.14),CAO(44.32),
SIO2(46.54) (X)
AL2O3(15.0),CAO(40.0),
SIO2(45.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-74

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	3.500	1.520	33.1
1400.00	5.977	2.965	1.288	19.4
1450.00	5.804	2.526	1.097	12.5
1500.00	5.640	2.145	0.931	8.54

SYSTEM
AL2O3(12.50),CAO(39.77),
SIO2(47.72) (X)
AL2O3(20.0),CAO(35.0),
SIO2(45.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-75

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	6.513	2.829	674.
1250.00	6.566	5.606	2.435	272.
1300.00	6.357	4.828	2.097	125.
1350.00	6.161	4.148	1.801	63.3
1400.00	5.977	3.614	1.569	37.1
1450.00	5.804	3.118	1.354	22.6
1500.00	5.640	2.708	1.176	15.0

SYSTEM
AL2O3(16.04),CAO(34.99),
SIO2(24.98) (X)
AL2O3(25.0),CAO(30.0),
SIO2(45.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-76

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	4.883	2.121	132.
1400.00	5.977	4.250	1.846	70.1
1450.00	5.804	3.714	1.613	41.0
1500.00	5.640	3.270	1.420	26.3

SYSTEM
AL2O3(19.76),CAO(29.94),
SIO2(50.30) (X)
AL2O3(30.0),CAO(25.0),
SIO2(45.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-77

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	4.256	1.848	70.5

SYSTEM
AL2O3(2.91),CAO(47.66),
SIO2(49.43) (X)
AL2O3(5.0),CAO(45.0),
SIO2(50.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-78

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	1.564	0.679	4.78

SYSTEM
AL2O3(5.90),CAO(43.40),
SIO2(50.63) (X)
AL2O3(10.0),CAO(40.0),
SIO2(50.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-79

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.955	1.283	19.2
1450.00	5.804	2.493	1.083	12.1
1500.00	5.640	2.108	0.915	8.23

SYSTEM
AL2O3(9.17),CAO(38.92),
SIO2(51.90) (X)
AL2O3(15.0),CAO(35.0),
SIO2(50.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-80

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	7.131	3.097	1250.
1200.00	6.789	6.151	2.671	469.
1250.00	6.566	5.342	2.320	209.
1300.00	6.357	4.654	2.021	105.
1350.00	6.161	4.045	1.757	57.1
1400.00	5.977	3.547	1.540	34.7
1450.00	5.804	3.086	1.340	21.9
1500.00	5.640	2.660	1.155	14.3

SYSTEM
AL2O3(12.55),CAO(34.22),
SIO2(53.23) (X)
AL2O3(20.0),CAO(30.0),
SIO2(50.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-81

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	6.271	2.723	529.
1300.00	6.357	5.509	2.393	247.
1350.00	6.161	4.828	2.097	125.
1400.00	5.977	4.261	1.851	70.9
1450.00	5.804	3.745	1.626	42.3
1500.00	5.640	3.408	1.480	30.2

SYSTEM
AL2O3(16.10),CAO(29.27),
SIO2(54.63) (X)
AL2O3(25.0),CAO(25.0),
SIO2(50.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-82

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	4.603	1.999	99.8
1500.00	5.640	4.055	1.761	57.7

SYSTEM
AL2O3(2.92),CAO(42.52),
SIO2(54.56) (X)
AL2O3(5.0),CAO(40.0),
SIO2(55.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-83

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.549	1.107	12.8
1500.00	5.640	2.128	0.924	8.40

SYSTEM
AL2O3(5.99),CAO(38.11),
SIO2(55.90) (X)
AL2O3(10.0),CAO(35.0),
SIO2(55.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-84

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	4.762	2.068	117.
1350.00	6.161	4.108	1.784	60.8
1400.00	5.977	3.575	1.553	35.7
1450.00	5.804	3.105	1.348	22.3
1500.00	5.640	2.715	1.179	15.1

SYSTEM
AL2O3(9.2),CAO(33.49),
SIO2(57.30) (X)
AL2O3(15.0),CAO(30.0),
SIO2(55.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-85

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	7.930	3.444	2780.
1200.00	6.789	6.985	3.033	1080.
1250.00	6.566	6.122	2.659	456.
1300.00	6.357	5.146	2.352	225.
1350.00	6.161	4.796	2.083	121.
1400.00	5.977	4.293	1.865	73.2
1450.00	5.804	3.802	1.651	44.8
1500.00	5.640	3.353	1.456	28.6

SYSTEM
AL2O3(12.60),CAO(28.62),
SIO2(58.78) (X)
AL2O3(20.0),CAO(25.0),
SIO2(55.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-86

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	8.981	3.900	7950.
1200.00	6.789	7.962	3.458	2870.
1250.00	6.566	7.090	3.079	1200.
1300.00	6.357	6.363	2.763	580.
1350.00	6.161	5.733	2.490	309.
1400.00	5.977	5.142	2.233	171.
1450.00	5.804	4.592	1.994	98.7
1500.00	5.640	4.119	1.789	61.5

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SYSTEM
AL2O3(16.16),CAO(23.50),
SIO2(60.33) (X)
AL2O3(25.0),CAO(20.0),
SIO2(55.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-87

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	6.492	2.820	660.
1450.00	5.804	5.759	2.501	317.
1500.00	5.640	5.153	2.238	173.

SYSTEM
AL2O3(0.0),CAO(41.67),
SIO2(58.33) (X)
AL2O3(0.0),CAO(40.0),
SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-88

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	2.222	0.965	9.23

-

SYSTEM
AL2O3(2.93),CAO(37.33),
SIO2(59.74) (X)
AL2O3(5.0),CAO(35.0),
SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-89

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	3.674	1.595	39.4
1450.00	5.804	3.219	1.398	25.0
1500.00	5.640	2.839	1.233	17.1

--

SYSTEM
AL2O3(6.01),CAO(32.79),
SIO2(61.20) (X)
AL2O3(10.0),CAO(30.0),
SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-90

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	7.832	3.401	2520.
1200.00	6.789	6.898	2.996	990.
1250.00	6.566	6.043	2.624	421.
1300.00	6.357	5.394	2.342	220.
1350.00	6.161	4.836	2.100	126.
1400.00	5.977	4.402	1.912	81.6
1450.00	5.804	3.945	1.713	51.7
1500.00	5.640	3.484	1.513	32.6

SYSTEM
AL2O3(9.24),CAO(28.01),
SIO2(62.75) (X)
AL2O3(15.0),CAO(25.0),
SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-91

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	9.269	4.025	10600.
1200.00	6.789	8.224	3.572	3730.
1250.00	6.566	7.352	3.193	1560.
1300.00	6.357	6.593	2.863	730.
1350.00	6.161	5.969	2.592	391.
1400.00	5.977	5.366	2.330	214.
1450.00	5.804	4.852	2.107	128.
1500.00	5.640	4.353	1.890	77.7

SYSTEM
AL2O3(12.65),CAO(22.99),
SIO2(64.37) (X)
AL2O3(20.0),CAO(20.0),
SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-92

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	9.596	4.167	14700.
1250.00	6.566	8.657	3.760	5750.
1300.00	6.357	7.836	3.403	2530.
1350.00	6.161	7.139	3.100	1260.
1400.00	5.977	6.497	2.822	663.
1450.00	5.804	5.866	2.548	353.
1500.00	5.640	5.318	2.310	204.

SYSTEM
AL2O3(16.22),CAO(17.70),
SIO2(66.08) (X)
AL2O3(25.0),CAO(15.0),
SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-93

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	7.824	3.398	2500.
1450.00	5.804	7.107	3.086	1220.
1500.00	5.640	6.431	2.793	621.

SYSTEM
AL2O3(0.0),CAO(36.58),
SIO2(63.42) (X)
AL2O3(0.0),CAO(35.0),
SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-94

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	3.122	1.356	22.7

SYSTEM
AL2O3(2.94),CAO(32.12),
SIO2(64.94) (X)
AL2O3(5.0),CAO(30.0),
SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-95

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	4.247	1.844	69.9
1500.00	5.640	3.742	1.625	42.2

SYSTEM
AL2O3(6.03),CAO(27.42),
SIO2(66.54) (X)
AL2O3(10.0),CAO(25.0),
SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-96

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	9.315	4.045	11100.
1200.00	6.789	8.333	3.619	4160.
1250.00	6.566	7.484	3.250	1780.
1300.00	6.357	6.750	2.931	854.
1350.00	6.161	6.131	2.663	460.
1400.00	5.977	5.545	2.408	256.
1450.00	5.804	5.024	2.182	152.
1500.00	5.640	4.550	1.976	94.6

SYSTEM
AL2O3(9.28),CAO(22.49),
SIO2(68.23) (X)
AL2O3(15.0),CAO(20.0),
SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-97

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	8.412	3.653	4500.
1350.00	6.161	7.581	3.292	1960.
1400.00	5.977	6.947	3.017	1040.
1450.00	5.804	6.353	2.759	574.
1500.00	5.640	5.740	2.493	311.

SYSTEM
AL2O3(12.69),CAO(17.31),
SIO2(70.0) (X)
AL2O3(20.0),CAO(15.0),
SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-98

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	10.35	4.494	31200.
1300.00	6.357	9.596	4.167	14700.
1350.00	6.161	8.770	3.809	6440.
1400.00	5.977	8.074	3.507	3210.
1450.00	5.804	7.371	3.201	1590.
1500.00	5.640	6.846	2.973	940.

SYSTEM
AL2O3(16.29),CAO(11.84),
SIO2(71.87) (X)
AL2O3(25.0),CAO(10.0),
SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-99

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	8.284	3.598	3960.
1500.00	5.640	7.550	3.279	1900.

SYSTEM
AL2O3(6.06),CAO(22.02),
SIO2(71.93) (X)
AL2O3(10.0),CAO(20.0),
SIO2(70.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-100

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	6.975	3.029	1070.
1450.00	5.804	6.397	2.778	600.
1500.00	5.640	5.889	2.558	361.

--

SYSTEM
AL2O3(9.31),CAO(16.93),
SIO2(73.75) (X)
AL2O3(15.0),CAO(15.0),
SIO2(70.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-101

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	12.002	5.212	1.63*10E5
1250.00	6.566	10.946	4.754	56700.
1300.00	6.357	10.008	4.346	22200.
1350.00	6.161	9.197	3.994	9870.
1400.00	5.977	8.453	3.671	4690.
1450.00	5.804	7.779	3.378	2390.
1500.00	5.640	7.185	3.121	1320.

--

SYSTEM
AL2O3(12.74),CAO(11.58),
SIO2(75.67) (X)
AL2O3(20.0),CAO(10.0),
SIO2(70.0) (%)

AUTHOR
MACHIN AND YEE (1948)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

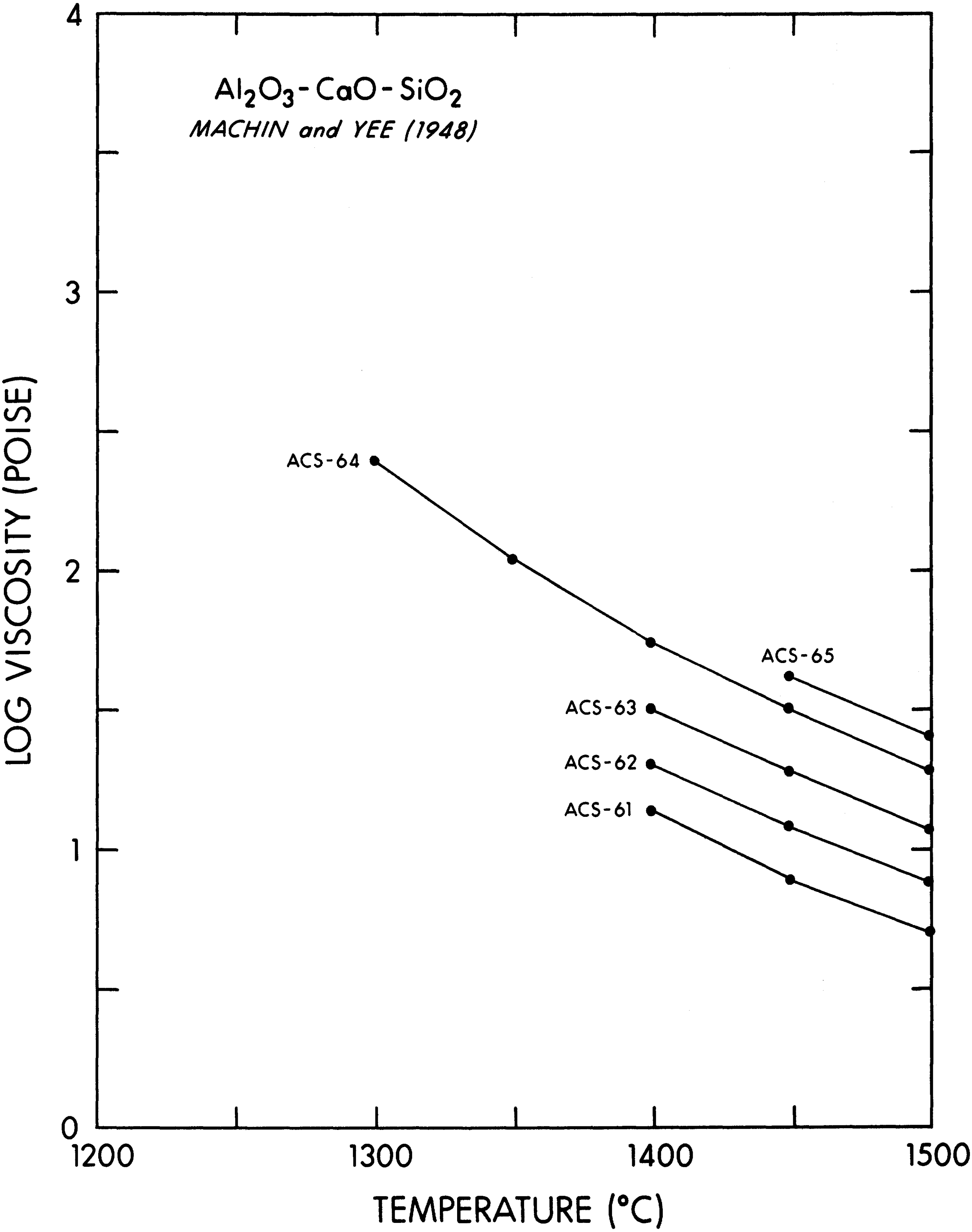
DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

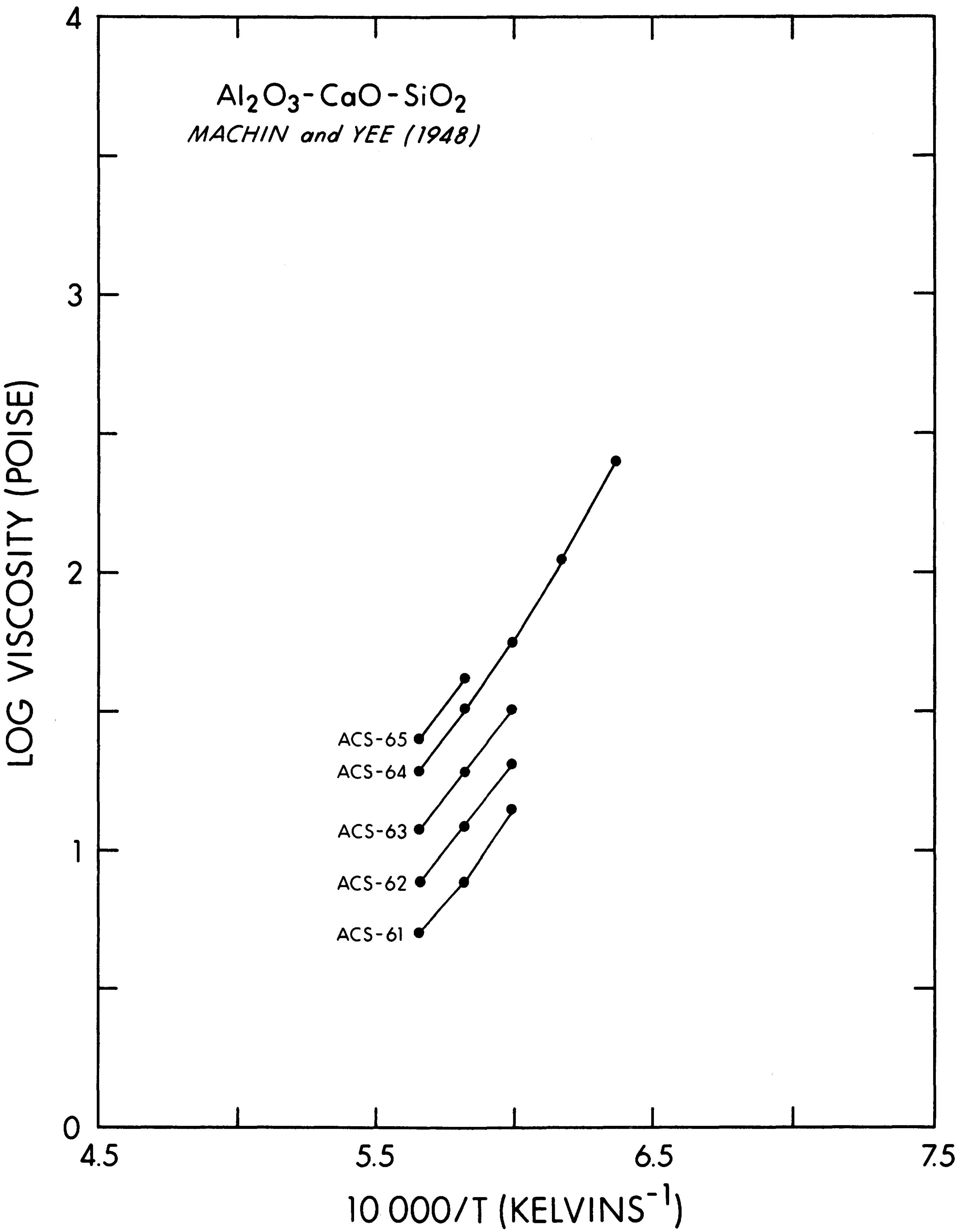
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-102

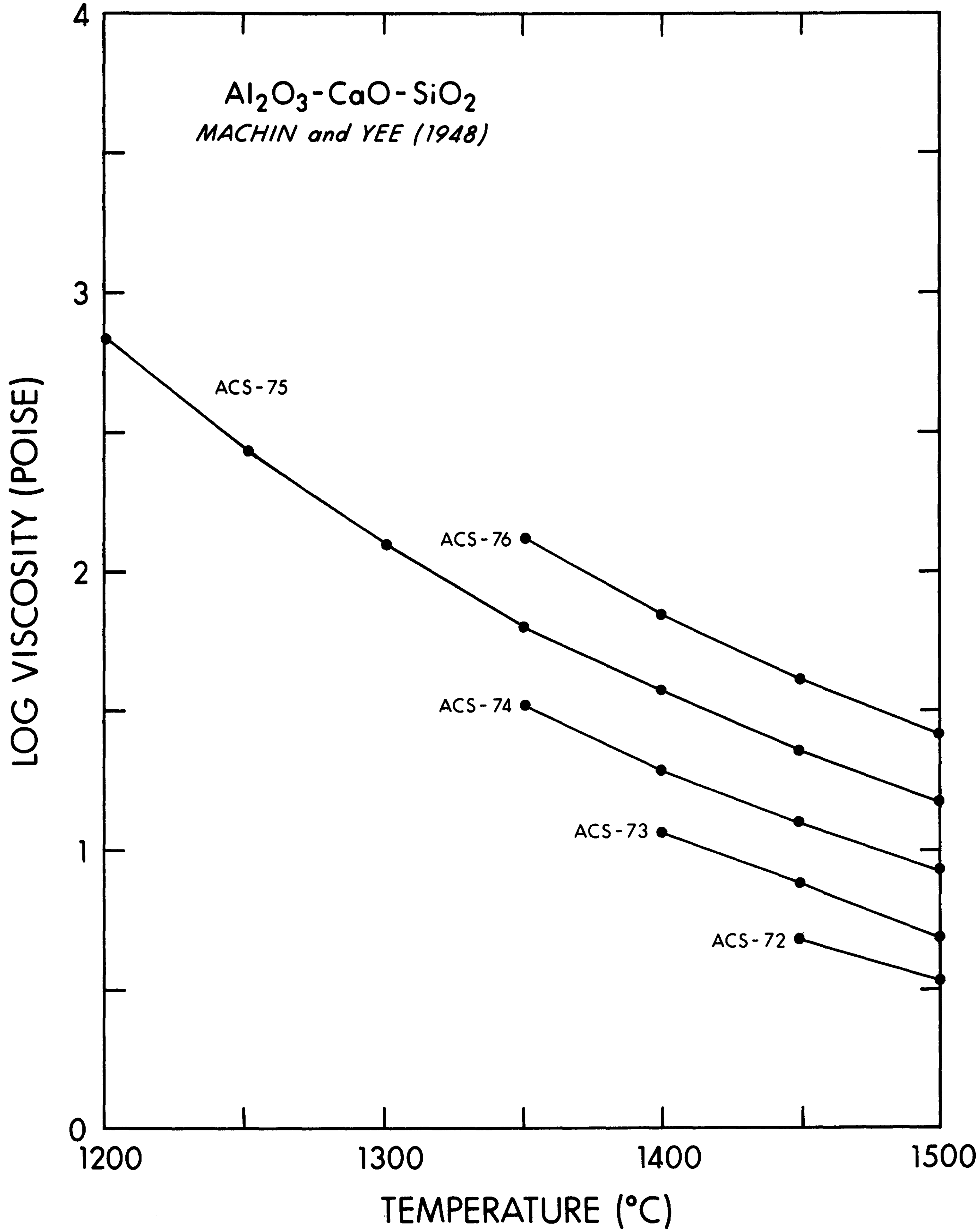
T	Z	LN(N)	LOG(N)	N
1300.00	6.357	11.760	5.107	1.28*10E5
1350.00	6.161	10.741	4.665	46200.
1400.00	5.977	9.809	4.260	18200.
1450.00	5.804	9.020	3.918	8270.
1500.00	5.640	8.281	3.597	3950.



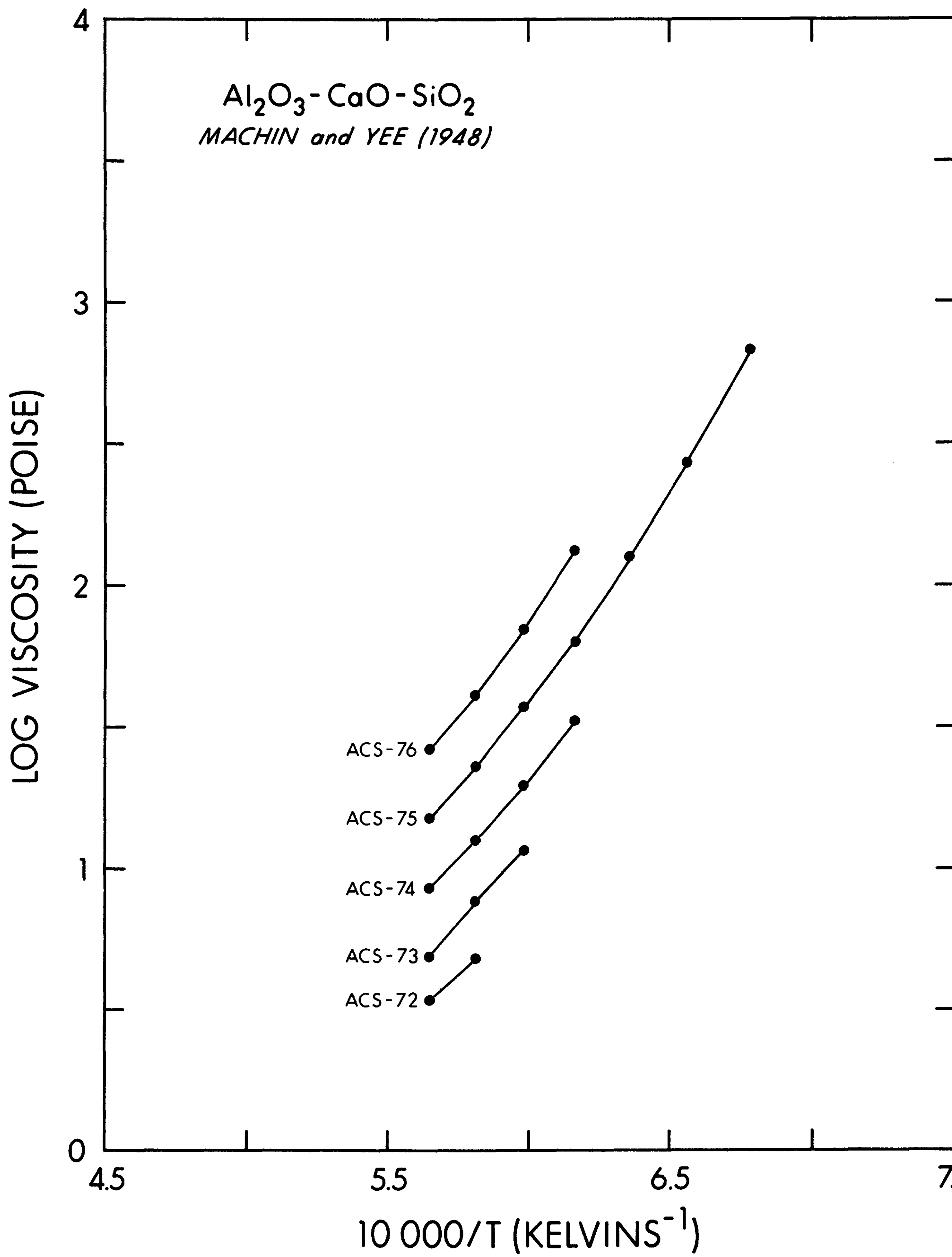
Al₂O₃-CaO-SiO₂
MACHIN and YEE (1948)
ACS-64
ACS-65
ACS-63
ACS-62
ACS-61
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500



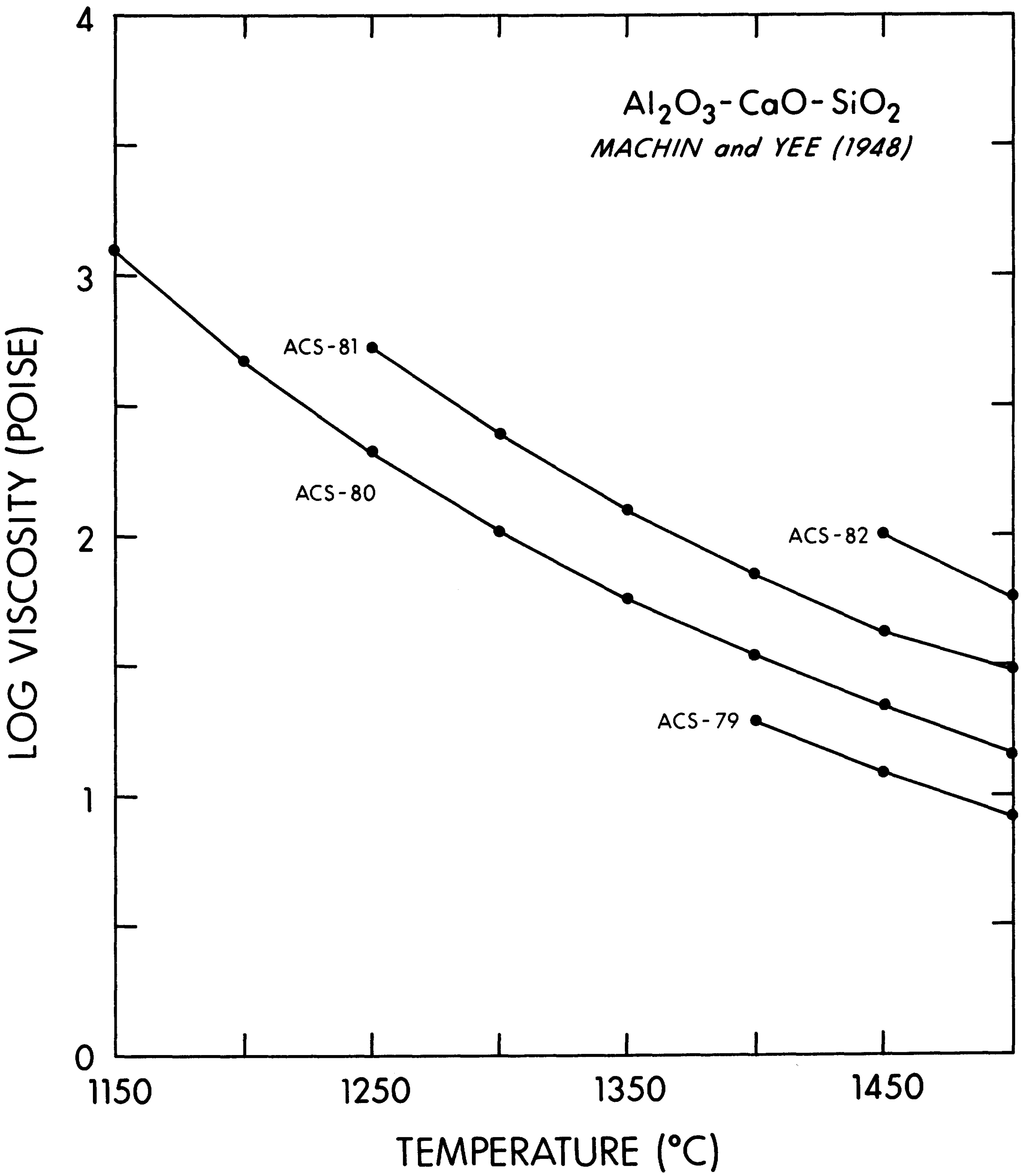
Al_2O_3-CaO-SiO_2
MACHIN and YEE (1948)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
ACS-65
ACS-64
ACS-63
ACS-62
ACS-61
0
1
2
3
4
4.5
5.5
6.5
7.5



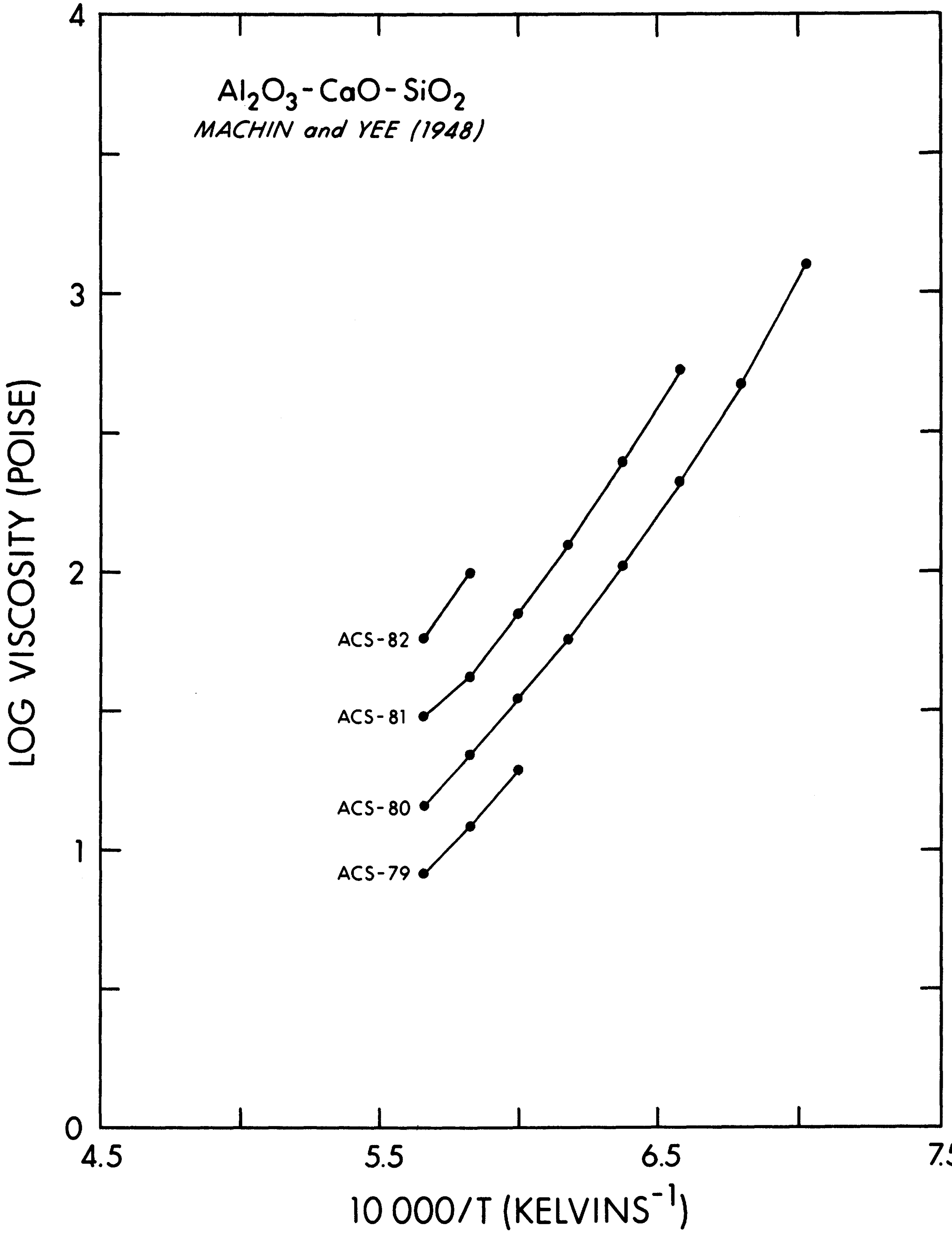
Al_2O_3-CaO-SiO_2
MACHIN and YEE (1948)
ACS-75
ACS-76
ACS-74
ACS-73
ACS-72
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
4
3
2
1
0
1200
1300
1400
1500

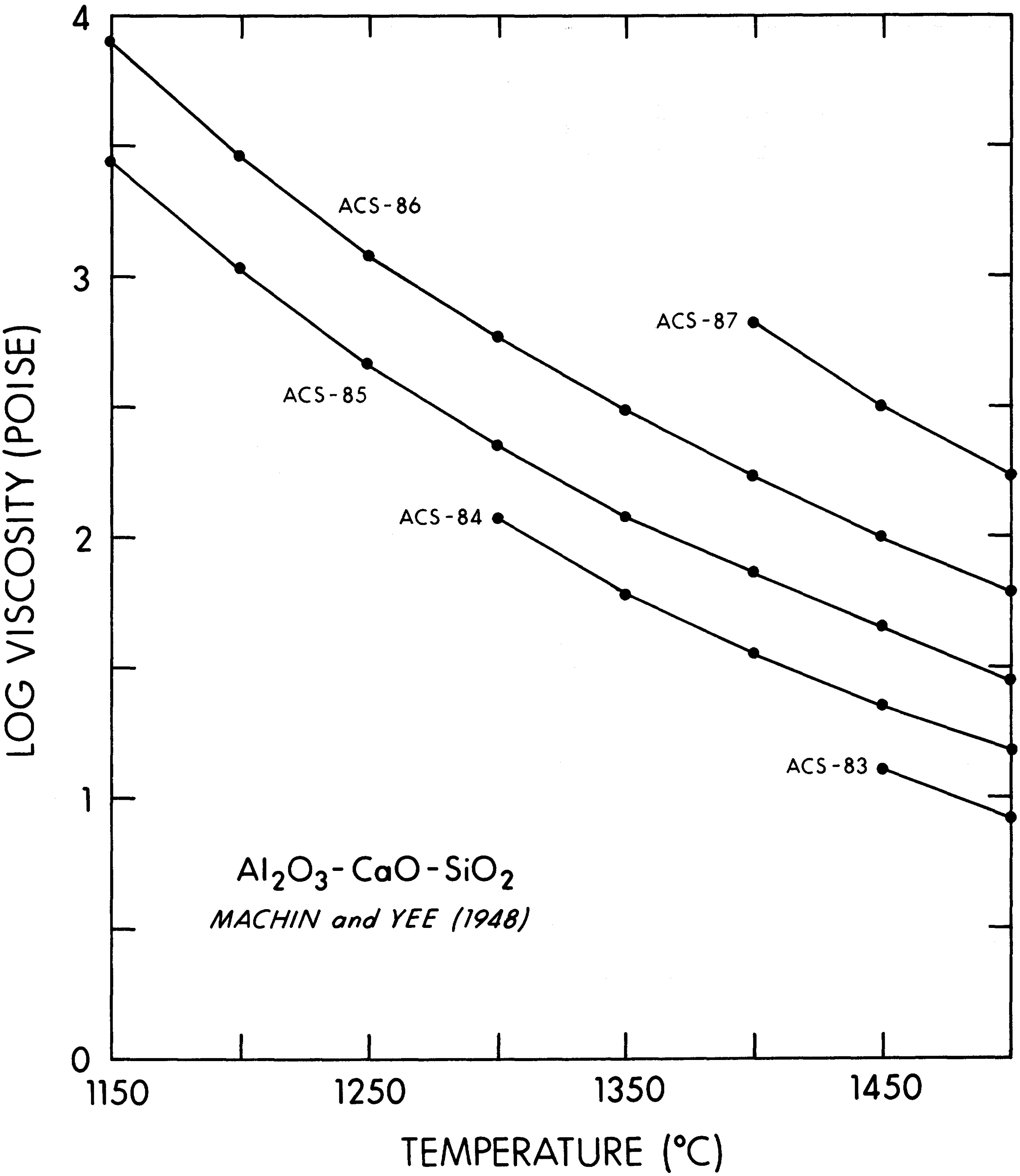


Al_2O_3 - CaO - SiO_2
MACHIN and YEE (1948)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
ACS-76
ACS-75
ACS-74
ACS-73
ACS-72
4
3
2
1
0
4.5
5.5
6.5
7.5

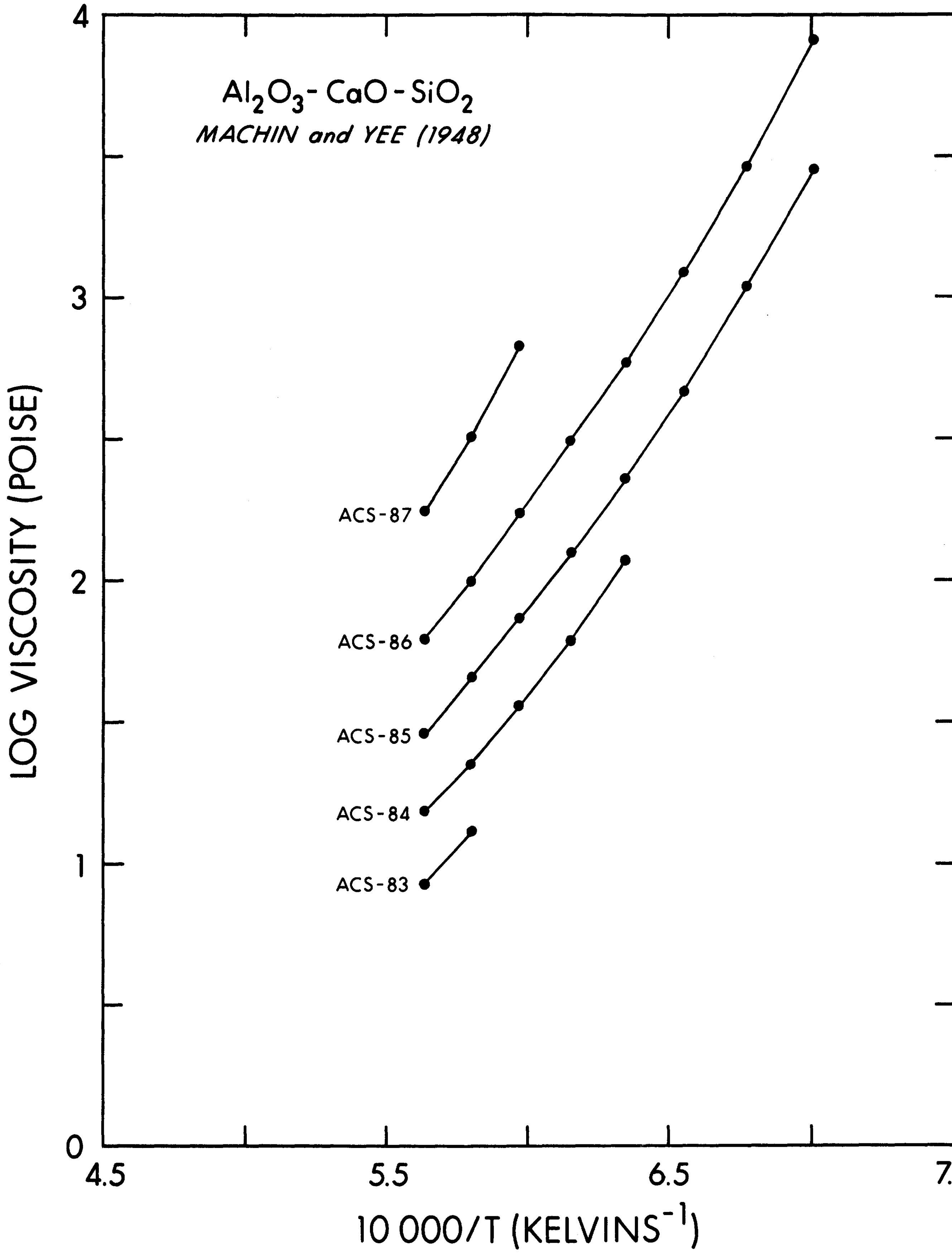


Al_2O_3-CaO-SiO_2
MACHIN and YEE (1948)
ACS-81
ACS-80
ACS-82
ACS-79
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1150
1250
1350
1450

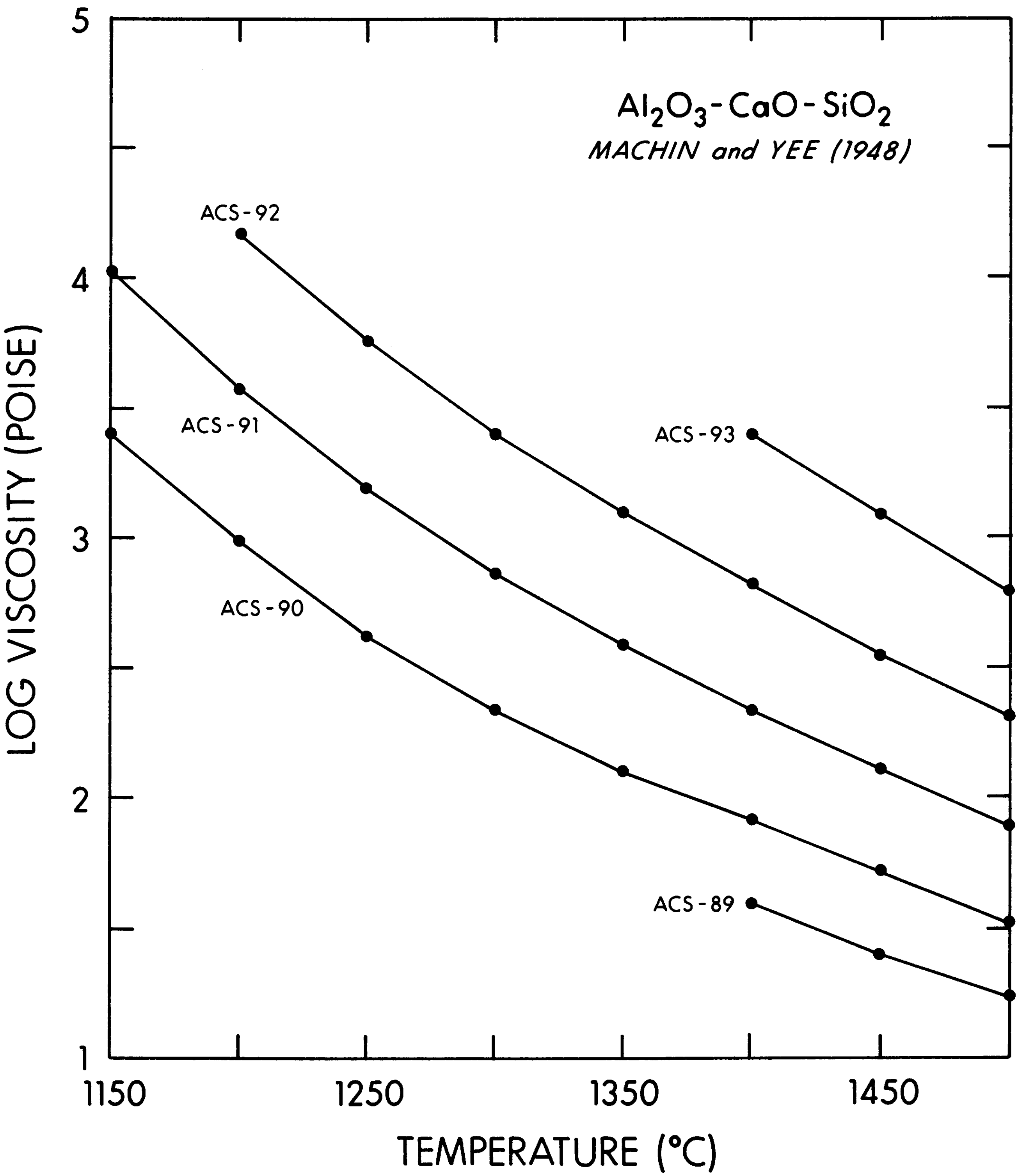

Al_2O_3 - CaO - SiO_2
MACHIN and YEE (1948)
ACS-82
ACS-81
ACS-80
ACS-79
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5



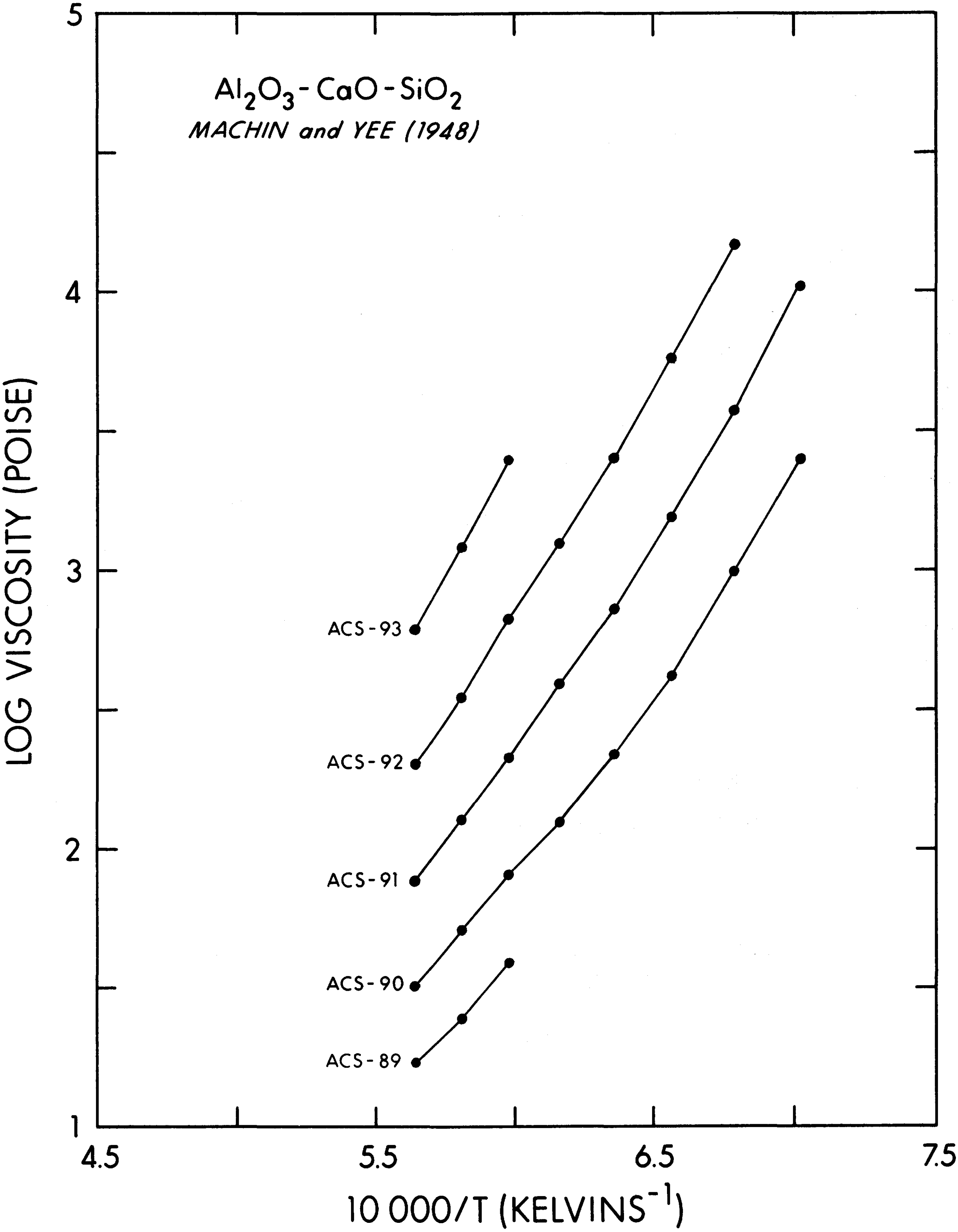
4
3
2
1
0
LOG VISCOSITY (POISE)
1150
1250
1350
1450
TEMPERATURE (°C)
ACS-86
ACS-87
ACS-85
ACS-84
ACS-83
Al_2O_3-CaO-SiO_2
MACHIN and YEE (1948)



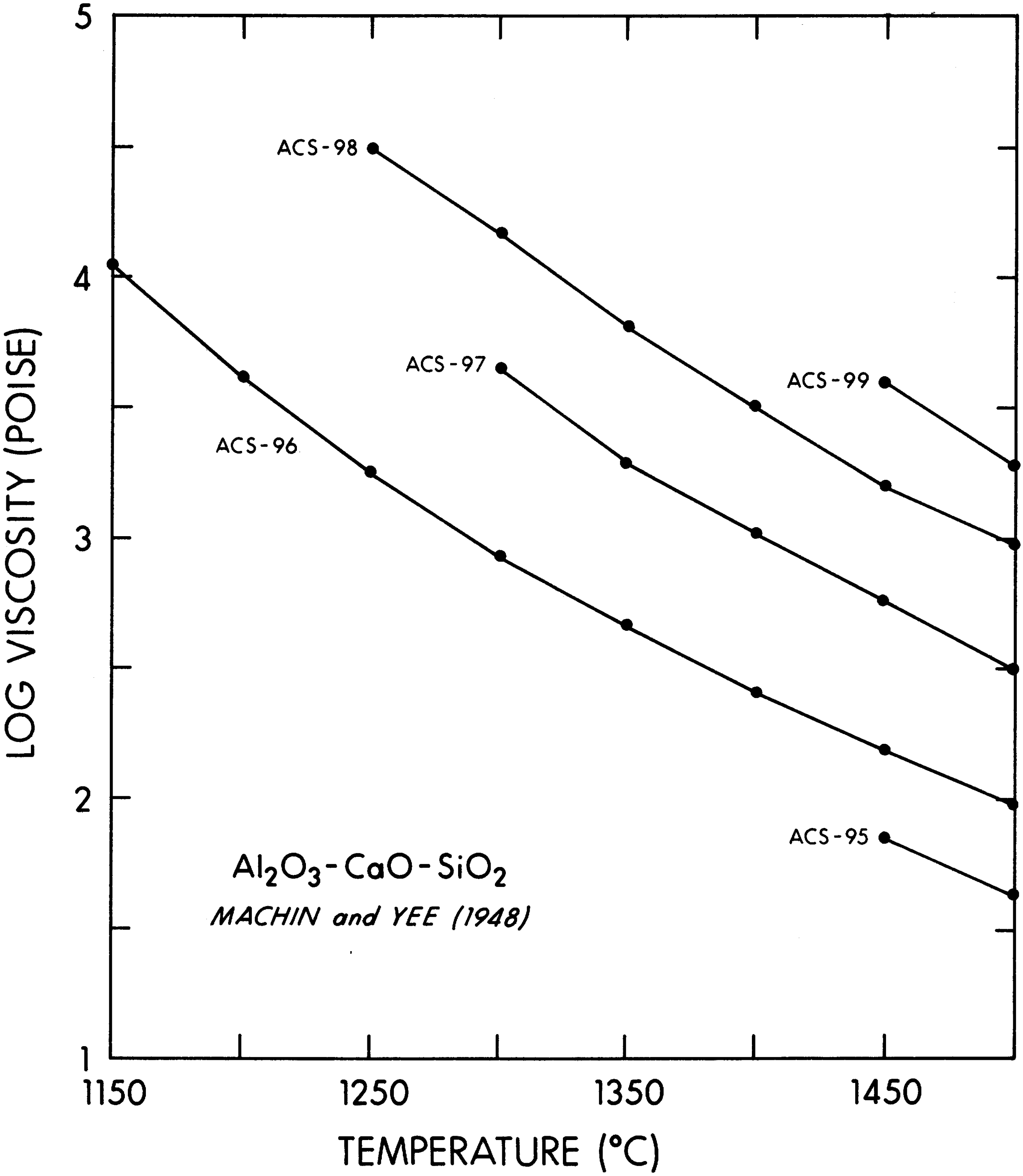
Al_2O_3 - CaO - SiO_2
MACHIN and YEE (1948)
ACS-87
ACS-86
ACS-85
ACS-84
ACS-83
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
4.5
5.5
6.5
7.5



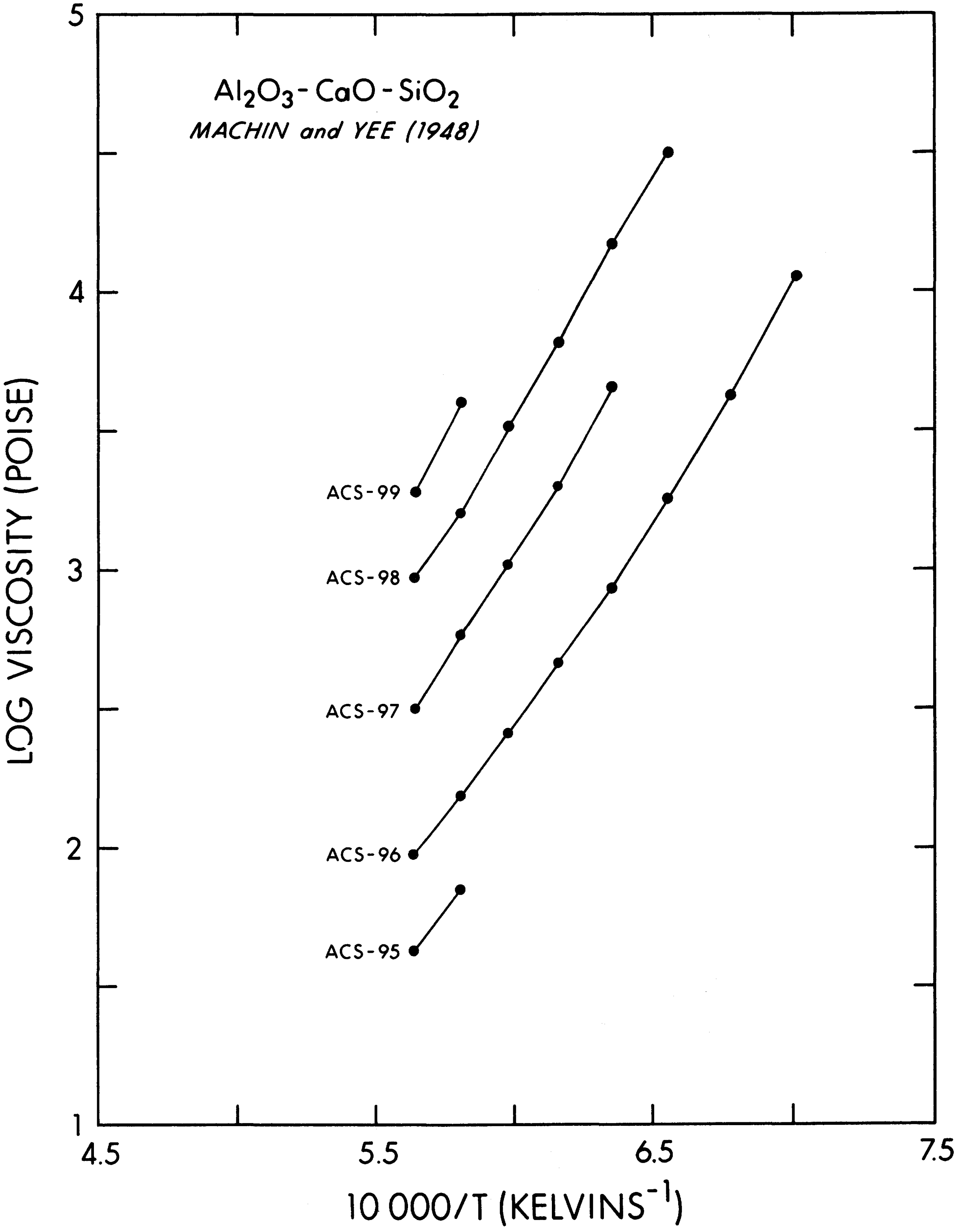
Al_2O_3-CaO-SiO_2
MACHIN and YEE (1948)
ACS-92
ACS-91
ACS-93
ACS-90
ACS-89
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
5
4
3
2
1
1150
1250
1350
1450

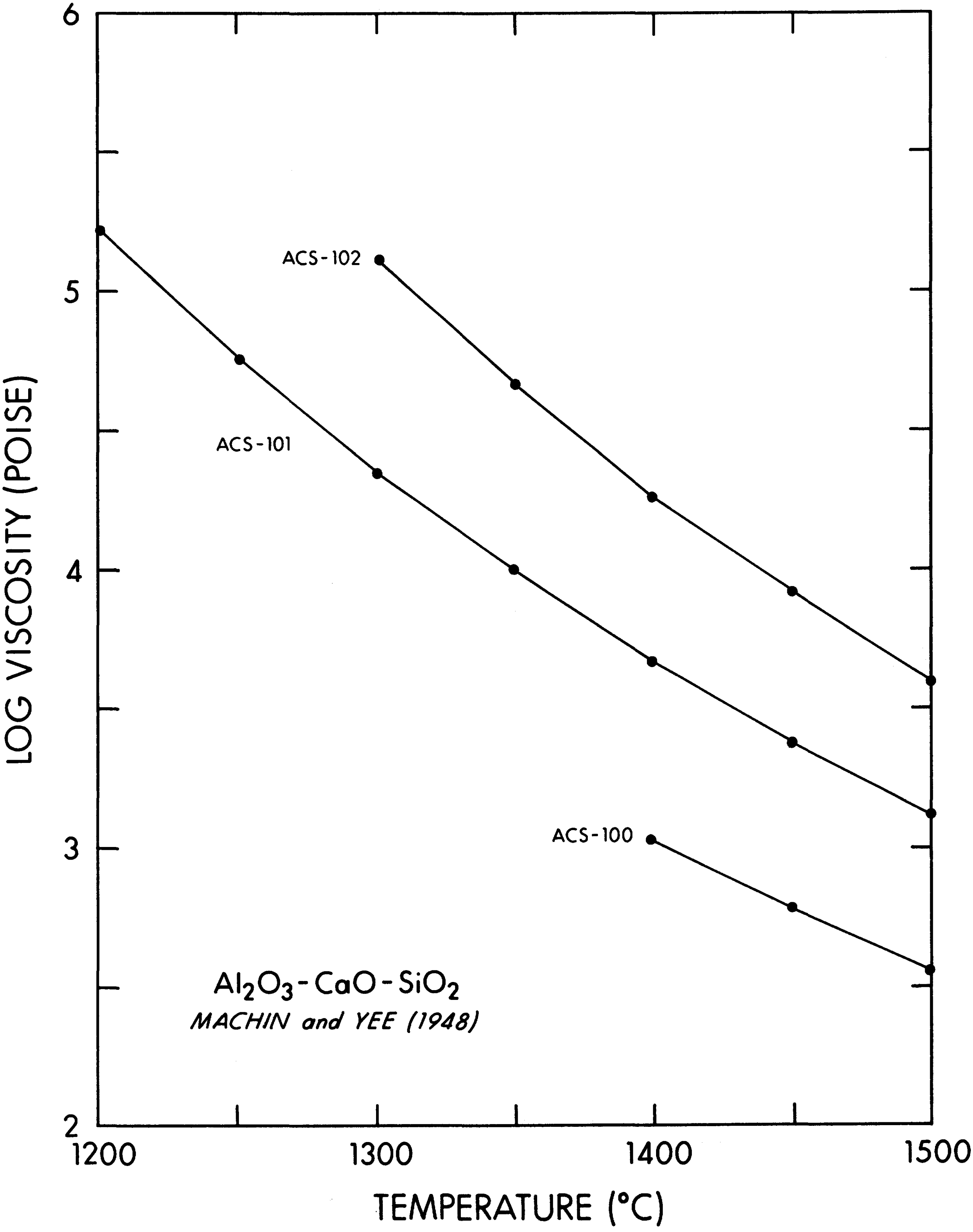


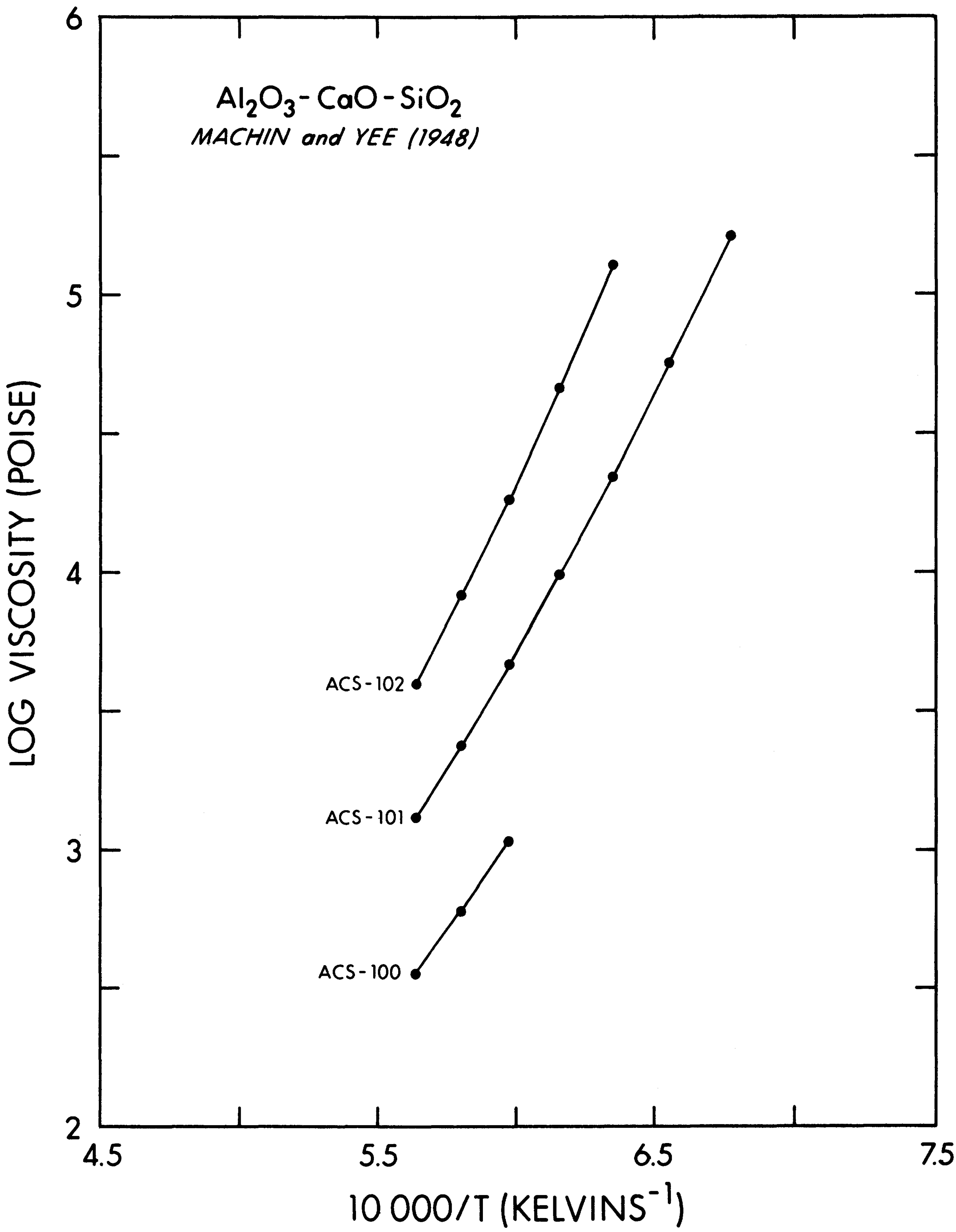
Al_2O_3 - CaO - SiO_2
MACHIN and YEE (1948)
ACS - 93
ACS - 92
ACS - 91
ACS - 90
ACS - 89
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
5
4
3
2
1
4.5
5.5
6.5
7.5



5
4
3
2
1
LOG VISCOSITY (POISE)
ACS-98
ACS-97
ACS-99
ACS-96
ACS-95
Al2O3-CaO-SiO2
MACHIN and YEE (1948)
1150
1250
1350
1450
TEMPERATURE (°C)


Al_2O_3 - CaO - SiO_2
MACHIN and YEE (1948)
ACS-99
ACS-98
ACS-97
ACS-96
ACS-95
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
5
4
3
2
1
4.5
5.5
6.5
7.5


6
5
4
3
2
LOG VISCOSITY (POISE)
1200
1300
1400
1500
TEMPERATURE (°C)
ACS-102
ACS-101
ACS-100
Al2O3-CaO-SiO2
MACHIN and YEE (1948)



Al_2O_3 - CaO - SiO_2
MACHIN and YEE (1948)
ACS - 102
ACS - 101
ACS - 100
6
5
4
3
2
4.5
5.5
6.5
7.5
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})

SYSTEM
AL2O3(3.0),CAO(37.0),SIO2(60.0) (X)
AL2O3(5.0),CAO(35.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-103

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	3.674	1.595	39.4
1450.00	5.804	3.219	1.398	25.0
1500.00	5.640	5.839	1.233	17.1

SYSTEM
AL2O3(6.0),CAO(33.0),SIO2(61.0) (X)
AL2O3(10.0),CAO(30.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-104

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	6.043	2.624	421.
1300.00	6.357	5.394	2.342	220.
1350.00	6.161	4.836	2.100	126.
1400.00	5.977	4.402	1.912	81.6
1450.00	5.804	3.945	1.713	51.7
1500.00	5.640	3.484	1.513	32.6

SYSTEM
AL2O3(9.0),CAO(28.0),SIO2(63.0) (X)
AL2O3(15.0),CAO(25.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-105

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	7.352	3.193	1560.
1300.00	6.357	6.593	2.863	730.
1350.00	6.161	5.966	2.591	390.
1400.00	5.977	5.366	2.330	214.
1450.00	5.804	4.852	2.107	128.
1500.00	5.640	4.353	1.890	77.7

SYSTEM
AL2O3(12.65),CAO(22.98),
SIO2(64.37) (X)
AL2O3(20.0),CAO(20.0),
SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-106

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	8.657	3.760	5750.
1300.00	6.357	7.836	3.403	2530.
1350.00	6.161	7.139	3.100	1260.
1400.00	5.977	6.497	2.822	663.
1450.00	5.804	5.866	2.548	353.
1500.00	5.640	5.318	2.310	204.

SYSTEM
AL2O3(16.22),CAO(17.70),
SIO2(66.08) (X)
AL2O3(25.0),CAO(15.0),
SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-107

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	7.863	3.415	2600.
1450.00	5.804	7.107	3.086	1220.
1500.00	5.640	6.431	2.793	621.

SYSTEM
AL2O3(2.94),CAO(32.11),
SIO2(64.94) (X)
AL2O3(5.0),CAO(30.0),
SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-108

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	4.247	1.844	69.9
1500.00	5.640	3.742	1.625	42.2

SYSTEM
AL2O3(6.03),CAO(27.42),
SIO2(66.55) (X)
AL2O3(10.0),CAO(25.0),
SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-109

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	7.484	3.250	1780.
1300.00	6.357	6.750	2.931	854.
1350.00	6.161	6.131	2.663	460.
1400.00	5.977	5.545	2.408	256.
1450.00	5.804	5.024	2.182	152.
1500.00	5.640	4.550	1.976	94.6

SYSTEM
AL2O3(9.28),CAO(22.49),
SIO2(68.23) (X)
AL2O3(15.0),CAO(20.0),
SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-110

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	8.412	3.653	4500.
1350.00	6.161	7.581	3.292	1960.
1400.00	5.977	6.947	3.017	1040.
1450.00	5.804	6.353	2.759	574.
1500.00	5.640	5.740	2.493	311.

SYSTEM
AL2O3(12.69),CAO(17.31),
SIO2(70.00) (X)
AL2O3(20.0),CAO(15.0),
SIO2(65.0) (%9)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-111

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	10.348	4.494	31200.
1300.00	6.357	9.596	4.167	14700.
1350.00	6.161	8.770	3.809	6440.
1400.00	5.977	8.074	3.507	3210.
1450.00	5.804	7.371	3.201	1590.
1500.00	5.640	6.846	2.973	940.

SYSTEM
AL2O3(16.29),CAO(11.84),
SIO2(71.87) (X)
AL2O3(25.0),CAO(10.0),
SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-112

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	8.284	3.598	3960.
1500.00	5.640	7.550	3.279	1900.

SYSTEM
AL2O3(15.91),CAO(46.29),
SIO2(37.80) (X)
AL2O3(25.0),CAO(40.0),
SIO2(35.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-113

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.991	1.299	19.9
1450.00	5.804	2.468	1.072	11.8
1500.00	5.640	2.015	0.875	7.5

SYSTEM
AL2O3(23.50),CAO(36.62),
SIO2(39.88) (X)
AL2O3(35.0),CAO(30.0),
SIO2(35.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-114

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	5.513	2.394	248.
1350.00	6.161	4.691	2.037	109.
1400.00	5.977	4.004	1.739	54.8
1450.00	5.804	3.447	1.497	31.4
1500.00	5.640	2.944	1.279	19.0

SYSTEM
AL2O3(2.90),CAO(52.77),
SIO2(44.33) (X)
AL2O3(5.0),CAO(50.0),
SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

ACS-115

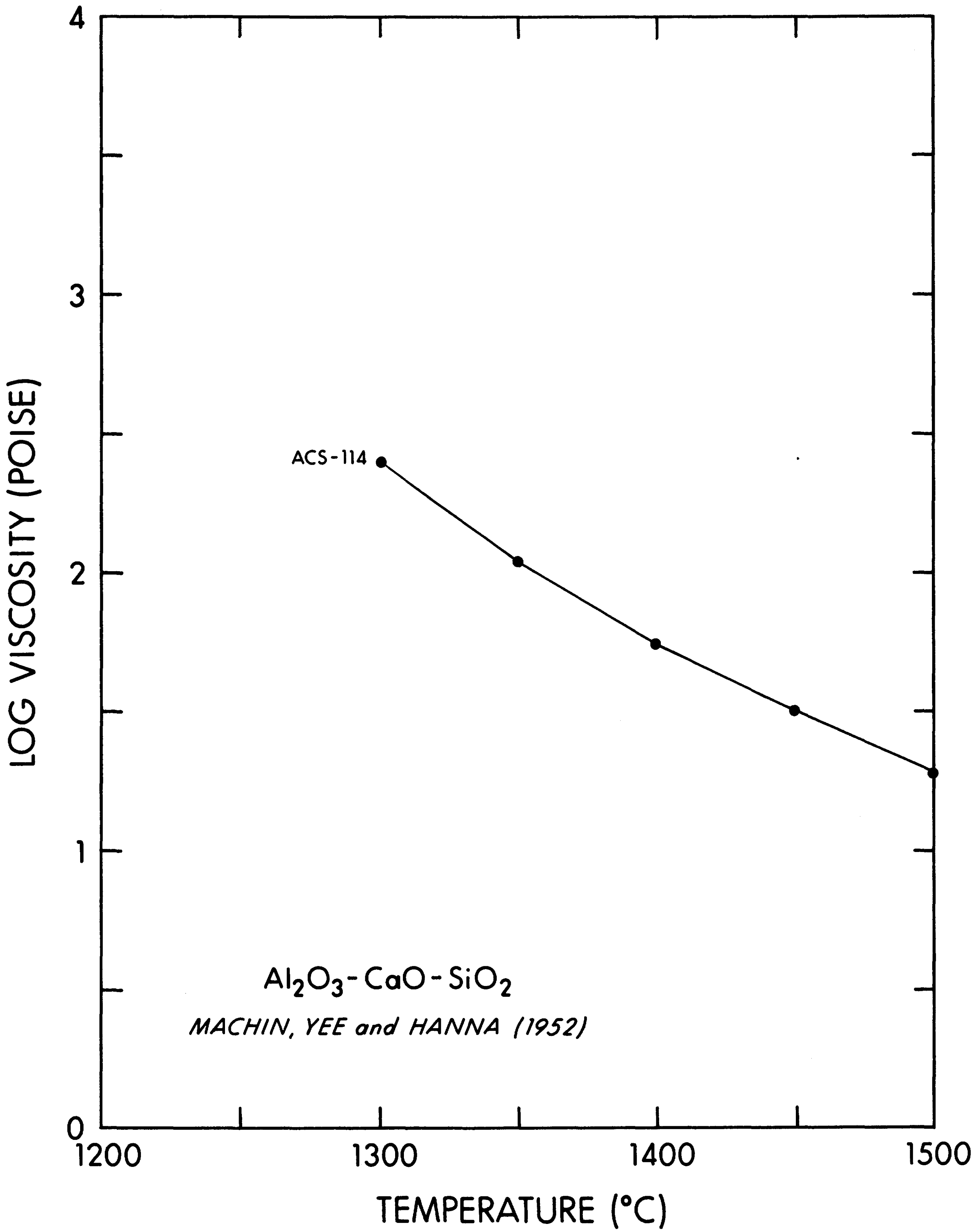
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

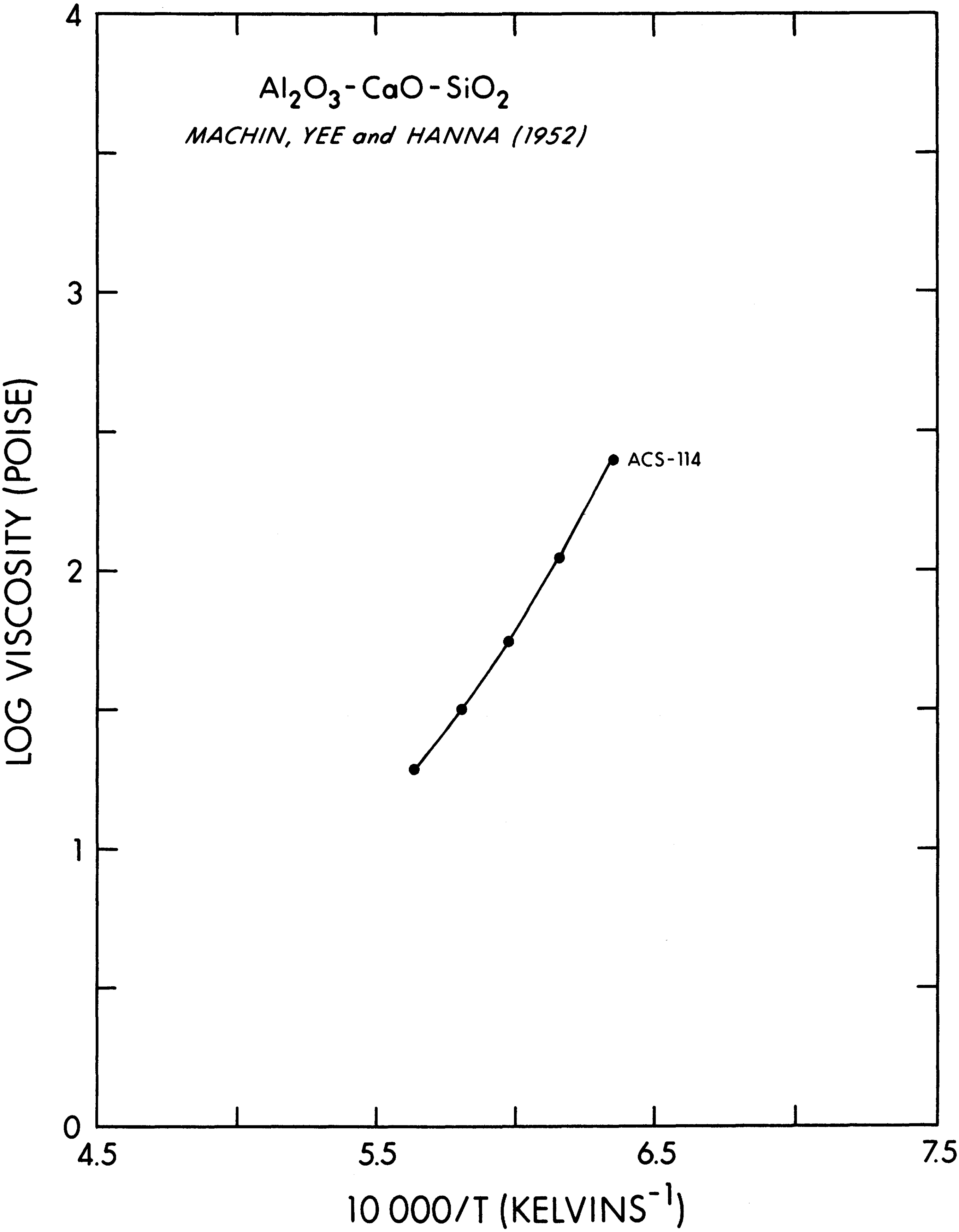
DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	1.560	0.681	4.80
1500.00	5.640	1.227	0.533	3.41


4
3
2
1
0
LOG VISCOSITY (POISE)
ACS-114
Al_2O_3-CaO-SiO_2
MACHIN, YEE and HANNA (1952)
1200
1300
1400
1500
TEMPERATURE (°C)



Al_2O_3 - CaO - SiO_2
MACHIN, YEE and HANNA (1952)
ACS-114
LOG VISCOSITY (POISE)
4
3
2
1
0
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})

SYSTEM
AL2O3(5.95),CAO(48.65),
SIO2(45.41) (X)
AL2O3(10.0),CAO(45.0),
SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-116

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.451	1.064	11.6
1450.00	5.804	2.023	0.879	7.56
1500.00	5.640	1.625	0.706	5.08

SYSTEM
AL2O3(9.14),CAO(44.32),
SIO2(46.54) (X)
AL2O3(15.0),CAO(40.0),
SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-117

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	3.500	1.520	33.1
1400.00	5.977	2.965	1.288	19.4
1450.00	5.804	2.534	1.100	12.6
1500.00	5.640	2.145	0.931	8.54

SYSTEM
AL2O3(12.50),CAO(39.78),
SIO2(47.73) (X)
AL2O3(20.0),CAO(35.0),
SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-118

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.606	2.435	272.
1300.00	6.357	4.828	2.097	125.
1350.00	6.161	4.148	1.801	63.3
1400.00	5.977	3.616	1.571	37.2
1450.00	5.804	3.118	1.354	22.6
1500.00	5.640	2.708	1.176	15.0

SYSTEM
AL2O3(16.03),CAO(34.99),
SIO2(48.98) (X)
AL2O3(25.0),CAO(30.0),
SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-119

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	4.883	2.121	132.
1400.00	5.977	4.248	1.843	70.0
1450.00	5.804	3.714	1.613	41.0
1500.00	5.640	3.270	1.420	26.3

SYSTEM
AL2O3(19.76),CAO(29.94),
SIO2(50.30) (X)
AL2O3(30.0),CAO(25.0),
SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-120

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	4.256	1.848	70.5

SYSTEM
AL2O3(18.8),CAO(51.2),
SIO2(30.0) (X)
AL2O3(29.08),CAO(43.57),
SIO2(27.35)

AUTHOR
ROSSIN, BERSAN, AND URBAIN
(1964)

MEASUREMENT METHOD
ROTATIONAL-CYC. VISCOMETER

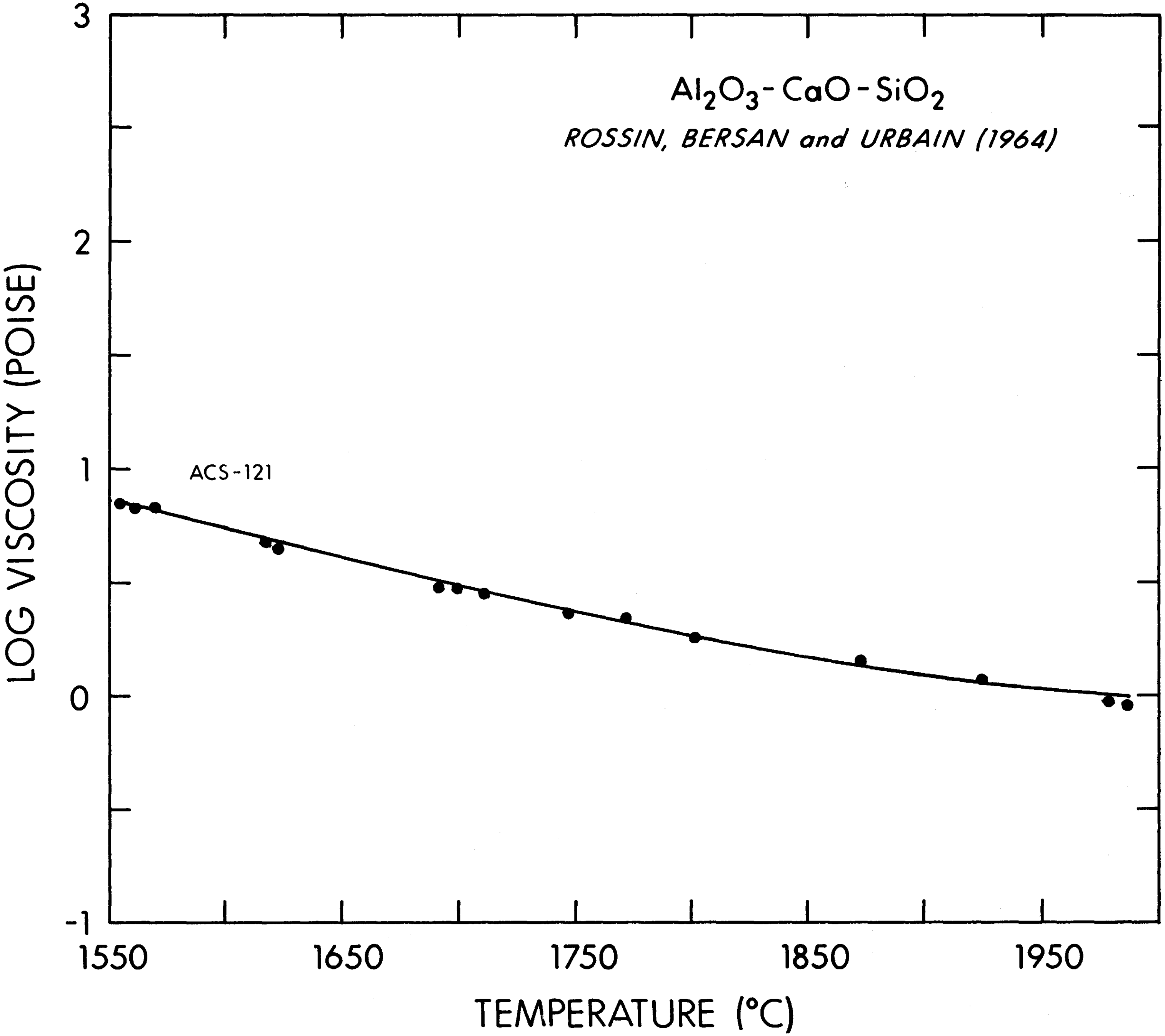
DERIVED FROM
FIG. 9

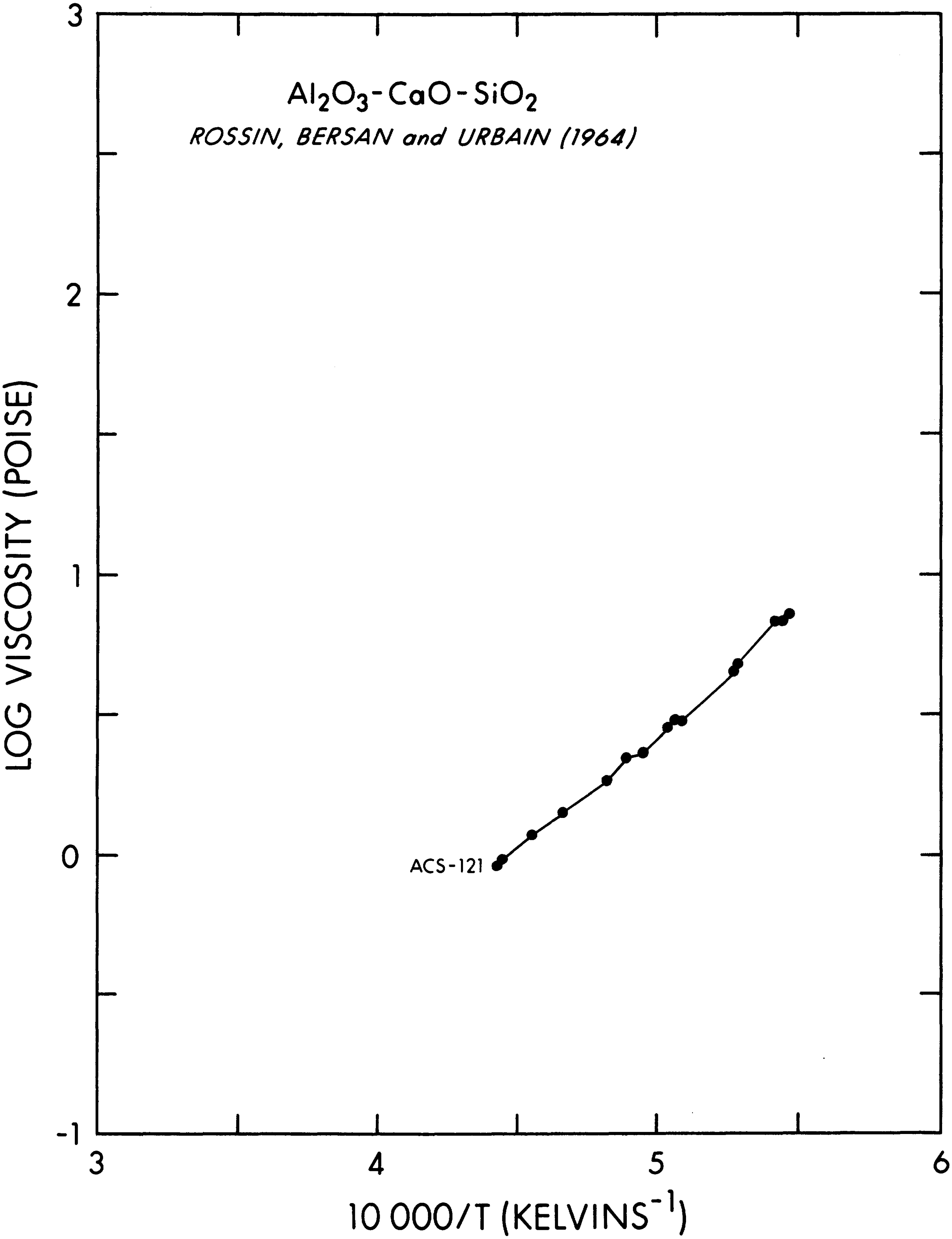
N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACS-121

T	Z	LN(N)	LOG(N)	N
1555.2	5.470	1.957	.850	7.079
1561.9	5.450	1.911	.830	6.761
1570.3	5.425	1.911	.830	6.761
1617.4	5.290	1.554	.675	4.732
1622.7	5.275	1.497	.650	4.467
1691.6	5.090	1.094	.475	2.985
1699.4	5.070	1.094	.475	2.985
1711.1	5.040	1.036	.450	2.818
1747.2	4.950	.829	.360	2.291
1772.0	4.890	.783	.340	2.188
1801.7	4.820	.599	.260	1.820
1872.9	4.660	.345	.150	1.413
1924.8	4.550	.161	.070	1.175
1979.3	4.440	-.046	-.020	.955
1986.9	4.425	-.092	-.040	.912


Al₂O₃-CaO-SiO₂
ROSSIN, BERSAN and URBAIN (1964)
ACS-121
LOG VISCOSITY (POISE)
3
2
1
0
-1
1550
1650
1750
1850
1950
TEMPERATURE (°C)


Al_2O_3-CaO-SiO_2
ROSSIN, BERSAN and URBAIN (1964)
ACS-121
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
3
2
1
0
-1
3
4
5
6

SYSTEM

$Al_2O_3(.25)K_2O(.25)SiO_2(.50)$ (X)

AUTHOR

N'DALA et al. (1984)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

AKS-1

T	Z	LN(N)	LOG(N)	N
1711.	5.040	7.48	3.24	1772.
1751.	4.940	7.13	3.09	1248.
1796.	4.833	6.52	2.83	678.
1826.	4.764	6.17	2.67	478.

SYSTEM
AL_2O_3(5.0), MGO(41.0), SIO_2(54.0) (X)
AL_2O_3(10.0), MGO(30.0), SIO_2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-1

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	3.016	1.310	20.4

SYSTEM
AL_2O_3(8.0), MGO(35.0), SIO_2(57.0) (X)
AL_2O_3(15.0), MGO(25.0), SIO_2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-2

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	4.771	2.072	118.
1450.00	5.804	4.228	1.836	68.6
1500.00	5.640	3.706	1.610	40.7

SYSTEM
AL_2O_3(11.60), MGO(29.34),
SIO_2(59.06) (X)
AL_2O_3(20.0), MGO(20.0),
SIO_2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-3

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	6.288	2.731	538.
1400.00	5.977	5.595	2.430	269.
1450.00	5.804	4.997	2.170	148.
1500.00	5.640	4.464	1.939	86.8

SYSTEM
AL_2O_3(15.17), MGO(23.03),
SIO_2(61.80) (X)
AL_2O_3(25.0), MGO(15.0),
SIO_2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-4

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	9.019	3.917	8260.
1300.00	6.357	8.020	3.483	3040.
1350.00	6.161	7.178	3.117	1310.
1400.00	5.977	6.417	2.787	612.
1450.00	5.804	5.762	2.502	318.
1500.00	5.640	5.165	2.243	175.

SYSTEM
AL2O3(8.53),MGO(28.76),
SIO2(62.71) (X)
AL2O3(15.0),MGO(20.0),
SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE 8(1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-5

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	7.479	3.248	1770.
1350.00	6.161	6.657	2.891	778.
1400.00	5.977	5.971	2.593	392.
1450.00	5.804	5.375	2.334	216.
1500.00	5.640	4.836	2.100	126.

SYSTEM
AL2O3(11.89),MGO(22.55),
SIO2(65.56) (X)
AL2O3(20.0),MGO(15.0),
SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-6

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	9.425	4.093	12400.
1300.00	6.357	8.311	3.610	4070.
1350.00	6.161	7.591	3.297	1980.
1400.00	5.977	6.863	2.980	956.
1450.00	5.804	6.190	2.688	488.
1500.00	5.640	5.572	2.420	263.

SYSTEM
AL2O3(15.57),MGO(15.75),
SIO2(68.68) (X)
AL2O3(25.0),MGO(10.0),
SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-7

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	7.758	3.369	2340.
1450.00	5.804	7.003	3.041	1100.
1500.00	5.640	6.342	2.754	568.

SYSTEM
AL2O3(26.25),MGO(26.25),SIO2(47.5) (X)

AUTHOR
RIEBLING (1964)

MEASUREMENT METHOD
RESTRAINED SPHERE

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-8

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	1.792	0.778	6.

SYSTEM
AL2O3(6.125),MGO(43.875),
SIO2(50.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
RIEBLING (1964)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-9

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	1.082	0.470	2.95

SYSTEM
AL2O3(6.25),MGO(43.75),SIO2(50.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
RIEBLING (1964)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-10

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	1.664	0.723	5.28

SYSTEM
AL2O3(12.9),MGO(37.1),SIO2(50.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
RIEBLING (1964)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-11

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	2.268	0.985	9.66

SYSTEM
AL2O3(12.9),MGO(37.1),SIO2(50.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
RIEBLING (1964)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-12

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	1.649	0.716	5.2

SYSTEM
AL2O3(19.76),MGO(30.24),SIO2(50.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
RIEBLING (1964)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-13

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	2.565	1.114	13.0

SYSTEM
AL2O3(19.8),MGO(30.2),SIO2(50.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
RIEBLING (1964)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-14

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	1.946	0.845	7.

SYSTEM
AL2O3(25.0),MGO(25.0),SIO2(50.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
RIEBLING (1964)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-15

T	Z	LN(N)	LOG(N)	N
1600.00	5.339	2.833	1.230	17.0

SYSTEM
AL2O3(25.0),MGO(25.0),SIO2(50.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE

N (POISES)
T (DEGREES C)

AUTHOR
RIEBLING (1964)
DERIVED FROM
TABLE

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-16

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	2.079	0.903	8.

SYSTEM
AL2O3(24.0),MGO(24.0),SIO2(52.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
RIEBLING (1964)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-17

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	2.3:2	1.000	10.

SYSTEM
AL2O3(22.5),MGO(22.5),SIO2(55.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
RIEBLING (1964)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-18

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	2.639	1.146	14.

SYSTEM
AL2O3(18.5),MGO(18.5),SIO2(63.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
RIEBLING (1964)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-19

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	3.738	1.623	42.

SYSTEM
AL2O3(20.25),MGO(20.25),SIO2(63.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
RIEBLING (1964)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgS-20

T	Z	LN(N)	LOG(N)	N
1700.00	5.068	3.135	1.362	23.

```
 SYSTEM                                          AUTHOR
AL2O3(15.75),MGO(15.75),SIO2(68.5)  (X)RIEBLING (1964)
 MEASUREMENT METHOD                                DERIVED FROM
 RESTRAINED SPHERE                                    TABLE
 N (POISES)                                  P = 1.0 ATM.

 T (DEGREES C)                               Z = 10000.0/T(K)  (1/K)
   T          Z        LN(N)     LOG(N)       N
 1700.00    5.068    4.317     1.875        75.
```

AMgS-21

```
 SYSTEM                                          AUTHOR
AL2O3(14.75),MGO(14.75),SIO2(70.5)  (X)RIEBLING (1964)
 MEASUREMENT METHOD                                DERIVED FROM
 RESTRAINED SPHERE                                    TABLE
 N (POISES)                                  P = 1.0 ATM.
 T (DEGREES C)                               Z = 10000.0/T(K)  (1/K)
   T          Z        LN(N)     LOG(N)       N
 1700.00    5.068    4.787     2.079       120.
```

AMgS-22

```
 SYSTEM                                          AUTHOR
AL2O3(12.25),MGO(12.25),SIO2(75.0)  (X)RIEBLING (1964)
 MEASUREMENT METHOD                                DERIVED FROM
 RESTRAINED SPHERE                                    TABLE
 N (POISES)                                  P = 1.0 ATM.
 T (DEGREES C)                               Z = 10000.0/T(K)  (1/K)
   T          Z        LN(N)     LOG(N)       N
 1700.00    5.068    5.704     2.477       300.
```

AMgS-23

SYSTEM

$Al_2O_3(.25)Na_2O(.25)SiO_2(.50)$ (X)

AUTHOR

N'DALA et al. (1984)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

ANS-1

T	Z	LN(N)	LOG(N)	N
1594.	5.356	7.55	3.27	1900.
1624.	5.271	6.98	3.03	1074.
1678.	5.125	6.45	2.80	632.
1728.	4.997	6.03	2.61	415.

SYSTEM
CAO(9.0),MGO(39.0),SIO2(52.0) (X)
CAO(10.0),MGO(30.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

MgCS-1

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	2.031	0.882	7.62

SYSTEM
CAO(14.0),MGO(33.0),SIO2(53.0) (X)
CAO(15.0),MGO(25.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

MgCS-2

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.885	1.253	17.9
1450.00	5.804	2.361	1.025	10.6
1500.00	5.640	1.981	0.860	7.25

SYSTEM
CAO(19.0),MGO(27.0),SIO2(54.0) (X)
CAO(20.0),MGO(20.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

MgCS-3

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	3.288	1.428	26.8
1400.00	5.977	2.827	1.228	16.9
1450.00	5.804	2.398	1.041	11.0
1500.00	5.640	2.054	0.892	7.8

SYSTEM
CAO(25.0),MGO(20.0),SIO2(55.0) (X)
CAO(25.0),MGO(15.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

MgCS-4

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	3.321	1.442	27.7
1400.00	5.977	2.901	1.260	18.2
1450.00	5.804	2.501	1.086	12.2
1500.00	5.640	2.166	0.941	8.72

SYSTEM
CAO(34.0),MGO(2.0),SIO2(64.0) (X)
CAO(30.0),MGO(10.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

MgCS-5

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	3.405	1.479	30.1
1400.00	5.977	2.960	1.286	19.1
1450.00	5.804	2.534	1.100	12.6
1500.00	5.640	2.180	0.947	8.85

SYSTEM
CAO(36.0),MGO(7.0),SIO2(57.0) (X)
CAO(35.0),MGO(5.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

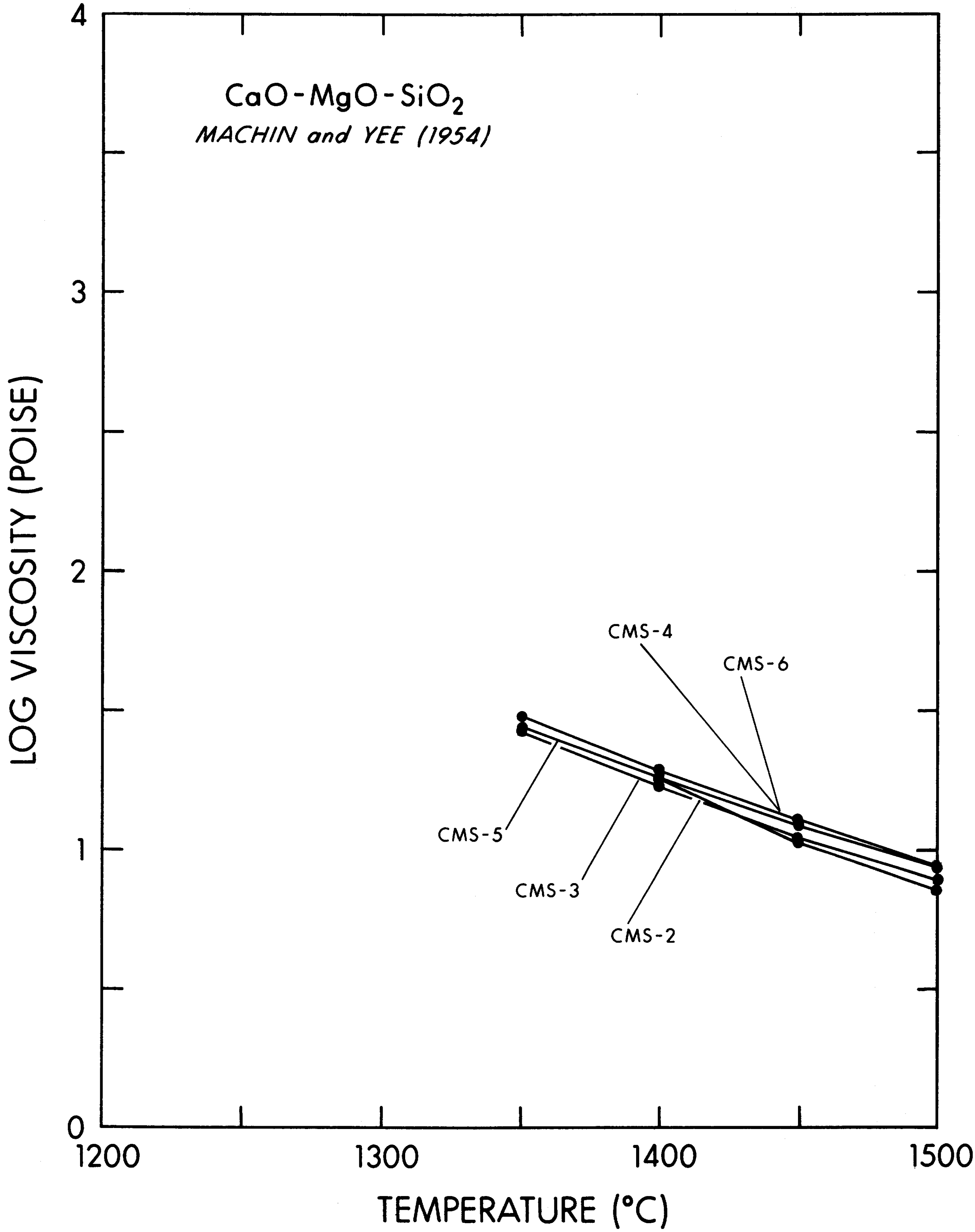
DERIVED FROM
TABLE I

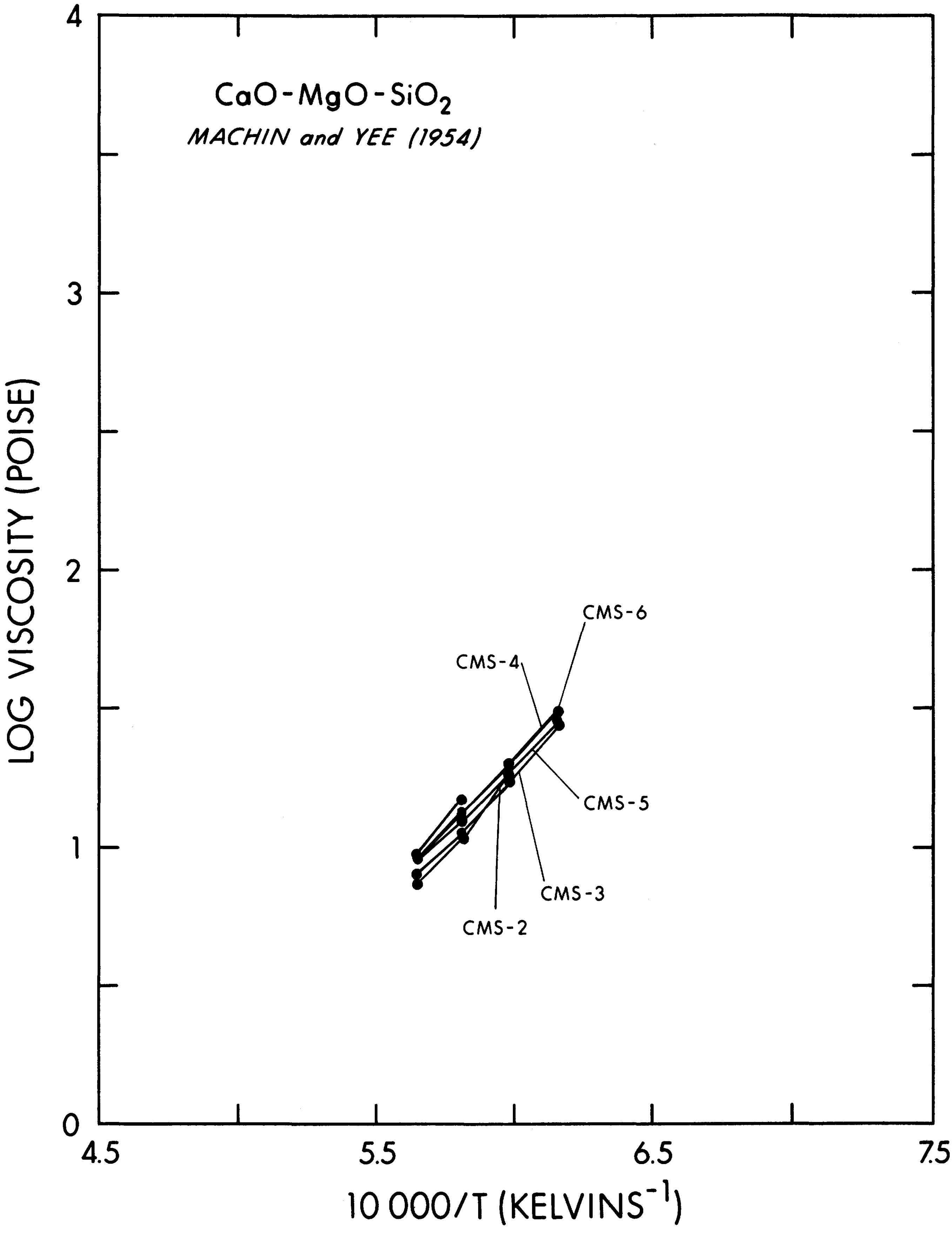
N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

MgCS-6

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	3.411	1.481	30.3
1400.00	5.977	2.950	1.281	19.1
1450.00	5.804	2.549	1.107	12.8
1500.00	5.640	2.178	0.946	8.83


CaO-MgO-SiO2
MACHIN and YEE (1954)
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500
CMS-4
CMS-6
CMS-5
CMS-3
CMS-2


CaO-MgO-SiO2
MACHIN and YEE (1954)
CMS-6
CMS-4
CMS-5
CMS-3
CMS-2
LOG VISCOSITY (POISE)
4
3
2
1
0
4.5
5.5
6.5
7.5
10 000/T (KELVINS-1)

SYSTEM | | | | AUTHOR
MGO(7.03),CAO(50.53),SIO2(42.44) (X) MACHIN, YEE AND HANNA (1952)
MGO(5.0),CAO(50.0),SIO2(45.0) (%)
MEASUREMENT METHOD — DERIVED FROM
OSCILLATING-CYC. VISCOMETER — TABLE II
N (POISES) — P = 1.0 ATM.
T (DEGREES C) — Z = 10000.0/T(K) (1/K)

MgCS-7

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.495	0.649	4.46
1450.00	5.804	1.125	0.489	3.08
1500.00	5.640	0.811	0.352	2.25

SYSTEM — AUTHOR
MGO(13.79),CAO(44.59),SIO2(41.62) (X) MACHIN, YEE AND HANNA (1952)
MGO(10.0),CAO(45.0),SIO2(45.0) (%)
MEASUREMENT METHOD — DERIVED FROM
OSCILLATING-CYC. VISCOMETER — TABLE II
N (POISES) — P = 1.0 ATM.
T (DEGREES C) — Z = 10000.0/T(K) (1/K)

MgCS-8

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.493	0.648	4.45
1450.00	5.804	1.122	0.487	3.07
1500.00	5.640	0.806	0.350	2.24

SYSTEM — AUTHOR
MGO(20.28),CAO(38.88),SIO2(40.83) (X) MACHIN, YEE AND HANNA (1952)
MGO(15.0),CAO(40.0),SIO2(45.0) (%)
MEASUREMENT METHOD — DERIVED FROM
OSCILLATING-CYC. VISCOMETER — TABLE II
N (POISES) — P = 1.0 ATM.
T (DEGREES C) — Z = 10000.0/T(K) (1/K)

MgCS-9

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.413	0.614	4.11
1450.00	5.804	1.061	0.461	2.89
1500.00	5.640	0.742	0.322	2.10

SYSTEM — AUTHOR
MGO(26.54),CAO(33.39),SIO2(40.07) (X) MACHIN, YEE AND HANNA (1952)
MGO(20.0),CAO(35.0),SIO2(45.0) (%)
MEASUREMENT METHOD — DERIVED FROM
OSCILLATING-CYC. VISCOMETER — TABLE II
N (POISES) — P = 1.0 ATM.
T (DEGREES C) — Z = 10000.0/T(K) (1/K)

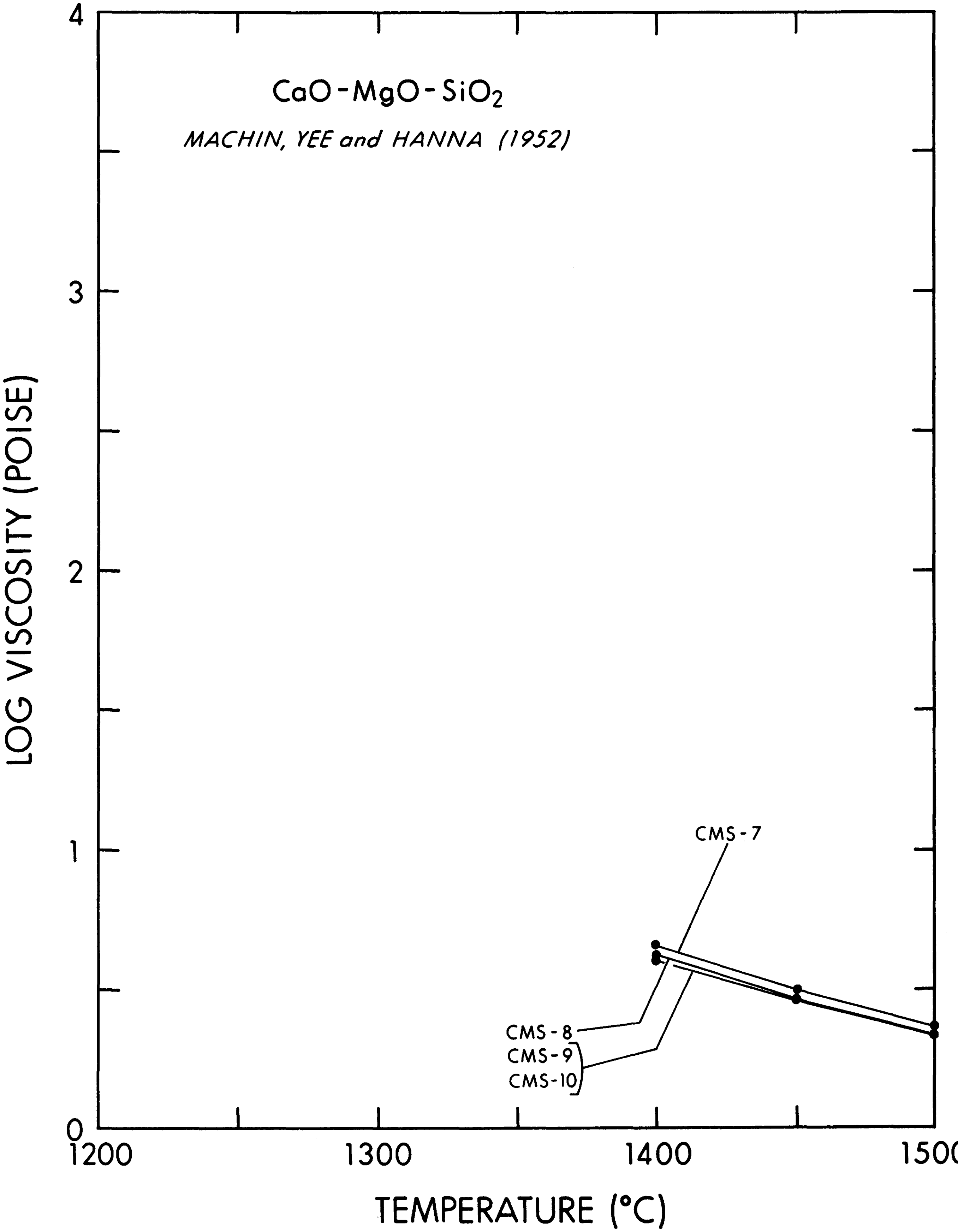
MgCS-10

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.376	0.598	3.96
1450.00	5.804	1.044	0.453	2.84
1500.00	5.640	0.747	0.324	2.11

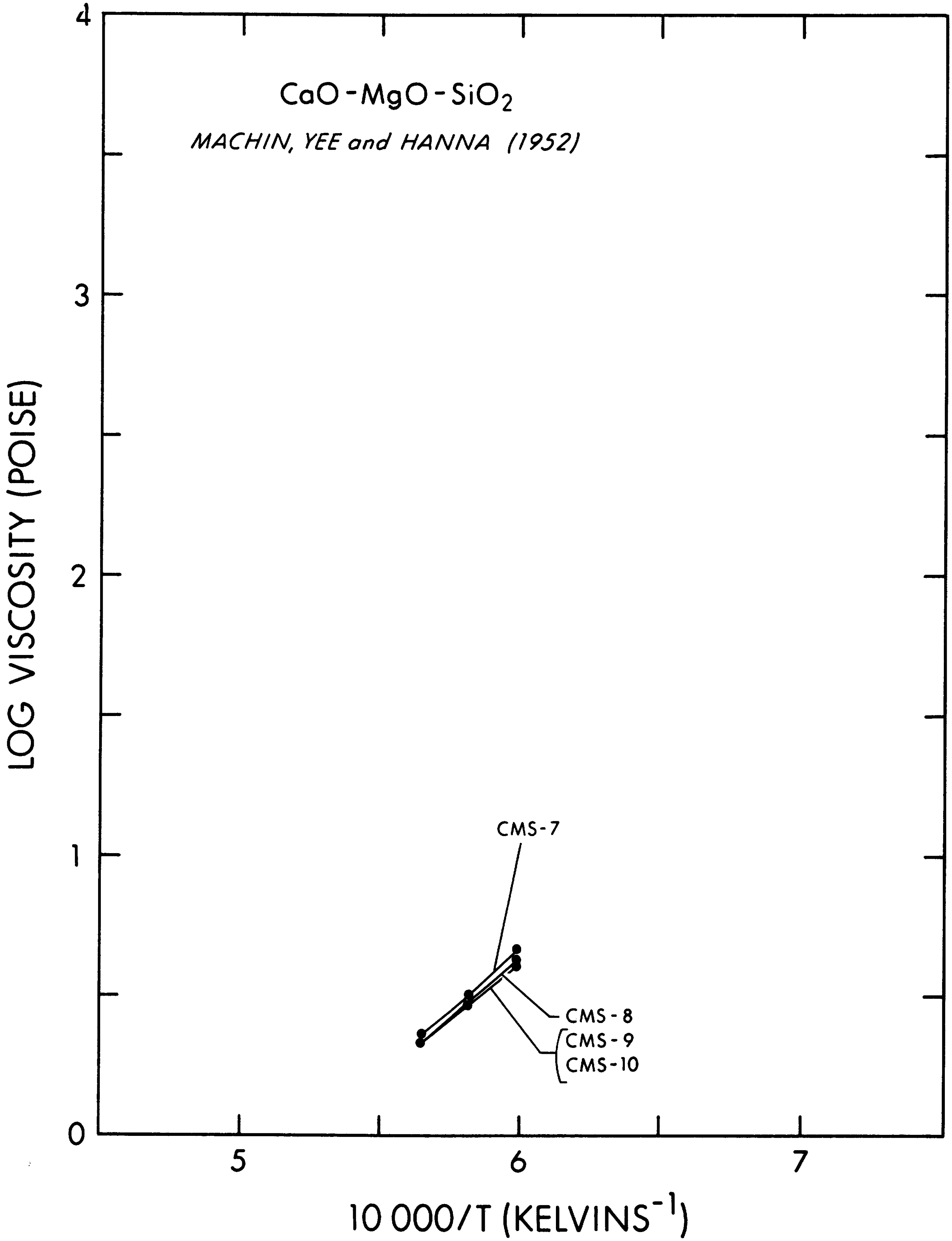
SYSTEM — AUTHOR
MGO(32.57),CAO(28.10),SIO2(39.33) (X) MACHIN, YEE AND HANNA (1952)
MGO(25.0),CAO(30.0),SIO2(45.0) (%)
MEASUREMENT METHOD — DERIVED FROM
OSCILLATING-CYC. VISCOMETER — TABLE II
N (POISES) — P = 1.0 ATM.
T (DEGREES C) — Z = 10000.0/T(K) (1/K)

MgCS-11

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	0.663	0.288	1.94



CaO-MgO-SiO2
MACHIN, YEE and HANNA (1952)
CMS-7
CMS-8
CMS-9
CMS-10
LOG VISCOSITY (POISE)
0
1
2
3
4
1200
1300
1400
1500
TEMPERATURE (°C)



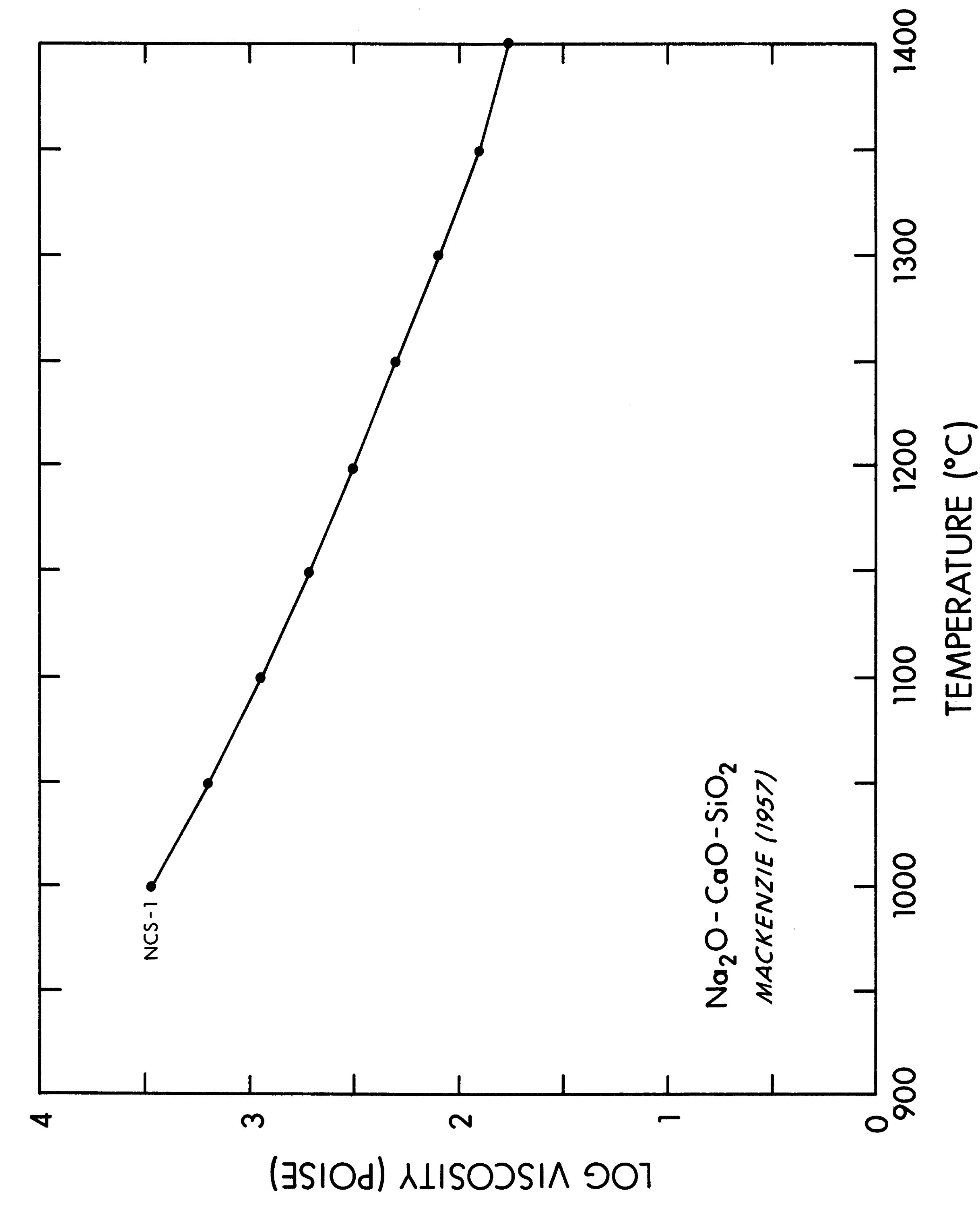
CaO-MgO-SiO2
MACHIN, YEE and HANNA (1952)
LOG VISCOSITY (POISE)
10 000/T (KELVINS-1)
0
1
2
3
4
5
6
7
CMS-7
CMS-8
CMS-9
CMS-10

SYSTEM
NA2O(23.4),CAO(5.6),SIO2(71.0) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

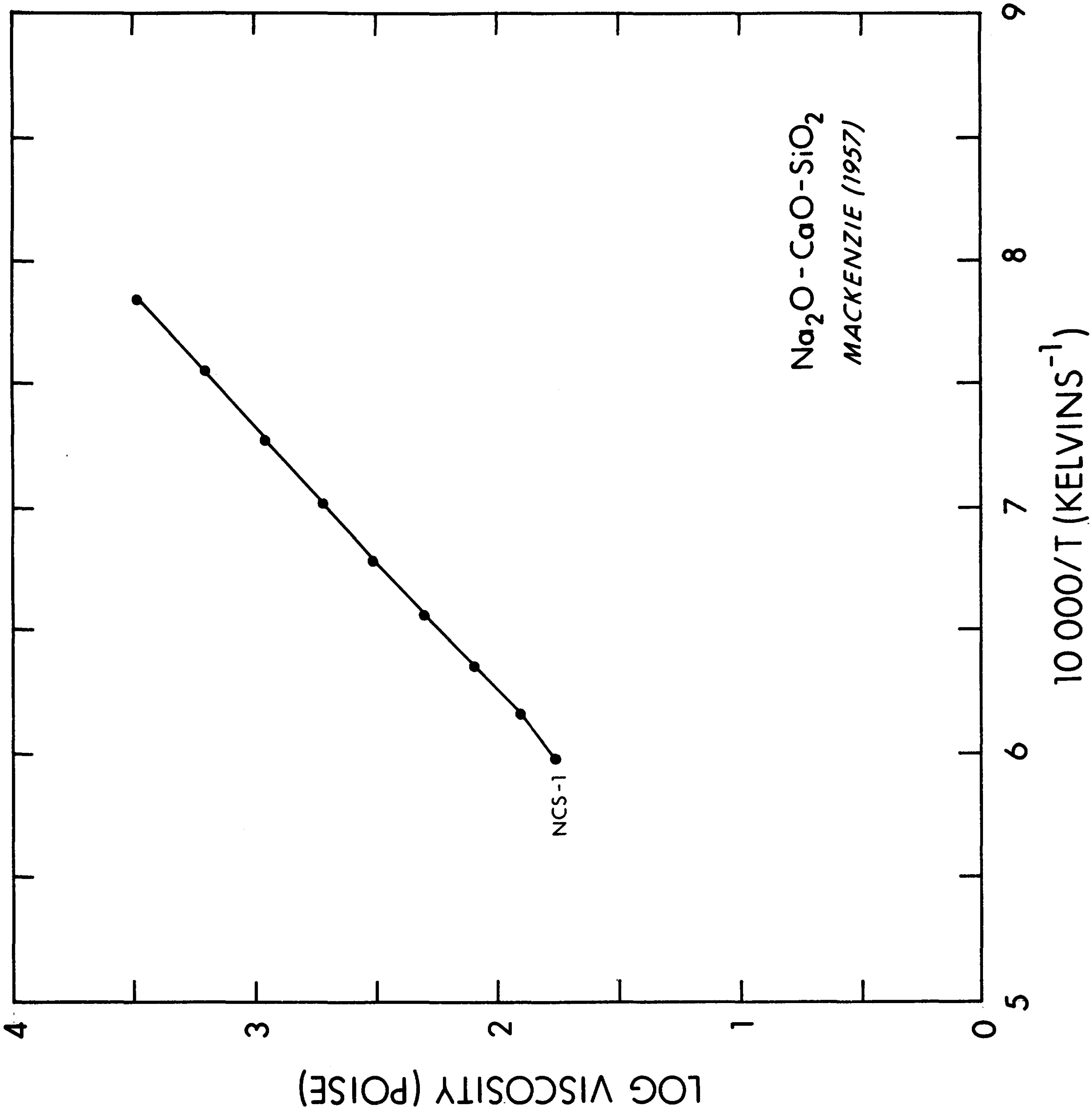
AUTHOR
MACKENZIE (1957)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NCS-1

T	Z	LN(N)	LOG(N)	N
1000.00	7.855	8.003	3.476	2990.
1050.00	7.559	7.371	3.201	1590.
1100.00	7.283	6.797	2.952	895.
1150.00	7.027	6.263	2.720	525.
1200.00	6.789	5.775	2.508	322.
1250.00	6.566	5.303	2.303	201.
1300.00	6.357	4.828	2.097	125.
1350.00	6.161	4.387	1.905	80.4
1400.00	5.977	4.055	1.761	57.7



LOG VISCOSITY (POISE)
0
1
2
3
4
TEMPERATURE (°C)
900
1000
1100
1200
1300
1400
NCS-1
Na_2O-CaO-SiO_2
MACKENZIE (1957)

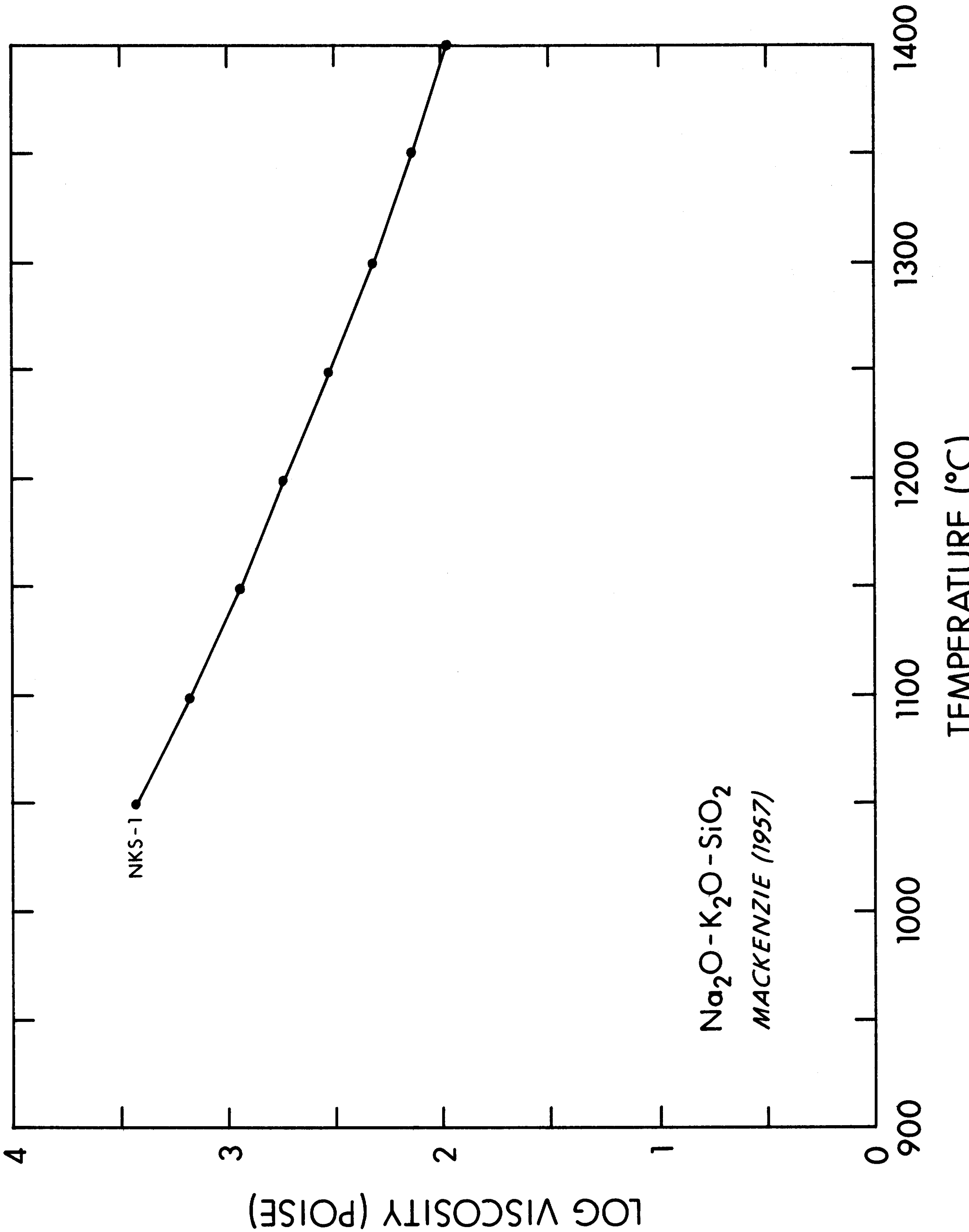

Na2O-CaO-SiO2
MACKENZIE (1957)
NCS-1
LOG VISCOSITY (POISE)
10 000/T (KELVINS-1)
0
1
2
3
4
5
6
7
8
9

SYSTEM
NA2O(7.2),K2O(18.5),SIO2(74.3) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

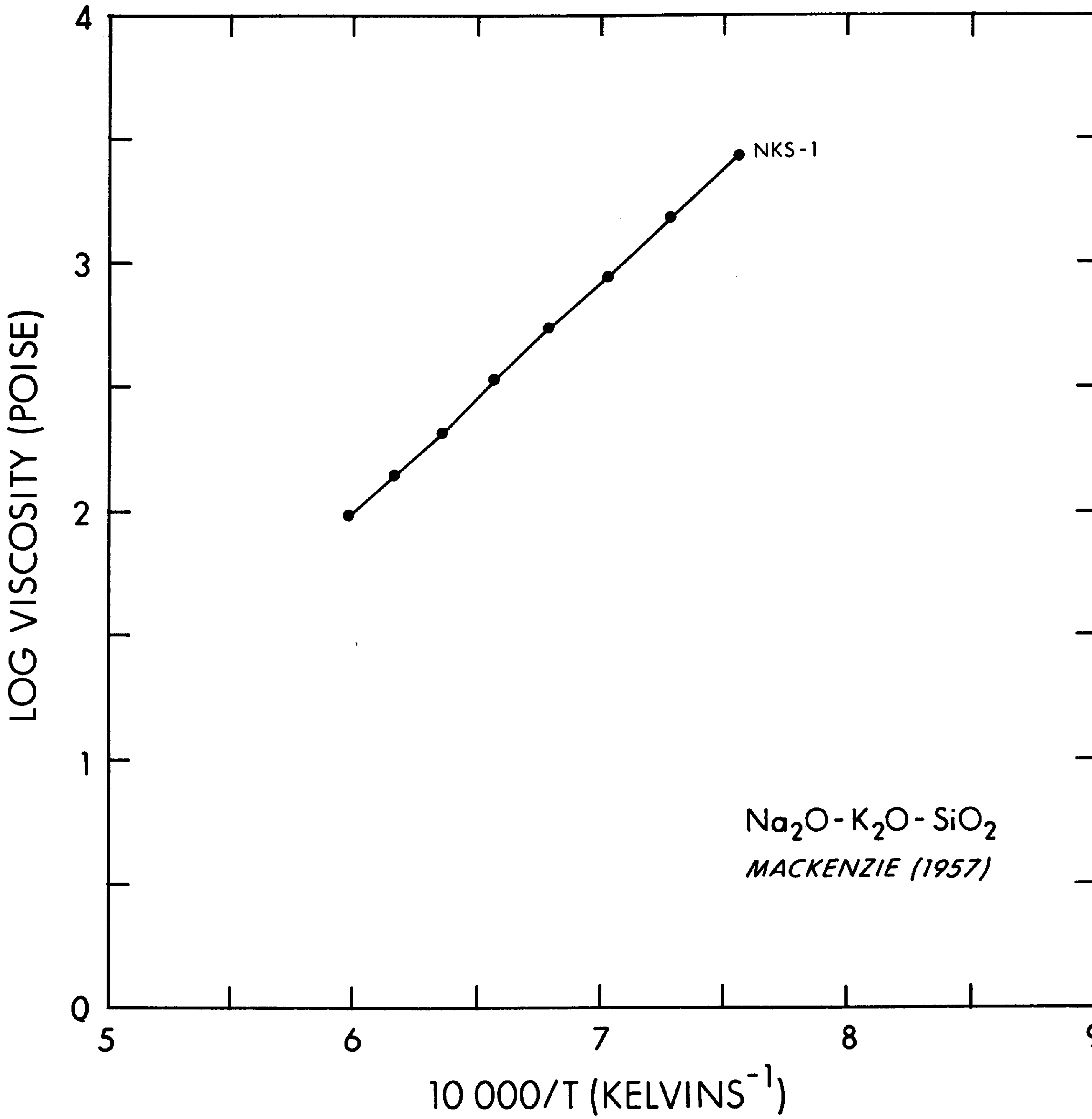
AUTHOR
MACKENZIE (1957)
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NKS-1

T	Z	LN(N)	LOG(N)	N
1050.00	7.559	7.901	3.431	2700.
1100.00	7.283	7.320	3.179	1510.
1150.00	7.027	6.777	2.943	877.
1200.00	6.789	6.303	2.737	546.
1250.00	6.566	5.817	2.526	336.
1300.00	6.357	5.336	2.318	208.
1350.00	6.161	4.934	2.143	139.
1400.00	5.977	4.566	1.983	96.2



LOG VISCOSITY (POISE)
0
1
2
3
4
TEMPERATURE (°C)
900
1000
1100
1200
1300
1400
NKS-1
$Na_2O-K_2O-SiO_2$
MACKENZIE (1957)



4
3
2
1
0
LOG VISCOSITY (POISE)
NKS-1
Na_2O-K_2O-SiO_2
MACKENZIE (1957)
5
6
7
8
9
10 000/T (KELVINS^{-1})

SYSTEM
NA2O(21.8),LI2O(11.4),SIO2(66.8) (X)

AUTHOR
MACKENZIE (1957)
DERIVED FROM
TABLE

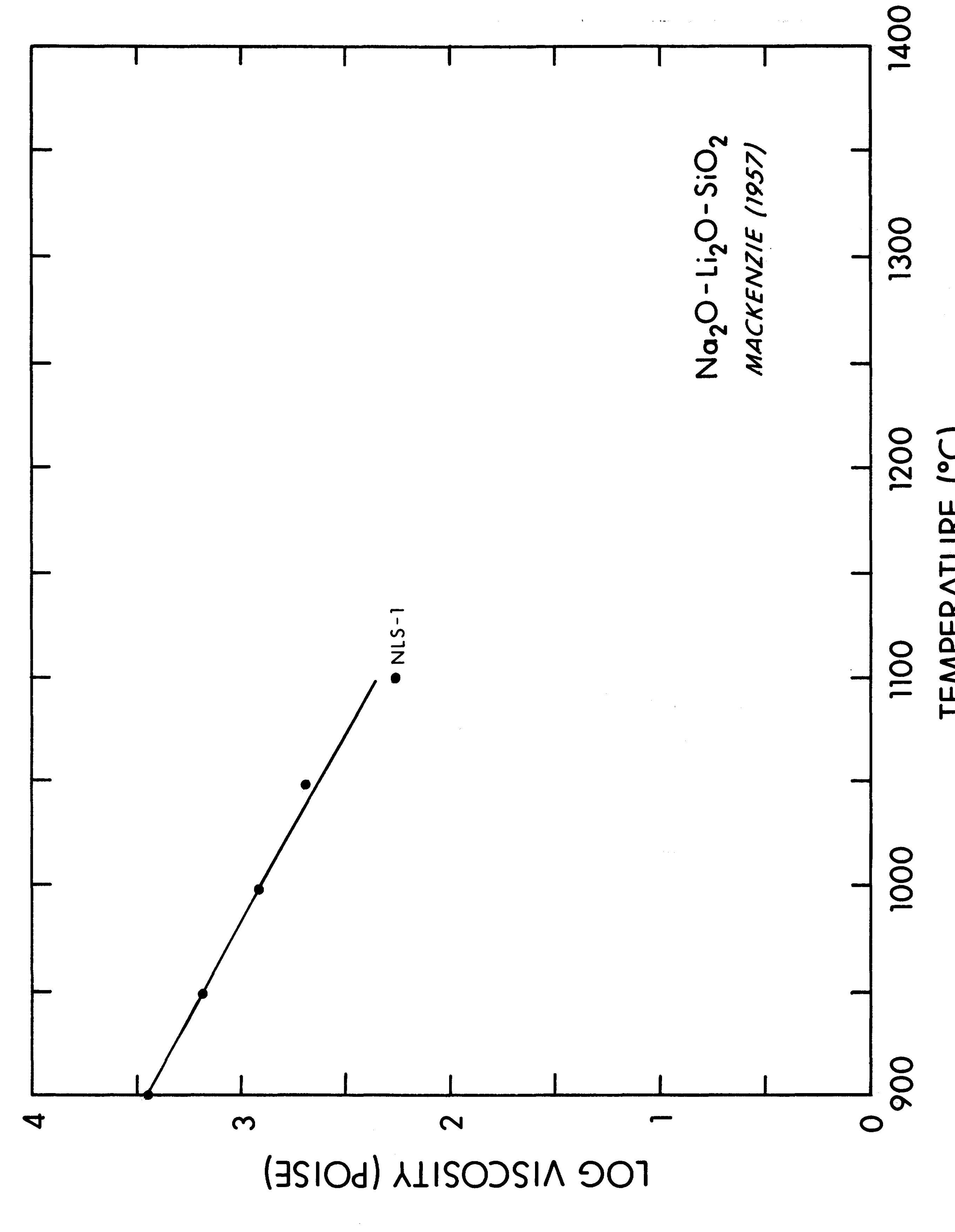
MEASUREMENT METHOD
RESTRAINED SPHERE

N (POISES)
T (DEGREES C)

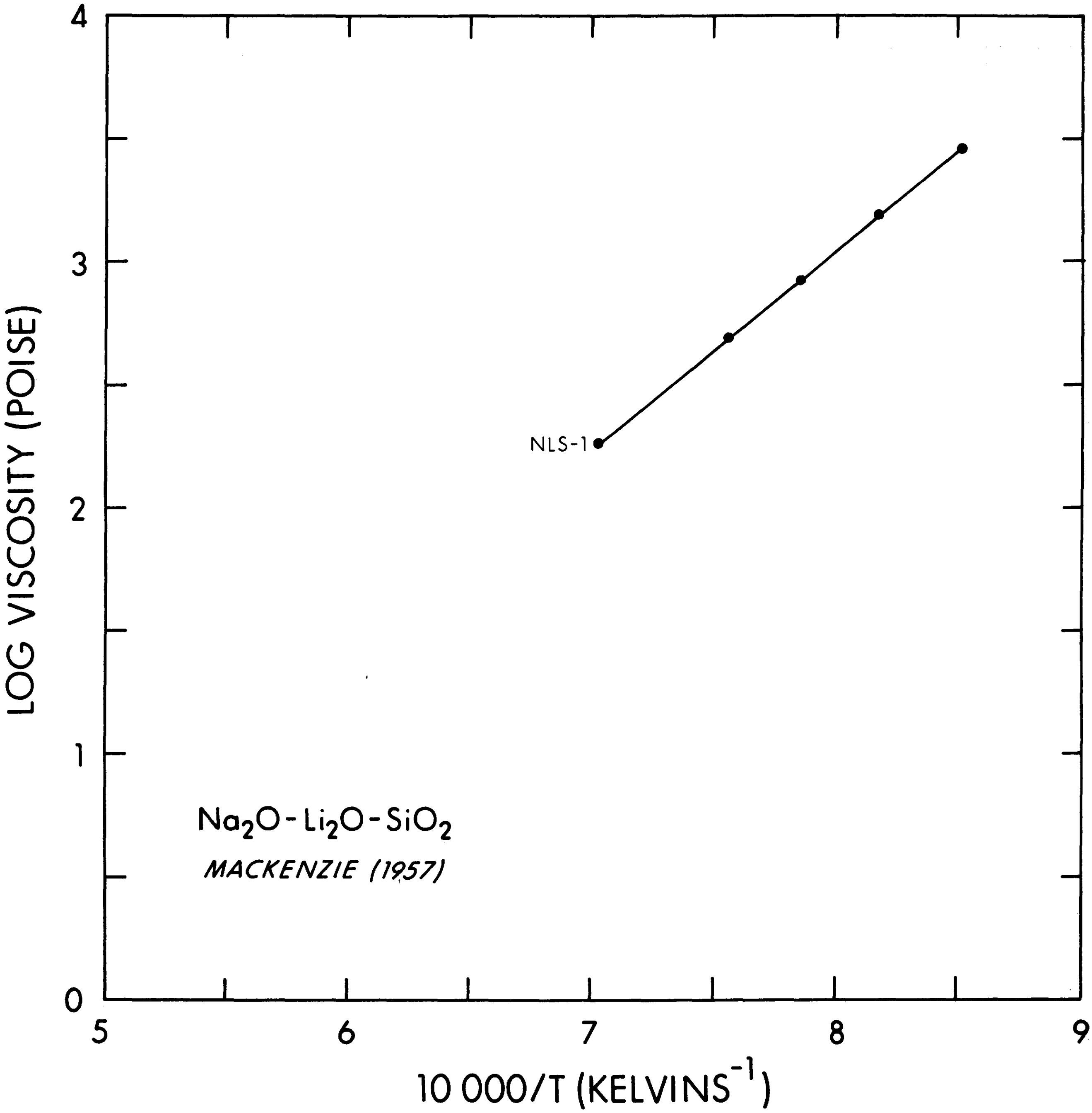
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

NLS-1

T	Z	LN(N)	LOG(N)	N
900.00	8.525	7.979	3.465	2920.
950.00	8.177	7.340	3.188	1540.
1000.00	7.855	6.719	2.918	828.
1050.00	7.559	6.192	2.689	489.
1100.00	7.027	5.204	2.260	182.



$Na_2O-Li_2O-SiO_2$
MACKENZIE (1957)
NLS-1
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
900
1000
1100
1200
1300
1400



LOG VISCOSITY (POISE)
4
3
2
1
0
5
6
7
8
9
10 000/T (KELVINS^{-1})
NLS-1
Na_2O-Li_2O-SiO_2
MACKENZIE (1957)

Four-Component Systems

SYSTEM
AL2O3(8.8),CAO(37.3),
CAF2(4.0),SIO2(49.9) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
BILLS (1963)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACCS-1

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.812	2.09	123.0
1300.00	6.357	4.191	1.82	66.07
1350.00	6.161	3.730	1.62	41.69
1400.00	5.977	3.247	1.41	25.70
1450.00	5.804	2.947	1.28	19.05
1500.00	5.640	2.579	1.12	13.18

SYSTEM
AL2O3(12.2),CAO(45.5),
CAF2(1.6),SIO2(41.6) (X)

MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
BILLS (1963)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACCS-2

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.605	2.00	100.0
1300.00	6.357	3.868	1.68	47.86
1350.00	6.161	3.247	1.41	25.70
1400.00	5.977	2.809	1.22	16.60
1450.00	5.804	2.372	1.03	10.72
1500.00	5.640	2.049	0.89	7.762

SYSTEM
AL2O3(11.4),CAO(41.6),
CAF2(8.2),SIO2(38.9) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
BILLS (1963)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACCS-3

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	3.753	1.63	42.66
1300.00	6.357	3.178	1.38	23.99
1350.00	6.161	2.602	1.13	13.49
1400.00	5.977	2.257	0.98	9.550
1450.00	5.804	2.164	0.94	8.710
1500.00	5.640	1.911	0.83	6.761

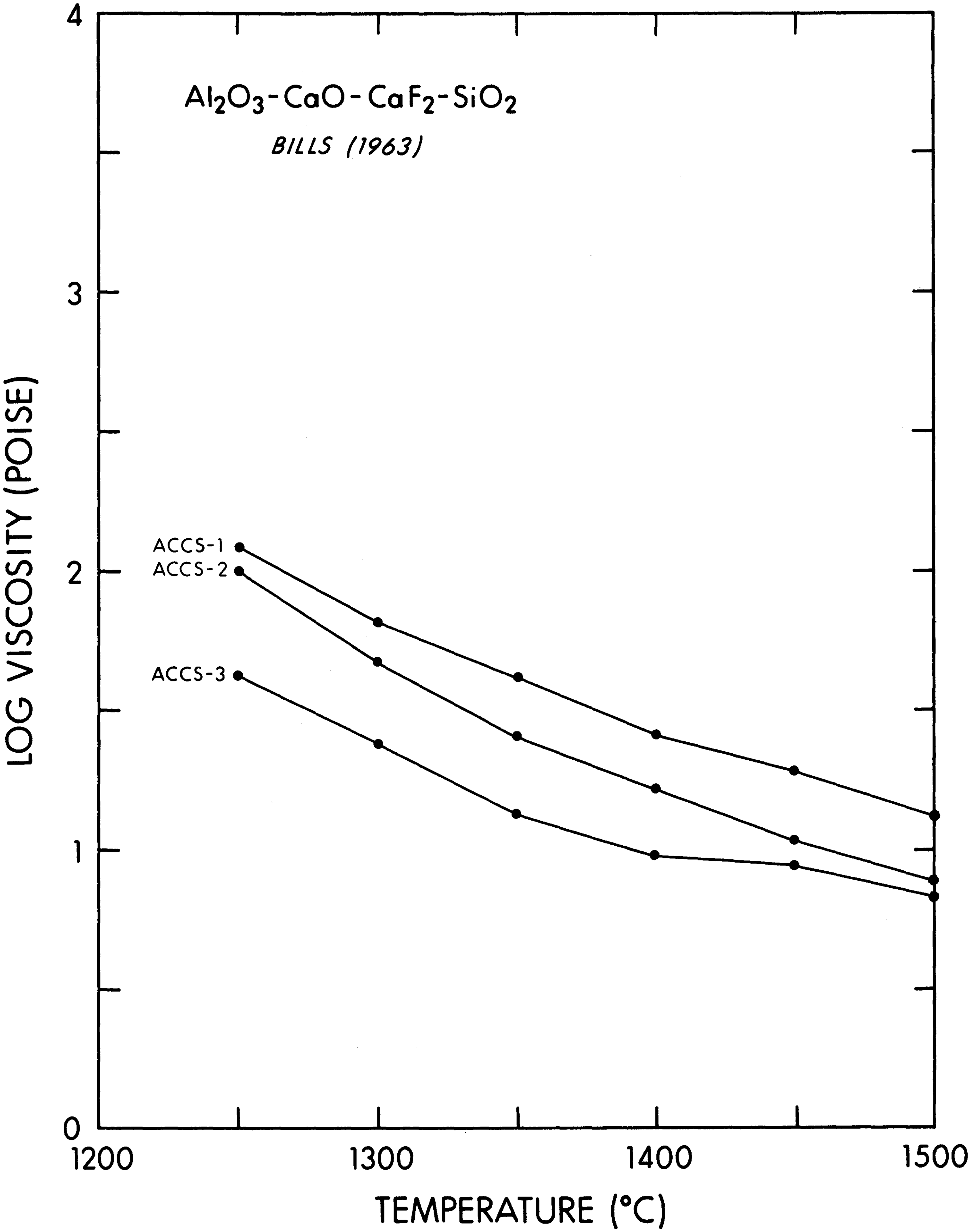
SYSTEM
AL2O3(8.0),CAO(34.0),
CAF2(12.4),SIO2(45.5) (X)
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
BILLS (1963)

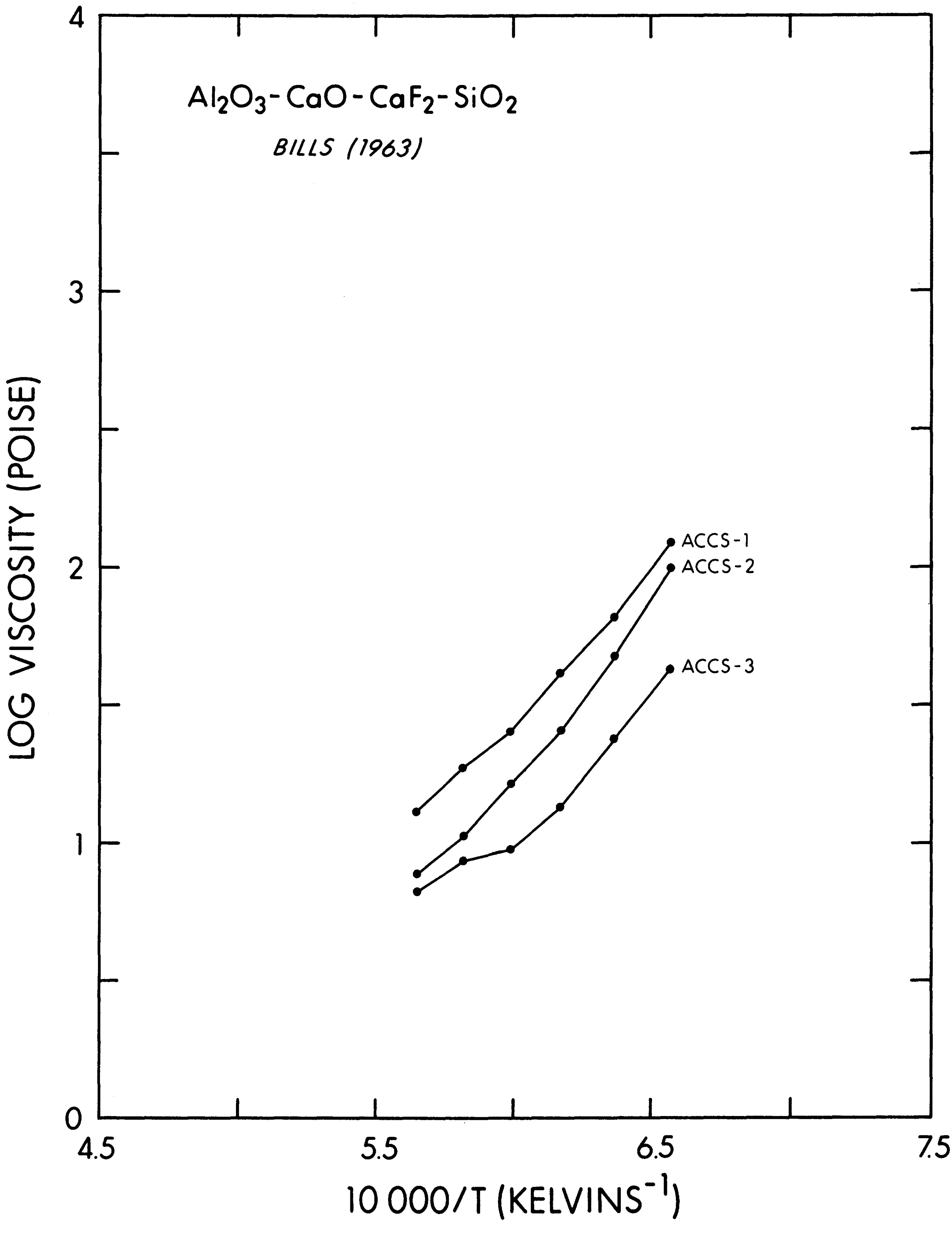
DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACCS-4

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	3.500	1.52	33.11
1300.00	6.357	3.062	1.33	21.38
1350.00	6.161	2.901	1.26	18.20
1400.00	5.977	2.556	1.11	12.88
1450.00	5.804	2.533	1.10	12.59
1500.00	5.640	2.441	1.06	11.48



Al_2O_3-CaO-CaF_2-SiO_2
BILLS (1963)
ACCS-1
ACCS-2
ACCS-3
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500


Al_2O_3-CaO-CaF_2-SiO_2
BILLS (1963)
ACCS-1
ACCS-2
ACCS-3
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
4.5
5.5
6.5
7.5

SYSTEM
AL2O3(8.83),CAO(17.41),
FEO(0.0),SIO2(73.76) (X)
AL2O3(14.2),CAO(15.4),
FEO(0.0),SIO2(69.9) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACFS-1

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	9.413	4.088	12300.
1400.00	5.977	8.678	3.769	5870.
1450.00	5.804	8.033	3.489	3080.

SYSTEM
AL2O3(8.29),CAO(13.82),
FEO(3.92),SIO2(73.97) (X)
AL2O3(13.2),CAO(12.1),
FEO(4.4),SIO2(69.4) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACFS-2

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	9.319	4.047	11200.
1400.00	5.977	8.648	3.756	5700.
1450.00	5.804	8.006	3.477	3000.

SYSTEM
AL2O3(9.93),CAO(10.35),
FEO(7.09),SIO2(72.63) (X)
AL2O3(15.7),CAO(9.0),
FEO(7.9),SIO2(67.7) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACFS-3

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	9.200	3.996	9900.
1400.00	5.977	8.585	3.728	5350.
1450.00	5.804	7.962	3.458	2870.

SYSTEM
AL2O3(11.08),CAO(24.439,
FEO(0.0),SIO2(64.49) (X)
AL2O3(17.4),CAO(21.1),
FEO(0.0),SIO2(59.7) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACFS-4

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	9.292	4.035	10900.
1300.00	6.357	8.240	3.579	3790.
1350.00	6.161	7.444	3.233	1710.
1400.00	5.997	6.780	2.944	880.
1450.00	5.804	6.273	2.724	530.

SYSTEM
AL2O3(12.12),CAO(19.91),
FEO(3.86),SIO2(64.11) (X)
AL2O3(18.7),CAO(16.9),
FEO(4.2),SIO2(58.3) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACFS-5

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	8.916	3.872	7450.
1300.00	6.357	8.055	3.498	3150.
1350.00	6.161	7.293	3.167	1470.
1400.00	5.977	6.593	2.863	730.
1450.00	5.804	5.966	2.591	390.

SYSTEM
AL2O3(11.24),CAO(16.87),
FEO(7.24),SIO2(64.65) (X)
AL2O3(17.2),CAO(14.2),
FEO(7.8),SIO2(58.3) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACFS-6

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	8.674	3.767	5850.
1300.00	6.357	7.804	3.389	2450.
1350.00	6.161	7.090	3.079	1200.
1400.00	5.977	6.446	2.799	630.
1450.00	5.804	5.799	2.519	330.

SYSTEM
AL2O3(11.89),CAO(16.92),
FEO(6.60),SIO2(64.59) (X)
AL2O3(18.4),CAO(14.4),
FEO(7.2),SIO2(58.9) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACFS-7

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	8.669	3.765	5820.
1300.00	6.357	7.824	3.398	2500.
1350.00	6.161	7.155	3.107	1280.
1400.00	5.977	6.492	2.820	660.
1450.00	5.804	5.858	2.544	350.

SYSTEM
AL2O3(5.58),CAO(33.47),
FEO(0.0),SIO2(60.95) (X)
AL2O3(9.3),CAO(30.7),
FEO(0.0),SIO2(59.9) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACFS-8

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	7.467	3.243	1750.
1250.00	6.566	6.579	2.857	720.
1300.00	6.357	5.784	2.512	325.
1350.00	6.161	4.942	2.146	140.
1400.00	5.977	4.094	1.778	60.
1450.00	5.804	3.689	1.602	40.

SYSTEM
AL2O3(5.55),CAO(29.14),
FEO(3.98),SIO2(61.33) (X)
AL2O3(9.1),CAO(26.3),
FEO(4.6),SIO2(59.3) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACFS-9

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	7.346	3.190	1550.
1250.00	6.566	6.454	2.803	635.
1300.00	6.357	5.652	2.455	285.
1350.00	6.161	4.828	2.097	125.
1400.00	5.977	3.912	1.699	50.0
1450.00	5.804	3.555	1.544	35.0

SYSTEM
AL2O3(5.91),CAO(27.36),
FEO(6.89),SIO2(59.84) (X)
AL2O3(9.5),CAO(24.2),
FEO(7.8),SIO2(56.7) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACFS-10

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	7.170	3.114	1300.
1250.00	6.566	6.328	2.748	560.
1300.00	6.357	5.561	2.415	260.
1350.00	6.161	4.745	2.061	115.
1400.00	5.977	3.807	1.653	45.
1450.00	5.804	3.401	1.477	30.

SYSTEM
AL2O3(12.50),CAO(12.35),
FEO(0.0),SIO2(75.15) (X)
AL2O3(19.5),CAO(10.6),
FEO(0.0),SIO2(69.1) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACFS-11

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	9.036	3.924	8400.

SYSTEM
AL2O3(12.18),CAO(9.14),
FEO(3.75),SIO2(74.92) (X)
AL2O3(18.9),CAO(7.8),
FEO(4.1),SIO2(68.5) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACFS-12

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	8.902	3.866	7350.

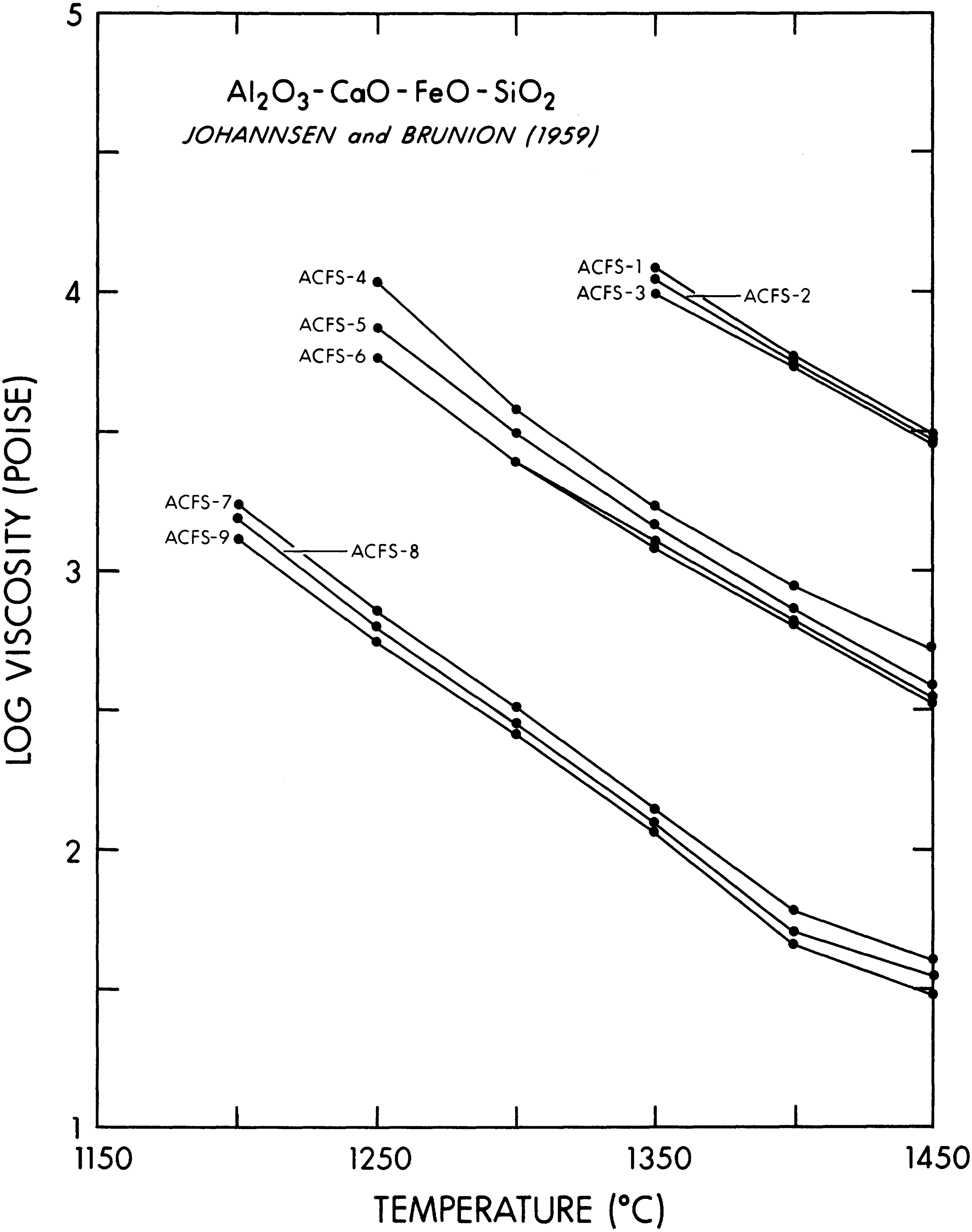
SYSTEM
AL2O3(12.20),CAO(5.52),
FEO(7.49),SIO2(74.79) (X)
AL2O3(18.5),CAO(4.6),
FEO(8.0),SIO2(66.5) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
JOHANNSEN AND BRUNION (1959)

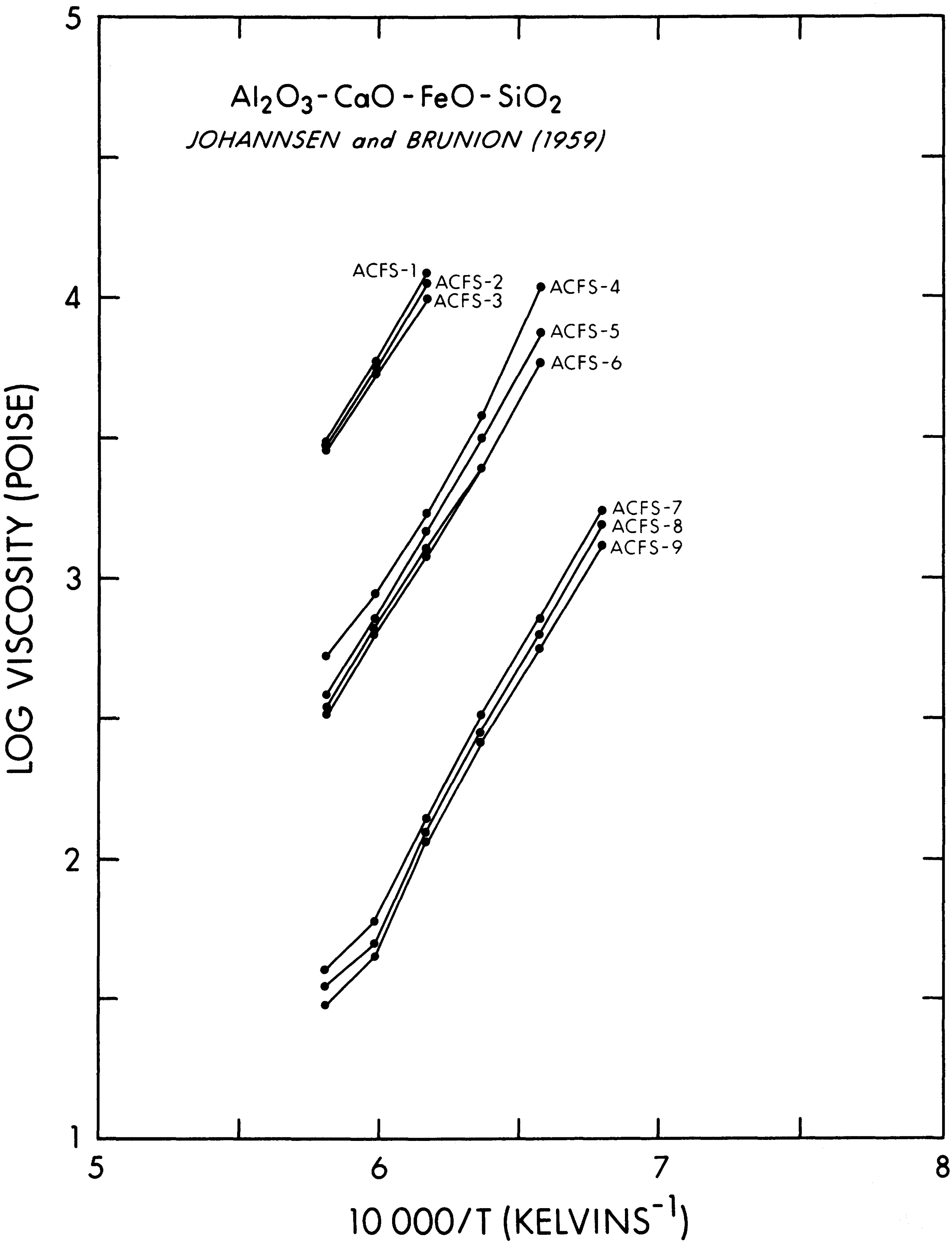
DERIVED FROM
TABLE 6
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACFS-13

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	8.666	3.763	5800.



Al_2O_3 - CaO - FeO - SiO_2
JOHANNSEN and BRUNION (1959)
ACFS-1
ACFS-2
ACFS-3
ACFS-4
ACFS-5
ACFS-6
ACFS-7
ACFS-8
ACFS-9
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
5
4
3
2
1
1150
1250
1350
1450



$Al_2O_3 - CaO - FeO - SiO_2$
JOHANNSEN and BRUNION (1959)
ACFS-1
ACFS-2
ACFS-3
ACFS-4
ACFS-5
ACFS-6
ACFS-7
ACFS-8
ACFS-9
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
5
4
3
2
1
5
6
7
8

SYSTEM

$Al_2O_3(.19)CaO(.11)K_2O(.08)SiO_2(.62)$ (X)

AUTHOR

N'DALA et al. (1984)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

ACKS-1

T	Z	LN(N)	LOG(N)	N
1285.	6.418	10.63	4.61	41357.
1289.	6.402	10.48	4.55	35596.
1345.	6.180	9.58	4.16	14472.
1350.	6.161	9.44	4.09	12581.
1423.	5.896	8.46	3.67	4722.
1425.	5.889	8.42	3.65	4536.
1431.	5.868	8.35	3.62	4230.
1454.	5.790	8.12	3.52	3361.
1463.	5.760	7.91	3.43	2724.
1494.	5.659	7.47	3.24	1754.
1499.	5.643	7.40	3.21	1635.
1566.	5.437	6.66	2.89	780.
1571.	5.422	6.61	2.87	742.
1617.	5.291	6.10	2.64	445.
1625.	5.268	5.91	2.56	368.

SYSTEM

$Al_2O_3(.19)CaO(.14)K_2O(.06)SiO_2(.62)$ (X)

AUTHOR

N'DALA et al. (1984)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

ACKS-2

T	Z	LN(N)	LOG(N)	N
1323.	6.265	10.50	4.56	36315.
1414.	5.927	8.64	3.75	5653.
1403.	5.966	7.71	3.34	2230.
1466.	5.750	7.73	3.35	2275.
1467.	5.747	7.72	3.35	2252.
1556.	5.467	6.91	3.00	1002.
1630.	5.254	6.00	2.60	403.
1671.	5.144	5.36	2.32	212.
1672.	5.141	5.35	2.32	210.
1699.	5.070	5.15	2.23	172.
1703.	5.060	4.92	2.13	137.
1710.	5.042	4.92	2.13	137.
1719.	5.020	4.91	2.13	135.
1765.	4.906	4.38	1.90	79.
1771.	4.892	4.36	1.89	78.

SYSTEM
AL2O3(14.91),CAO(18.19),
MNO(0.0),SIO2(66.91) (X)
AL2O3(22.8),CAO(15.39),
MNO(0.0),SIO2(60.3) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACMS-1

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	8.039	3.491	3100.
1450.00	5.804	7.162	3.111	1290.

SYSTEM
AL2O3(14.70),CAO(14.98),
MNO(4.08),SIO2(66.24) (X)
AL2O3(22.3),CAO(12.5),
MNO(4.3),SIO2(59.2) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACMS-2

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	~9.105	~3.954	~9000.
1350.00	6.161	8.256	3.585	3850.
1400.00	5.977	7.534	3.272	1870.
1450.00	5.804	6.898	2.996	990.

SYSTEM
AL2O3(15.20),CAO(11.27),
MNO(7.57),SIO2(65.96) (X)
AL2O3(22.8),CAO(9.3),
MNO(7.9),SIO2(58.3) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

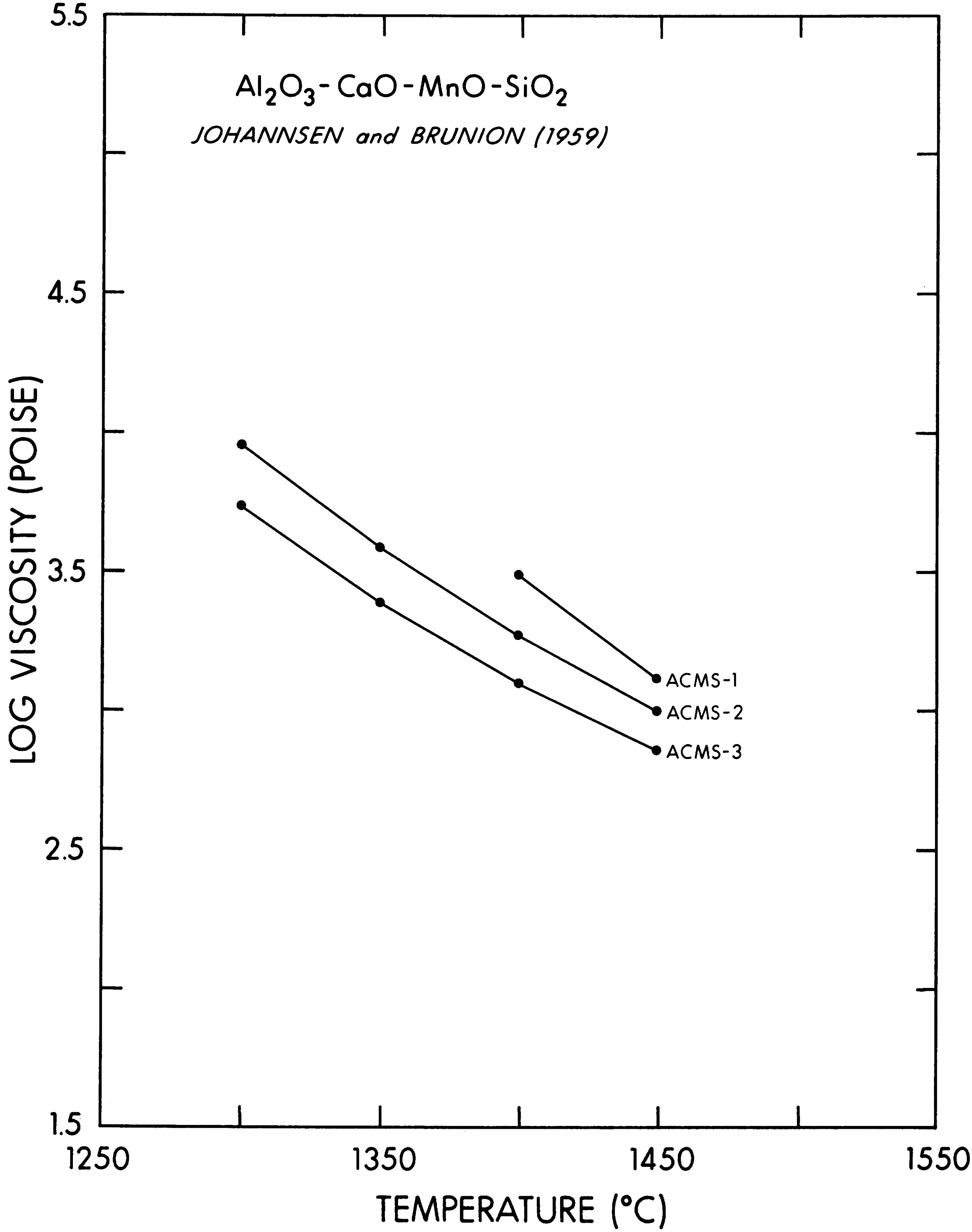
DERIVED FROM
TABLE 6

N (POISES)
T (DEGREES C)

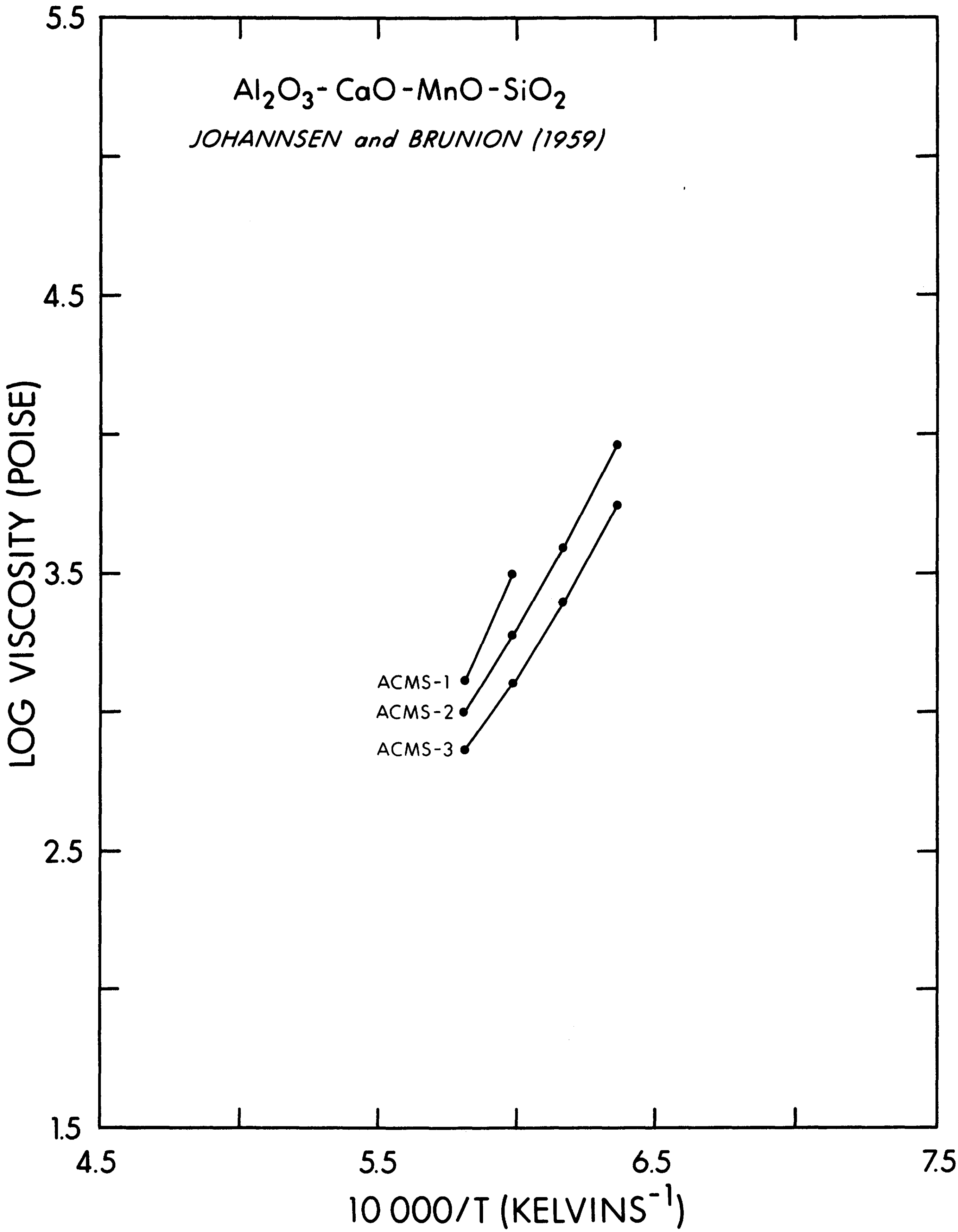
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACMS-3

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	~8.613	~3.740	~5500.
1350.00	6.161	7.808	3.391	2460.
1400.00	5.977	7.131	3.097	1250.
1450.00	5.804	6.579	2.857	720.



Al_2O_3-CaO-MnO-SiO_2
JOHANNSEN and BRUNION (1959)
ACMS-1
ACMS-2
ACMS-3
5.5
4.5
3.5
2.5
1.5
LOG VISCOSITY (POISE)
1250
1350
1450
1550
TEMPERATURE (°C)



Al_2O_3- CaO - MnO - SiO_2
JOHANNSEN and BRUNION (1959)
ACMS-1
ACMS-2
ACMS-3
LOG VISCOSITY (POISE)
5.5
4.5
3.5
2.5
1.5
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})

SYSTEM

$Al_2O_3(.19)CaO(.12)Na_2O(.08)SiO_2(.61)$ (X)

AUTHOR

N'DALA et al. (1984)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

ACNS-1

T	Z	LN(N)	LOG(N)	N
1253.	6.553	10.34	4.49	30946.
1310.	6.317	9.34	4.05	11384.
1316.	6.293	9.30	4.03	10938.
1370.	6.086	8.49	3.68	4865.
1372.	6.079	8.30	3.60	4023.
1453.	5.793	7.39	3.20	1619.
1460.	5.770	7.34	3.18	1540.
1550.	5.485	6.32	2.74	555.
1554.	5.473	6.29	2.73	539.
1556.	5.467	6.23	2.70	507.
1614.	5.299	5.74	2.49	311.
1619.	5.285	5.59	2.42	267.
1617.	5.291	5.64	2.44	281.
1643.	5.219	5.42	2.35	225.
1648.	5.205	5.31	2.30	202.

SYSTEM

$Al_2O_3(.19)CaO(.13)Na_2O(.06)SiO_2(.62)$ (X)

AUTHOR

N'DALA et al. (1984)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

ACNS-2

T	Z	LN(N)	LOG(N)	N
1435.	5.854	8.10	3.51	3294.
1438.	5.844	7.20	3.12	1339.
1495.	5.656	6.84	2.97	934.
1574.	5.414	5.87	2.54	354.
1576.	5.408	6.00	2.60	403.
1634.	5.243	5.28	2.29	196.
1696.	5.078	4.81	2.08	122.
1721.	5.015	4.73	2.05	113.
1748.	4.948	4.29	1.86	72.

SYSTEM
AL2O3(11.08),CAO(24.43),
TIO2(0.0),SIO2(64.49) (X)
AL2O3(17.4),CAO(21.1),
TIO2(0.0),SIO2(59.7) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 8

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACTS-1

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	9.292	4.035	10900.
1300.00	6.357	8.240	3.579	3790.
1350.00	6.161	7.444	3.233	1710.
1400.00	5.977	6.780	2.944	880.
1450.00	5.804	6.273	2.724	530.

SYSTEM
AL2O3(12.22),CAO(19.97),
TIO2(3.40),SIO2(64.41) (X)
AL2O3(18.8),CAO(16.9),
TIO2(4.1),SIO2(58.4) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 8

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACTS-2

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	9.220	4.004	10100.
1300.00	6.357	8.189	3.556	3600.
1350.00	6.161	7.409	3.217	1650.
1400.00	5.977	6.768	2.940	870.
1450.00	5.804	6.109	2.653	450.

SYSTEM
AL2O3(12.29),CAO(15.89),
TIO2(7.04),SIO2(64.78) (X)
AL2O3(18.7),CAO(13.3),
TIO2(8.4),SIO2(58.1) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 8

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACTS-3

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	9.042	3.927	8450.
1300.00	6.357	8.175	3.550	3550.
1350.00	6.161	7.396	3.212	1630.
1400.00	5.977	6.721	2.919	830.
1450.00	5.804	6.040	2.623	420.

SYSTEM
AL2O3(10.57),CAO(29.05),
TIO2(0.0),SIO2(60.38) (X)
AL2O3(17.2),CAO(26.0),
TIO2(0.0),SIO2(57.9) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 8

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACTS-4

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	7.450	3.236	1720.
1300.00	6.357	6.579	2.857	720.
1350.00	6.161	5.829	2.531	340.
1400.00	5.977	5.193	2.255	180.
1450.00	5.804	4.787	2.079	120.

SYSTEM
AL2O3(11.02),CAO(23.81),
TIO2(5.54),SIO2(59.63) (X)
AL2O3(17.0),CAO(20.2),
TIO2(6.7),SIO2(54.2) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 8

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACTS-5

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	7.139	3.100	1260.
1300.00	6.357	6.337	2.752	565.
1350.00	6.161	5.720	2.484	305.
1400.00	5.977	5.136	2.230	170.
1450.00	5.804	4.654	2.021	105.

SYSTEM
AL2O3(12.05),CAO(24.42),
TIO2(11.26),SIO2(52.28) (X)
AL2O3(18.3),CAO(20.4),
TIO2(13.4),SIO2(46.8) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 8

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACTS-6

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	5.193	2.255	180.
1350.00	6.161	4.605	2.000	100.
1400.00	5.977	3.912	1.699	50.
1450.00	5.804	3.401	1.477	30.

SYSTEM
AL2O3(12.90),CAO(24.18),
TIO2(16.20),SIO2(46.72) (X)
AL2O3(19.3),CAO(19.9),
TIO2(19.0),SIO2(41.2) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

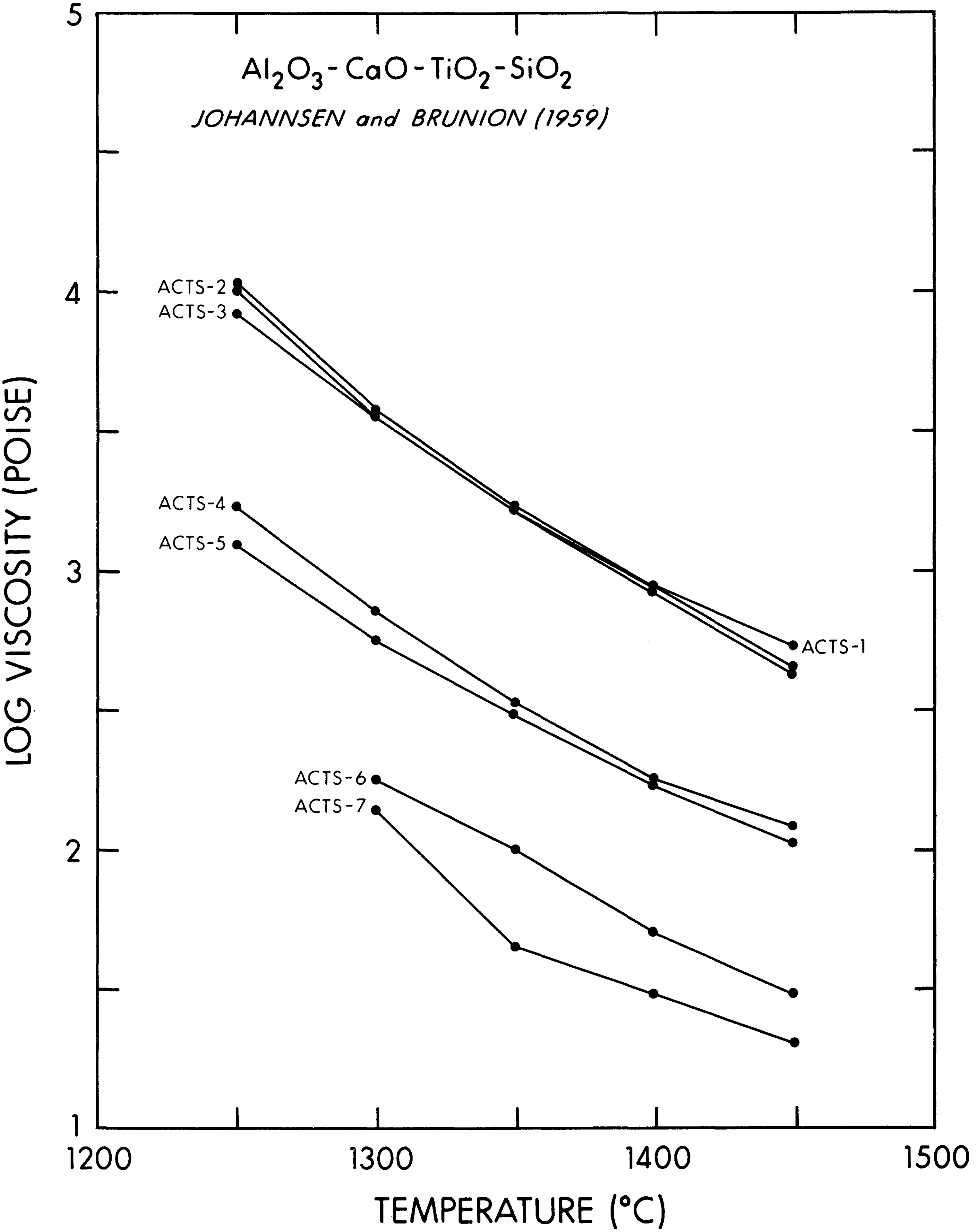
DERIVED FROM
TABLE 8

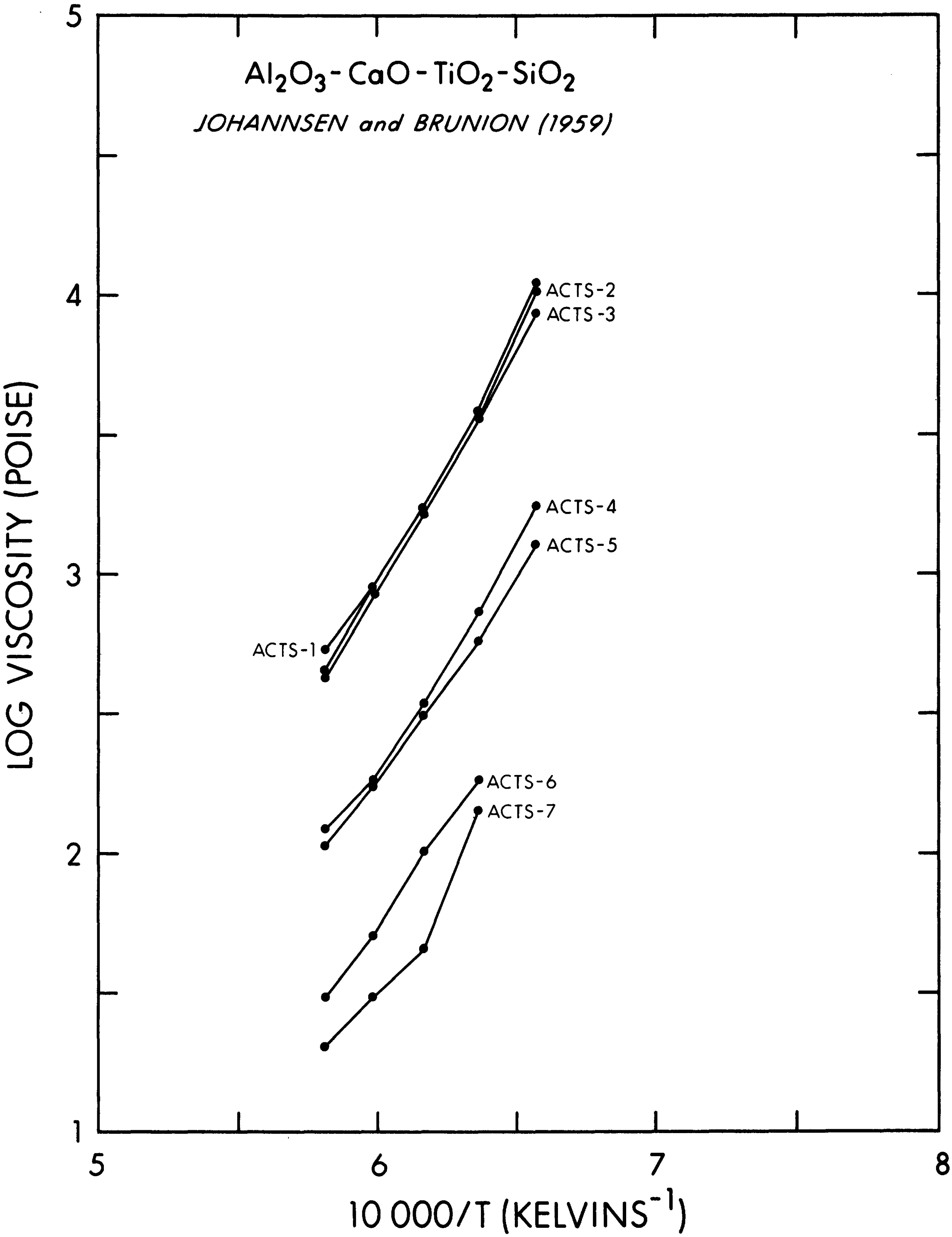
N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACTS-7

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	4.942	2.146	140.
1350.00	6.161	3.807	1.653	45.
1400.00	5.977	3.401	1.477	30.
1450.00	5.804	2.996	1.301	20.


Al_2O_3 - CaO - TiO_2 - SiO_2
JOHANNSEN and BRUNION (1959)
ACTS-1
ACTS-2
ACTS-3
ACTS-4
ACTS-5
ACTS-6
ACTS-7
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
5
4
3
2
1
1200
1300
1400
1500


Al_2O_3 - CaO - TiO_2 - SiO_2
JOHANNSEN and BRUNION (1959)
ACTS-1
ACTS-2
ACTS-3
ACTS-4
ACTS-5
ACTS-6
ACTS-7
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
5
4
3
2
1
5
6
7
8

SYSTEM
AL2O3(5.84),CAO(37.18),
MGO(7.39),SIO2(49.58) (X)
AL2O3(10.0),CAO(35.0),
MGO(5.0),SIO2(50.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-1

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	3.077	1.336	21.7
1450.00	5.804	2.701	1.173	14.9
1500.00	5.640	2.186	0.949	8.9
1550.00	5.485	1.775	0.771	5.9

SYSTEM
AL2O3(5.72),CAO(31.22),
MGO(14.48),SIO2(48.57) (X)
AL2O3(10.0),CAO(30.0),
MGO(10.0),SIO2(50.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-2

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.950	1.281	19.1
1500.00	5.640	1.825	0.792	6.2
1550.00	5.485	1.459	0.633	4.3

SYSTEM
AL2O3(5.82),CAO(42.35),
MGO(7.36),SIO2(44.46) (X)
AL2O3(10.9),CAO(40.0),
MGO(5.0),SIO2(45.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-3

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.303	1.000	10.0
1450.00	5.804	2.001	0.869	7.4
1500.00	5.640	1.686	0.732	5.4
1550.00	5.485	1.386	0.602	4.0

SYSTEM
AL2O3(5.70),CAO(36.30),
MGO(14.43),SIO2(43.56) (X)
AL2O3(10.0),CAO(35.0),
MGO(10.0),SIO2(45.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-4

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.175	0.944	8.8
1450.00	5.804	1.841	0.799	6.3
1500.00	5.640	1.435	0.623	4.2
1550.00	5.485	1.030	0.447	2.8

SYSTEM
AL2O3(5.59),CAO(30.50),
MGO(21.21),SIO2(42.69) (X)
AL2O3(10.0),CAO(30.0),
MGO(15.0),SIO2(45.0) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-5

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.740	0.756	5.7
1450.00	5.804	1.435	0.623	4.2
1500.00	5.640	1.131	0.491	3.1
1550.00	5.485	0.875	0.380	2.4

SYSTEM
AL2O3(5.80),CAO(47.47),
MGO(7.34),SIO2(39.39) (X)
AL2O3(10.0),CAO(45.0),
MGO(5.0),SIO2(40.0) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-6

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.758	0.763	5.8
1450.00	5.804	1.131	0.491	3.1
1500.00	5.640	1.065	0.462	2.9
1550.00	5.485	0.788	0.342	2.2

SYSTEM
AL2O3(5.69),CAO(41.35),
MGO(14.38),SIO2(38.59) (X)
AL2O3(10.0),CAO(40.0),
MGO(10.0),SIO2(40.0) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-7

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.723	0.748	5.6
1450.00	5.804	1.335	0.580	3.8
1500.00	5.640	0.956	0.415	2.6
1550.00	5.485	0.642	0.279	1.9

SYSTEM
AL2O3(5.57),CAO(35.46),
MGO(21.14),SIO2(37.82) (X)
AL2O3(10.0),CAO(35.0),
MGO(15.0),SIO2(40.0) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-8

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.504	0.653	4.5
1450.00	5.804	1.131	0.491	3.1
1500.00	5.640	0.693	0.301	2.0
1550.00	5.485	0.336	0.146	1.4

SYSTEM
AL2O3(11.64),CAO(31.74),
MGO(22.07),SIO2(34.55) (X)
AL2O3(20.0),CAO(30.0),
MGO(15.0),SIO2(35.0) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-9

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.104	0.914	8.2
1450.00	5.804	1.589	0.690	4.9
1500.00	5.640	1.163	0.505	3.2
1550.00	5.485	0.993	0.431	2.7

SYSTEM
AL2O3(5.78),CAO(52.56),
MGO(7.31),SIO2(34.34) (X)
AL2O3(10.0),CAO(50.0),
MGO(5.0),SIO2(35.0) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-10

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	1.902	0.826	6.7
1500.00	5.640	1.099	0.477	3.0
1550.00	5.485	0.788	0.342	2.2

SYSTEM
AL2O3(5.67),CAO(46.35),
MGO(14.33),SIO2(33.65) (X)
AL2O3(10.0),CAO(45.0),
MGO(10.0),SIO2(35.0) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-11

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.589	0.690	4.9
1450.00	5.804	1.030	0.447	2.8
1500.00	5.640	0.588	0.255	1.8
1550.00	5.485	0.336	0.146	1.4

SYSTEM
AL2O3(5.55),CAO(40.39),
MGO(21.07),SIO2(32.98) (X)
AL2O3(10.0),CAO(40.0),
MGO815.0),SIO2(35.0) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-12

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.253	0.544	3.5
1450.00	5.804	0.742	0.322	2.1
1500.00	5.640	0.336	0.146	1.4
1550.00	5.485	0.095	0.041	1.1

SYSTEM
AL2O3(5.65),CAO(51.33),
MGO(14.28),SIO2(28.74) (X)
AL2O3(10.0),CAO(50.0),
MGO(10.0),SIO2(30.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-13

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	3.332	1.447	28.0
1500.00	5.640	2.674	1.161	14.5
1550.00	5.485	2.116	0.919	8.3

SYSTEM
AL2O3(5.54),CAO(45.28),
MGO(21.0),SIO2(28.18) (X)
AL2O3(10.0),CAO(45.0),
MGO(15.0),SIO2(30.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-14

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.460	1.068	11.7
1500.00	5.640	1.099	0.477	3.0
1550.00	5.485	0.742	0.322	2.1

SYSTEM
AL2O3(11.56),CAO(42.02),
MGO(21.92),SIO2(24.51) (X)
AL2O3(20.0),CAO(40.0),
MGO(15.0),SIO2(25.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-15

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.740	0.756	5.7
1450.00	5.804	1.163	0.505	3.2
1500.00	5.640	0.916	0.398	2.5
1550.00	5.485	0.742	0.322	2.1

SYSTEM
AL2O3(11.76),CAO(53.43),
MGO(14.87),SIO2(19.95) (X)
AL2O3(20.0),CAO(50.0),
MGO(10.0),SIO2(20.0) (%)

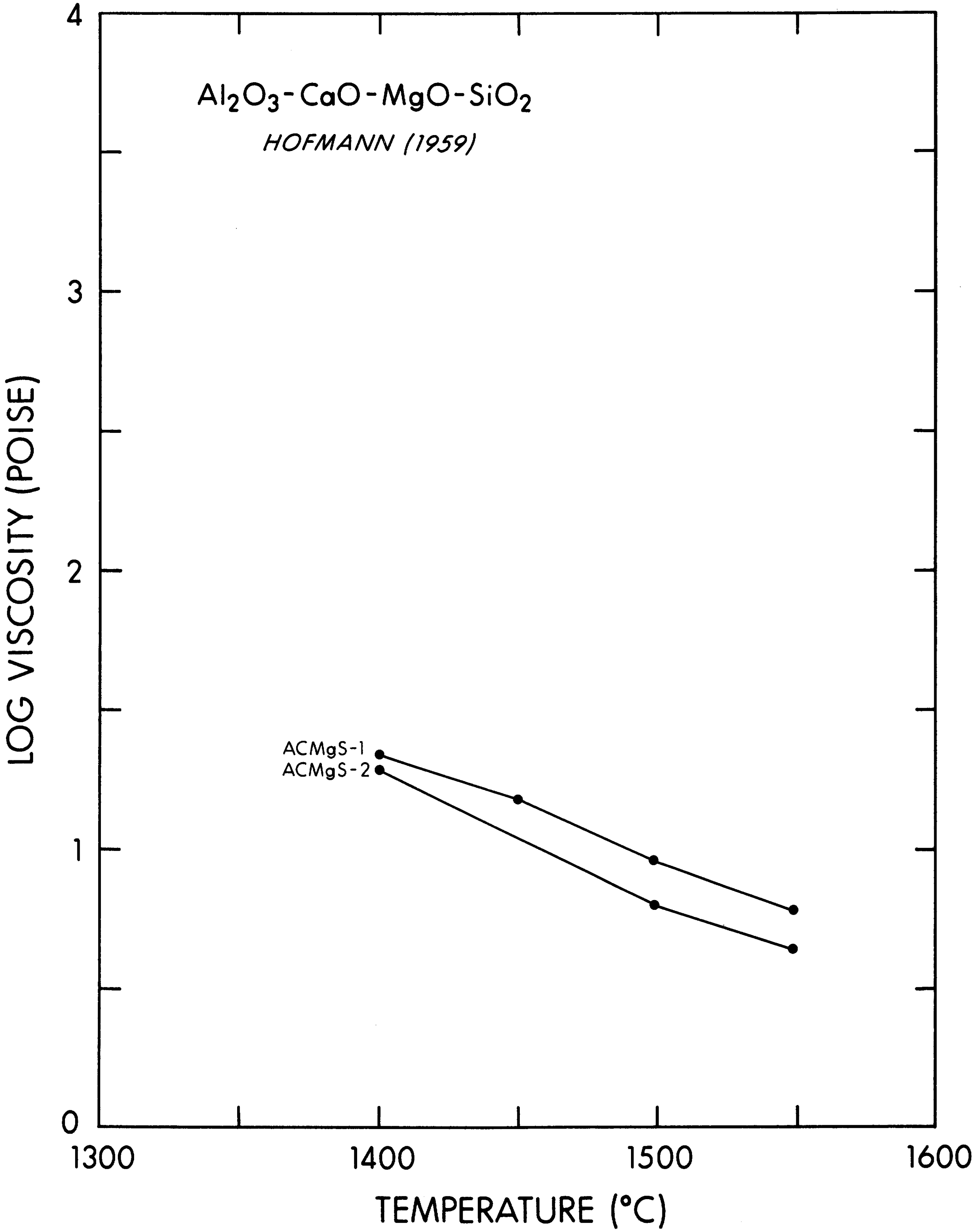
AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

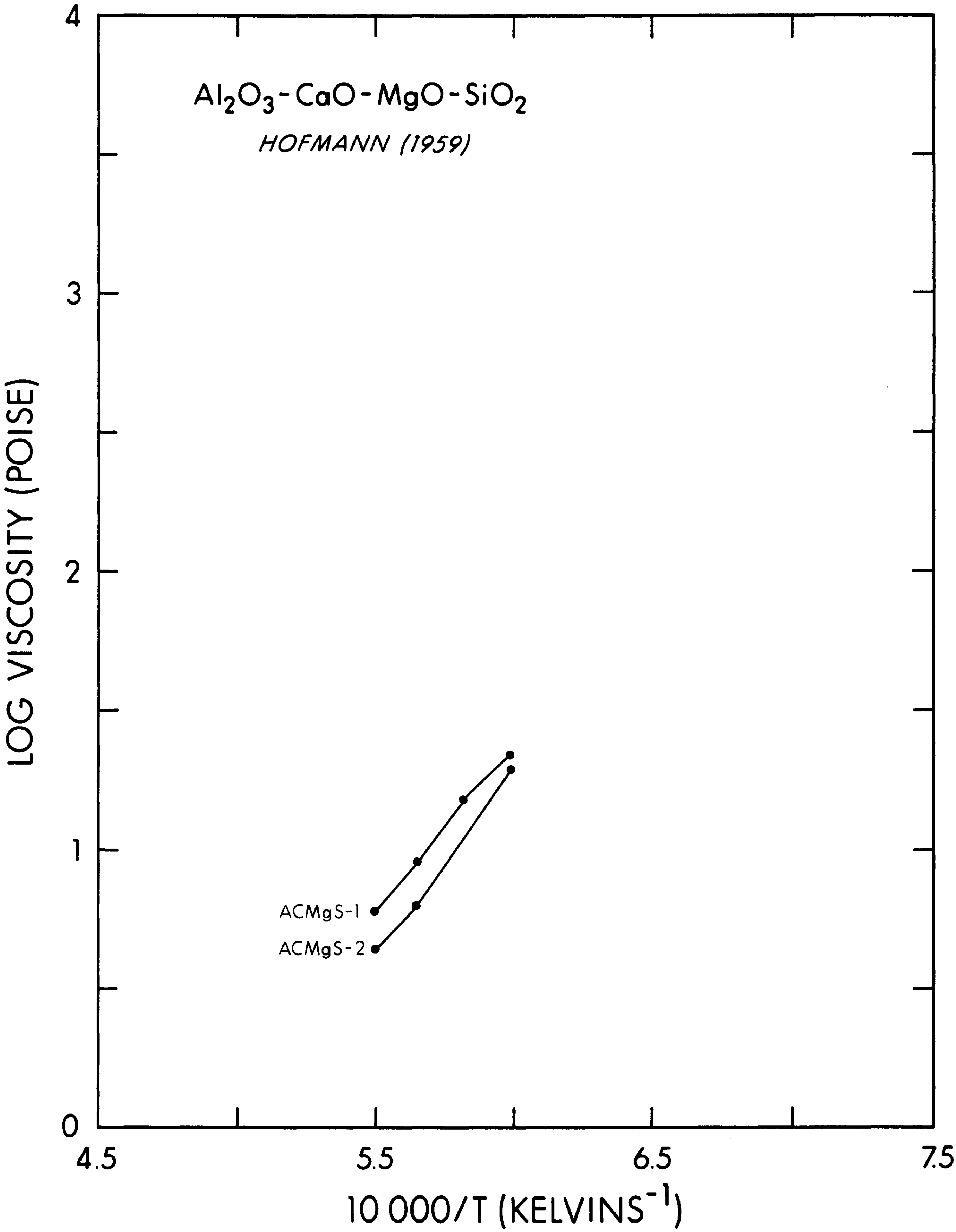
DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-16

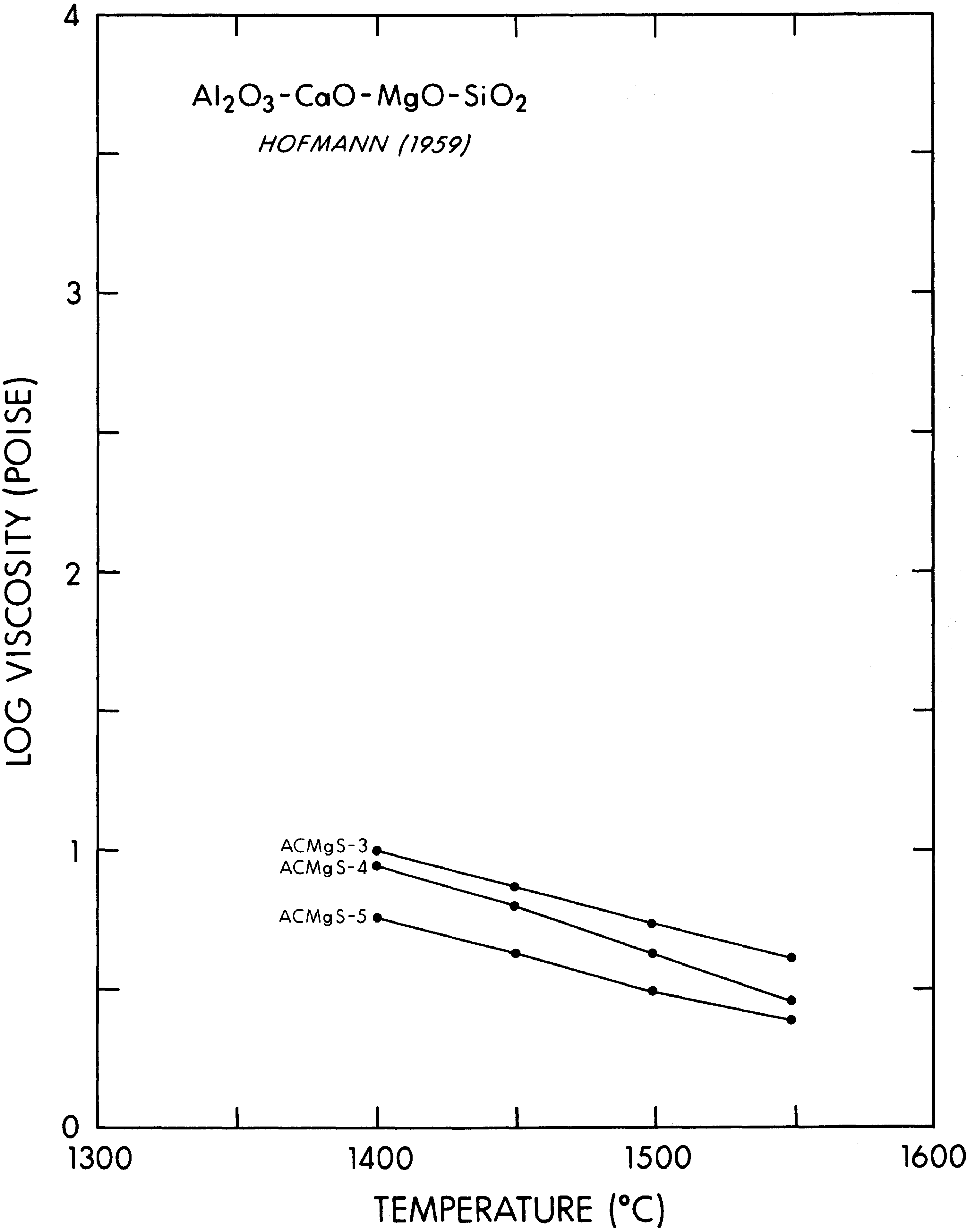
T	Z	LN(N)	LOG(N)	N
1450.00	5.804	3.059	1.328	21.3
1500.00	5.640	1.668	0.724	5.3
1550.00	5.485	1.482	0.643	4.4



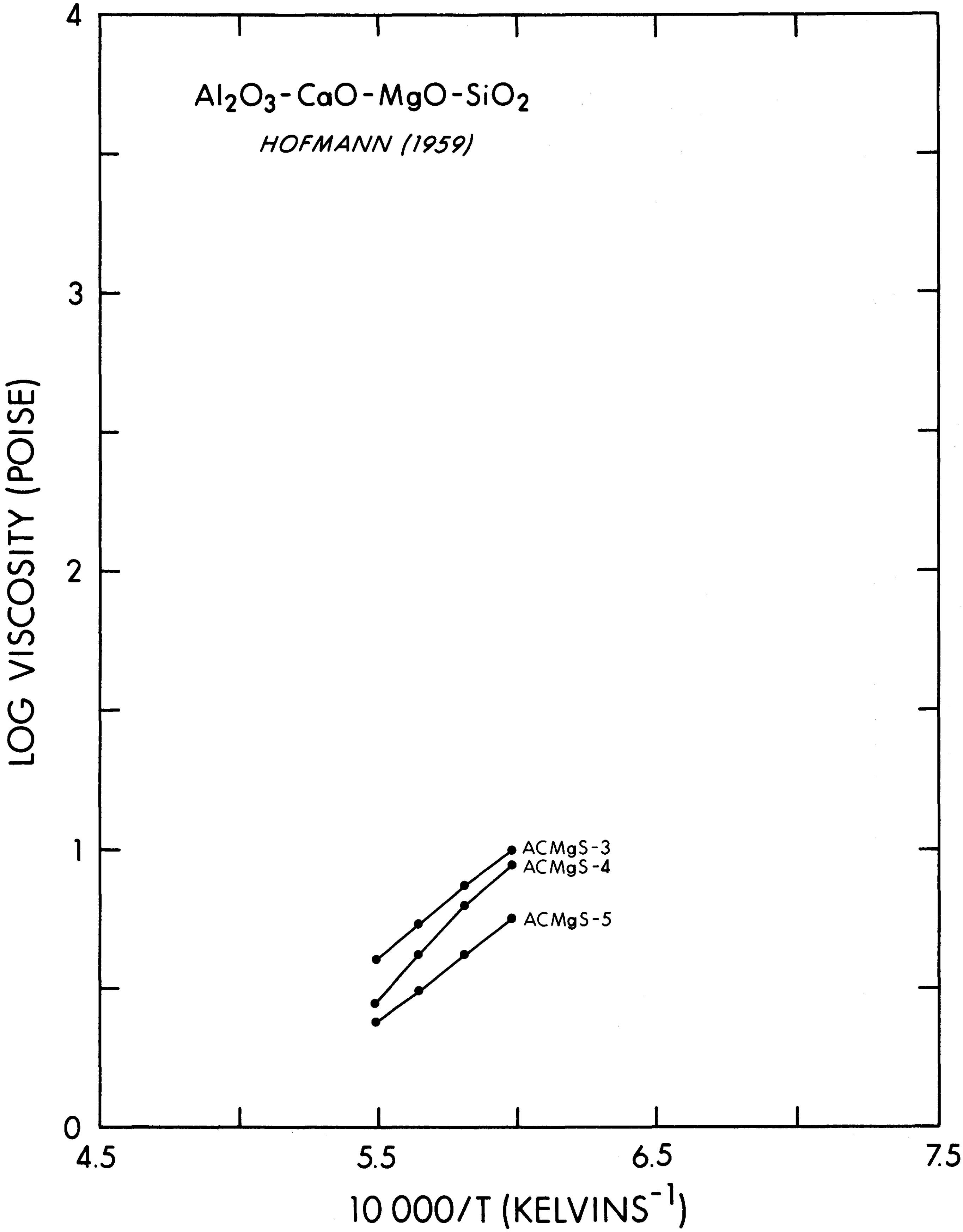
Al_2O_3-CaO-MgO-SiO_2
HOFMANN (1959)
ACMgS-1
ACMgS-2
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1300
1400
1500
1600



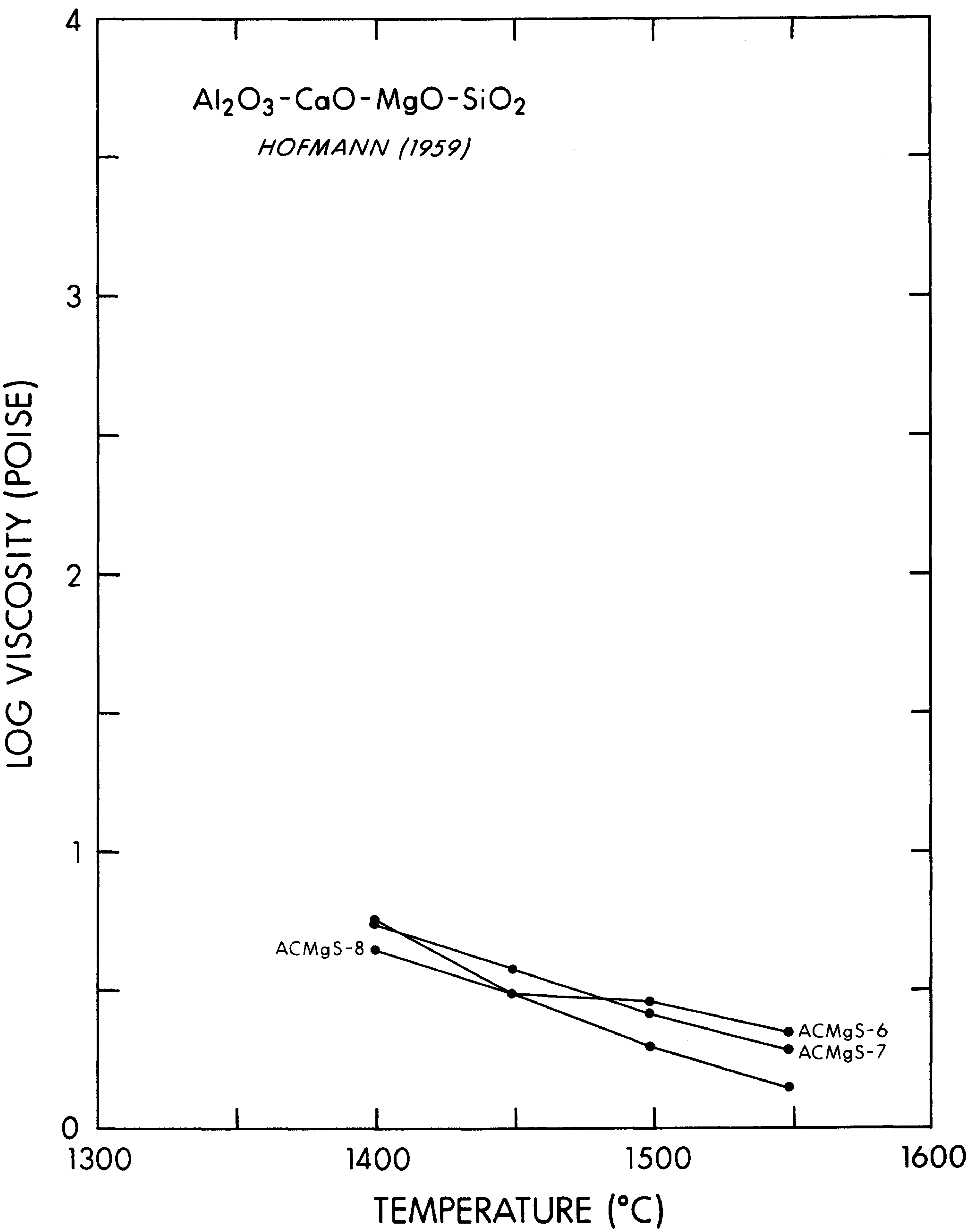
Al_2O_3-CaO-MgO-SiO_2
HOFMANN (1959)
LOG VISCOSITY (POISE)
4
3
2
1
0
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})
ACMgS-1
ACMgS-2



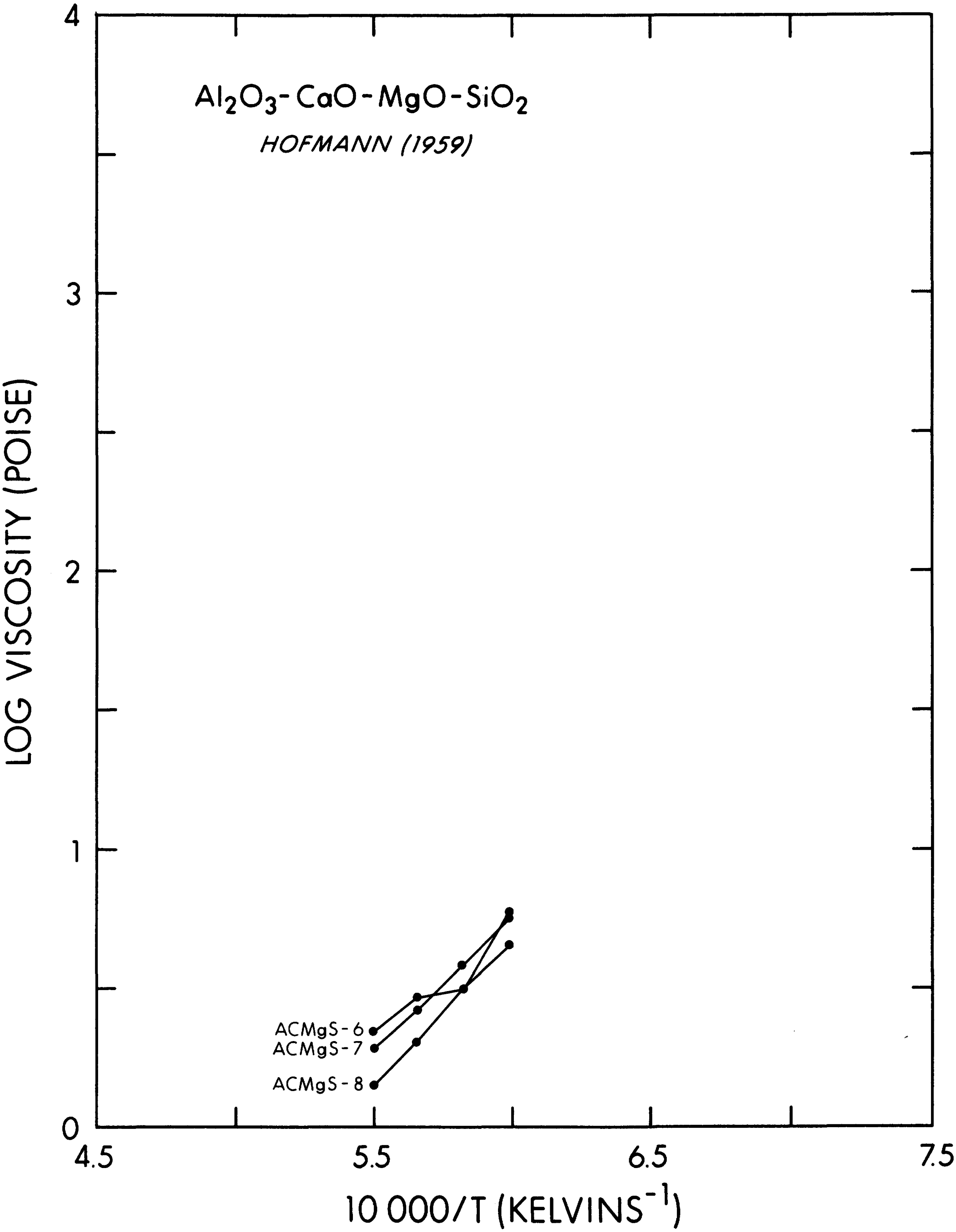
Al_2O_3-CaO-MgO-SiO_2
HOFMANN (1959)
LOG VISCOSITY (POISE)
0
1
2
3
4
ACMgS-3
ACMgS-4
ACMgS-5
1300
1400
1500
1600
TEMPERATURE (°C)



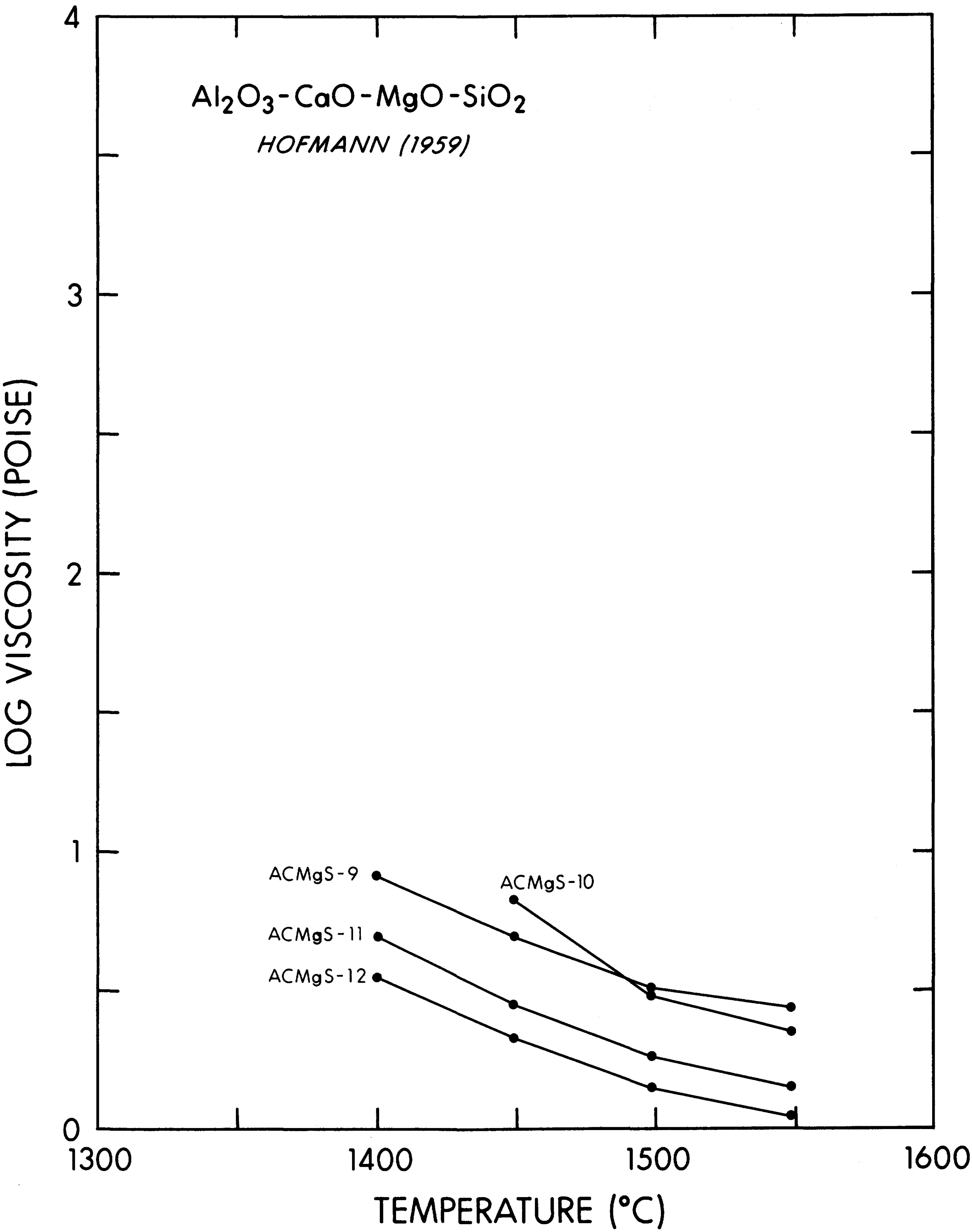
Al_2O_3-CaO-MgO-SiO_2
HOFMANN (1959)
ACMgS-3
ACMgS-4
ACMgS-5
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5

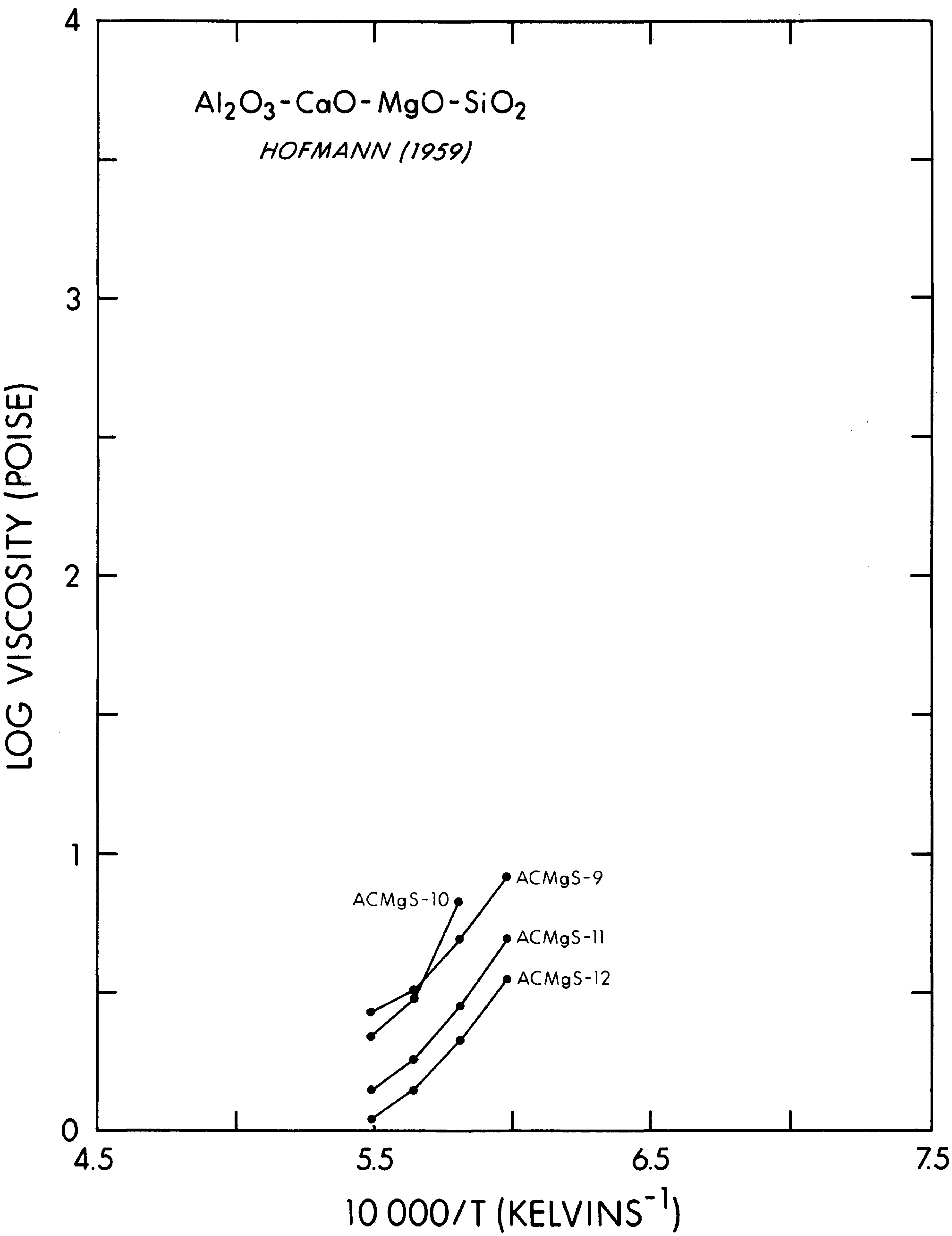


Al_2O_3-CaO-MgO-SiO_2
HOFMANN (1959)
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
4
3
2
1
0
1300
1400
1500
1600
ACMgS-8
ACMgS-6
ACMgS-7

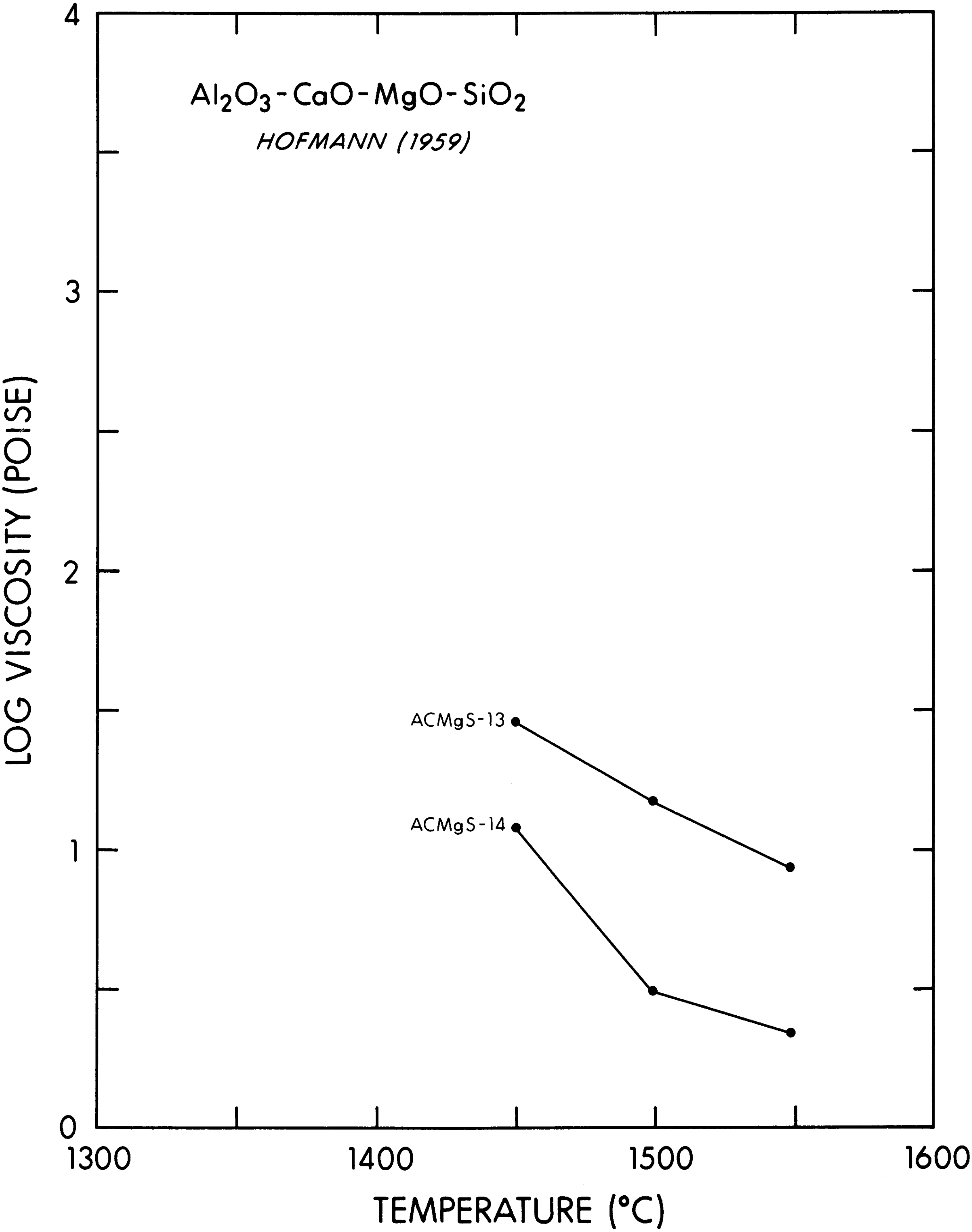


Al2O3-CaO-MgO-SiO2
HOFMANN (1959)
LOG VISCOSITY (POISE)
4
3
2
1
0
ACMgS-6
ACMgS-7
ACMgS-8
4.5
5.5
6.5
7.5
10 000/T (KELVINS-1)

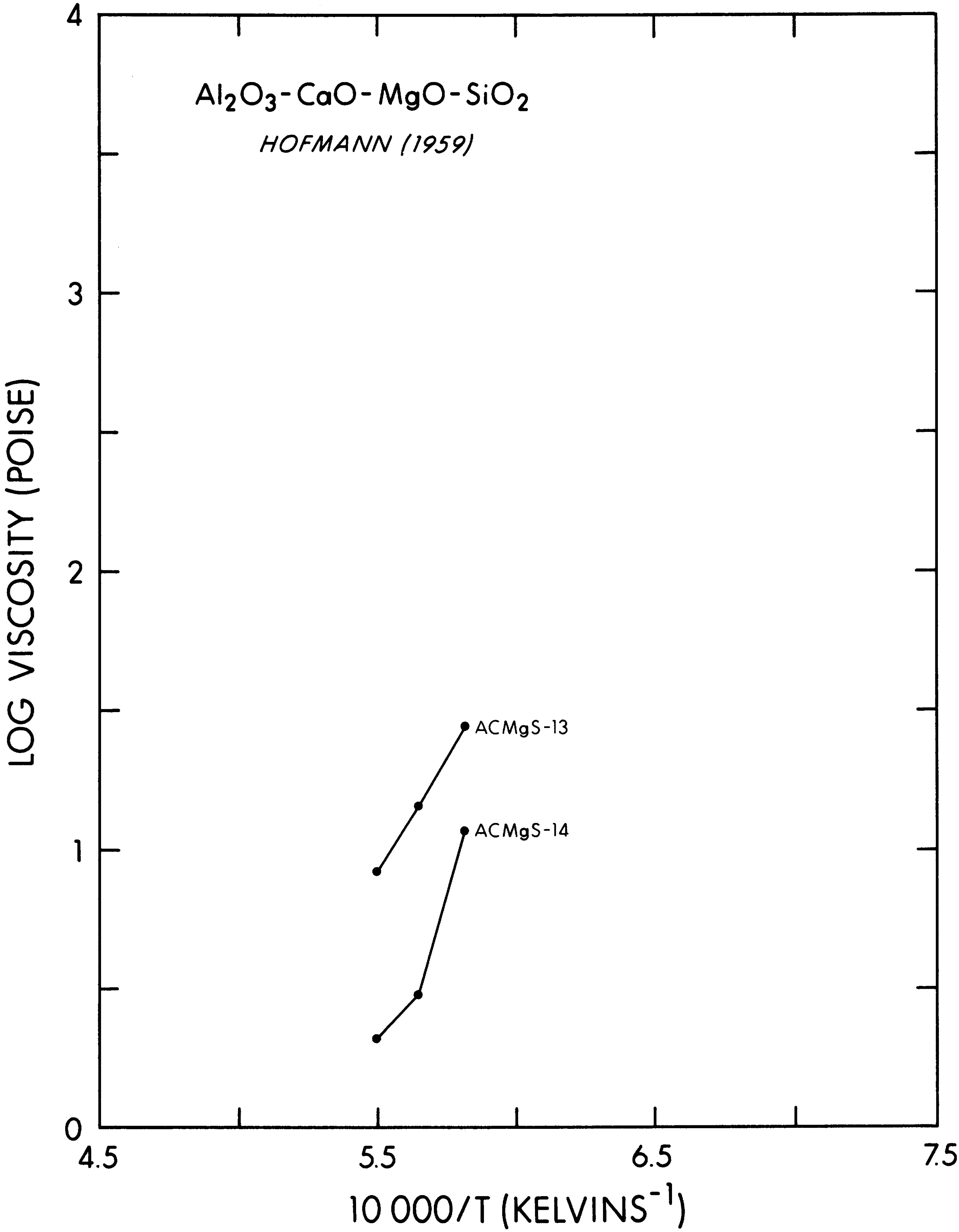

Al2O3-CaO-MgO-SiO2
HOFMANN (1959)
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1300
1400
1500
1600
ACMgS-9
ACMgS-10
ACMgS-11
ACMgS-12



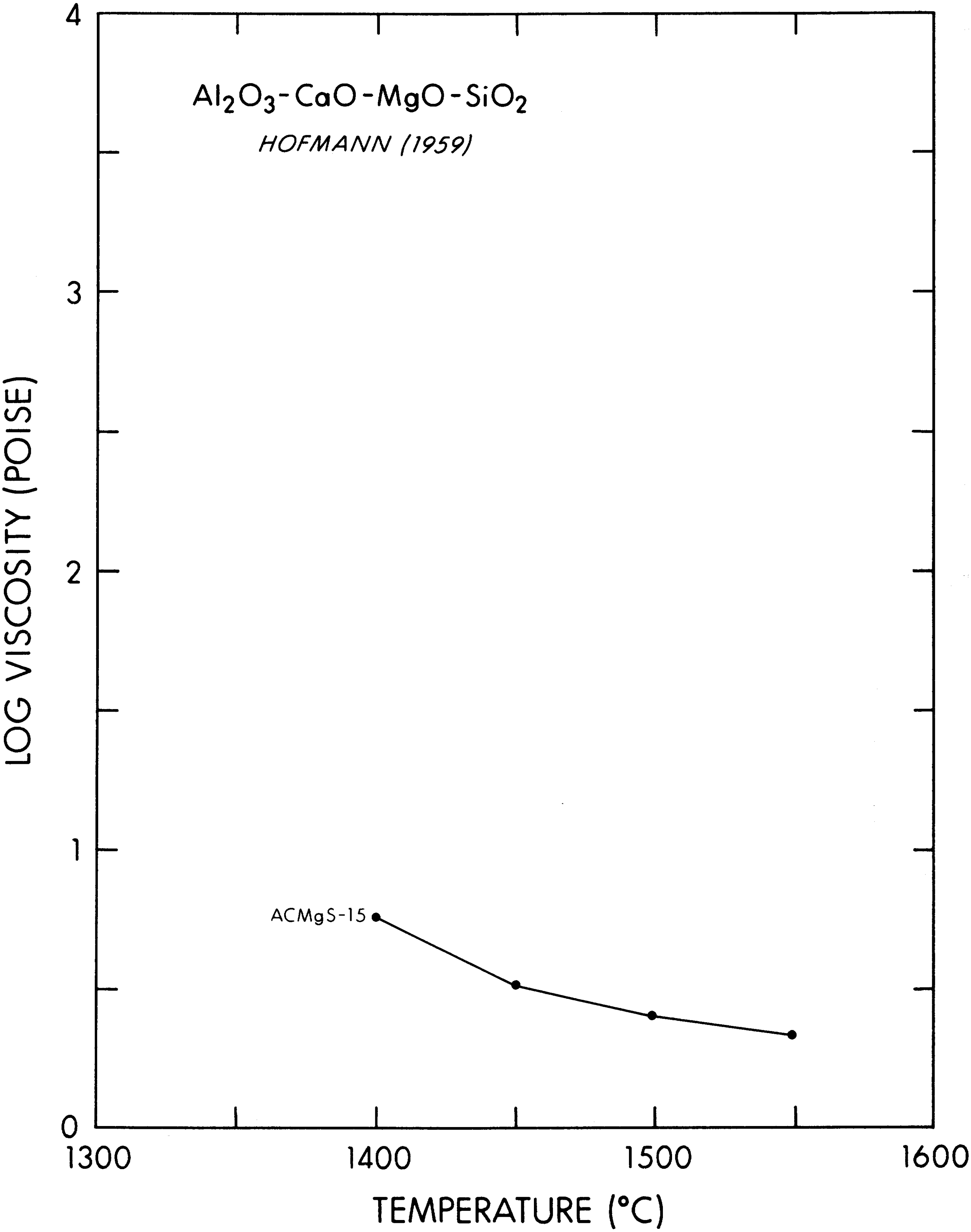
Al_2O_3-CaO-MgO-SiO_2
HOFMANN (1959)
LOG VISCOSITY (POISE)
4
3
2
1
0
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})
ACMgS-10
ACMgS-9
ACMgS-11
ACMgS-12



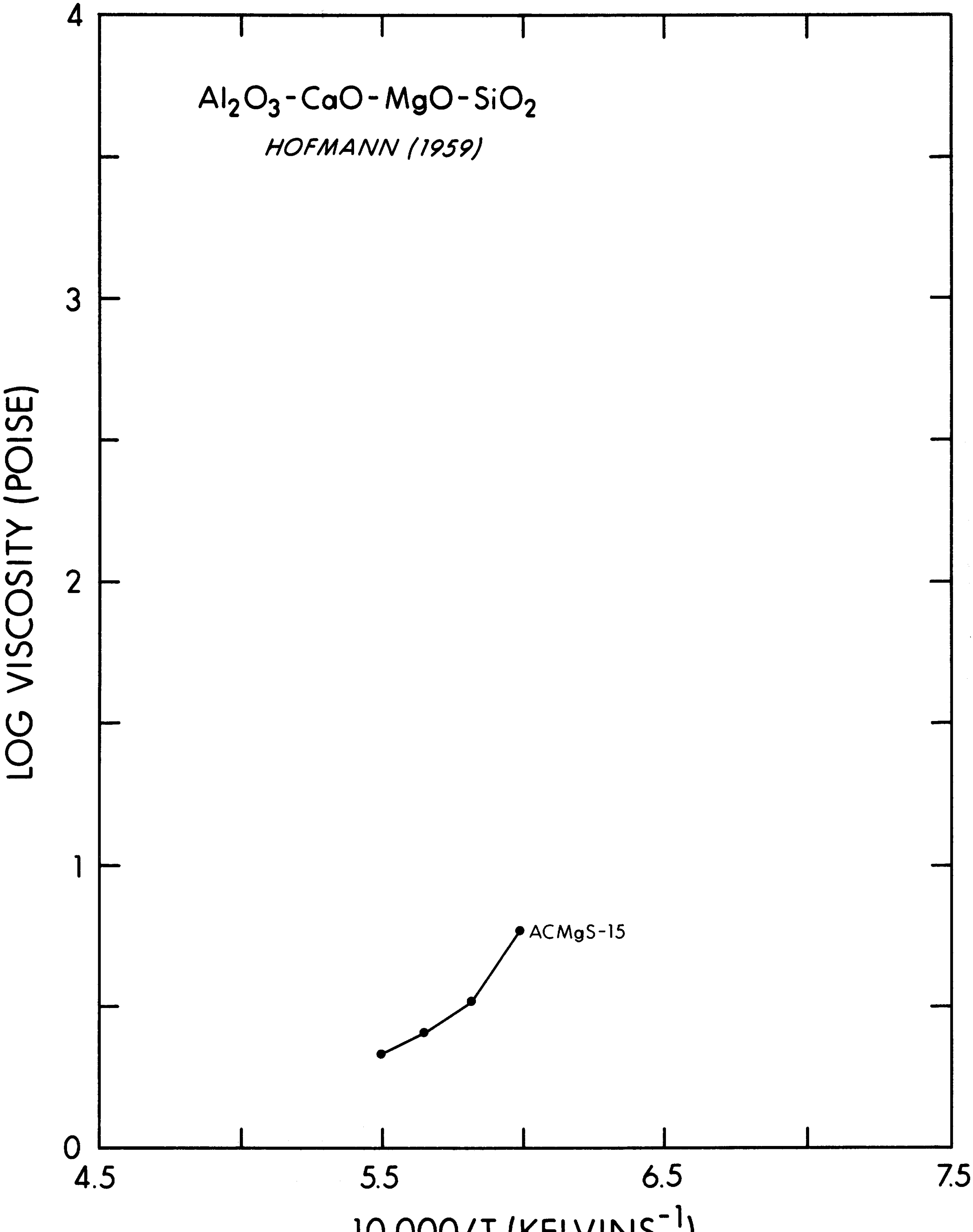
Al_2O_3 - CaO - MgO - SiO_2
HOFMANN (1959)
ACMgS-13
ACMgS-14
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1300
1400
1500
1600



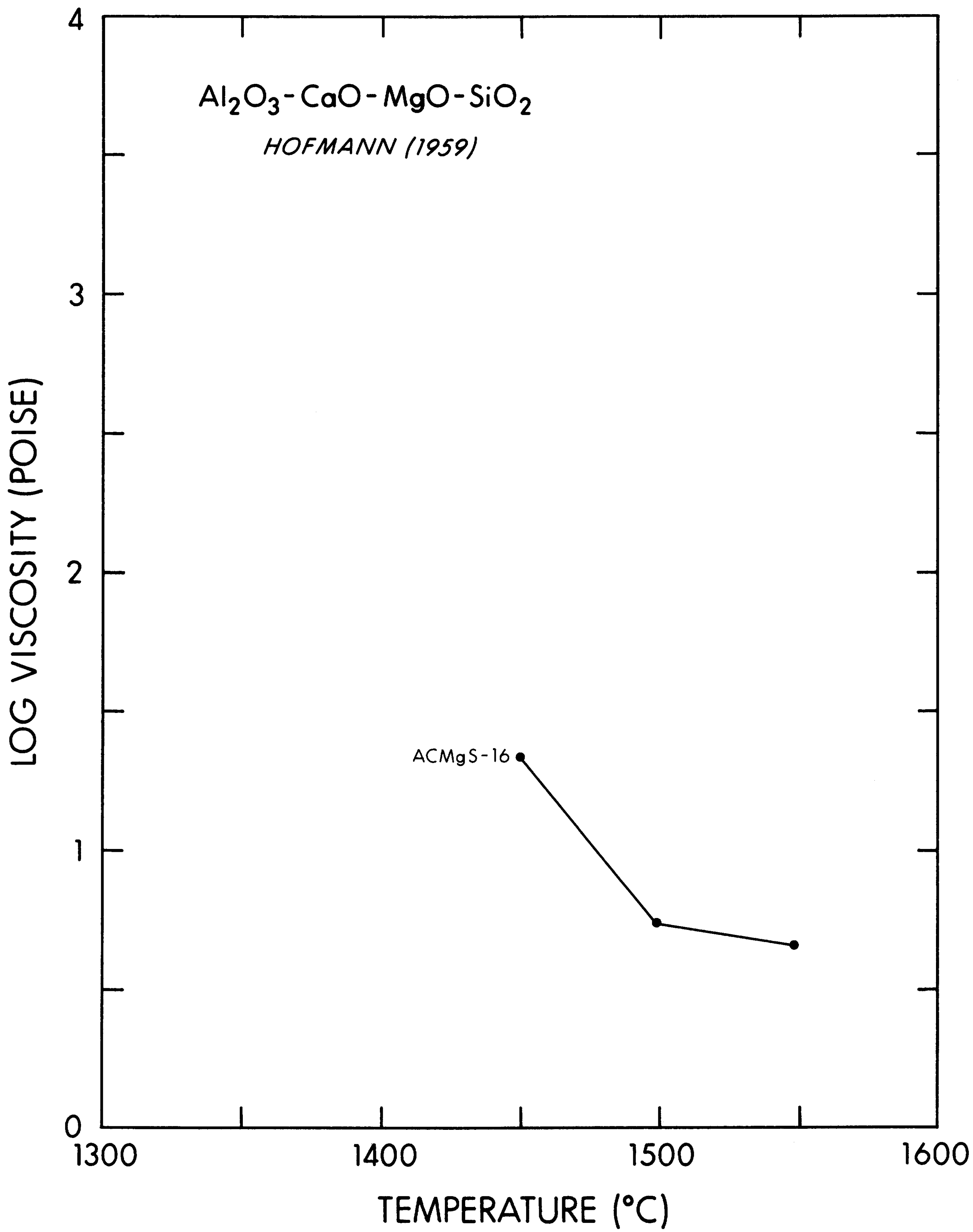
Al2O3-CaO-MgO-SiO2
HOFMANN (1959)
ACMgS-13
ACMgS-14
LOG VISCOSITY (POISE)
0
1
2
3
4
4.5
5.5
6.5
7.5
10 000/T (KELVINS^-1)

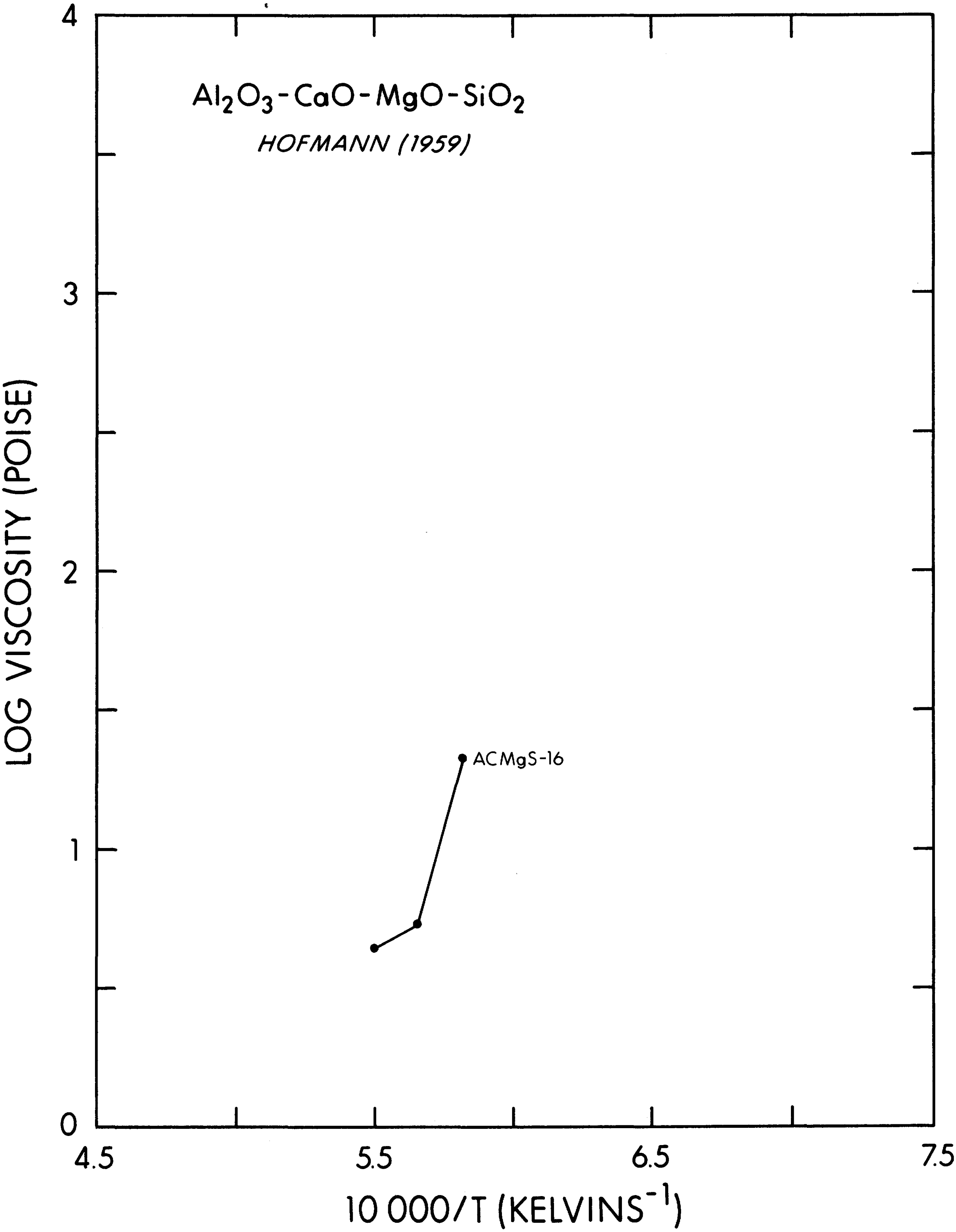


Al_2O_3-CaO-MgO-SiO_2
HOFMANN (1959)
ACMgS-15
LOG VISCOSITY (POISE)
4
3
2
1
0
1300
1400
1500
1600
TEMPERATURE (°C)



Al_2O_3-CaO-MgO-SiO_2
HOFMANN (1959)
ACMgS-15
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5


Al2O3-CaO-MgO-SiO2
HOFMANN (1959)
ACMgS-16
LOG VISCOSITY (POISE)
0
1
2
3
4
1300
1400
1500
1600
TEMPERATURE (°C)



Al2O3-CaO-MgO-SiO2
HOFMANN (1959)
ACMgS-16
LOG VISCOSITY (POISE)
10 000/T (KELVINS-1)
0
1
2
3
4
4.5
5.5
6.5
7.5

SYSTEM

AL2O3(10.94),CAO(10.0),
MGO(9.89),SIO2(69.17) (X)
AL2O3(17.9),CAO(9.0),
MGO(6.4),SIO2(66.7) (%)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

N (POISES)
T (DEGREES C)

AUTHOR

JOHANNSEN AND BRUNION (1959)

DERIVED FROM
TABLE 7

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-17

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	9.132	3.966	9250.
1350.00	6.161	8.355	3.628	4250.
1400.00	5.977	7.682	3.336	2170.
1450.00	5.804	6.985	3.033	1080.

SYSTEM

AL2O3(10.96),CAO(0.0),
MGO(20.03),SIO2(69.01) (X)
AL2O3(18.4),CAO(0.0),
MGO(13.3),SIO2(68.3) (%)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

N (POISES)
T (DEGREES C)

AUTHOR

JOHANNSEN AND BRUNION (1959)

DERIVED FROM
TABLE 7

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-18

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	9.148	3.973	9400.
1350.00	6.161	8.331	3.618	4150.
1400.00	5.977	7.565	3.286	1930.
1450.00	5.804	6.877	2.987	970.

SYSTEM

AL2O3(10.96),CAO(19.94),
MGO(0.0),SIO2(69.10) (X)
AL2O3(17.5),CAO(17.5),
MGO(0.0),SIO2(65.0) (%)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

N (POISES)
T (DEGREES C)

AUTHOR

JOHANNSEN AND BRUNION (1959)

DERIVED FROM
TABLE 7

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-19

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	9.629	4.182	15200.
1300.00	6.357	8.825	3.833	6800.
1350.00	6.161	8.036	3.490	3090.
1400.00	5.977	7.320	3.179	1510.
1450.00	5.804	6.659	2.892	780.

SYSTEM

AL2O3(9.22),CAO(0.0),
MGO(28.10),SIO2(62.68) (X)
AL2O3(16.1),CAO(0.0),
MGO(19.4),SIO2(64.5) (%)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

N (POISES)
T (DEGREES C)

AUTHOR

JOHANNSEN AND BRUNION (1959)

DERIVED FROM
TABLE 7

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-20

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	7.534	3.272	1870.
1350.00	6.161	6.768	2.940	870.
1400.00	5.977	6.040	2.623	420.
1450.00	5.804	5.298	2.301	200.

SYSTEM
AL2O3(14.33),CAO(13.02),
MGO(13.12),SIO2(59.53) (X)
AL2O3(23.2),CAO(11.6),
MGO(8.4),SIO2(56.8) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 7

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-21

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	7.300	3.170	1480.
1350.00	6.161	6.507	2.826	670.
1400.00	5.977	5.737	2.491	310.
1450.00	5.804	5.011	2.176	150.

SYSTEM
AL2O3(9.21),CAO(13.94),
MGO(13.99),SIO2(62.86) (X)
AL2O3(15.5),CAO(12.9),
MGO(9.3),SIO2(62.3) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 7

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS- 22

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	7.990	3.470	2950.
1300.00	6.357	7.139	3.100	1260.
1350.00	6.161	6.430	2.792	620.
1400.00	5.977	5.737	2.491	310.
1450.00	5.804	5.011	2.176	150.

SYSTEM
AL2O3(14.34),CAO(0.0),
MGO(26.15),SIO2(59.52) (X)
AL2O3(24.0),CAO(0.0),
MGO(17.3),SIO2(58.7) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 7

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-2 3

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	7.462	3.241	1740.
1350.00	6.161	6.380	2.771	590.
1400.00	5.977	5.598	2.431	270.
1450.00	5.804	5.011	2.176	150.

SYSTEM
AL2O3(14.36),CAO(26.10),
MGO(0.0),SIO2(59.55) (X)
AL2O3(22.5),CAO(22.5),
MGO(0.0),SIO2(55.0) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 7

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-2 4

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	7.056	3.064	1160.
1350.00	6.161	6.254	2.716	520.
1400.00	5.977	5.598	2.431	270.
1450.00	5.804	4.977	2.161	145.

SYSTEM
AL2O3(9.24),CAO(28.0),
MGO(0.0),SIO2(62.75) (X)
AL2O3(15.0),CAO(25.0),
MGO(0.0),SIO2(60.0) (%)

AUTHOR
JOHANNSEN AND BRUNION (1959)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

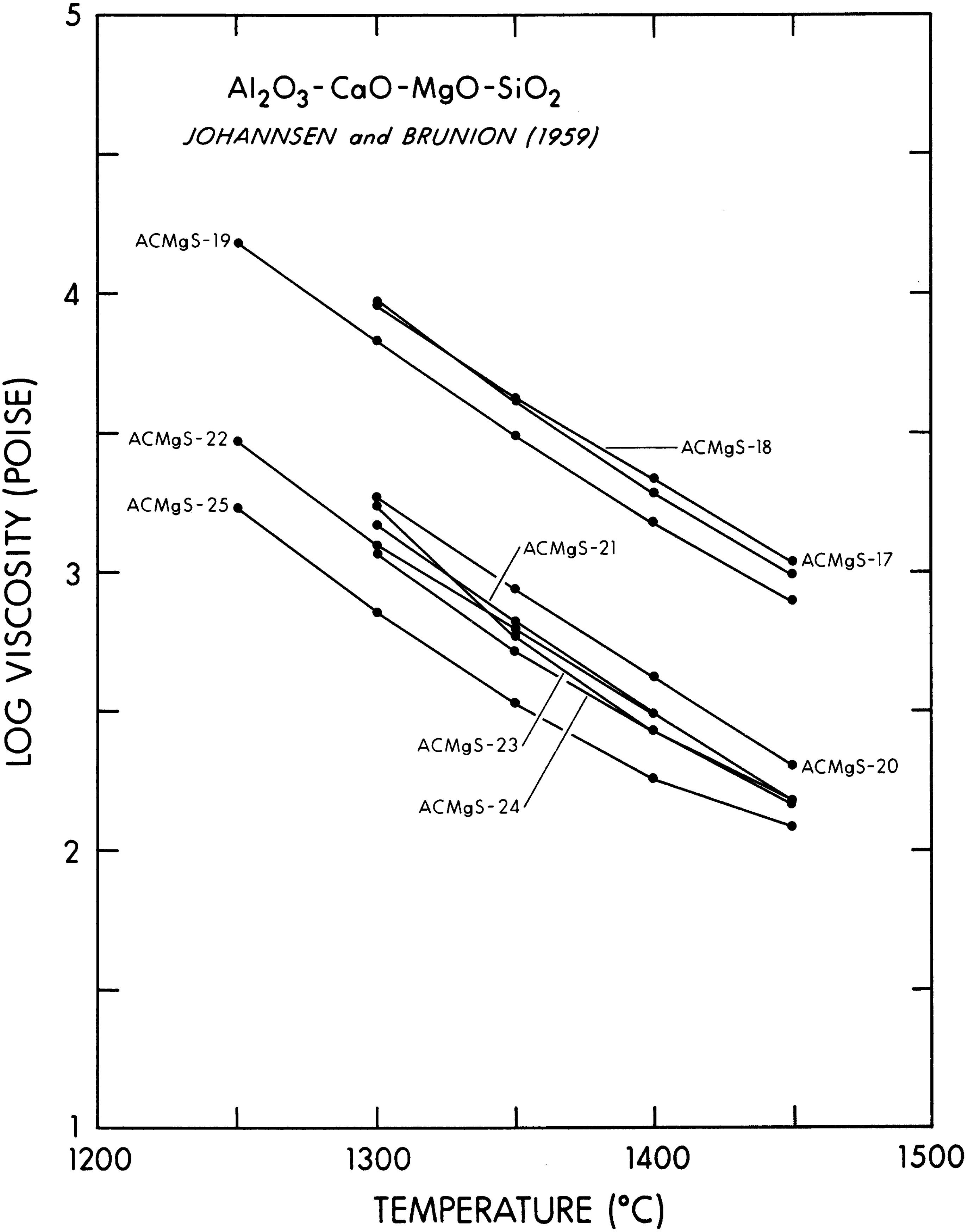
DERIVED FROM
TABLE 7

N (POISES)
T (DEGREES C)

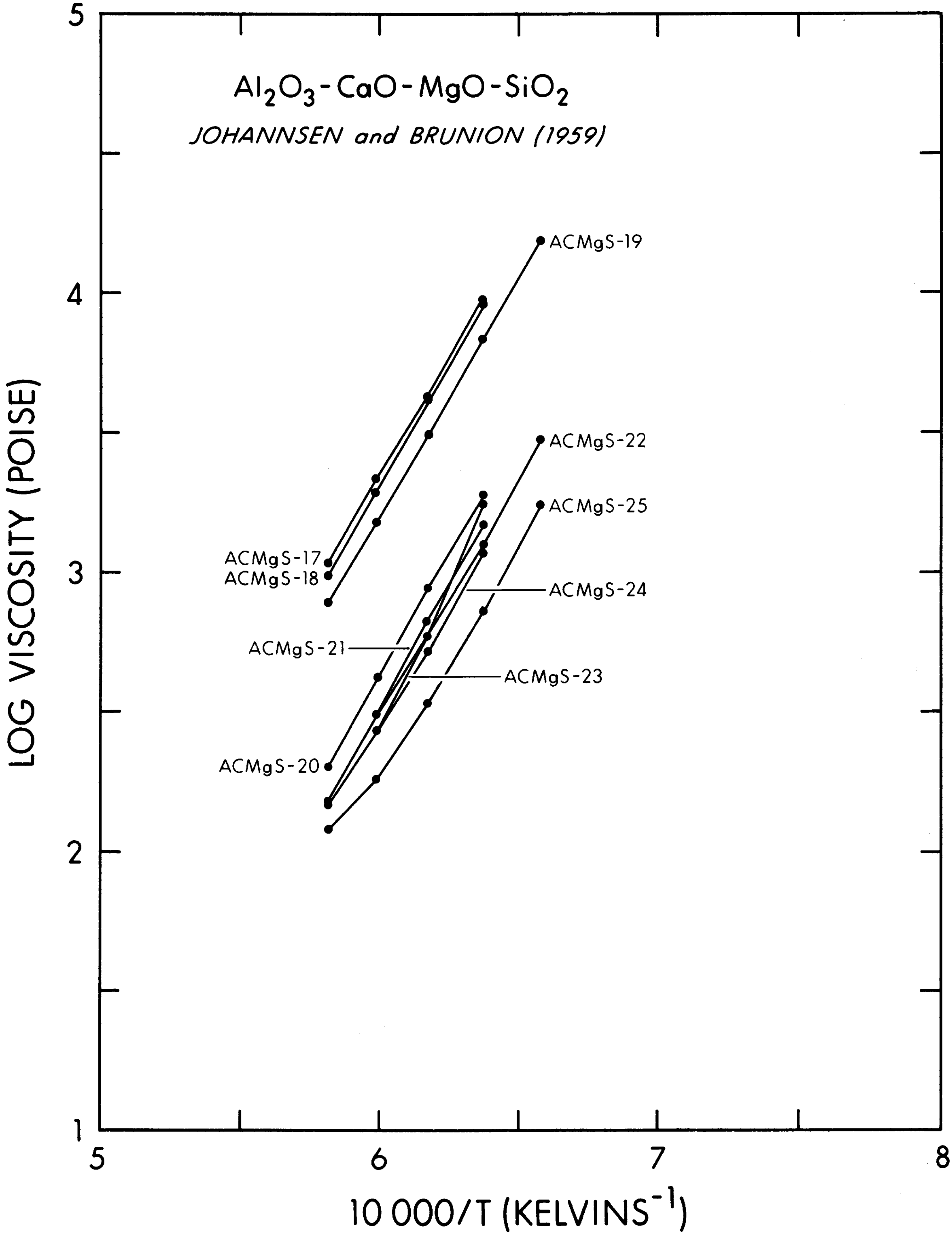
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-25

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	7.450	3.236	1720.
1300.00	6.357	6.579	2.857	720.
1350.00	6.161	5.829	2.531	340.
1400.00	5.977	5.193	2.255	180.
1450.00	5.804	4.787	2.079	120.



Al_2O_3-CaO-MgO-SiO_2
JOHANNSEN and BRUNION (1959)
ACMgS-19
ACMgS-18
ACMgS-17
ACMgS-22
ACMgS-25
ACMgS-21
ACMgS-20
ACMgS-23
ACMgS-24
5
4
3
2
1
1200
1300
1400
1500
LOG VISCOSITY (POISE)
TEMPERATURE (°C)


Al_2O_3-CaO-MgO-SiO_2
JOHANNSEN and BRUNION (1959)
ACMgS-19
ACMgS-17
ACMgS-18
ACMgS-22
ACMgS-25
ACMgS-24
ACMgS-21
ACMgS-23
ACMgS-20
LOG VISCOSITY (POISE)
5
4
3
2
1
5
6
7
8
10 000/T ($KELVINS^{-1}$)

SYSTEM
AL2O3(19.22),MGO(8.10),
CAO(29.15),SIO2(43.53) (X)
AL2O3(30.0),MGO(5.0),
CAO(25.0),SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA (1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-26

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	4.564	1.982	96.0
1400.00	5.977	3.939	1.711	51.37
1450.00	5.804	3.414	1.483	30.40
1500.00	5.640	2.941	1.277	18.94

SYSTEM
AL2O3(18.70),MGO(15.85),
CAO(22.81),SIO2(42.55) (X)
AL2O3(30.0),MGO(10.0),
CAO(20.0),SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA (1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-27

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	4.251	1.846	70.18
1400.00	5.977	3.662	1.590	38.94
1450.00	5.804	3.140	1.364	23.10
1500.00	5.640	2.687	1.167	14.69

SYSTEM
AL2O3(15.60),MGO(7.90),
CAO(35.08),SIO2(42.42) (X)
AL2O3(25.0),MGO(5.0),
CAO(30.0),SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA (1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-28

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.366	2.330	214.0
1300.00	6.357	4.590	1.993	98.46
1350.00	6.161	3.898	1.693	49.32
1400.00	5.977	3.359	1.459	28.75
1450.00	5.804	2.906	1.262	18.29
1500.00	5.640	2.497	1.085	12.15

SYSTEM
AL2O3(15.26),MGO(15.45),
CAO(27.79),SIO2(41.50) (X)
AL2O3(25.0),MGO(10.0),
CAO(25.0),SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA (1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-29

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.065	2.200	158.4
1300.00	6.357	4.321	1.877	75.26
1350.00	6.161	3.684	1.600	39.81
1400.00	5.977	3.141	1.364	23.12
1450.00	5.804	2.731	1.186	15.35
1500.00	5.640	2.416	1.049	11.20

SYSTEM
AL2O3(12.17),MGO(7.70),
CAO(38.76),SIO2(41.37) (X)
AL2O3(20.0),MGO(5.0),
COAO(30.0),SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA (1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-30

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.751	2.063	115.7
1300.00	6.357	4.016	1.744	55.50
1350.00	6.161	3.382	1.469	29.43
1400.00	5.977	2.886	1.253	17.92
1450.00	5.804	2.421	1.052	11.26
1500.00	5.640	2.040	0.886	7.69

SYSTEM
AL2O3(11.91),MGO(15.08),
CAO(32.52),SIO2(40.49) (X)
AL2O3(20.0), MGO(10.0),
CAO(30.0),SIO2(40.0) (%)

AUTHOR
MACHINA AND HANNA (1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-31

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.587	1.992	98.2
1300.00	6.357	3.791	1.646	44.30
1350.00	6.161	3.209	1.394	24.76
1400.00	5.977	2.718	1.134	15.15
1450.00	5.804	2.307	1.002	10.04
1500.00	5.640	1.937	0.841	6.94

SYSTEM
AL2O3(11.67),MGO(22.14),
CAO(26.55),SIO2(39.64) (X)
AL2O3(20.0),MGO(15.0),
CAO(25.0),SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA(1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-32

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.313	1.873	74.63
1300.00	6.357	3.564	1.548	35.29
1350.00	6.161	3.032	1.317	20.74
1400.00	5.977	2.552	1.108	12.83
1450.00	5.804	2.125	0.923	8.37
1500.00	5.640	1.725	0.749	5.61

SYSTEM
AL2O3(11.43),MGO(28.92),
CAO(20.82),SIO2(38.83) (X)
AL2O3(20.0),MGO(20.0),
CAO(20.0),SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA (1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-33

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.526	1.097	12.50
1450.00	5.804	2.041	0.887	7.70
1500.00	5.640	1.688	0.733	5.41

SYSTEM
AL2O3(8.91),MGO(7.52),
CAO(43.21),SIO2(40.36) (X)
AL2O3(15.0),MGO(5.0),
CAO(40.0),SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA (1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-34

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	3.447	1.497	31.42
1350.00	6.161	2.975	1.292	19.58
1400.00	5.977	2.476	1.075	11.89
1450.00	5.804	2.091	0.908	8.09
1500.00	5.640	1.613	0.701	5.02

SYSTEM
AL2O3(8.72),MGO(14.72),
CAO(37.02),SIO2(39.53) (X)
AL2O3(15.0),MGO(10.0),
CAO(35.0),SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA (1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-35

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	3.310	1.438	27.39
1350.00	6.161	2.792	1.213	16.32
1400.00	5.977	2.300	0.999	9.97
1450.00	5.804	1.872	0.813	6.5
1500.00	5.640	1.454	0.631	4.28

SYSTEM
AL2O3(8.38),MGO(28.26),
CAO(25.41),SIO2(37.95) (X)
AL2O3(15.0),MGO(20.0),
CAO(25.0),SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA (1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-36

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.121	0.921	8.34
1450.00	5.804	1.714	0.744	5.55
1500.00	5.640	1.194	0.584	3.84

SYSTEM
AL2O3(8.55),MGO(21.63),
CAO(31.10),SIO2(38.72) (X)
AL2O3(15.0),MGO(15.0),
CAO(30.0),SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA (1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-37

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.082	1.773	59.28
1300.00	6.357	3.094	1.344	22.07
1350.00	6.161	2.544	1.105	12.73
1400.00	5.977	2.082	0.904	8.02
1450.00	5.804	1.673	0.737	5.33
1500.00	5.640	1.314	0.571	3.72

SYSTEM
AL2O3(8.21),MGO(34.64),
CAO(19.94),SIO2(37.95) (X)
AL2O3(15.0),MGO(25.0),
CAO(20.0),SIO2(40.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND HANNA (1945)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-38

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	1.194	0.519	3.30

SYSTEM
AL2O3(5.80),MGO(7.34),
CAO(47.45),SIO2(39.41) (X)
AL2O3(10.0),MGO(5.0),
CAO(45.0),SIO2(40.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND HANNA (1945)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-39

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	2.329	1.012	10.27
1400.00	5.977	1.913	0.831	6.77
1450.00	5.804	1.526	0.663	4.60
1500.00	5.640	1.191	0.517	3.29

SYSTEM
AL2O3(5.68),MGO(14.38),
CAO(41.33),SIO2(38.61) (X)
AL2O3(10.0),MGO(10.0),
CAO(40.0),SIO2(40.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND HANNA (1945)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-40

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	2.276	0.989	9.74
1400.00	5.977	1.856	0.806	6.40
1450.00	5.804	1.452	0.630	4.27
1500.00	5.640	1.092	0.474	2.98

SYSTEM
AL2O3(5.46),MGO(27.63),
CAO(29.81),SIO2(37.10) (X)
AL2O3(10.0),MGO(20.0),
CAO(30.0),SIO2(40.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND HANNA (1945)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-41

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	2.169	0.942	8.75
1400.00	5.977	1.705	0.740	5.50
1450.00	5.804	1.330	0.577	3.78
1500.00	5.640	1.033	0.449	2.81

SYSTEM
AL2O3(5.57),MGO(21.14),
CAO(35.45),SIO2(37.84) (X)
AL2O3(10.0),MGO(15.0),
CAO(35.0),SIO2(40.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND HANNA (1945)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-42

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	2.117	0.920	8.31
1400.00	5.977	1.660	0.721	5.26
1450.00	5.804	1.292	0.561	3.64
1500.00	5.640	0.963	0.418	2.62

SYSTEM
AL2O3(5.36),MGO(33.88),
CAO(24.37),SIO2(36.39) (X)
AL2O3(10.0),MGO(25.0),
CAO(25.0),SIO2(40.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND HANNA (1945)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-43

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	0.900	0.391	2.46

SYSTEM
AL2O3(2.78),MGO(14.05),
CAO(45.44),SIO2(37.73) (X)
AL2O3(5.0),MGO(15.0),
CAO(40.0),SIO2(40.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND HANNA (1945)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-44

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	0.806	0.350	2.24

SYSTEM
AL2O3(2.72),MGO(20.67),
CAO(39.61),SIO2(37.0) (X)
AL2O3(5.0),MGO(15.0),
CAO(40.0),SIO2(40.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND HANNA (1945)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-45

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	0.959	0.417	2.61
1500.00	5.640	0.688	0.299	1.99

SYSTEM
AL2O3(2.67),MGO(20.67),
CAO(34.01),SIO2(36.29) (X)
AL2O3(5.0),MGO(20.0),
CAO(35.0),SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA (1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-46

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	0.917	0.422	2.64
1500.00	5.640	0.647	0.281	1.91

SYSTEM
AL2O3(2.62),MGO(33.16),
CAO(28.61),SIO2(35.61) (X)
AL2O3(5.0),MGO(25.0),
CAO(30.0),SIO2(40.0) (%)

AUTHOR
MACHIN AND HANNA (1945)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

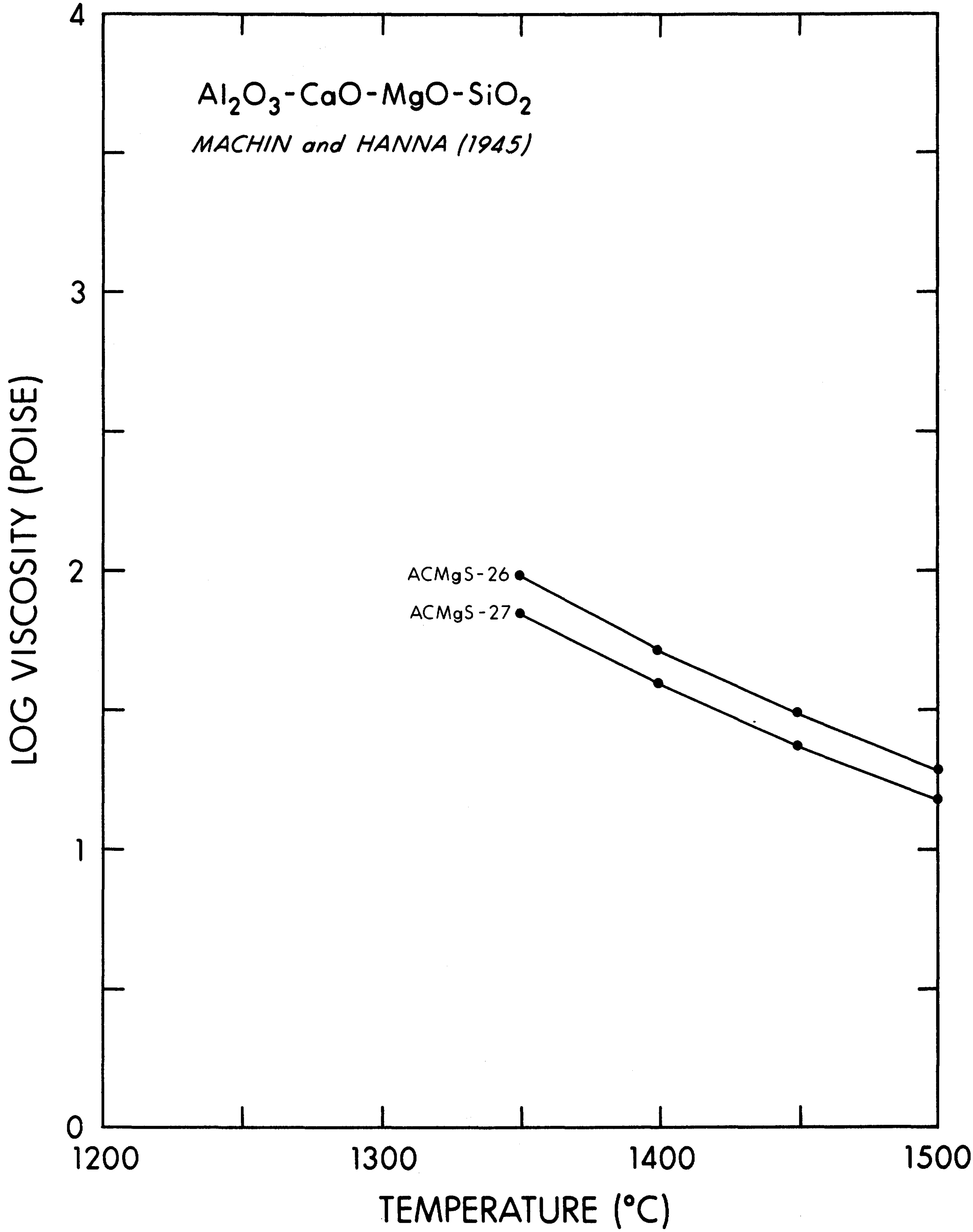
DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

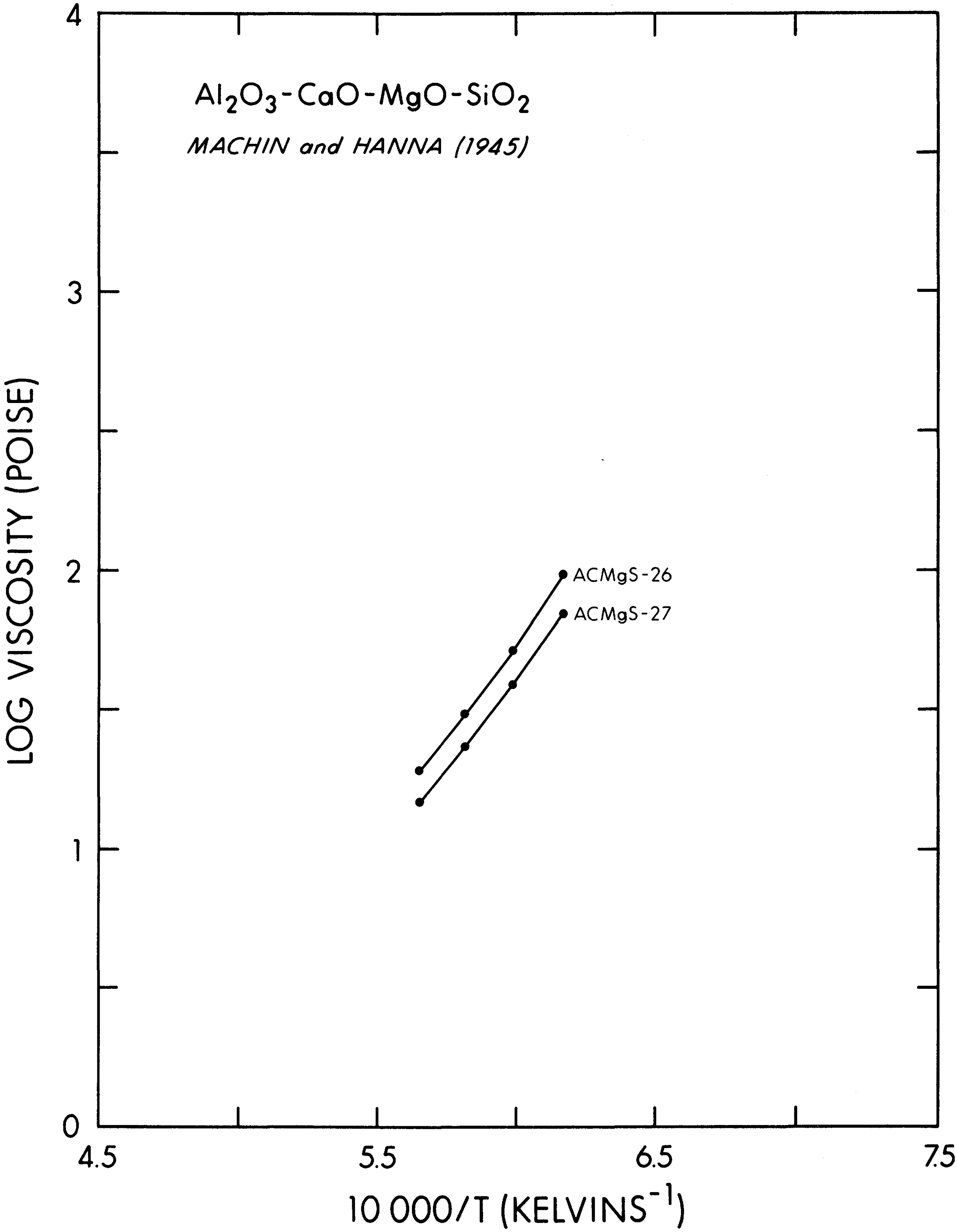
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-47

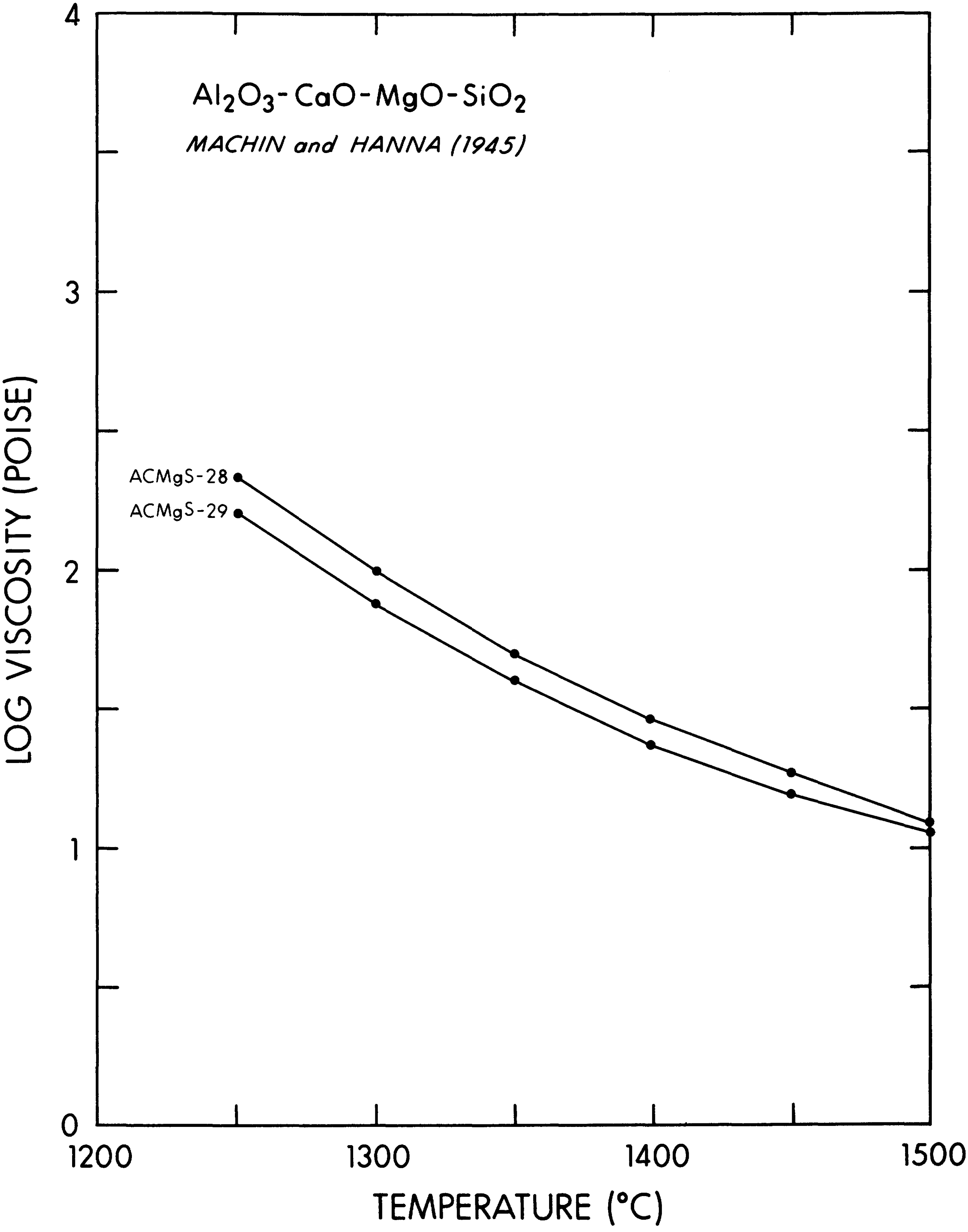
T	Z	LN(N)	LOG(N)	N
1500.00	5.640	0.642	0.279	1.90



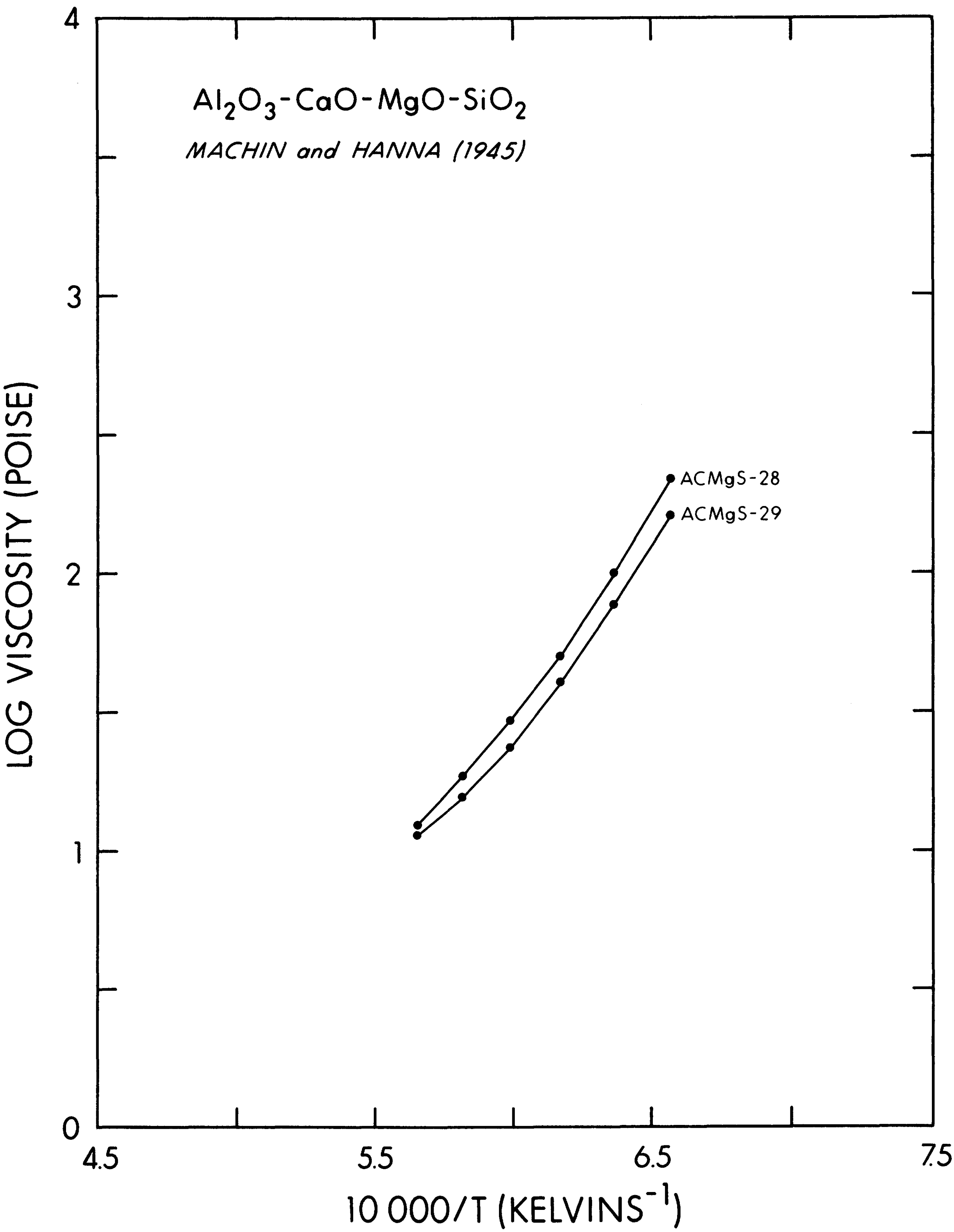
Al_2O_3-CaO-MgO-SiO_2
MACHIN and HANNA (1945)
ACMgS-26
ACMgS-27
LOG VISCOSITY (POISE)
4
3
2
1
0
1200
1300
1400
1500
TEMPERATURE (°C)

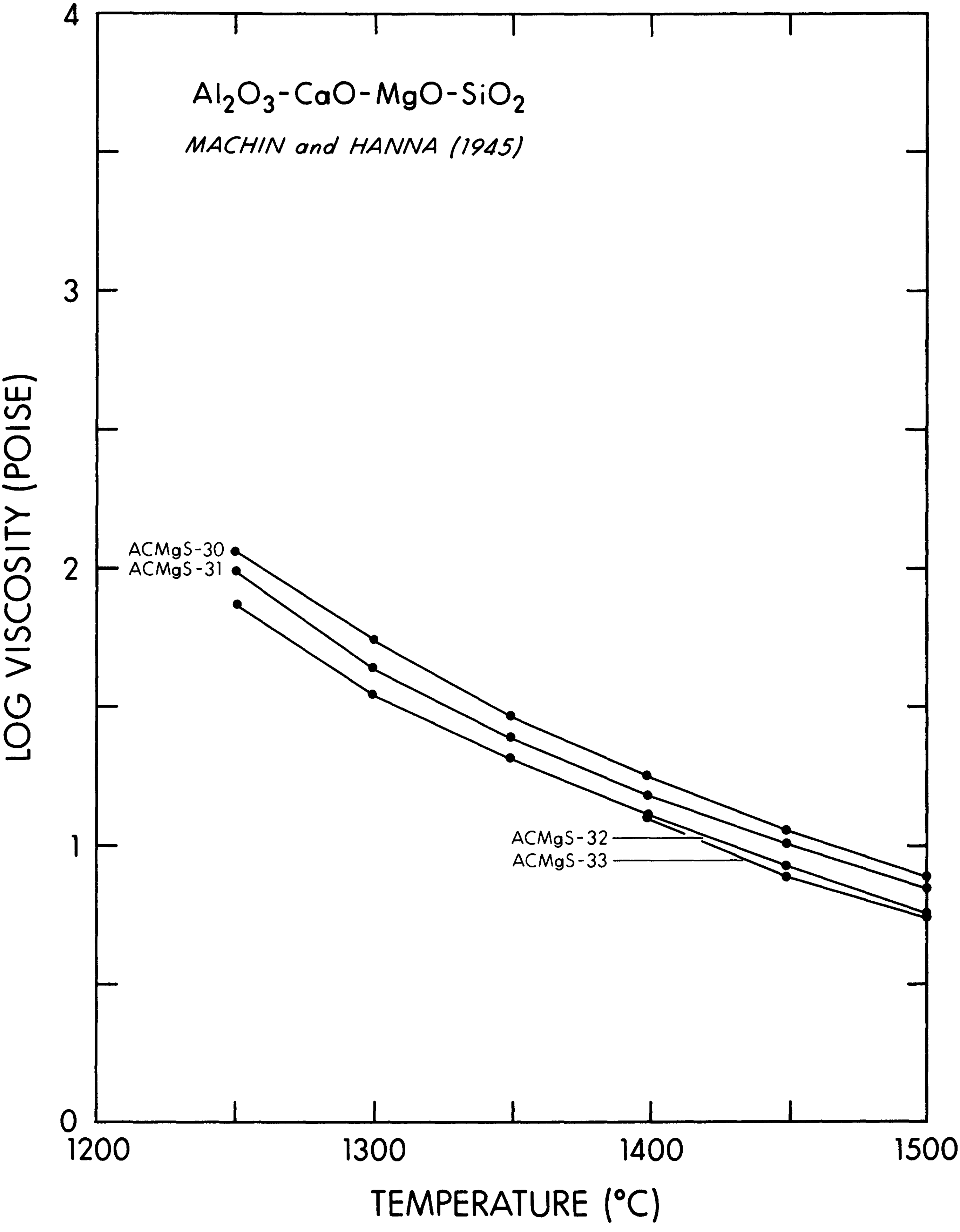


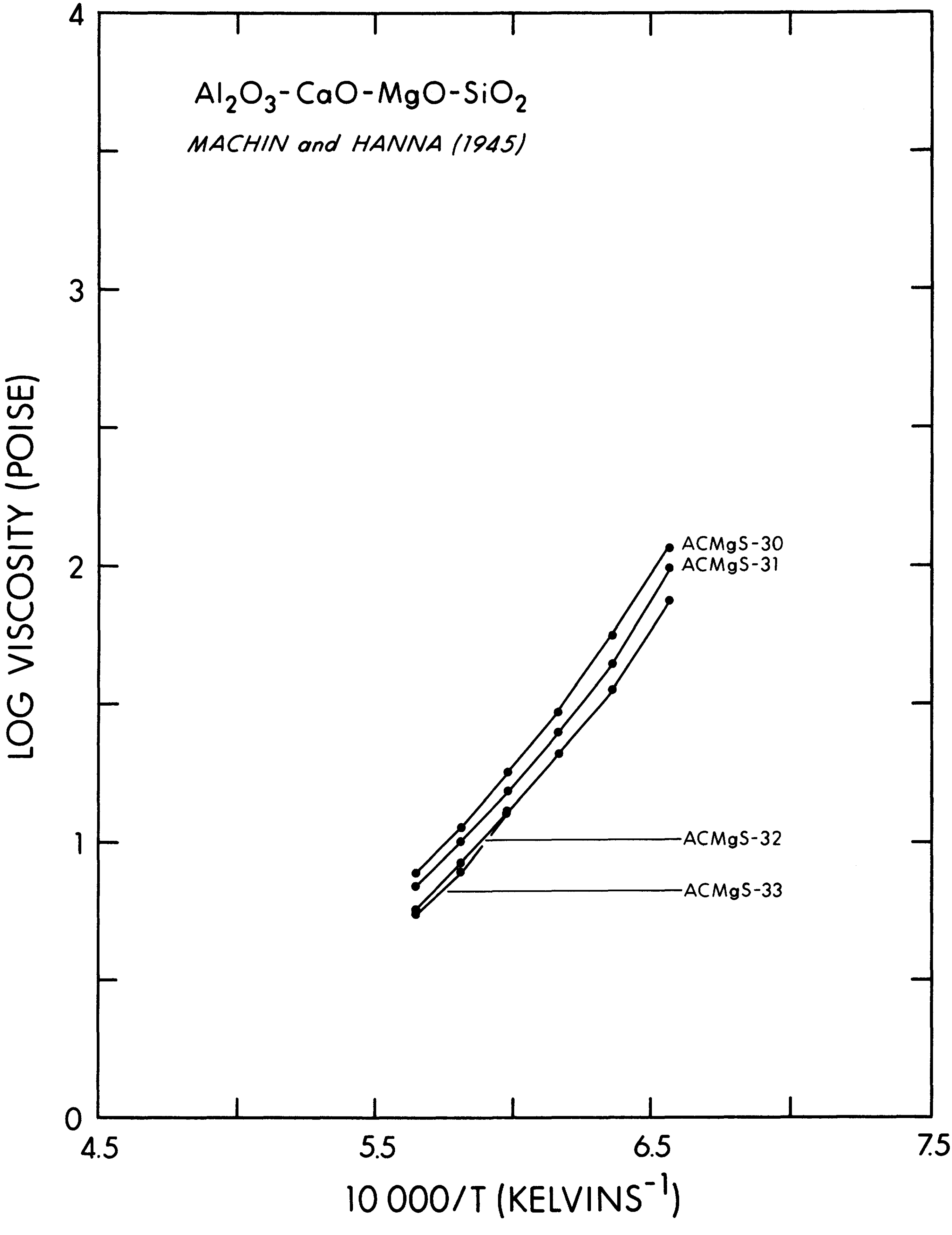
Al_2O_3-CaO-MgO-SiO_2
MACHIN and HANNA (1945)
ACMgS-26
ACMgS-27
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5



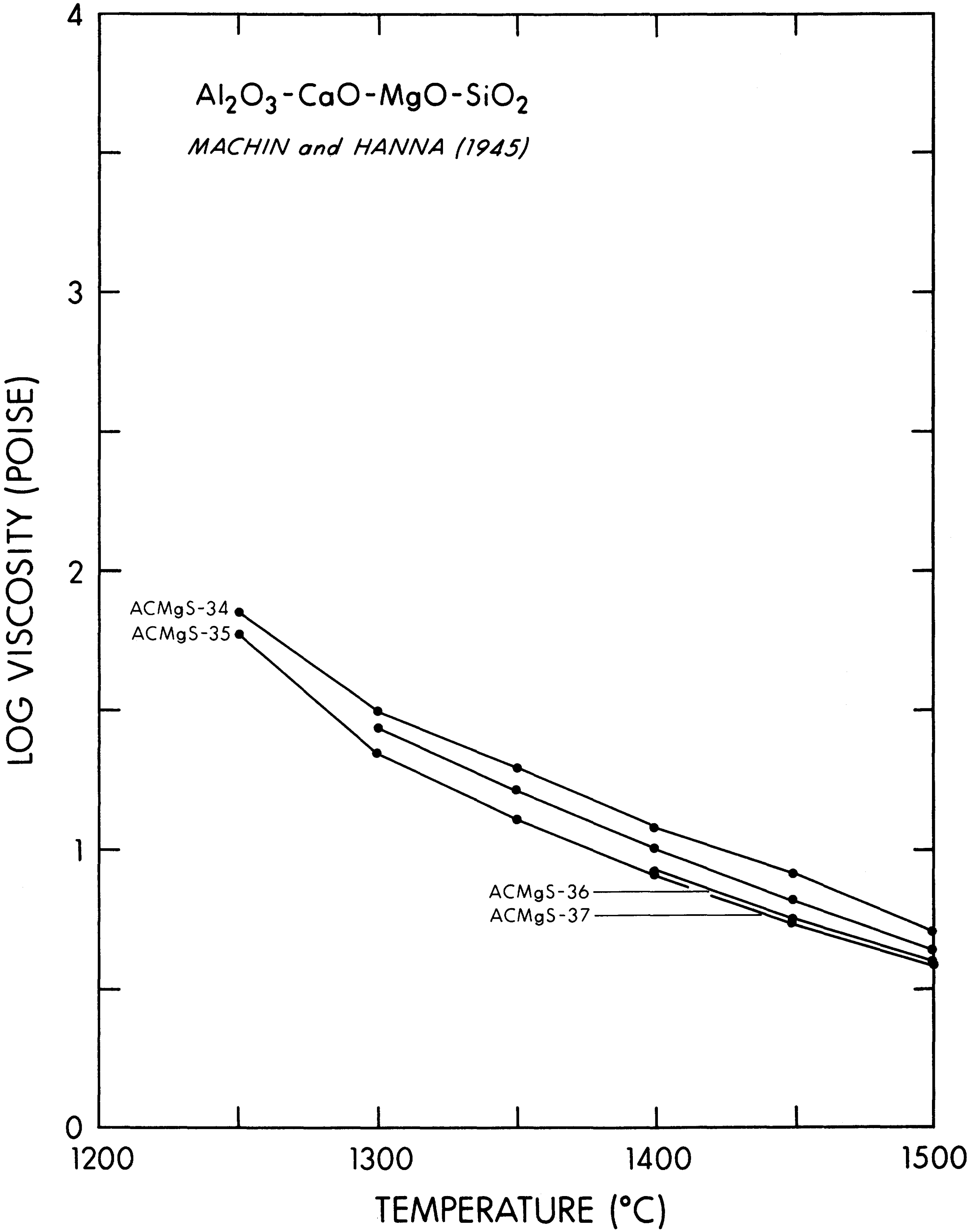
Al_2O_3-CaO-MgO-SiO_2
MACHIN and HANNA (1945)
ACMgS-28
ACMgS-29
LOG VISCOSITY (POISE)
0
1
2
3
4
1200
1300
1400
1500
TEMPERATURE (°C)


Al_2O_3-CaO-MgO-SiO_2
MACHIN and HANNA (1945)
ACMgS-28
ACMgS-29
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5

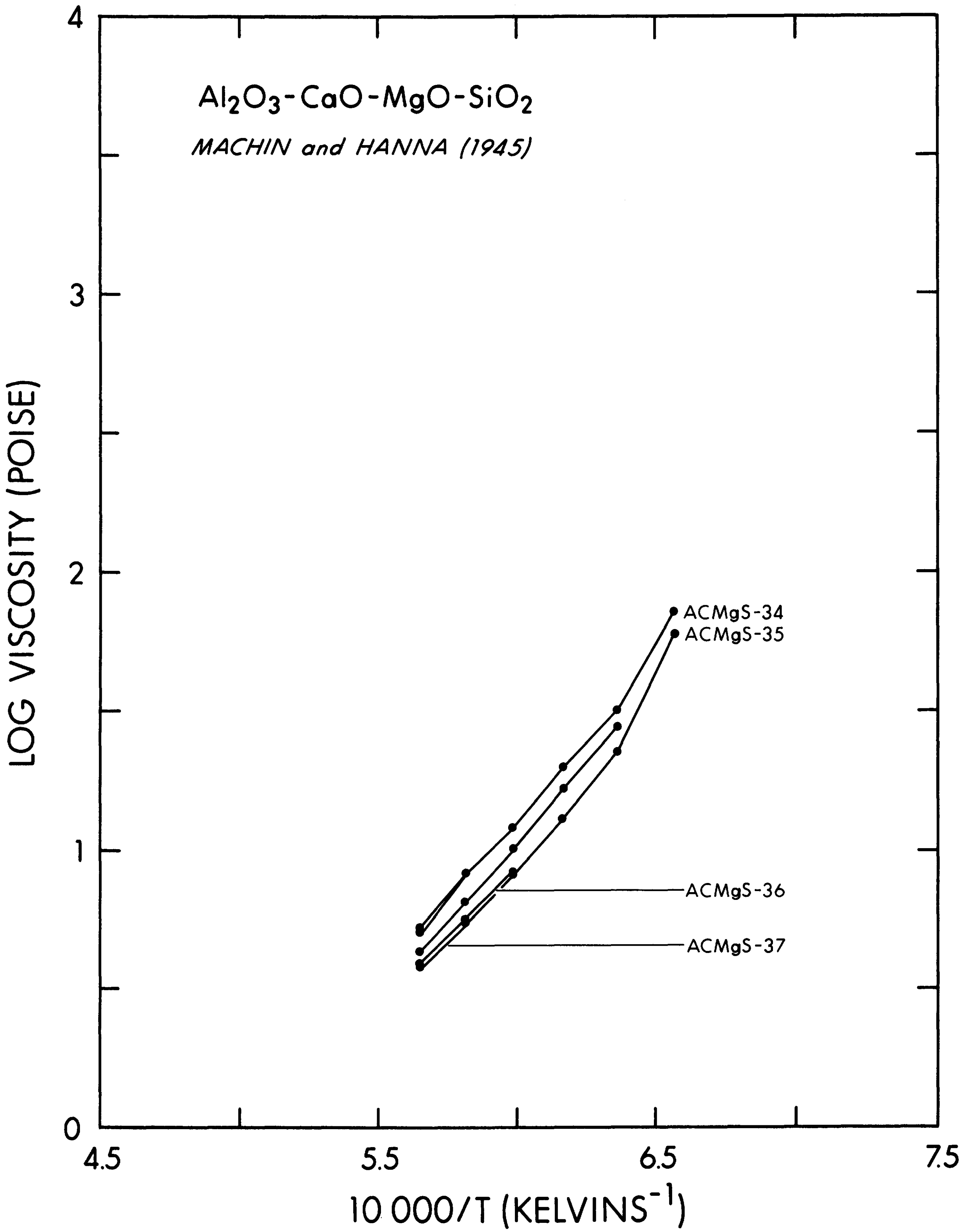

Al_2O_3-CaO-MgO-SiO_2
MACHIN and HANNA (1945)
ACMgS-30
ACMgS-31
ACMgS-32
ACMgS-33
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500

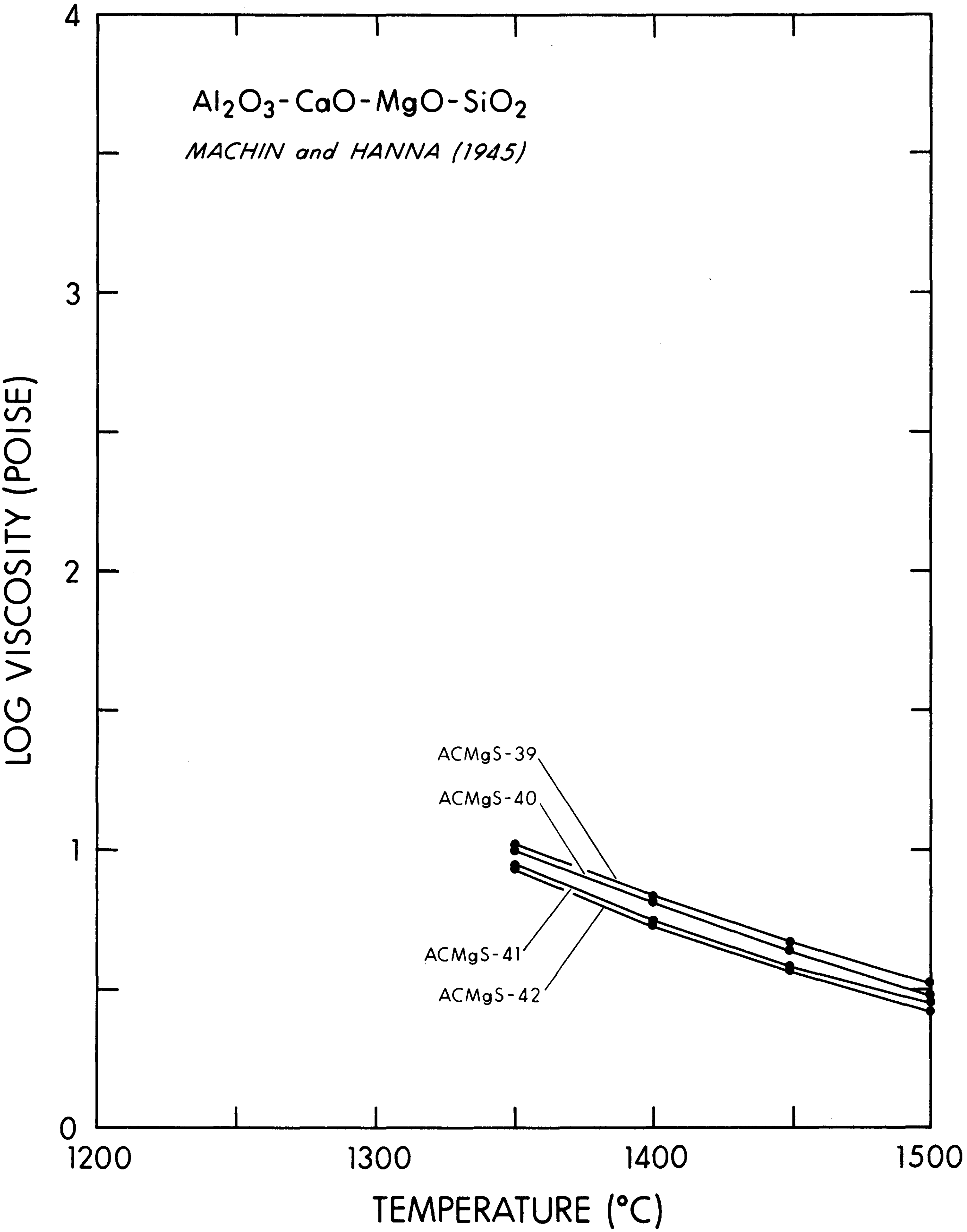


Al_2O_3-CaO-MgO-SiO_2
MACHIN and HANNA (1945)
ACMgS-30
ACMgS-31
ACMgS-32
ACMgS-33
LOG VISCOSITY (POISE)
0
1
2
3
4
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})

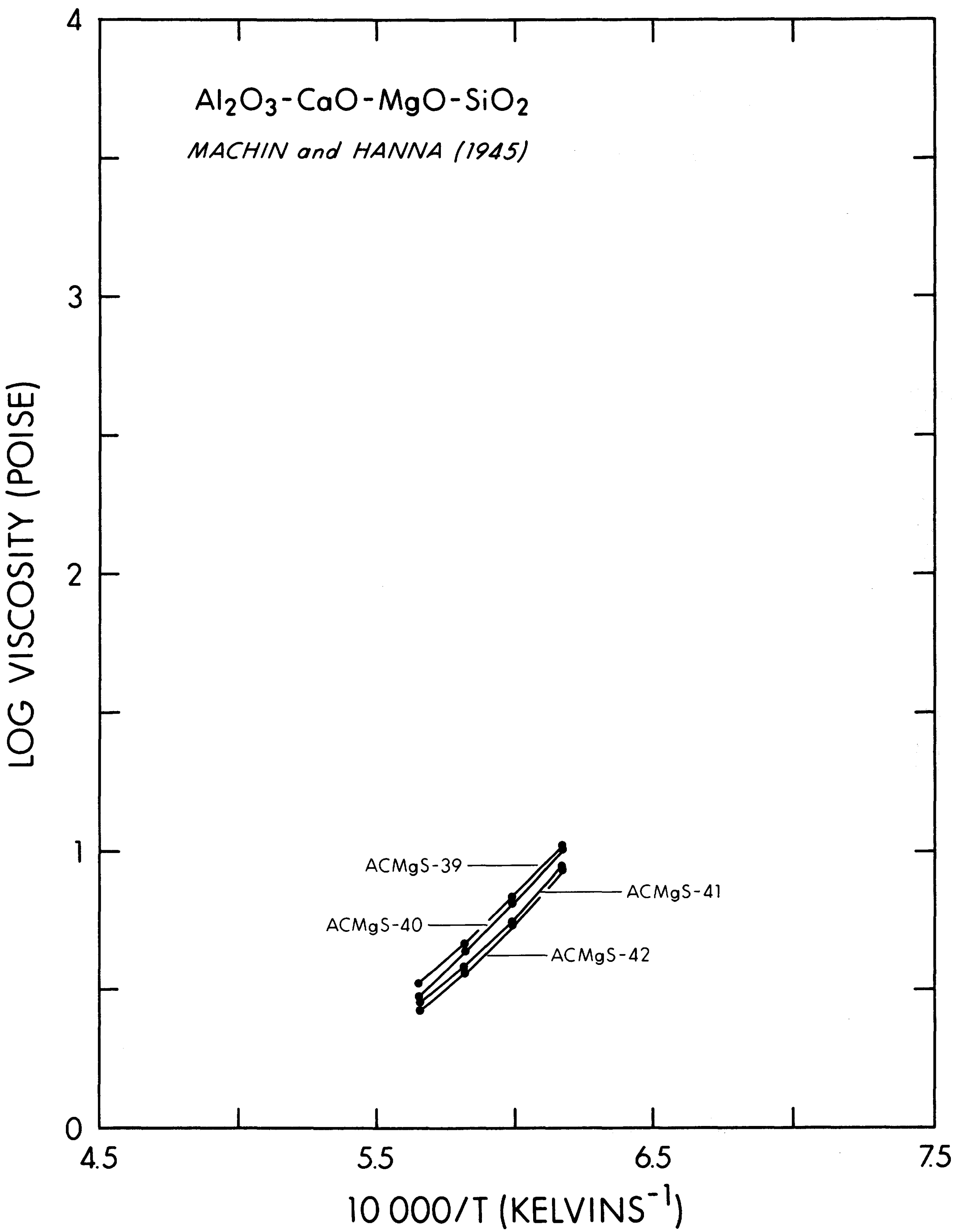


Al_2O_3-CaO-MgO-SiO_2
MACHIN and HANNA (1945)
ACMgS-34
ACMgS-35
ACMgS-36
ACMgS-37
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
4
3
2
1
0
1200
1300
1400
1500

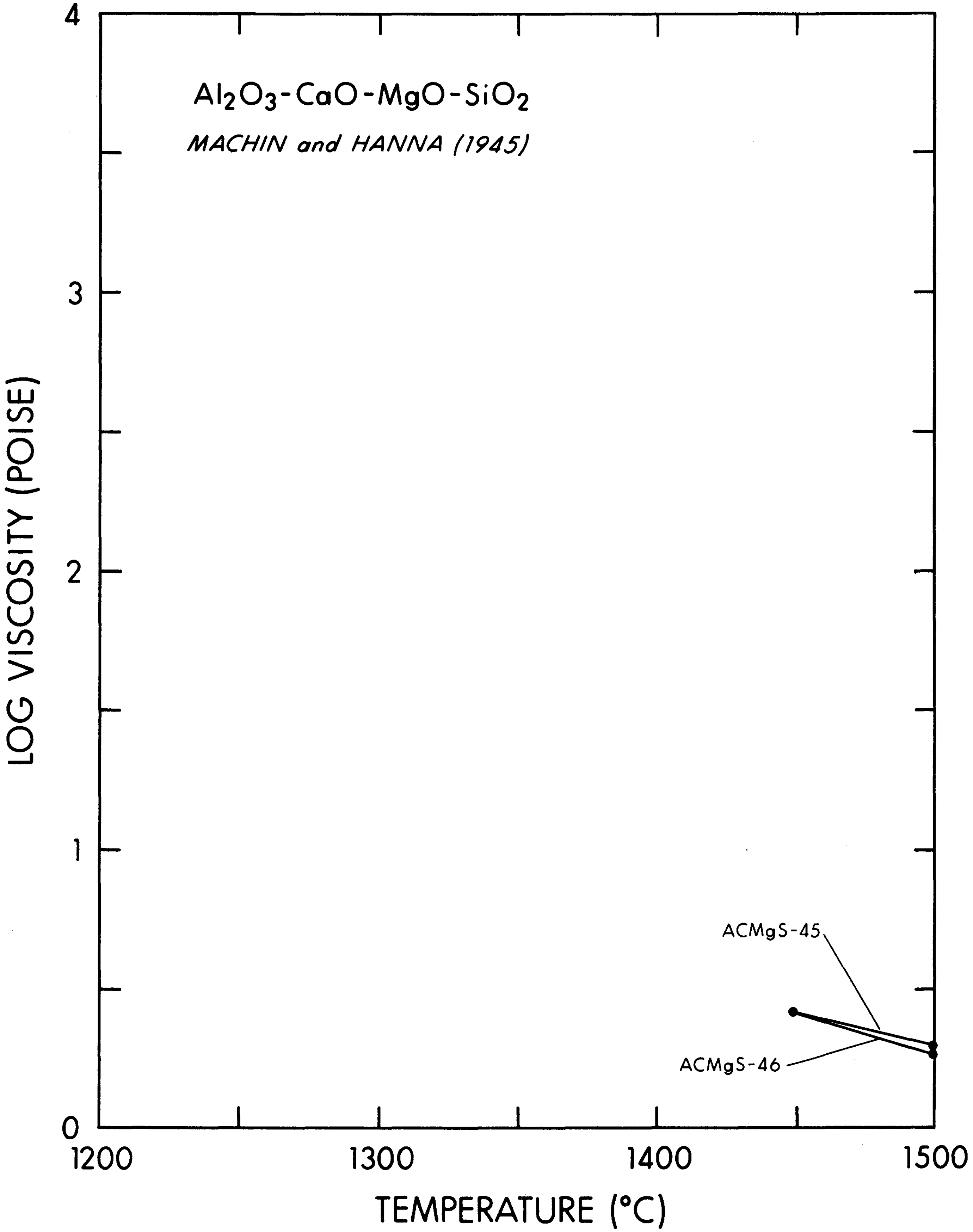

Al_2O_3-CaO-MgO-SiO_2
MACHIN and HANNA (1945)
ACMgS-34
ACMgS-35
ACMgS-36
ACMgS-37
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
4.5
5.5
6.5
7.5



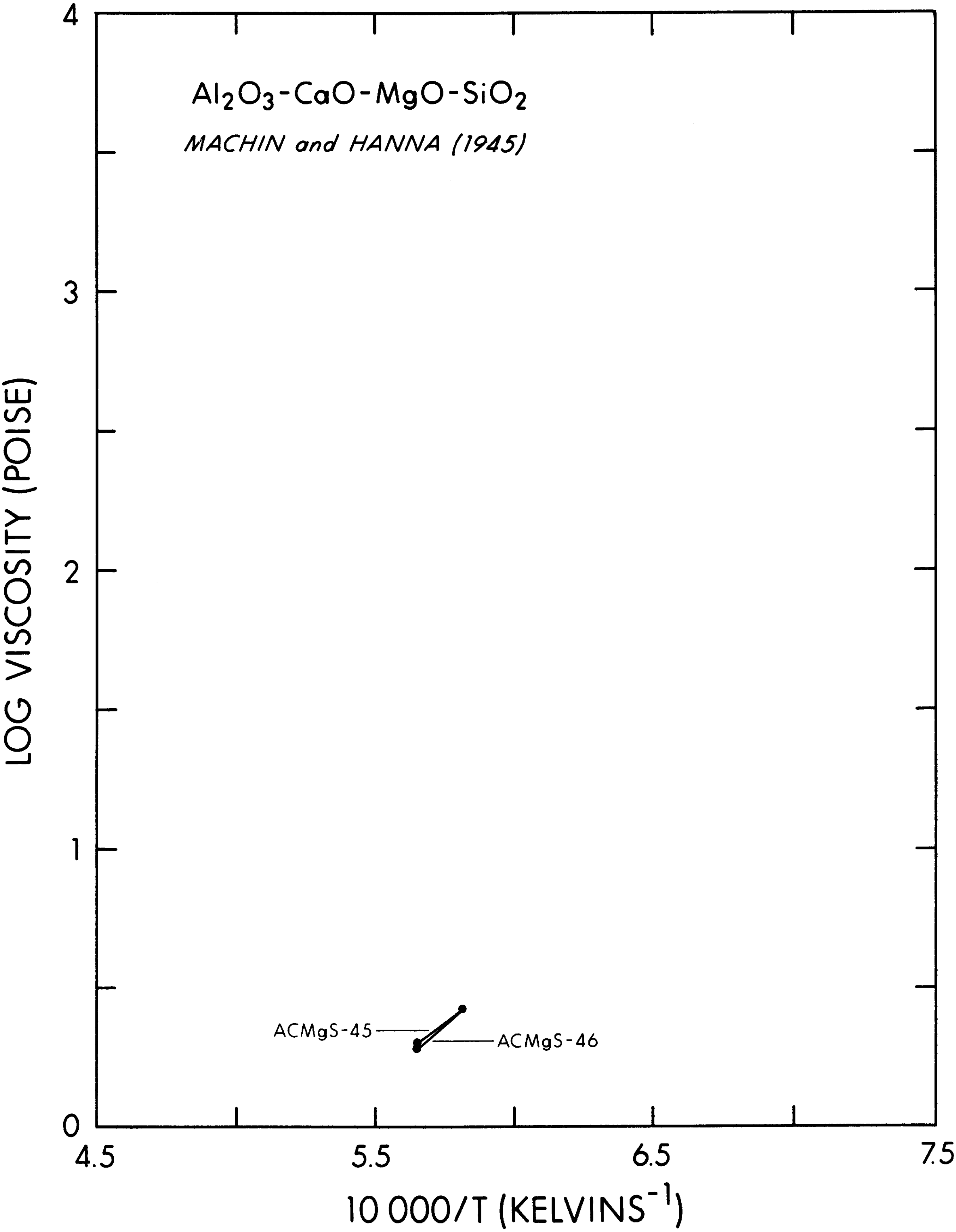
Al_2O_3-CaO-MgO-SiO_2
MACHIN and HANNA (1945)
ACMgS-39
ACMgS-40
ACMgS-41
ACMgS-42
LOG VISCOSITY (POISE)
4
3
2
1
0
1200
1300
1400
1500
TEMPERATURE (°C)



Al_2O_3-CaO-MgO-SiO_2
MACHIN and HANNA (1945)
ACMgS-39
ACMgS-40
ACMgS-41
ACMgS-42
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
4.5
5.5
6.5
7.5



Al2O3-CaO-MgO-SiO2
MACHIN and HANNA (1945)
ACMgS-45
ACMgS-46
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500



Al_2O_3-CaO-MgO-SiO_2
MACHIN and HANNA (1945)
ACMgS-45
ACMgS-46
LOG VISCOSITY (POISE)
4
3
2
1
0
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})

SYSTEM
AL2O3(15.92),CAO(5.79),
MGO(8.05),SIO2(70.24) (X)
AL2O3(25.0),CAO(5.0),
MGO(8.05),SIO2(70.24) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-48

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	6.937	3.013	1030.

SYSTEM
AL2O3(12.41),CAO(11.28),
MGO(7.85),SIO2(68.46) (X)
AL2O3(20.0),CAO(10.0),
MGO(5.0),SIO2(65.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-49

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	10.319	4.481	30300.
1300.00	6.357	9.384	4.076	11900.
1350.00	6.161	8.547	3.712	5150.
1400.00	5.977	7.787	3.382	2410.
1450.00	5.804	7.090	3.079	1200.
1500.00	5.640	6.509	2.827	671.

SYSTEM
AL2O3(12.15),CAO(5.52),
MGO(15.36),SIO2(66.97) (X)

AL2O3(20.0),CAO(5.0),
MGO(10.0),SIO2(65.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-50

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	9.770	4.243	17500.
1300.00	6.357	8.841	3.839	6910.
1350.00	6.161	8.010	3.479	3010.
1400.00	5.977	7.265	3.155	1430.
1450.00	5.804	6.603	2.867	737.
1500.00	5.640	6.038	2.622	419.

SYSTEM
AL2O3(15.86),CAO(11.53),
MGO(8.02),SIO2(64.59) (X)
AL2O3(25.0),CAO(10.0),
MGO(5.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-51

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	9.798	4.255	18000.
1300.00	6.357	8.883	3.858	7210.
1350.00	6.161	7.983	3.467	2930.
1400.00	5.977	7.208	3.130	1350.
1450.00	5.804	6.503	2.824	667.
1500.00	5.640	5.855	2.543	349.

SYSTEM
AL2O3(9.08),CAO(16.5),
MGO(7.65),SIO2(66.76) (X)
AL2O3(15.0),CAO(15.0),
MGO(5.0),SIO2(65.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-52

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	9.051	3.931	8530.
1300.00	6.357	8.126	3.529	3380.
1350.00	6.161	7.371	3.201	1590.
1400.00	5.977	6.711	2.914	821.
1450.00	5.804	6.096	2.647	444.
1500.00	5.640	5.549	2.410	257.

SYSTEM
AL2O3(15.51),CAO(5.64),
MGO(15.69),SIO2(63.16) (X)
AL2O3(25.0),CAO(5.0),
MGO(10.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-53

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	9.393	4.079	12000.
1300.00	6.357	8.309	3.609	4060.
1350.00	6.161	7.450	3.236	1720.
1400.00	5.977	6.703	2.911	815.
1450.00	5.804	6.023	2.616	413.
1500.00	5.640	5.429	2.358	228.

SYSTEM
AL2O3(8.89),CAO(10.77),
MGO(14.99),SIO2(65.35) (X)
AL2O3(15.0),CAO(10.0),
MGO(10.0),SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-54

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	8.828	3.834	6820.
1300.00	6.357	7.979	3.465	2920.
1350.00	6.161	7.258	3.152	1420.
1400.00	5.977	6.579	2.857	720.
1450.00	5.804	5.969	2.592	391.
1500.00	5.640	5.412	2.350	224.

SYSTEM
AL2O3(12.37),CAO(16.86),
MGO(7.82),SIO2(62.95) (X)
AL2O3(20.0),CAO(15.0),
MGO(5.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-55

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	8.747	3.799	6290.
1300.00	6.357	7.890	3.427	2670.
1350.00	6.161	7.082	3.076	1190.
1400.00	5.977	6.392	2.776	597.
1450.00	5.804	5.778	2.509	323.
1500.00	5.640	5.209	2.262	183.

SYSTEM
AL2O3(8.70),CAO(5.28),
MGO(22.01),SIO2(64.01) (X)
AL2O3(15.0),CAO(5.0),
MGO(15.0),SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-56

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	7.804	3.389	2450.
1350.00	6.161	7.021	3.049	1120.
1400.00	5.977	6.323	2.746	557.
1450.00	5.804	5.727	2.487	307.
1500.00	5.640	5.198	2.258	181.

SYSTEM
AL2O3(12.10),CAO(11.00),
MGO(15.30),SIO2(61.60) (X)
AL2O3(20.0),CAO(10.0),
MGO(10.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-57

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	8.394	3.645	4420.
1300.00	6.357	7.539	3.274	1880.
1350.00	6.161	6.752	2.932	856.
1400.00	5.977	6.087	2.643	440.
1450.00	5.804	5.472	2.377	238.
1500.00	5.640	4.920	2.137	137.

SYSTEM
AL2O3(5.91),CAO(21.47),
MGO(7.47),SIO2(65.15) (X)
AL2O3(10.0),CAO(20.0),
MGO(5.0),SIO2(65.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-58

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	7.816	3.394	2480.
1300.00	6.357	7.021	3.049	1120.
1350.00	6.161	6.360	2.762	578.
1400.00	5.977	5.762	2.502	318.
1450.00	5.804	5.263	2.286	193.
1500.00	5.640	4.736	2.057	114.

SYSTEM
AL2O3(5.78),CAO(15.78),
MGO(14.63),SIO2(63.81) (X)
AL2O3(10.0),CAO(15.0),
MGO(10.0),SIO2(65.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-59

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	6.918	3.004	1010.
1350.00	6.161	6.225	2.703	505.
1400.00	5.977	5.595	2.430	269.
1450.00	5.804	5.056	2.196	157.
1500.00	5.640	4.577	1.988	97.2

SYSTEM
AL2O3(5.67),CAO(10.30),
MGO(21.50),SIO2(62.52) (X)
AL2O3(10.0),CAO(10.0),
MGO(15.0),SIO2(65.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-60

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	5.464	2.373	236.
1450.00	5.804	4.913	2.134	136.
1500.00	5.640	4.459	1.937	86.4

SYSTEM
AL2O3(11.85),CAO(5.38),
MGO(22.47),SIO2(60.30) (X)
AL2O3(20.0),CAO(5.0),
MGO(15.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-61

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	7.754	3.367	2330.
1300.00	6.357	6.937	3.013	1030.
1350.00	6.161	6.196	2.691	491.
1400.00	5.977	5.553	2.412	258.
1450.00	5.804	4.942	2.146	140.
1500.00	5.640	4.432	1.925	84.1

SYSTEM
AL2O3(9.0),CAO(22.0),
MGO(8.0),SIO2(61.0) (X)
AL2O3(15.0),CAO(20.0),
MGO(5.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-62

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	7.507	3.260	1820.
1300.00	6.357	6.723	2.920	831.
1350.00	6.161	6.033	2.620	417.
1400.00	5.977	5.416	2.352	225.
1450.00	5.804	4.883	2.121	132.
1500.00	5.640	4.417	1.919	82.9

SYSTEM
AL2O3(9.0),CAO(16.0),
MGO(15.0),SIO2(60.0) (X)
AL2O3(15.0),CAO(15.0),
MGO(10.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-63

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	7.346	3.190	1550.
1300.00	6.357	6.541	2.841	693.
1350.00	6.161	5.864	2.547	352.
1400.00	5.977	5.268	2.288	194.
1450.00	5.804	4.718	2.049	112.
1500.00	5.640	4.236	1.839	69.1

SYSTEM
AL2O3(9.0),CAO(10.0),
MGO(22.0),SIO2(59.0) (X)
AL2O3(15.0),CAO(10.0),
MGO(15.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-64

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	7.073	3.072	1180.
1300.00	6.357	6.273	2.724	530.
1350.00	6.161	5.609	2.436	273.
1400.00	5.977	5.004	2.173	149.
1450.00	5.804	4.468	1.941	87.2
1500.00	5.640	3.985	1.731	53.8

SYSTEM
AL2O3(2.88),CAO(26.21),
MGO(7.29),SIO2(63.62) (X)
AL2O3(5.0),CAO(25.0),
MGO(5.0),SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-65

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	4.191	1.820	66.1
1500.00	5.640	3.833	1.665	46.2

SYSTEM
AL2O3(8.0),CAO(5.0),
MGO(29.9),SIO2(58.0) (X)
AL2O3(15.0),CAO(5.0),
MGO(20.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-66

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	5.464	2.373	236.
1400.00	5.977	4.796	2.083	121.
1450.00	5.804	4.319	1.876	75.1
1500.00	5.640	3.809	1.654	45.1

SYSTEM
AL2O3(2.82),CAO(20.55),
MGO(14.29),SIO2(62.34) (X)
AL2O3(5.0),CAO(20.0),
MGO(10.0),SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-67

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	4.191	1.820	66.1
1500.00	5.640	3.684	1.600	39.8

SYSTEM
AL2O3(2.77),CAO(15.11),
MGO(21.01),SIO2(61.11) (X)
AL2O3(5.0),CAO(15.0),
MGO(15.0),SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-68

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	4.159	1.806	64.0
1500.00	5.640	3.603	1.565	36.7

SYSTEM
AL2O3(6.0),CAO(27.0),
MGO(7.0),SIO2(60.0) (X)
AL2O3(10.0),CAO(25.0),
MGO(5.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-69

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	6.428	2.792	619.
1300.00	6.357	5.694	2.473	297.
1350.00	6.161	5.063	2.199	158.
1400.00	5.977	4.526	1.966	92.4
1450.00	5.804	4.057	1.762	57.8
1500.00	5.640	3.600	1.563	36.6

SYSTEM
AL2O3(5.56),CAO(5.05),
MGO(28.11),SIO2(61.28) (X)
AL2O3(10.0),CAO(5.0),
MGO(20.0),SIO2(65.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-70

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	4.828	2.097	125.
1500.00	5.640	4.312	1.873	34.6

SYSTEM
AL2O3(6.0),CAO(21.0),
MGO(14.0),SIO2(59.0) (X)
AL2O3(10.0),CAO(20.0),
MGO(10.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-71

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	6.286	2.730	537.
1300.00	6.357	5.557	2.413	259.
1350.00	6.161	4.934	2.143	139.
1400.00	5.977	4.378	1.901	79.7
1450.00	5.804	3.920	1.702	50.4
1500.00	5.640	3.481	1.512	32.5

SYSTEM
AL2O3(6.0),CAO(15.0),
MGO(21.0),SIO2(58.0) (X)
AL2O3(10.0),CAO(15.0),
MGO(15.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-72

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	6.170	2.679	478.
1300.00	6.357	5.424	2.356	227.
1350.00	6.161	4.804	2.086	122.
1400.00	5.977	4.263	1.851	71.0
1450.00	5.804	3.754	1.630	42.7
1500.00	5.640	3.350	1.455	28.5

SYSTEM
AL2O3(6.0),CAO(10.0),
MGO(28.0),SIO2(56.0) (X)
AL2O3(10.0),CAO(10.0),
MGO(20.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-73

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	4.710	2.045	111.
1400.00	5.977	4.132	1.794	62.3
1450.00	5.804	3.645	1.583	38.3
1500.00	5.640	3.215	1.396	24.9

SYSTEM
AL2O3(5.0),CAO(5.0),
MGO(34.0),SIO2(55.0) (X)
AL2O3(10.0),CAO(5.0),
MGO(25.0),SIO2(60.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN AND YEE (1954)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-74

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	3.558	1.545	35.1
1500.00	5.640	3.118	1.354	22.6

SYSTEM
AL2O3(3.0),CAO(31.0),
MGO(7.0),SIO2(59.0) (X)
AL2O3(5.0),CAO(30.0),
MGO(5.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-75

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.481	2.380	240.
1300.00	6.357	4.787	2.079	120.
1350.00	6.161	4.206	1.827	67.1
1400.00	5.977	3.689	1.602	40.0
1450.00	5.804	3.246	1.410	25.7
1500.00	5.640	2.868	1.246	17.6

SYSTEM
AL2O3(3.0),CAO(26.0),
MGO(14.0),SIO2(57.0) (X)
AL2O3(5.0),CAO(25.0),
MGO(10.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-76

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.193	2.255	180.
1300.00	6.357	4.553	1.977	94.9
1350.00	6.161	3.991	1.733	54.1
1400.00	5.977	3.575	1.553	35.7
1450.00	5.804	3.266	1.418	26.2
1500.00	5.640	2.851	1.238	17.3

SYSTEM
AL2O3(3.0),CAO(20.0),
MGO(21.0),SIO2(56.0) (X)
AL2O3(5.0),CAO(20.0),
MGO(15.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-77

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	4.654	2.021	105.
1350.00	6.161	4.059	1.763	57.9
1400.00	5.977	3.589	1.559	36.2
1450.00	5.804	3.148	1.367	23.3
1500.00	5.640	2.754	1.196	15.7

SYSTEM
AL2O3(3.0),CAO(15.0),
MGO(27.0),SIO2(55.0) (X)
AL2O3(5.0),CAO(15.0),
MGO(20.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-78

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	3.951	1.716	52.0
1400.00	5.977	3.456	1.501	31.7
1450.00	5.804	3.025	1.314	20.6
1500.00	5.640	2.632	1.143	13.9

SYSTEM
AL2O3(3.0),CAO(9.0),
MGO(34.0),SIO2(54.0) (X)
AL2O3(5.0),CAO(10.0),
MGO(25.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-79

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.976	1.292	19.6
1500.00	5.640	2.610	1.134	13.6

SYSTEM
AL2O3(3.0),CAO(5.0),
MGO(39.0),SIO2(52.0) (X)
AL2O3(5.0),CAO(5.0),
MGO(30.0),SIO2(60.0) (%)

AUTHOR
MACHIN AND YEE (1954)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

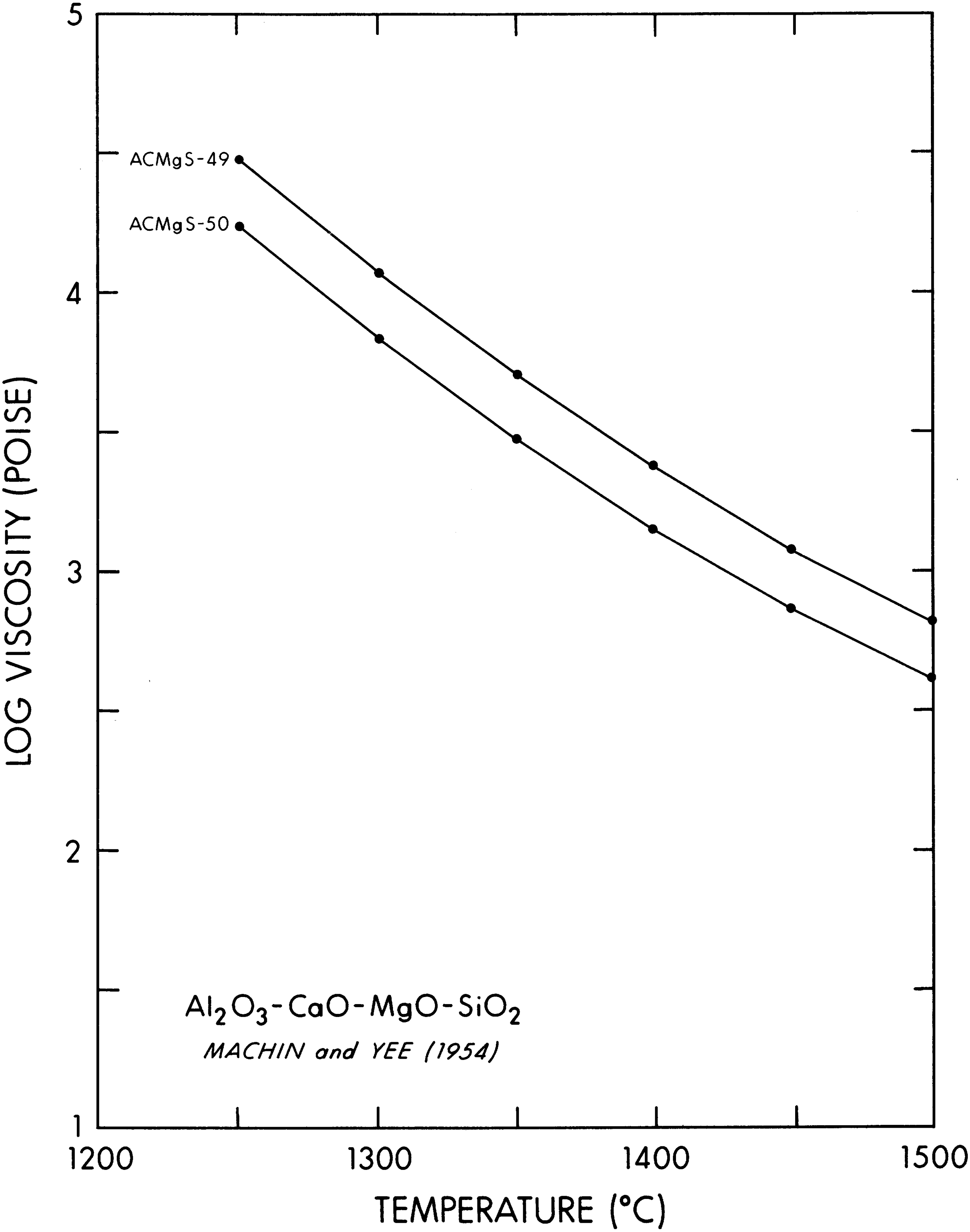
DERIVED FROM
TABLE I

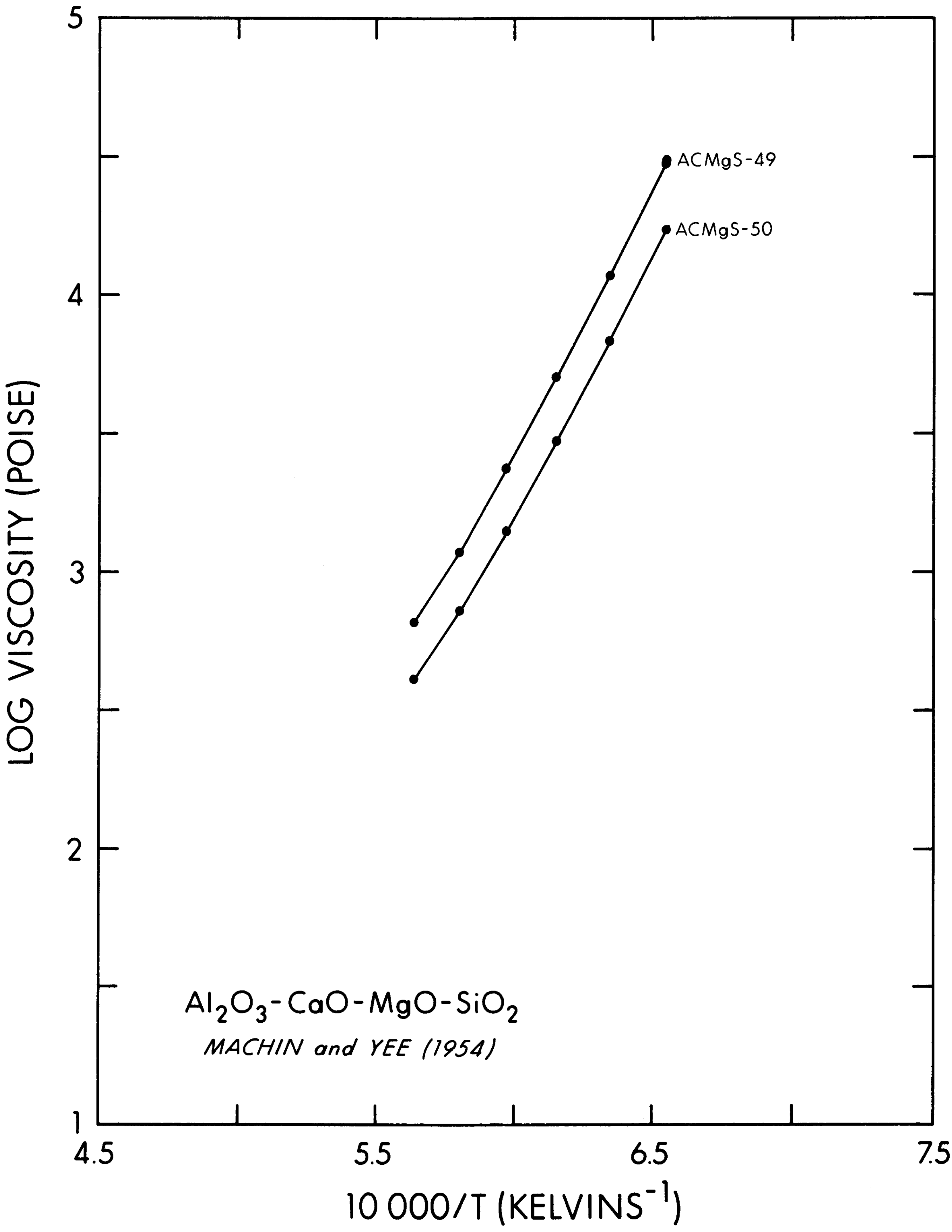
N (POISES)
T (DEGREES C)

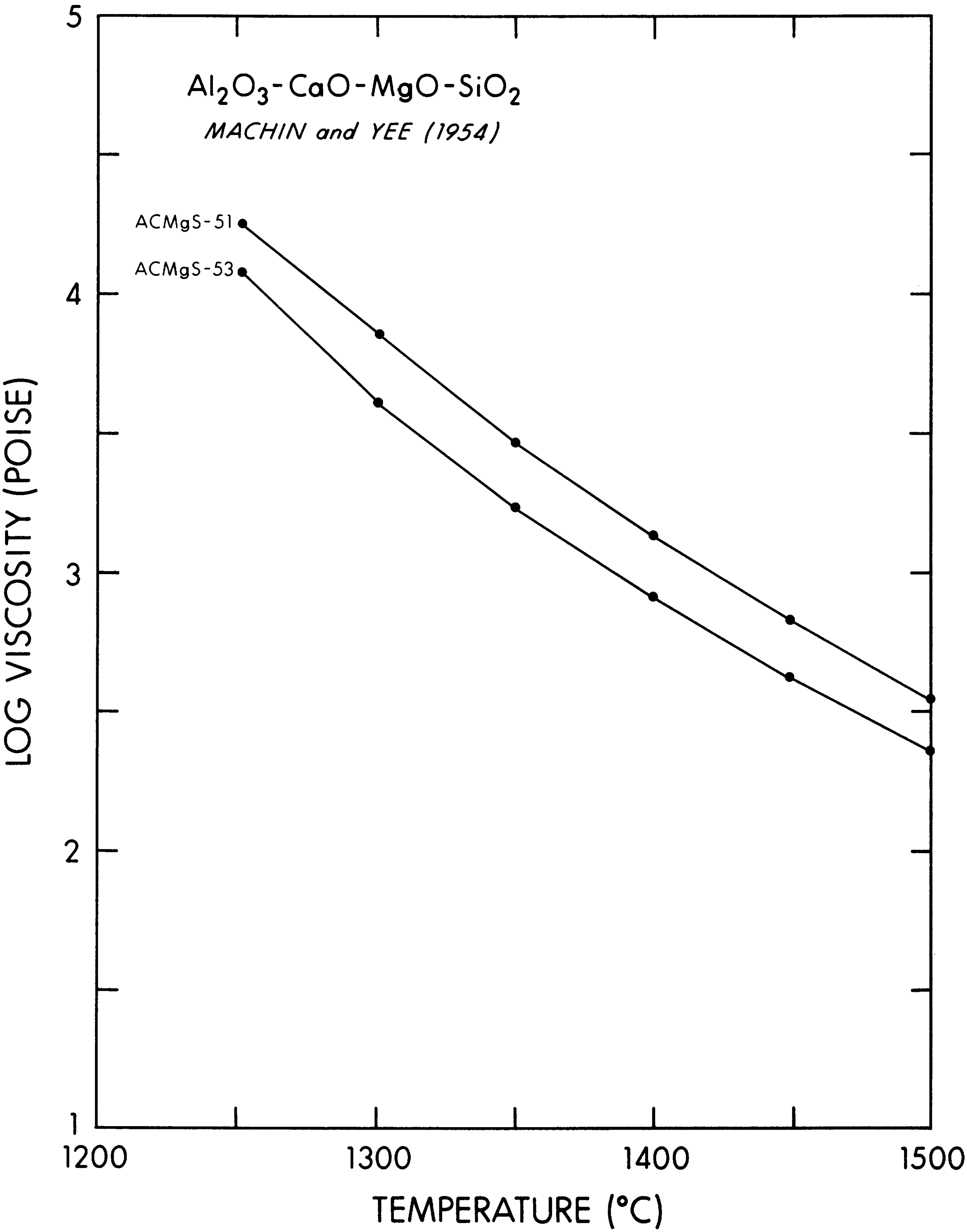
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-80

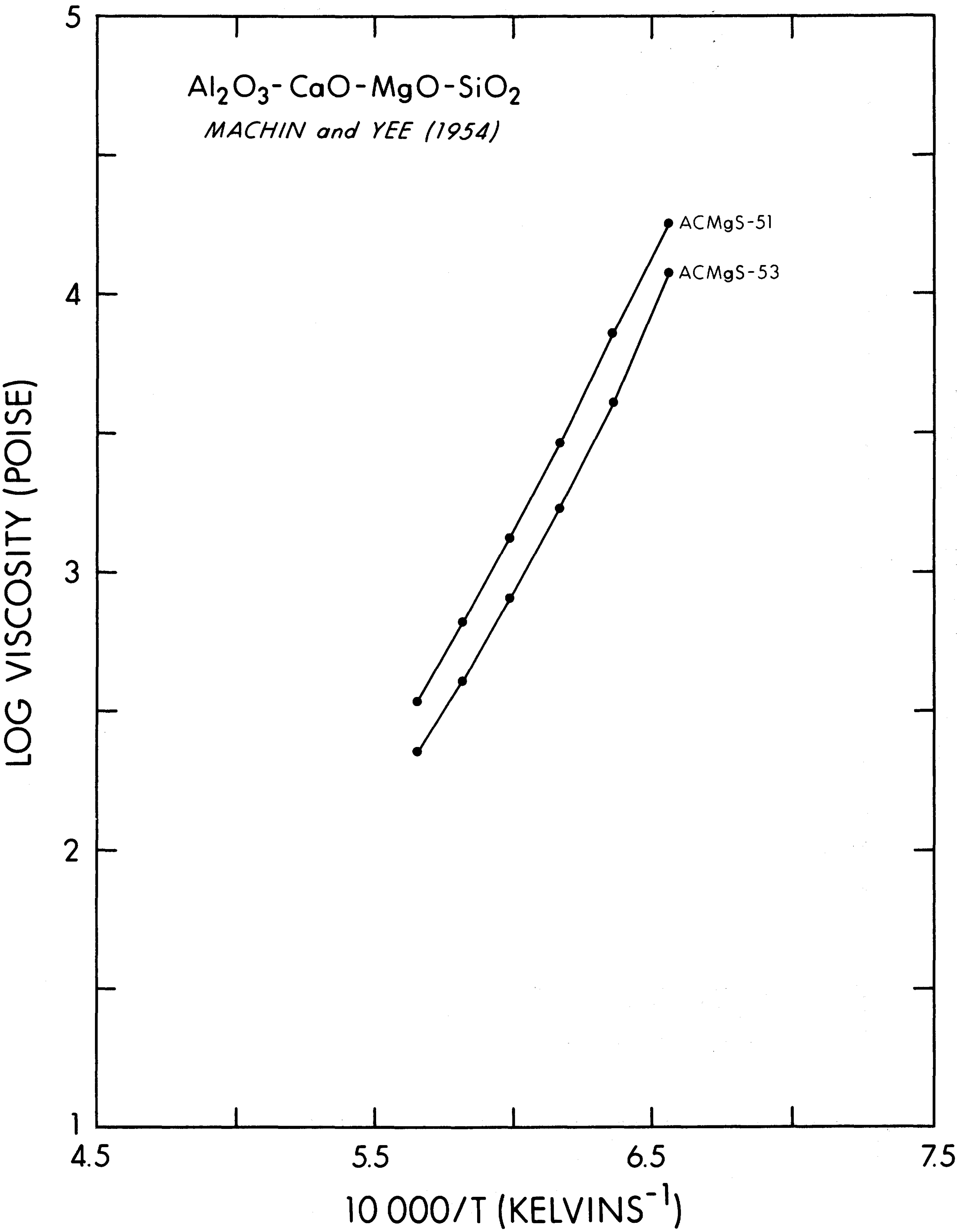
T	Z	LN(N)	LOG(N)	N
1500.00	5.640	2.451	1.064	11.6


5
4
3
2
1
ACMgS-49
ACMgS-50
Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)
LOG VISCOSITY (POISE)
1200
1300
1400
1500
TEMPERATURE (°C)

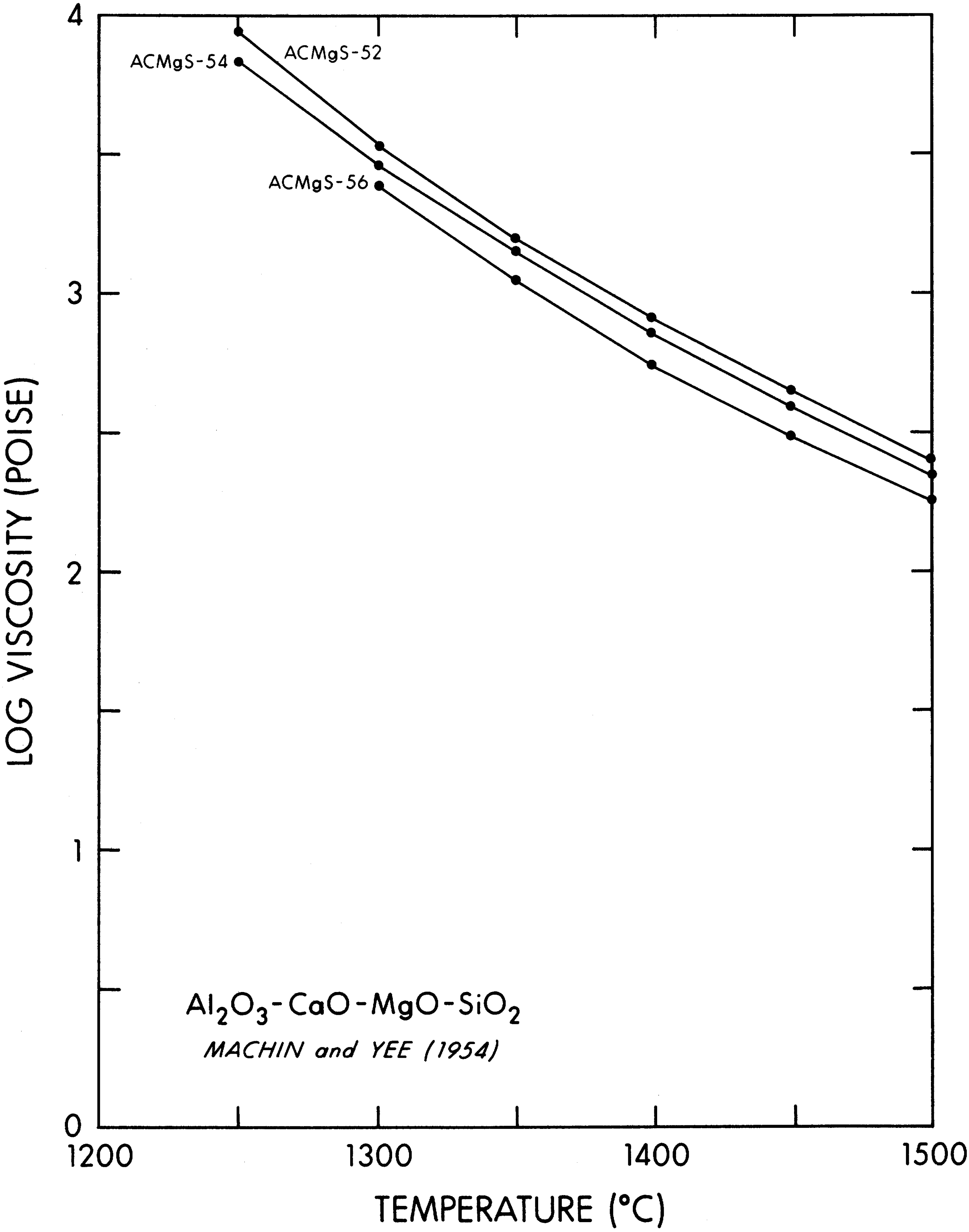

5
4
3
2
1
4.5
5.5
6.5
7.5
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
ACMgS-49
ACMgS-50
Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)

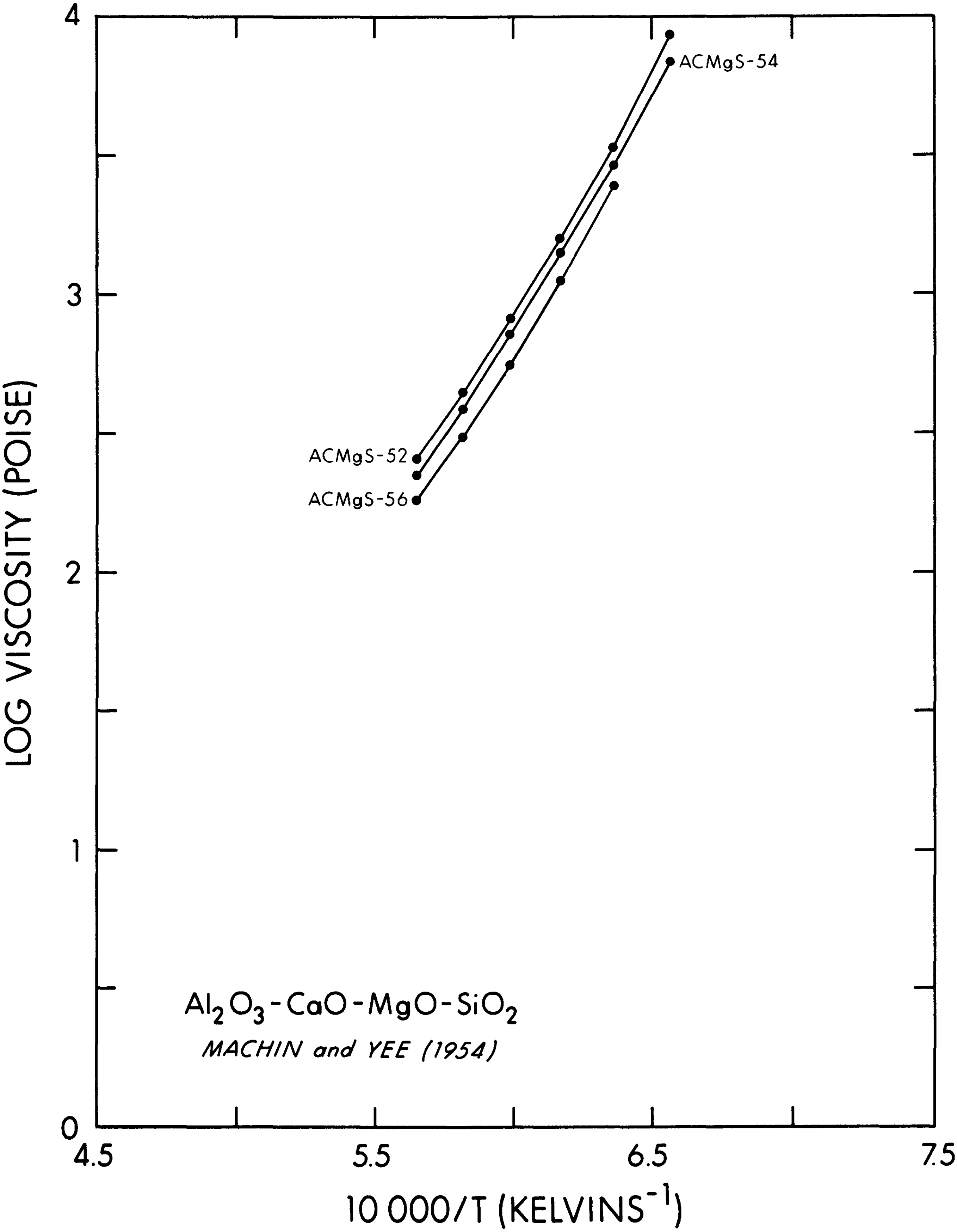


Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)
ACMgS-51
ACMgS-53
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
5
4
3
2
1
1200
1300
1400
1500

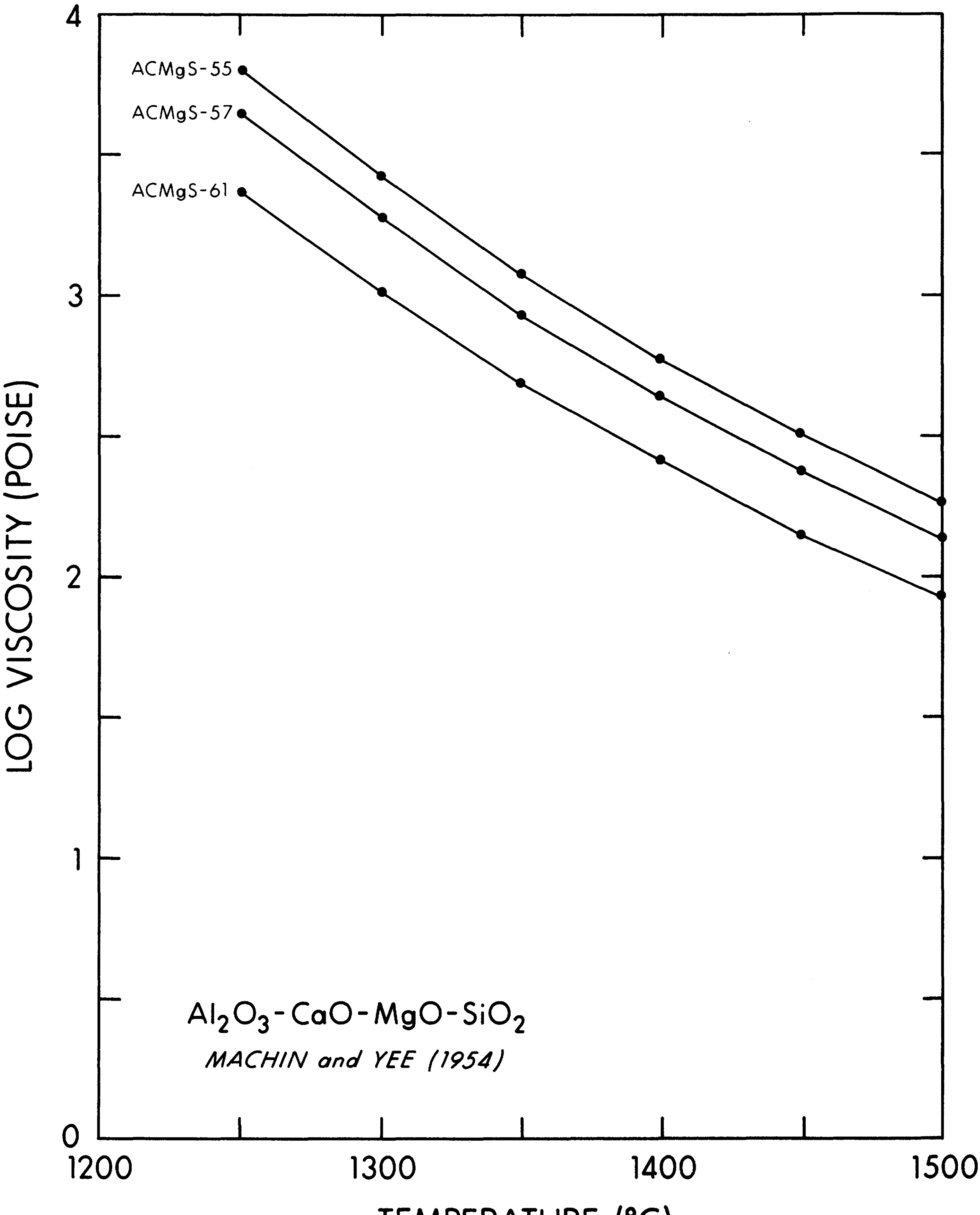


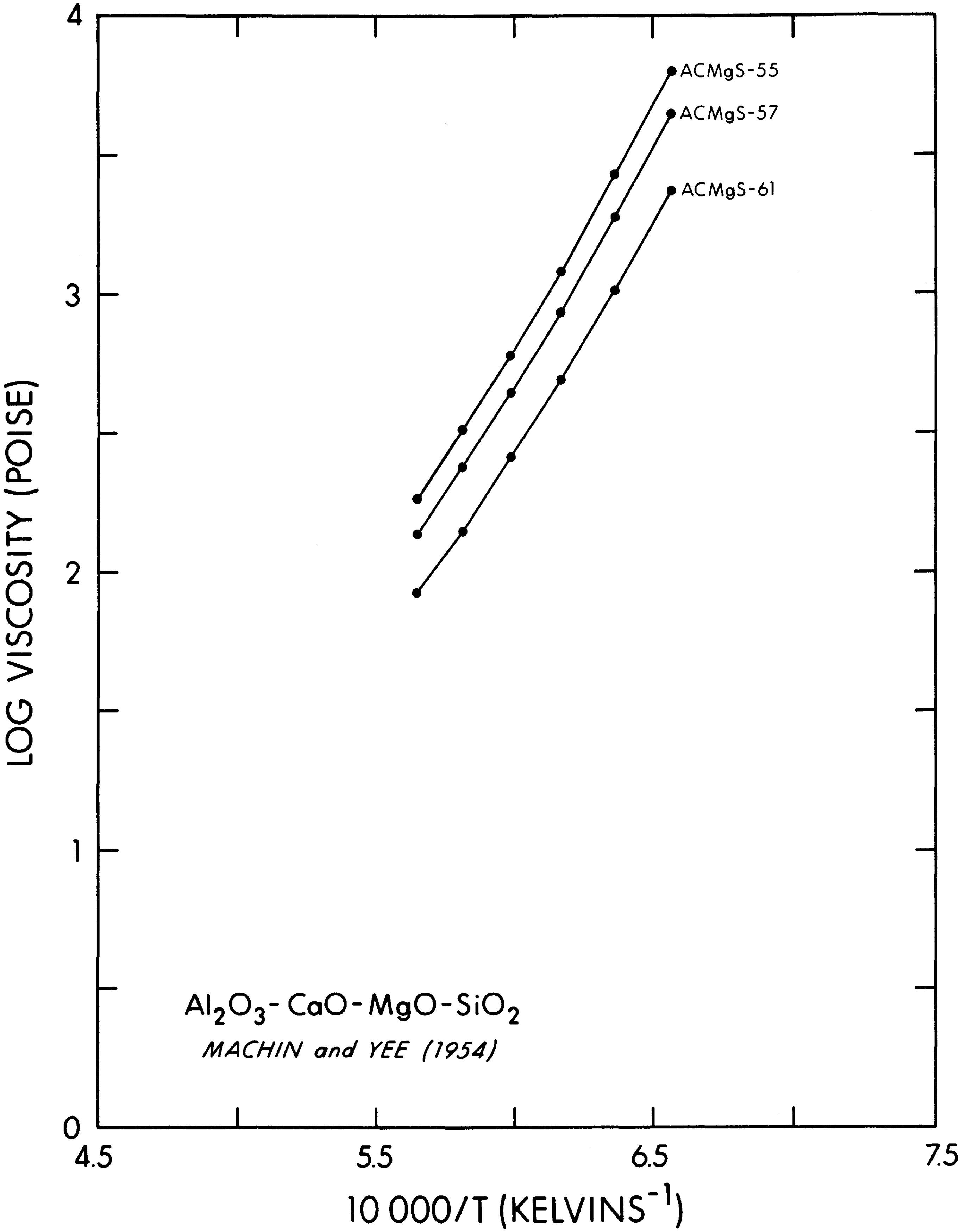
Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)
ACMgS-51
ACMgS-53
LOG VISCOSITY (POISE)
5
4
3
2
1
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})


4
3
2
1
0
1200
1300
1400
1500
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
ACMgS-54
ACMgS-52
ACMgS-56
Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)

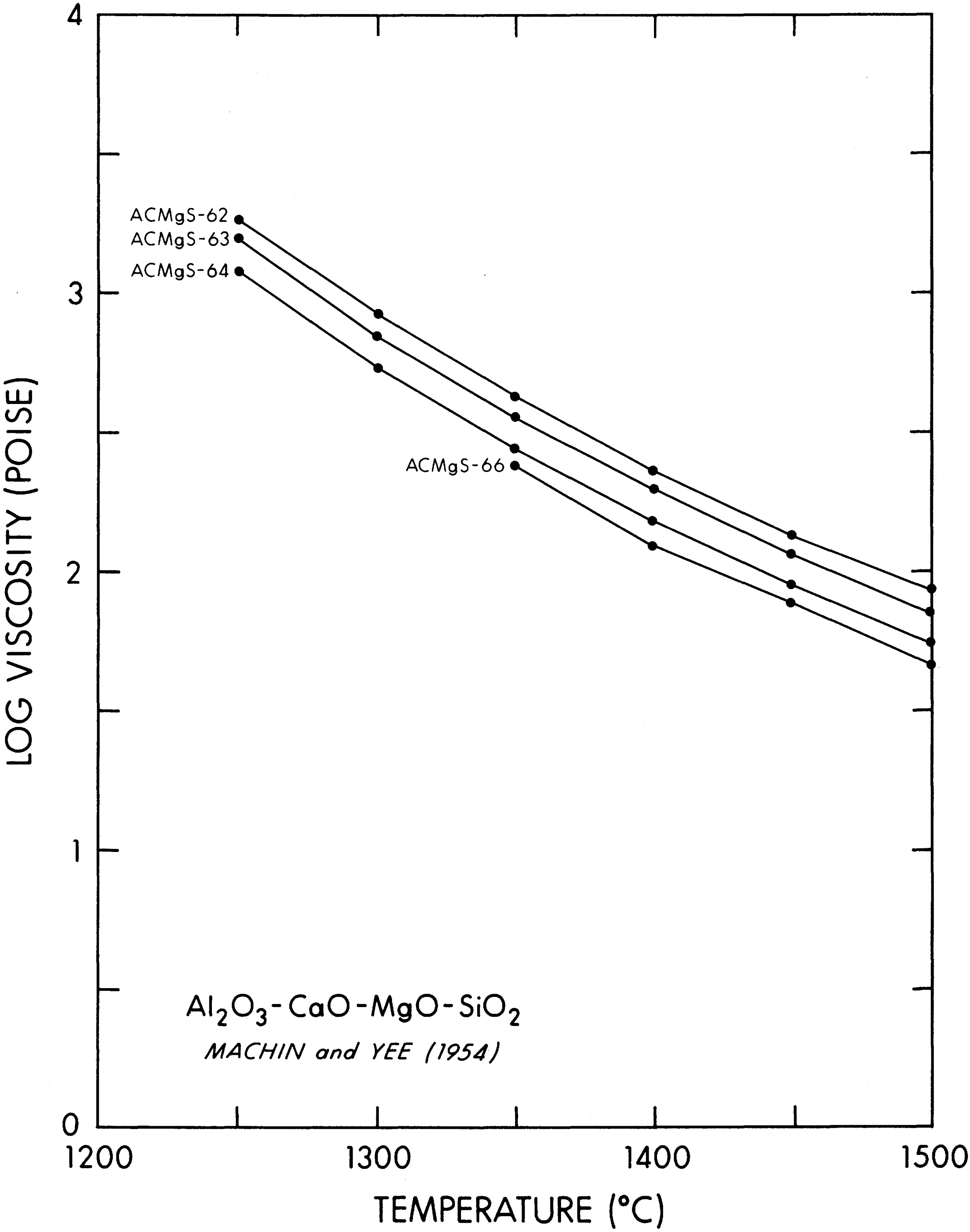


4
3
2
1
0
LOG VISCOSITY (POISE)
ACMgS-54
ACMgS-52
ACMgS-56
Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)
4.5
5.5
6.5
7.5
10 000/T ($KELVINS^{-1}$)

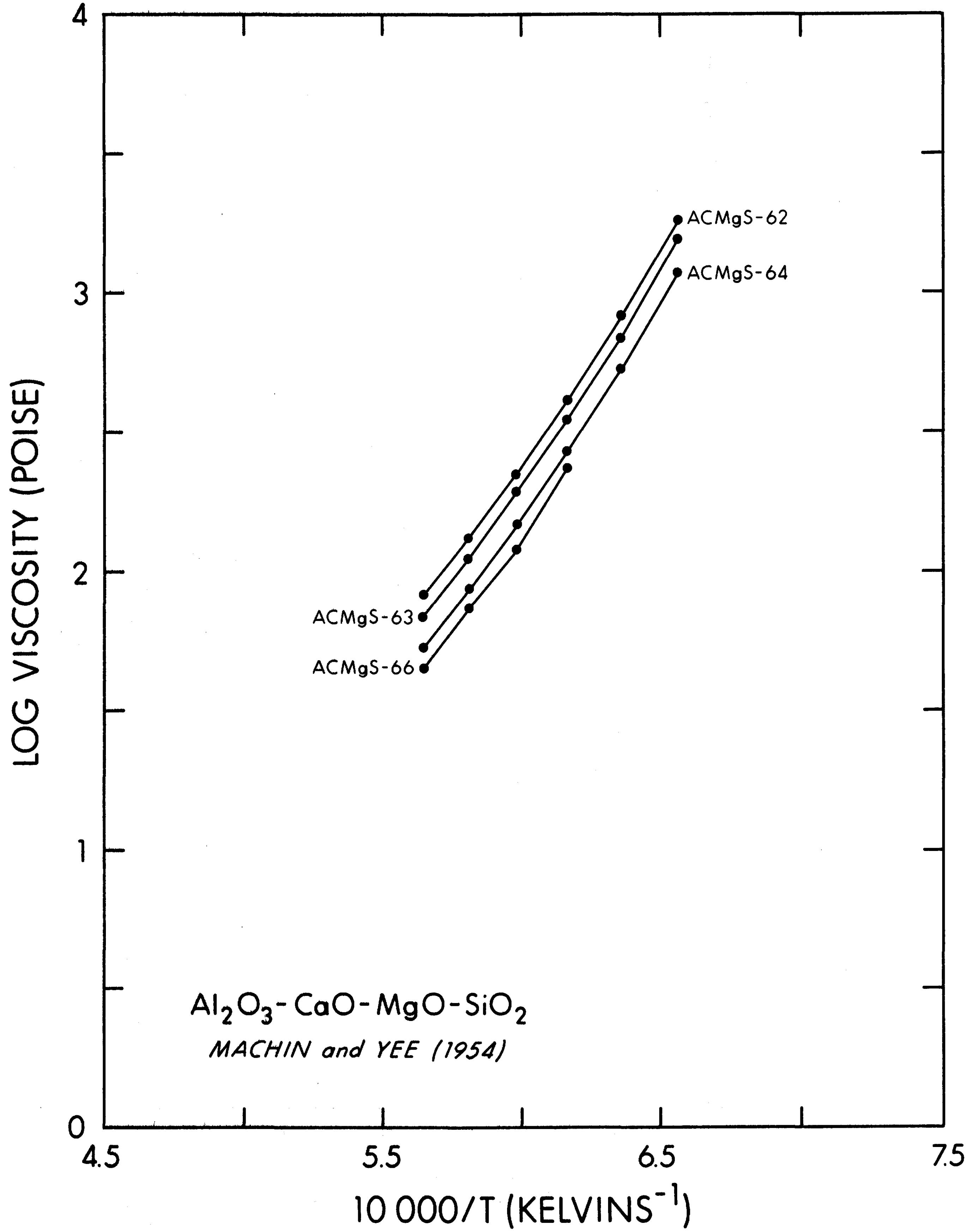

4
3
2
1
0
ACMgS-55
ACMgS-57
ACMgS-61
LOG VISCOSITY (POISE)
Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)
1200
1300
1400
1500
TEMPERATURE (°C)



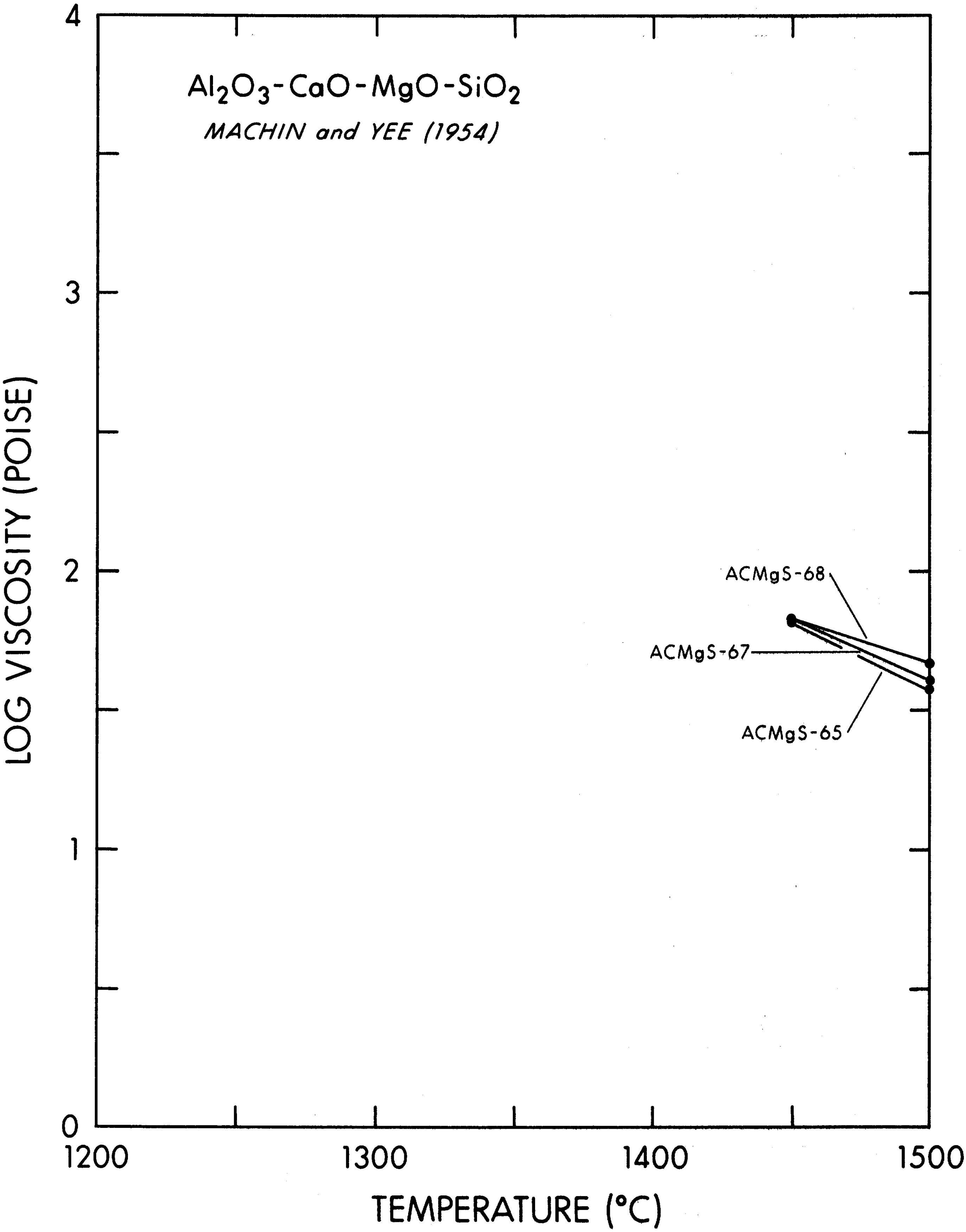
4
3
2
1
0
4.5
5.5
6.5
7.5
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
ACMgS-55
ACMgS-57
ACMgS-61
Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)



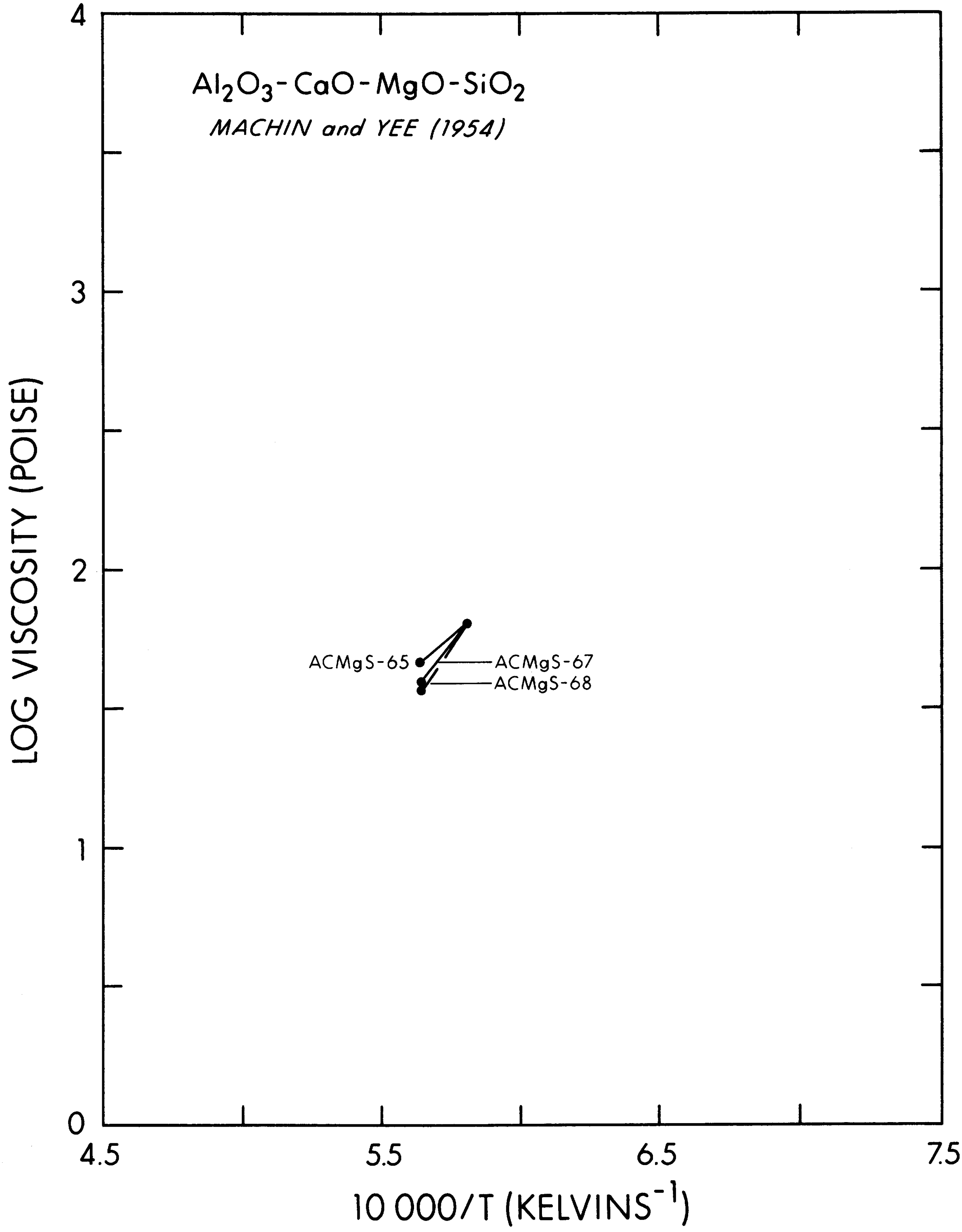
4
3
2
1
0
1200
1300
1400
1500
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
ACMgS-62
ACMgS-63
ACMgS-64
ACMgS-66
Al2O3-CaO-MgO-SiO2
MACHIN and YEE (1954)

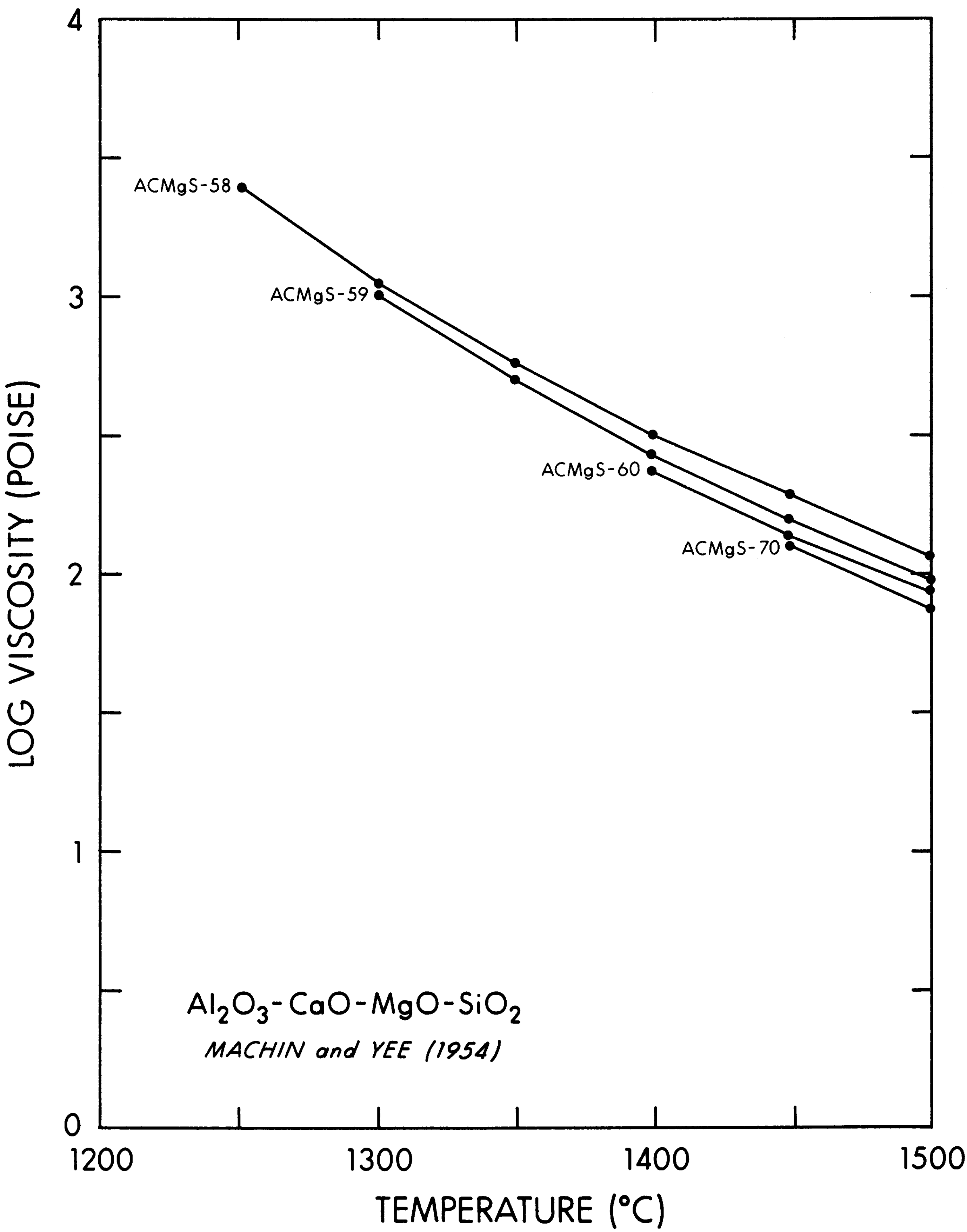


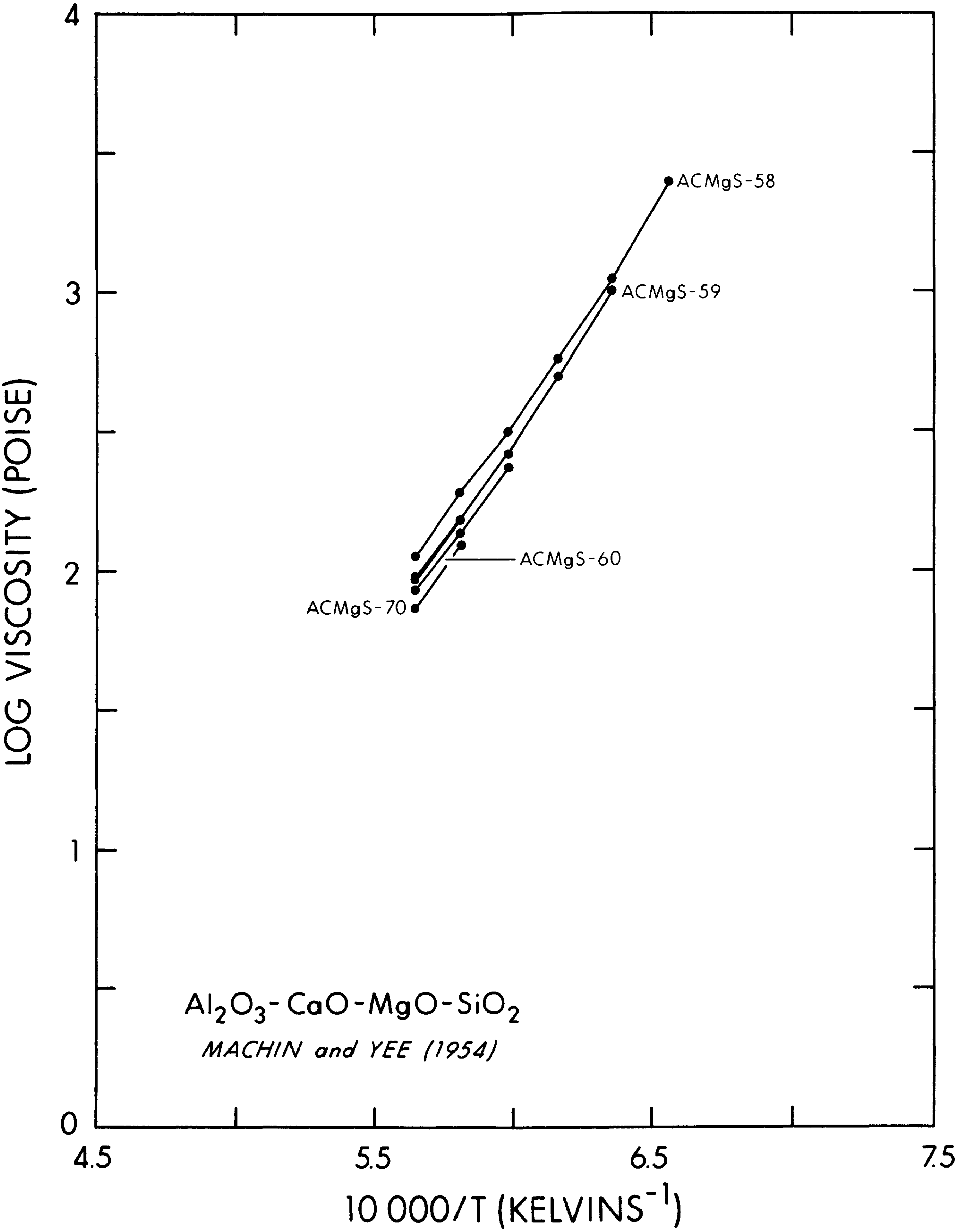
4
3
2
1
0
LOG VISCOSITY (POISE)
ACMgS-62
ACMgS-64
ACMgS-63
ACMgS-66
Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})

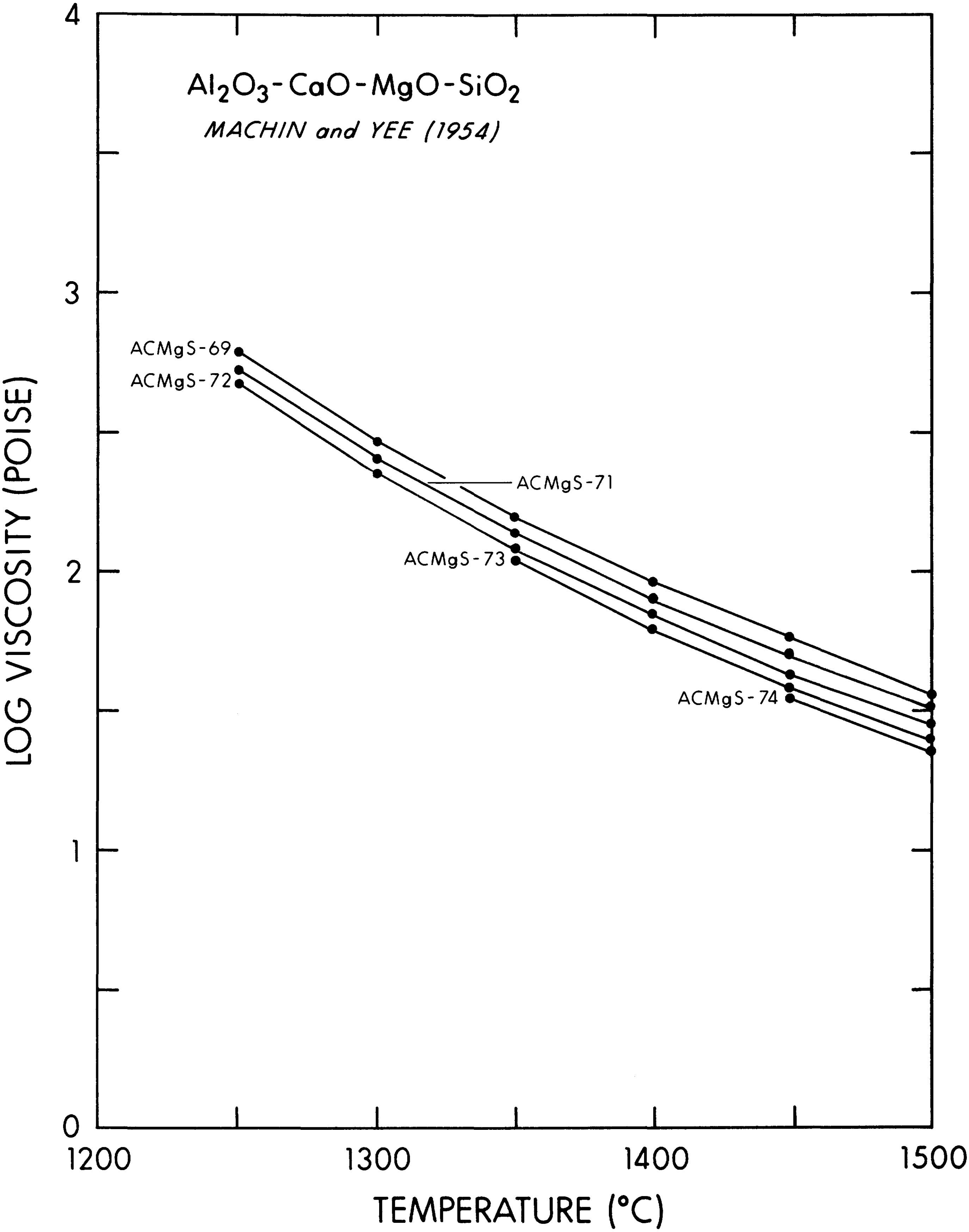


Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)
LOG VISCOSITY (POISE)
4
3
2
1
0
ACMgS-68
ACMgS-67
ACMgS-65
1200
1300
1400
1500
TEMPERATURE (°C)

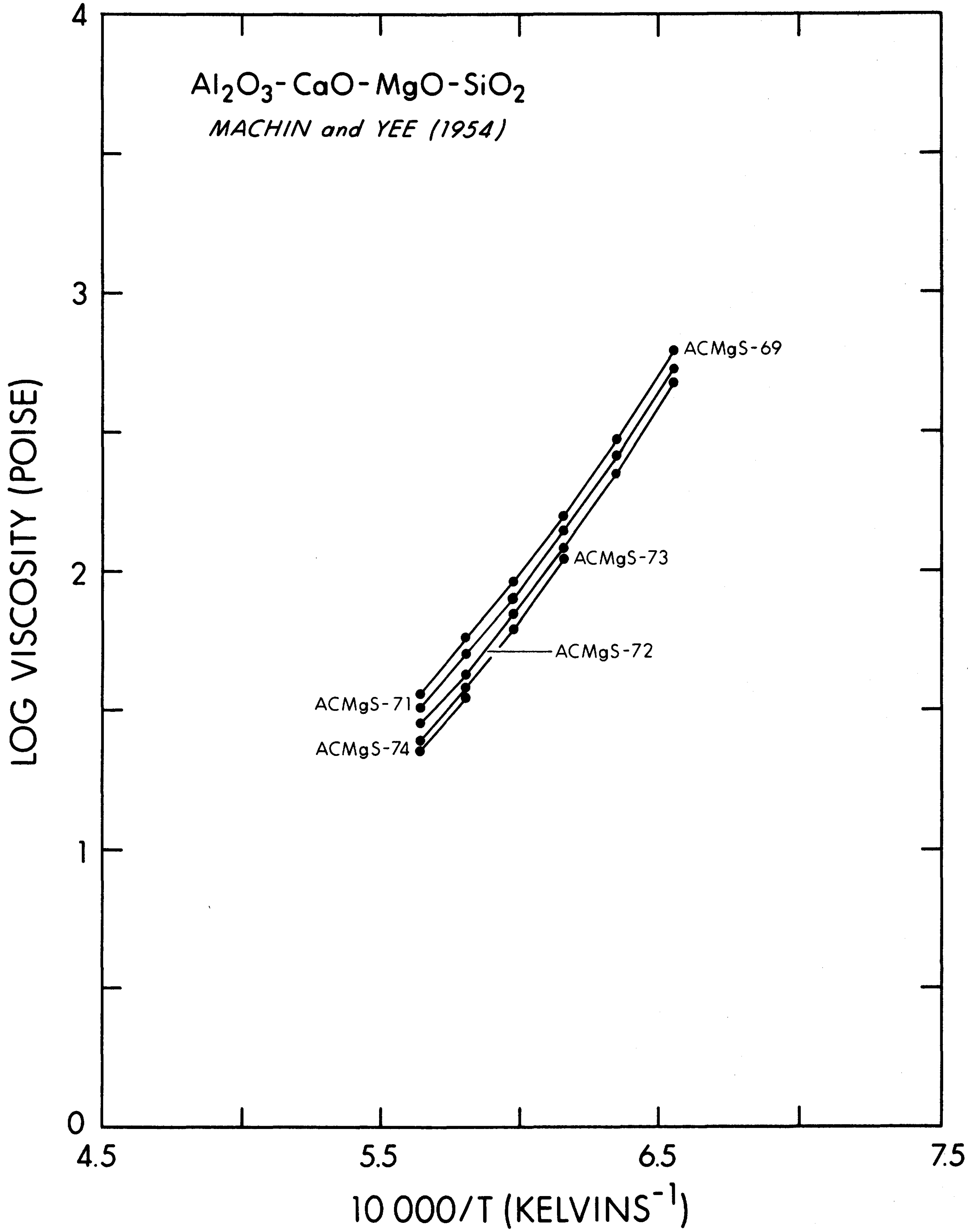

4
3
2
1
0
LOG VISCOSITY (POISE)
Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)
ACMgS-65
ACMgS-67
ACMgS-68
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})

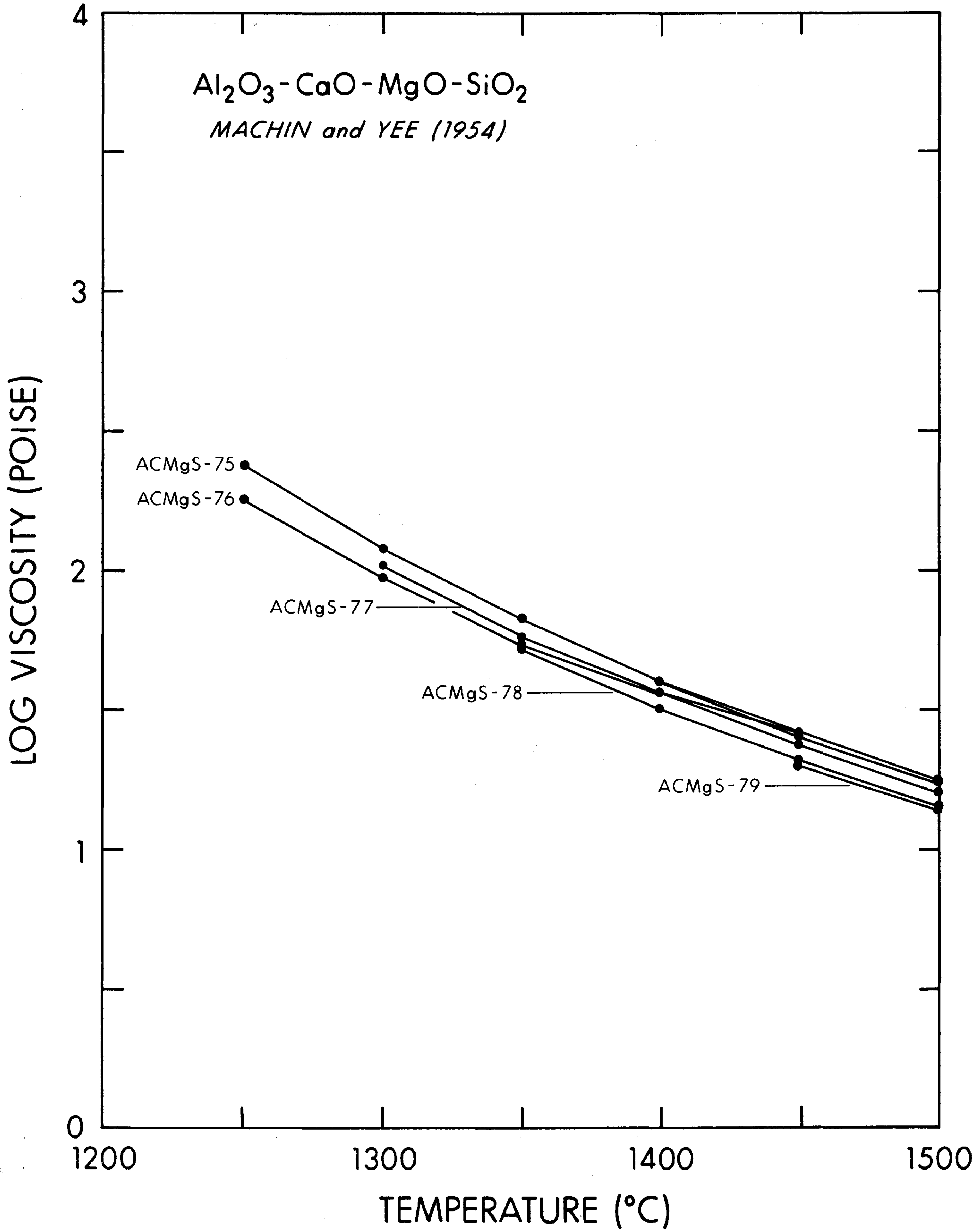

4
3
2
1
0
1200
1300
1400
1500
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
ACMgS-58
ACMgS-59
ACMgS-60
ACMgS-70
Al2O3-CaO-MgO-SiO2
MACHIN and YEE (1954)

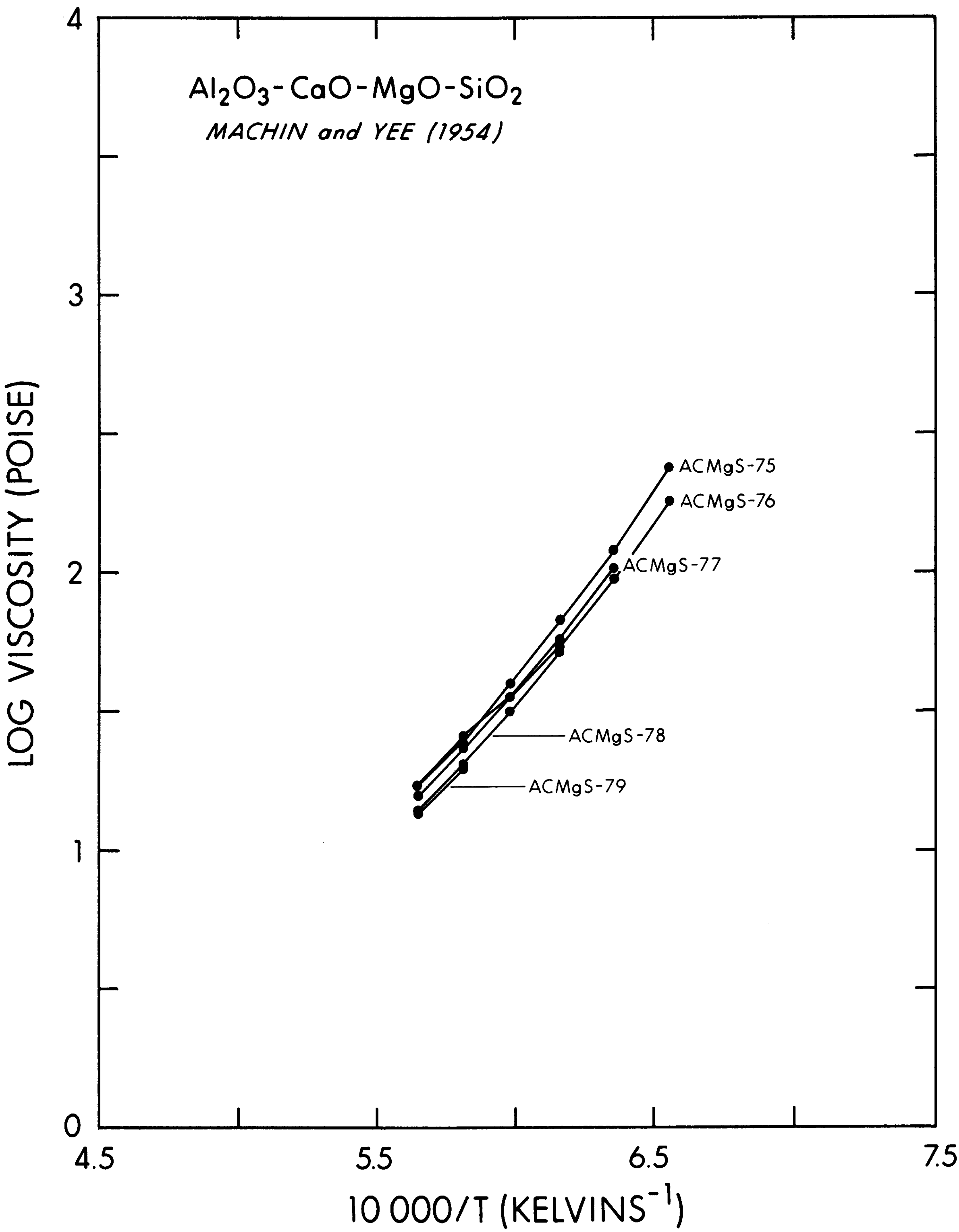

4
3
2
1
0
LOG VISCOSITY (POISE)
ACMgS-58
ACMgS-59
ACMgS-60
ACMgS-70
Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})



Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)
ACMgS-69
ACMgS-72
ACMgS-71
ACMgS-73
ACMgS-74
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500


Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)
ACMgS-69
ACMgS-73
ACMgS-72
ACMgS-71
ACMgS-74
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5


Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)
ACMgS-75
ACMgS-76
ACMgS-77
ACMgS-78
ACMgS-79
LOG VISCOSITY (POISE)
4
3
2
1
0
1200
1300
1400
1500
TEMPERATURE (°C)


Al_2O_3-CaO-MgO-SiO_2
MACHIN and YEE (1954)
ACMgS-75
ACMgS-76
ACMgS-77
ACMgS-78
ACMgS-79
LOG VISCOSITY (POISE)
0
1
2
3
4
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})

SYSTEM
AL2O3(5.67),MGO(14.33),
CAO(46.35),SIO2(33.65) (X)
AL2O3(10.0),MGO(10.0),
CAO(45.0),SIO2(35.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

AMgCS-81

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	0.833	0.362	2.3

SYSTEM
AL2O3(5.55),MGO(21.07),
CAO(40.39),SIO2(32.99) (X)
AL2O3(10.0),MGO(15.0),
CAO(40.0),SIO2(35.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

AMgCS-82

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	0.742	0.322	2.1

SYSTEM
AL2O3(8.10),MGO(20.50),
CAO(39.30),SIO2(32.10) (X)
AL2O3(15.0),MGO(15.0),
CAO(40.0),SIO2(35.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

AMgCS-83

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.946	0.845	7.0
1450.00	5.804	1.526	0.663	4.6
1500.00	5.640	1.099	0.477	3.0

SYSTEM
AL2O3(8.70),MGO(14.67),
CAO(42.18),SIO2(34.45) (X)
AL2O3(15.0),MGO(10.0),
CAO(40.0),SIO2(35.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

AMgCS-84

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.792	0.778	6.0
1450.00	5.804	1.361	0.591	3.9
1500.00	5.640	0.993	0.431	2.7

SYSTEM
AL2O3(8.52),MGO(21.56),
CAO(36.16),SIO2(33.76) (X)
AL2O3(15.0),MGO(15.0),
CAO(35.0), SIO2(35.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-85

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	2.116	0.919	8.3
1400.00	5.977	1.668	0.724	5.3
1450.00	5.804	1.281	0.556	3.6
1500.00	5.640	0.956	0.415	2.6

SYSTEM
AL2O3(12.14),MGO(7.67),
CAO(44.14),SIO2(36.05) (X)
AL2O3(20.0),MGO(5.0),
CAO(40.0),SIO2(35.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-86

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.434	1.057	11.4
1450.00	5.804	1.974	0.857	7.2
1500.00	5.640	1.569	0.681	4.8

SYSTEM
AL2O3(11.88),MGO(15.03),
CAO(37.80),SIO2(35.29) (X)
AL2O3(20.0),MGO(10.0),
CAO(35.0),SIO2(35.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-87

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	2.617	1.137	13.7
1400.00	5.977	2.104	0.914	8.2
1450.00	5.804	1.686	0.732	5.4
1500.00	5.640	1.411	0.613	4.1

SYSTEM
AL2O3(11.64),MGO(22.07),
CAO(31.73),SIO2(34.56) (X)
AL2O3(20.0),MGO(15.0),
CAO(30.0),SIO2(35.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-88

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.186	0.949	8.9
1450.00	5.804	1.740	0.756	5.7
1500.00	5.640	1.361	0.591	3.9

SYSTEM
AL2O3(15.56),MGO(7.87),
CAO(39.60),SIO2(36.97) (X)
AL2O3(25.0),MGO(5.0),
CAO(35.0),SIO2(35.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-89

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	3.239	1.407	25.5
1400.00	5.977	2.728	1.185	15.3
1450.00	5.804	2.241	0.973	9.4
1500.00	5.640	1.872	0.813	6.5

SYSTEM
AL2O3(15.22),MGO(15.40),
CAO(33.21),SIO2(36.17) (X)
AL2O3(25.0),MGO(10.0),
CAO(30.0),SIO2(35.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-90

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	3.684	1.600	39.8
1350.00	6.161	3.068	1.332	21.5
1400.00	5.977	2.565	1.114	13.0
1450.00	5.804	2.092	0.908	8.1
1500.00	5.640	1.723	0.748	5.6

SYSTEM
AL2O3(14.75),CAO(5.36),
MGO(29.84),SIO2(50.05) (X)
AL2O3(25.0),CAO(5.0),
MGO(20.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-91

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	5.308	2.305	202.
1350.00	6.161	4.625	2.009	102.
1400.00	5.977	4.006	1.740	54.9
1450.00	5.804	3.506	1.522	33.3
1500.00	5.640	3.045	1.322	21.0

SYSTEM
AL2O3(19.16),MGO(8.07),
CAO(34.84),SIO2(37.93) (X)
AL2O3(30.0),MGO(5.0),
CAO(30.0),SIO2(35.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE I
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-92

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	4.526	1.966	92.4
1350.00	6.161	3.875	1.683	48.2
1400.00	5.977	3.258	1.415	26.0
1450.00	5.804	2.809	1.220	16.6
1500.00	5.640	2.416	1.049	11.2

SYSTEM
AL2O3(18.73),MGO(15.80),
CAO(28.38),SIO2(37.09) (X)
AL2O3(30.0),MGO(10.0),
CAO(25.0),SIO2(35.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE I

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-93

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	3.447	1.497	31.4
1450.00	5.804	2.815	1.223	16.7
1500.00	5.640	2.219	0.964	9.2

SYSTEM
AL2O3(2.84),MGO(7.19),
CAO(46.53),SIO2(43.44) (X)
AL2O3(5.0),MGO(5.0),
CAO(45.0),SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-94

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.011	0.873	7.47
1450.00	5.804	1.591	0.691	4.91
1500.00	5.640	1.338	0.581	3.81

SYSTEM
AL2O3(2.79),MGO(14.19),
CAO(40.54),SIO2(42.57) (X)
AL2O3(5.0),MGO(10.0),
CAO(40.0),SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-95

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	2.332	1.013	10.3
1400.00	5.977	1.881	0.817	6.56
1450.00	5.804	1.433	0.622	4.19
1500.00	5.640	1.095	0.476	2.99

SYSTEM
AL2O3(2.73),MGO(20.74),
CAO(34.78),SIO2(41.75) (X)
AL2O3(5.0),MGO(15.0),
CAO(35.0),SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-96

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	2.201	0.956	9.03
1400.00	5.977	1.737	0.754	5.68
1450.00	5.804	1.381	0.600	3.98
1500.00	5.640	1.043	0.453	2.84

SYSTEM
AL2O3(2.68),CAO(29.25),
MGO(27.13),SIO2(40.95) (X)
AL2O3(5.0),CAO(30.0),
MGO(20.0),SIO2((45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-97

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.778	0.772	5.92
1450.00	5.804	1.335	0.580	3.80
1500.00	5.640	1.026	0.446	2.79

SYSTEM
AL2O3(2.63),MGO(33.27),
CAO(23.92),SIO2(40.18) (X)
AL2O3(5.0),MGO(25.0),
CAO(25.0),SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-98

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	0.900	0.391	2.46

SYSTEM
AL2O3(5.82),MGO(7.36),
CAO(42.35),SIO2(44.47) (X)
AL2O3(10.0),MGO(5.0),
CAO(40.0),SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-99

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.059	1.763	57.9
1300.00	6.357	3.388	1.471	29.6
1350.00	6.161	2.827	1.228	16.9
1400.00	5.977	2.361	1.025	10.6
1450.00	5.804	1.942	0.843	6.97
1500.00	5.640	1.567	0.680	4.79

SYSTEM
AL2O3(5.71),MGO(14.43),
CAO(36.30),SIO2(43.56) (X)
AL2O3(10.0),MGO(10.0),
CAO(35.0),SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-100

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	3.314	1.439	27.5
1350.00	6.161	2.773	1.204	16.0
1400.00	5.977	2.322	1.009	10.2
1450.00	5.804	1.932	0.839	6.90
1500.00	5.640	1.522	0.661	4.58

SYSTEM
AL2O3(5.59),MGO(21.21),
CAO(30.50),SIO2(42.70) (X)
AL2O3(10.0),MGO(15.0),
CAO(30.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-101

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	3.822	1.660	45.7
1300.00	6.357	3.135	1.362	23.0
1350.00	6.161	2.595	1.127	13.4
1400.00	5.977	2.174	0.944	8.79
1450.00	5.804	1.778	0.772	5.92
1500.00	5.640	1.404	0.610	4.07

SYSTEM
AL2O3(5.48),MGO(27.73),
CAO(24.92),SIO2(41.86) (X)
AL2O3(10.0),MGO(20.0),
CAO(25.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-102

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.128	0.924	8.40
1450.00	5.804	1.686	0.732	5.40
1500.00	5.640	1.361	0.591	3.90

SYSTEM
AL2O3(5.38),MGO(34.00),
CAO(19.55),SIO2(41.07) (X)
AL2O3(10.0),MGO(25.0),
CAO(20.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-103

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	1.300	0.565	3.67

SYSTEM
AL2O3(8.95),MGO(7.54),
CAO(37.96),SIO2(45.55) (X)
AL2O3(15.0),MGO(5.0),
CAO(35.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-104

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.625	2.009	102.
1300.00	6.357	3.928	1.706	50.8
1350.00	6.161	3.360	1.459	28.8
1400.00	5.977	2.851	1.238	17.3
1450.00	5.804	2.407	1.045	11.1
1500.00	5.640	2.028	0.881	7.60

SYSTEM
AL2O3(8.76),MGO(14.77),
CAO(31.86),SIO2(44.60) (X)

AUTHOR
MACHIN, YEE AND HANNA (1952)

AL2O3(15.0),MGO(10.0),
CAO(30.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-105

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.408	1.914	82.1
1300.00	6.357	3.747	1.627	42.4
1350.00	6.161	3.190	1.386	24.3
1400.00	5.977	2.715	1.179	15.1
1450.00	5.804	2.282	0.991	9.80
1500.00	5.640	1.911	0.830	6.76

SYSTEM
AL2O3(8.58),MGO(21.71),
CAO(26.01),SIO2(43.70) (X)

AUTHOR
MACHIN, YEE AND HANNA (1952)

AL2O3(15.0),MGO(15.0),
CAO(25.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-106

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	3.716	1.614	41.1
1350.00	6.161	3.148	1.367	23.3
1400.00	5.977	2.667	1.158	14.4
1450.00	5.804	2.246	0.975	9.45
1500.00	5.640	1.899	0.825	6.68

SYSTEM
AL2O3(8.41),MGO(28.37),
CAO(20.39),SIO2(42.83) (X)

AUTHOR
MACHIN, YEE AND HANNA (1952)

AL2O3(15.0),MGO(20.0),
CAO(20.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-107

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.501	1.086	12.2
1450.00	5.804	2.103	0.913	8.19
1500.00	5.640	1.787	0.776	5.97

SYSTEM
AL2O3(12.23),MGO(7.73),
CAO(33.35),SIO2(46.69) (X)

AUTHOR
MACHIN, YEE AND HANNA (1952)

AL2O3(20.0),MGO(5.0),
CAO(30.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-108

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.357	2.326	212.
1300.00	6.357	4.605	2.000	100.
1350.00	6.161	3.965	1.722	52.7
1400.00	5.977	3.447	1.497	31.4
1450.00	5.804	3.020	1.312	20.5
1500.00	5.640	2.754	1.196	15.7

SYSTEM
AL2O3(11.97),MGO(15.14),
CAO(27.20),SIO2(45.70) (X)
AL2O3(20.0),MGO(10.0),
CAO(25.0),SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-109

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.130	2.228	169.
1300.00	6.357	4.391	1.907	80.7
1350.00	6.161	3.764	1.634	43.1
1400.00	5.977	3.270	1.420	26.3
1450.00	5.804	2.845	1.236	17.2
1500.00	5.640	2.588	1.124	13.3

SYSTEM
AL2O3(11.72),MGO(22.23),
CAO(21.30),SIO2(44.75) (X)

AL2O3(20.0),MGO(15.0),
CAO(20.0),SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-110

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	4.203	1.825	66.9
1350.00	6.161	3.584	1.556	36.0
1400.00	5.977	3.082	1.338	21.8
1450.00	5.804	2.653	1.152	14.2
1500.00	5.640	2.273	0.987	9.71

SYSTEM
AL2O3(11.49),MGO(29.04),
CAO(15.65),SIO2(43.83) (X)
AL2O3(20.0),MGO(20.0),
CAO(15.0),SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-111

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	3.472	1.508	32.2
1400.00	5.977	2.950	1.281	19.1
1450.00	5.804	2.526	1.097	12.5
1500.00	5.640	2.129	0.925	8.41

SYSTEM
AL2O3(12.50),MGO(28.41),
CAO(11.36),SIO2(47.73) (X)
AL2O3(20.0),MGO(25.0),
CAO(10.0),SIO2(45.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-112

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.434	1.057	11.4
1500.00	5.640	2.044	0.888	7.72

SYSTEM
AL2O3(9.14),MGO(27.70),
CAO(16.62),SIO2(46.54) (X)
AL2O3(15.0),MGO(25.0),
CAO(15.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-113

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	1.611	0.700	5.01

SYSTEM
AL2O3(15.68),MGO(7.93),
CAO(28.50),SIO2(47.89) (X)
AL2O3(25.0),MGO(5.0),
CAO(25.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-114

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	4.663	2.025	106.
1400.00	5.977	4.047	1.757	57.2
1450.00	5.804	3.635	1.579	37.9
1500.00	5.640	3.105	1.348	22.3

SYSTEM
AL2O3(15.34),MGO(15.52),
CAO(22.30),SIO2(46.84) (X)
AL2O3(25.0),MGO(10.0),
CAO(20.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-115

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	5.024	2.182	152.
1350.00	6.161	4.331	1.881	76.0
1400.00	5.977	3.733	1.621	41.8
1450.00	5.804	3.408	1.480	30.2
1500.00	5.640	3.006	1.305	20.2

SYSTEM
AL2O3(15.01),MGO(22.78),
CAO(16.27),SIO2(45.84) (X)
AL2O3(25.0),MGO(15.0),
CAO(15.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-116

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	4.836	2.100	126.
1350.00	6.161	4.124	1.791	61.8
1400.00	5.977	3.595	1.561	36.4
1450.00	5.804	3.105	1.348	22.3
1500.00	5.640	2.667	1.158	14.4

SYSTEM
AL2O3(14.69),MGO(29.74),
CAO(10.68),SIO2(44.89) (X)
AL2O3(25.0),MGO(20.0),
CAO(10.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-117

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	4.654	2.021	105.
1350.00	6.161	3.945	1.713	51.7
1400.00	5.977	3.456	1.501	31.7
1450.00	5.804	2.996	1.301	20.0
1500.00	5.640	2.557	1.111	12.9

SYSTEM
AL2O3(16.03),MGO(29.15),
CAO(5.83),SIO2(48.98) (X)
AL2O3(25.0),MGO(25.0),
CAO(5.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-118

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	3.421	1.486	30.6
1450.00	5.804	2.833	1.230	17.0
1500.00	5.640	2.361	1.025	10.6

SYSTEM
AL2O3(19.31),MGO(8.14),
CAO(23.40),SIO2(49.15) (X)
AL2O3(30.0),MGO(5.0),
CAO(20.0),SIO2(45.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-119

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	4.325	1.879	75.6
1500.00	5.640	3.824	1.661	45.8

SYSTEM
AL2O3(0.0),CAO(45.63),
MGO(7.06),SIO2(47.32) (X)
AL2O3(0.0),CAO(45.0),
MGO(5.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-120

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	1.125	0.489	3.08

SYSTEM
AL2O3(0.0),CAO(39.77),
MGO(13.83),SIO2(46.40) (X)
AL2O3(0.0),CAO(40.0),
MGO(10.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-121

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.742	0.757	5.71
1450.00	5.804	1.364	0.592	3.91
1500.00	5.640	1.451	0.436	2.86

SYSTEM
AL2O3(0.0),CAO(34.13),
MGO(20.35),SIO2(45.52) (X)
AL2O3(0.0),CAO(35.0),
MGO(15.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-122

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	2.115	0.919	8.29
1400.00	5.977	1.685	0.732	5.39
1450.00	5.804	1.319	0.573	3.74
1500.00	5.640	0.986	0.428	2.68

SYSTEM
AL2O3(0.0),CAO(28.71),
MGO(26.62),SIO2(44.66) (X)
AL2O3(0.0),CAO(30.0),
MGO(20.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-123

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	2.039	0.885	7.68
1400.00	5.977	1.629	0.708	5.10
1450.00	5.804	1.270	0.551	3.56
1500.00	5.640	0.959	0.417	2.61

SYSTEM
AL2O3(0.0),CAO(23.49),
MGO(32.67),SIO2(43.84) (X)
AL2O3(0.0),CAO(25.0),
MGO(25.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-124

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	1.324	0.575	3.76
1500.00	5.640	1.030	0.447	2.80

SYSTEM
AL2O3(2.91),CAO(47.66),
MGO(0.0),SIO2(49.43) (X)
AL2O3(5.0),CAO(45.0),
MGO(0.0),SIO2(50.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE III

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-125

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	1.564	0.679	4.78

SYSTEM
AL2O3(2.85),CAO(41.51),
MGO(7.22),SIO2(48.43) (X)
AL2O3(5.0),CAO(40.0),
MGO(5.0),SIO2(50.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE III

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-126

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.272	0.987	9.70
1450.00	5.804	1.875	0.814	6.52
1500.00	5.640	1.560	0.678	4.76

SYSTEM
AL2O3(2.79),CAO(35.59),
MGO(14.15),SIO2(47.46) (X)
AL2O3(5.0),CAO(35.0),
MGO(10.0),SIO2(50.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE III

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-127

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	3.170	1.377	23.8
1350.00	6.161	2.653	1.152	14.2
1400.00	5.977	2.205	0.958	9.07
1450.00	5.804	1.805	0.784	6.08
1500.00	5.640	1.482	0.643	4.40

SYSTEM
AL2O3(2.74),CAO(29.92),
MGO(20.8),SIO2(46.54) (X)
AL2O3(5.0),CAO(30.0),
MGO(15.0),SIO2(50.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE III

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-128

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	3.020	1.312	20.5
1350.00	6.161	2.534	1.100	12.6
1400.00	5.977	2.103	0.913	8.19
1450.00	5.804	1.723	0.748	5.60
1500.00	5.640	1.423	0.618	4.15

SYSTEM
AL2O3(2.69),CAO(24.45),
MGO(27.21),SIO2(45.64) (X)
AL2O3(5.0),CAO(25.0),
MGO(20.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-129

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	3.161	1.373	23.6
1350.00	6.161	2.493	1.083	12.1
1400.00	5.977	2.089	0.907	8.08
1450.00	5.804	1.710	0.743	5.53
1500.00	5.640	1.369	0.594	3.93

SYSTEM
AL2O3(2.64),CAO(19.19),
MGO(33.38),SIO2(44.79) (X)
AL2O3(5.0),CAO(20.0),
MGO(25.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-130

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	1.652	0.718	5.22
1500.00	5.640	1.332	0.579	3.79

SYSTEM
AL2O3(5.97),CAO(43.40),
MGO(0.0),SIO2(50.63) (X)
AL2O3(10.0),CAO(40.0),
MGO(0.0),KSIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-131

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.955	1.283	19.2
1450.00	5.804	2.493	1.083	12.1
1500.00	5.640	2.108	0.915	8.23

SYSTEM
AL2O3(5.84),CAO(37.18),

MGO(7.39),SIO2(49.58) (X)
AL2O3(10.0),CAO(35.0),
MGO(5.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-132

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.499	1.954	89.9
1300.00	6.357	3.833	1.665	46.2
1350.00	6.161	3.300	1.433	27.1
1400.00	5.977	2.827	1.228	16.9
1450.00	5.804	2.389	1.037	10.9
1500.00	5.640	2.019	0.877	7.53

SYSTEM
AL2O3(5.72),CAO(31.22),
MGO(14.48),SIO2(48.57) (X)
AL2O3(10.0),CAO(30.0),
MGO(10.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-133

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.317	1.875	75.0
1300.00	6.357	3.666	1.592	39.1
1350.00	6.161	3.170	1.377	23.8
1400.00	5.977	2.708	1.176	15.0
1450.00	5.804	2.295	0.997	9.92
1500.00	5.640	1.959	0.851	7.09

SYSTEM
AL2O3(5.61),CAO(25.50),
MGO(21.28),SIO2(47.60) (X)
AL2O3(10.0),CAO(25.0),
MGO(15.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-134

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.208	1.827	67.2
1300.00	6.357	3.520	1.529	33.8
1350.00	6.161	3.040	1.320	20.9
1400.00	5.977	2.573	1.117	13.1
1450.00	5.804	2.186	0.949	8.90
1500.00	5.640	1.904	0.827	6.71

SYSTEM
AL2O3(5.50),CAO(20.0),
MGO(27.82),SIO2(46.67) (X)
AL2O3(10.0),CAO(20.0),
MGO(20.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-135

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	2.970	1.290	19.5
1400.00	5.977	2.501	1.086	12.2
1450.00	5.804	2.094	0.910	8.12
1500.00	5.640	1.772	0.769	5.88

SYSTEM
AL2O3(5.39),CAO(14.71),
MGO(34.11),SIO2(45.78) (X)
AL2O3(10.0),CAO(15.0),
MGO(25.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-136

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.076	0.901	7.97
1500.00	5.640	1.703	0.740	5.49

SYSTEM
AL2O3(9.17),CAO(38.92),
MGO(0.0),SIO2(51.90) (X)
AL2O3(15.0),CAO(35.0),
MGO(0.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-137

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.342	2.320	209.
1300.00	6.357	4.654	2.021	105.
1350.00	6.161	4.045	1.757	57.1
1400.00	5.977	3.550	1.542	34.8
1450.00	5.804	3.086	1.340	21.9
1500.00	5.640	2.660	1.155	14.3

SYSTEM
AL2O3(8.98),CAO(32.66),
MGO(7.57),SIO2(50.80) (X)
AL2O3(15.0),CAO(30.0),
MGO(5.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-138

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.209	2.262	183.
1300.00	6.357	4.524	1.965	92.2
1350.00	6.161	3.904	1.695	49.6
1400.00	5.977	3.450	1.498	31.5
1450.00	5.804	3.016	1.310	20.4
1500.00	5.640	2.721	1.182	15.2

SYSTEM
AL2O3(8.79),CAO(26.64),
MGO(14.83),SIO2(49.74) (X)
AL2O3(15.0),CAO(25.0),
MGO(10.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-139

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.075	2.204	160.
1300.00	6.357	4.386	1.905	80.3
1350.00	6.161	3.780	1.641	43.8
1400.00	5.977	3.329	1.446	27.9
1450.00	5.804	2.923	1.270	18.6
1500.00	5.640	2.549	1.107	12.8

SYSTEM
AL2O3(8.61),CAO(20.88),
MGO(21.79),SIO2(48.72) (X)
AL2O3(15.0),CAO(20.0),
MGO(15.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-140

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.920	2.137	137.
1300.00	6.357	4.240	1.841	69.4
1350.00	6.161	3.632	1.577	37.8
1400.00	5.977	3.190	1.386	24.3
1450.00	5.804	2.785	1.210	16.2
1500.00	5.640	2.389	1.037	10.9

SYSTEM
AL2O3(8.44),CAO(15.35),
MGO(28.46),SIO2(47.75) (X)
AL2O3(15.0),CAO(15.0),
MGO(20.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-141

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	3.555	1.544	35.0
1400.00	5.977	3.063	1.330	21.4
1450.00	5.804	2.617	1.137	13.7
1500.00	5.640	2.252	0.978	9.51

SYSTEM
AL2O3(8.27),CAO(10.03),
MGO(34.89),SIO2(46.81) (X)
AL2O3(15.0),CAO(10.0),
MGO(25.0),SIO2(50.0) (%)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-142

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.534	1.100	12.6
1500.00	5.640	2.104	0.914	8.2

SYSTEM
AL2O3(8.11),CAO(4.92),
MGO(41.05),SIO2(45.91) (X)
AL2O3(15.0),CAO(5.0),
MGO(30.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-143

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	2.153	0.935	8.61

SYSTEM
AL2O3(12.55),CAO(34.22),
MGO(0.0),SIO2(53.23) (X)
AL2O3(20.0),CAO(30.0),
MGO(0.0),SIO2(50.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE III

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-144

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	6.271	2.723	529.
1300.00	6.357	5.509	2.393	247.
1350.00	6.161	4.836	2.100	126.
1400.00	5.977	4.261	1.851	70.9
1450.00	5.804	3.745	1.626	42.3
1500.00	5.640	3.408	1.480	30.2

SYSTEM
AL2O3(12.28),CAO(27.89),
MGO(7.76),SIO2(52.07) (X)
AL2O3(20.0),CAO(25.0),
MGO(5.0),SIO2(50.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE III

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-145

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	6.184	2.686	485.
1300.00	6.357	5.425	2.356	227.
1350.00	6.161	4.745	2.061	115.
1400.00	5.977	4.164	1.808	64.3
1450.00	5.804	3.619	1.572	37.3
1500.00	5.640	3.227	1.401	25.2

SYSTEM
AL2O3(12.01),CAO(21.84),
MGO(15.19),SIO2(50.96) (X)
AL2O3(20.0),CAO(20.0),
MGO(10.0),SIO2(50.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE III

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-146

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.943	2.581	381.
1300.00	6.357	5.182	2.250	178.
1350.00	6.161	4.533	1.968	93.0
1400.00	5.977	3.985	1.731	53.8
1450.00	5.804	3.520	1.529	33.8
1500.00	5.640	3.100	1.346	22.2

SYSTEM
AL2O3(11.76),CAO(16.04),
MGO(22.31),SIO2(49.89) (X)
AL2O3(20.0),CAO(15.0),
MGO(15.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-147

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.624	2.442	277.
1300.00	6.357	4.898	2.127	134.
1350.00	6.161	4.264	1.852	71.1
1400.00	5.977	3.735	1.622	41.9
1450.00	5.804	3.270	1.420	26.3
1500.00	5.640	2.833	1.230	17.0

SYSTEM
AL2O3(11.52),CAO(10.47),
MGO(29.13),SIO2(48.87) (X)
AL2O3(20.0),CAO(10.0),
MGO(20.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-148

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	4.718	2.049	112.
1350.00	6.161	4.055	1.761	57.7
1400.00	5.977	3.523	1.530	33.9
1450.00	5.804	3.063	1.330	21.4
1500.00	5.640	2.660	1.155	14.3

SYSTEM
AL2O3(11.29),CAO(5.13),
MGO(35.69),SIO2(47.89) (X)
AL2O3(20.0),CAO(5.0),
MGO(25.0),SIO2(50.0) (%)
MEASUREMENT METHOD

OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM

TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-149

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	3.965	1.722	52.7
1400.00	5.977	3.497	1.519	33.0
1450.00	5.804	3.011	1.307	20.3
1500.00	5.640	2.580	1.121	13.2

SYSTEM
AL2O3(16.10),CAO(29.27),
MGO(0.0),SIO2(54.63) (X)
AL2O3(25.0),CAO(25.0),
MGO(0.0),SIO2(50.0) (%)
MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
MACHIN, YEE AND HANNA (1952)

DERIVED FROM
TABLE III
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-150

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	4.603	1.999	99.8
1500.00	5.640	4.055	1.761	57.7

SYSTEM
AL2O3(15.74),CAO(22.59),
MGO(7.96),SIO2(53.41) (X)
AL2O3(25.0),CAO(20.0),
MGO(5.0),SIO2(50.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE III

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-151

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	4.796	2.083	121.
1450.00	5.804	4.240	1.841	69.4
1500.00	5.640	3.728	1.619	41.6

SYSTEM
AL2O3(15.39),CAO(16.79),
MGO(15.57),SIO2(52.24) (X)
AL2O3(25.0),CAO(15.0),
MGO(10.0),SIO2(50.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE III

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-152

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	5.981	2.598	396.
1350.00	6.161	5.147	2.236	172.
1400.00	5.977	4.533	1.968	93.0
1450.00	5.804	3.976	1.727	53.3
1500.00	5.640	3.529	1.533	34.1

SYSTEM
AL2O3(15.06),CAO(10.95),
MGO(22.86),SIO2(51.12) (X)
AL2O3(25.0),CAO(10.0),
MGO(15.0),SIO2(50.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

DERIVED FROM
TABLE III

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-153

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	6.382	2.772	591.
1300.00	6.357	5.580	2.423	265.
1350.00	6.161	4.883	2.121	132.
1400.00	5.977	4.265	1.852	71.2
1450.00	5.804	3.704	1.609	40.6
1500.00	5.640	3.281	1.425	26.6

SYSTEM
AL2O3 (14.75), CAO (5.36),
MGO (29.84), SIO2 (50.05) (X)
AL2O3 (25.0), CAO (5.0),
MGO (20.0), SIO2 (50.0) (%)

AUTHOR
MACHIN, YEE AND HANNA (1952)

MEASUREMENT METHOD
OSCILLATING-CYC. VISCOMETER

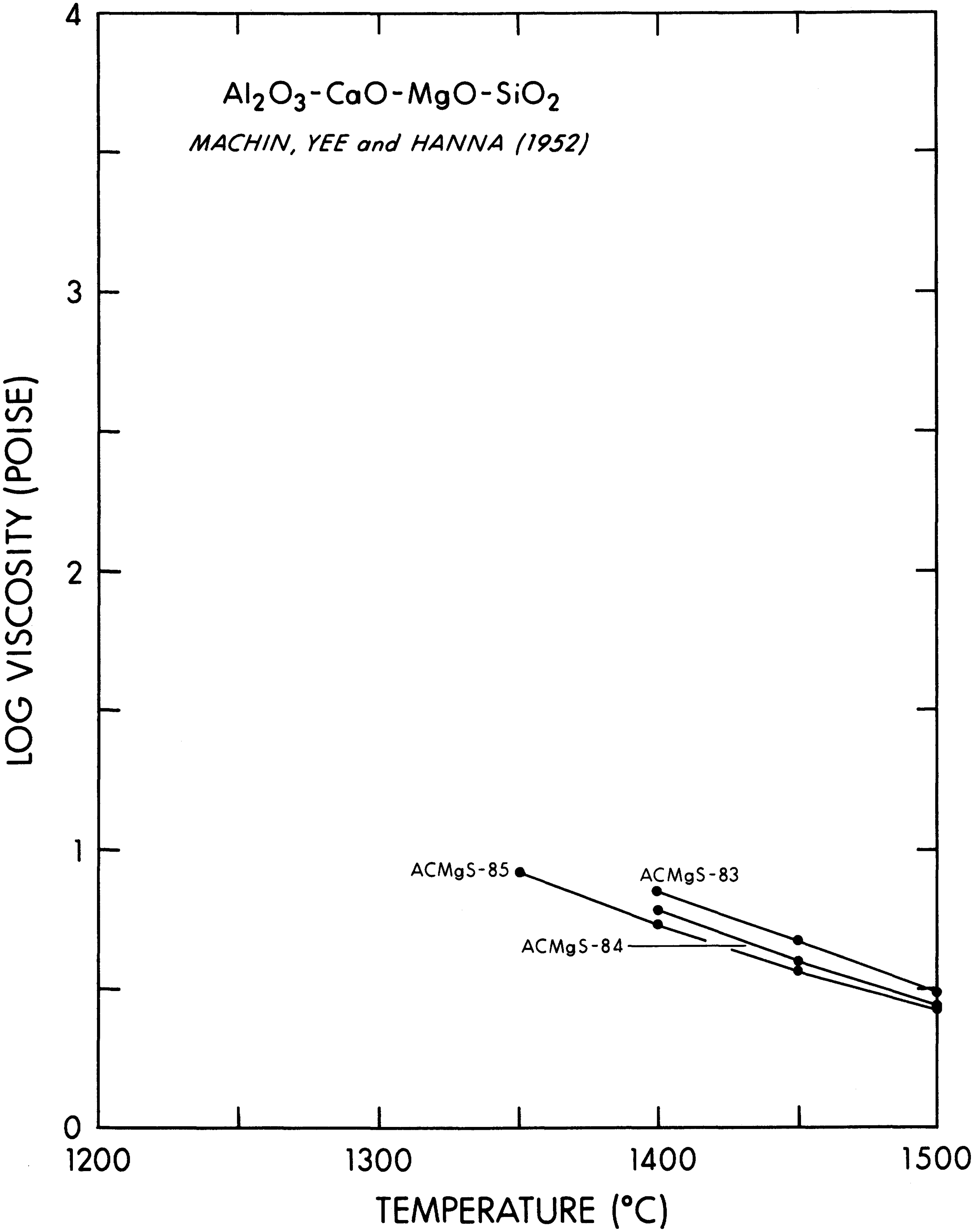
DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

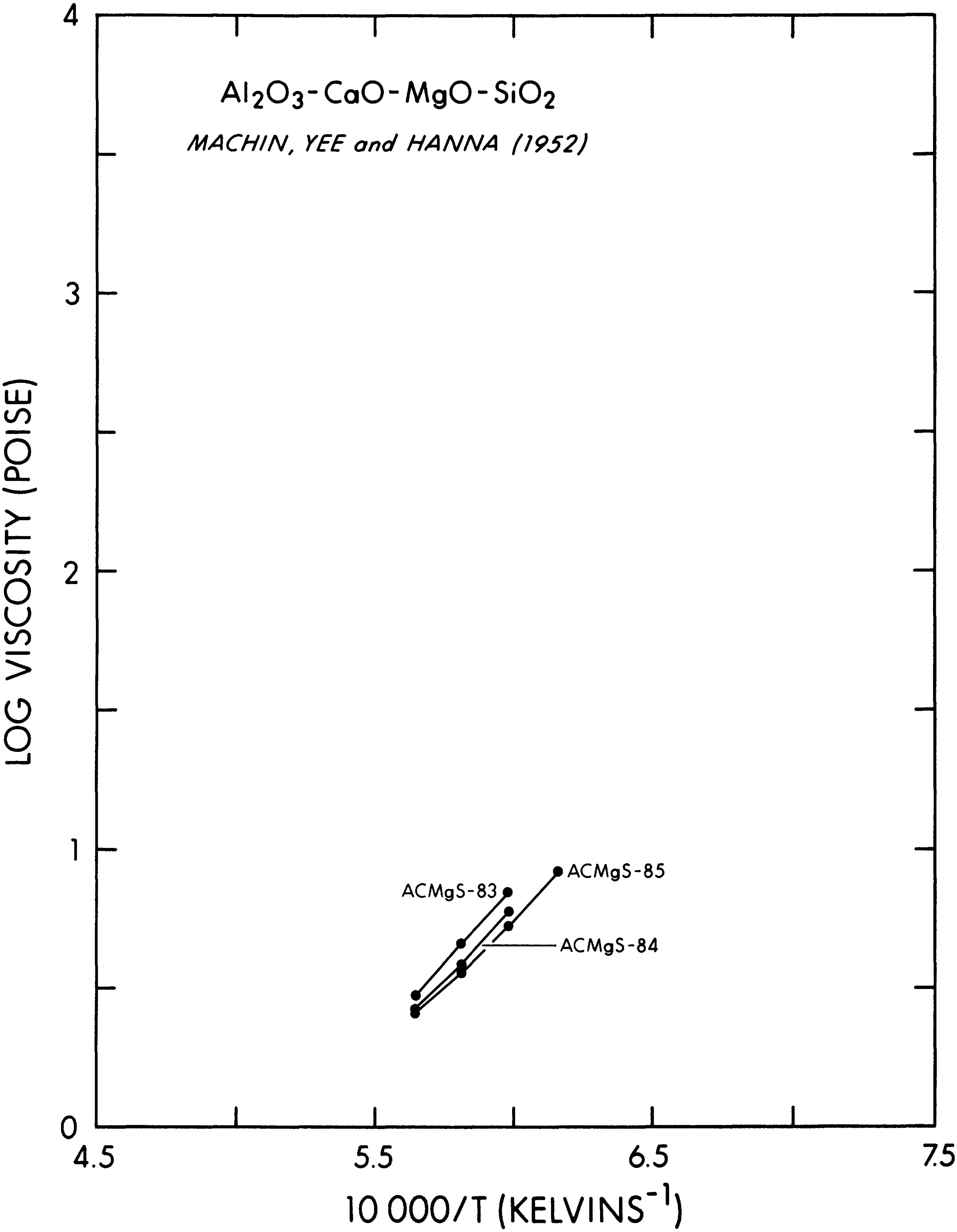
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCS-154

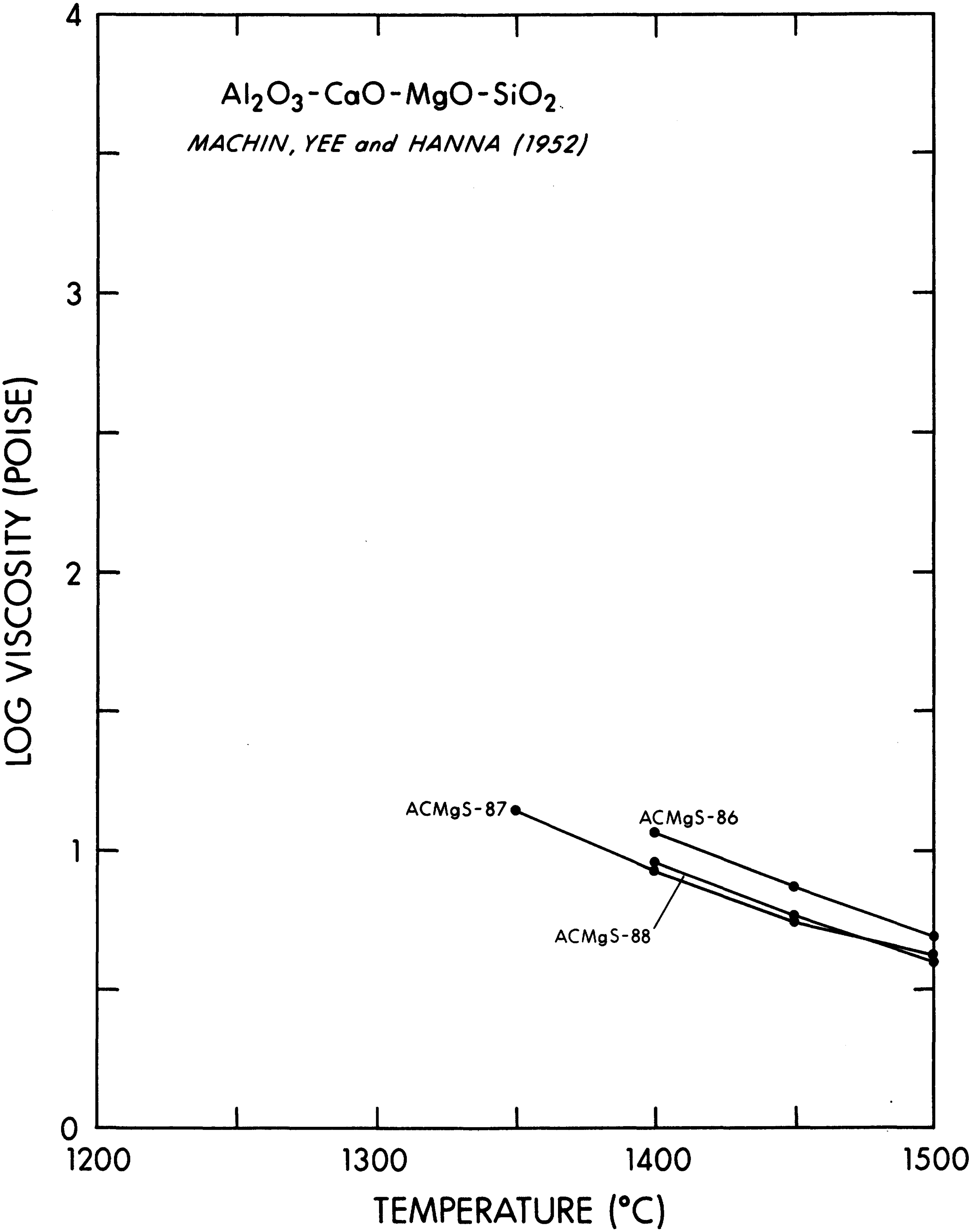
T	Z	LN(N)	LOG(N)	N
1300.	6.357	5.308	2.305	202.
1350.	6.161	4.625	2.009	102.
1400.	5.977	4.006	1.740	54.9
1450.	5.804	3.506	1.522	33.3
1500.	5.640	3.045	1.322	21.0

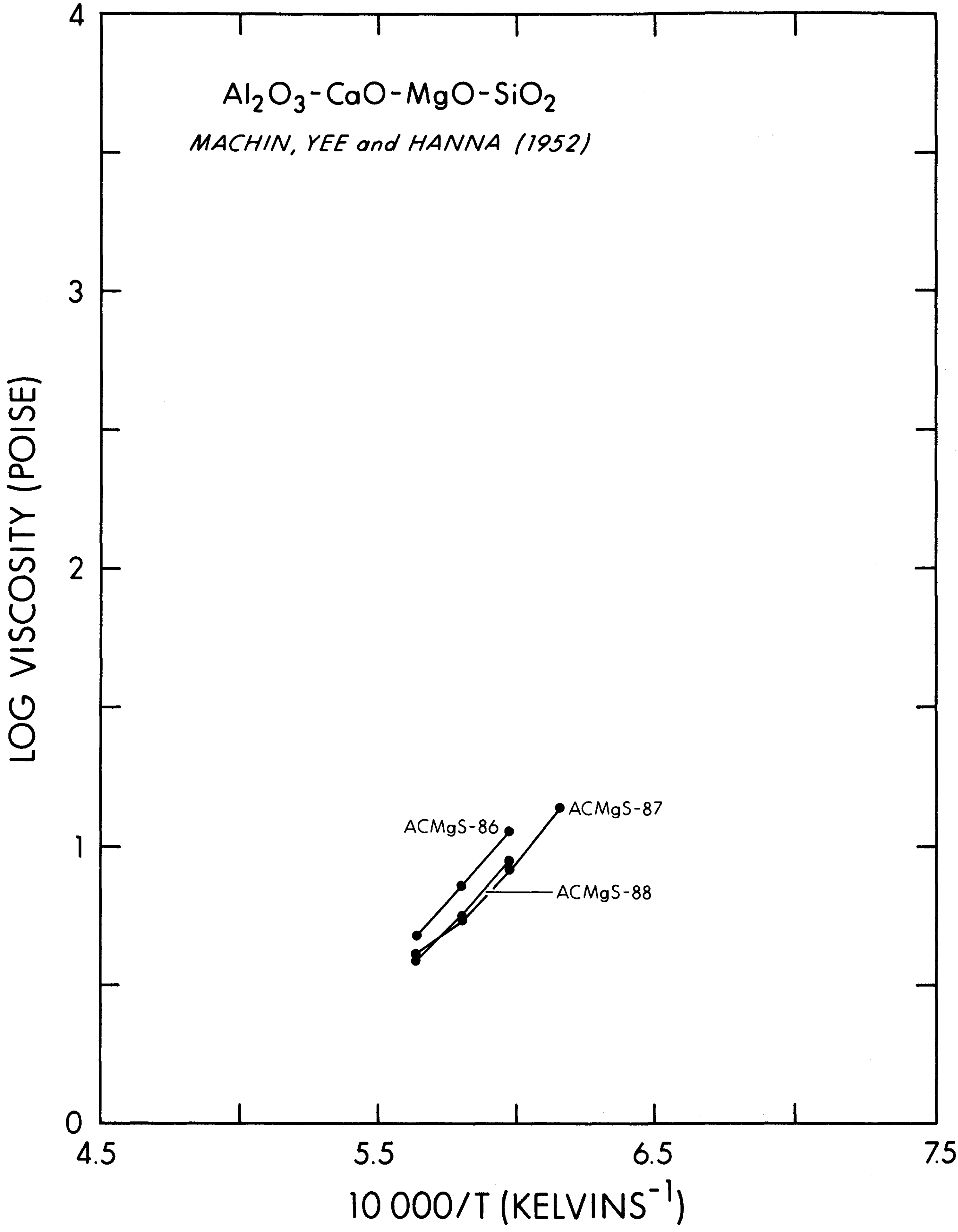


Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-85
ACMgS-83
ACMgS-84
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500

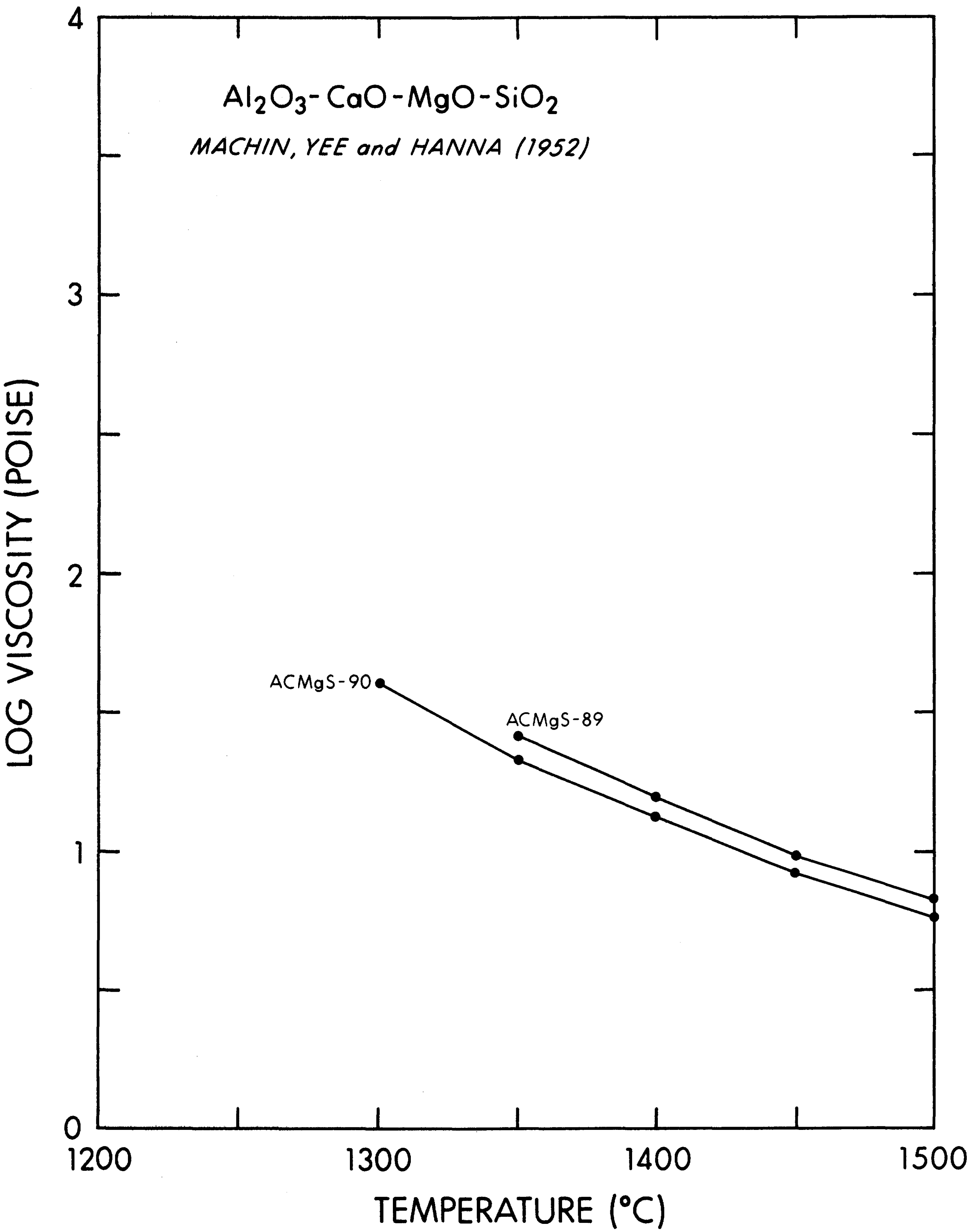


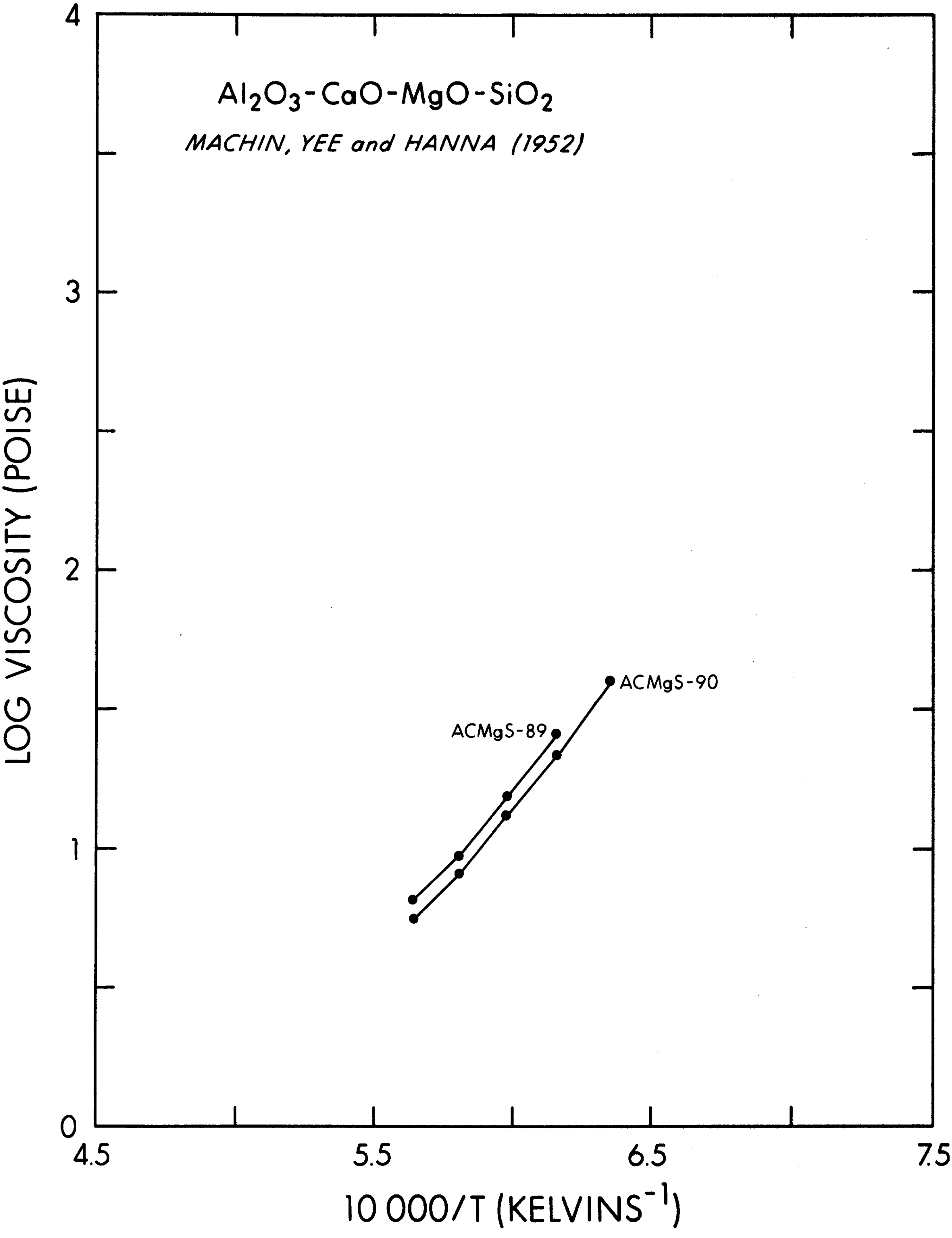
Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-83
ACMgS-85
ACMgS-84
LOG VISCOSITY (POISE)
0
1
2
3
4
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})


Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
LOG VISCOSITY (POISE)
4
3
2
1
0
1200
1300
1400
1500
TEMPERATURE (°C)
ACMgS-87
ACMgS-86
ACMgS-88

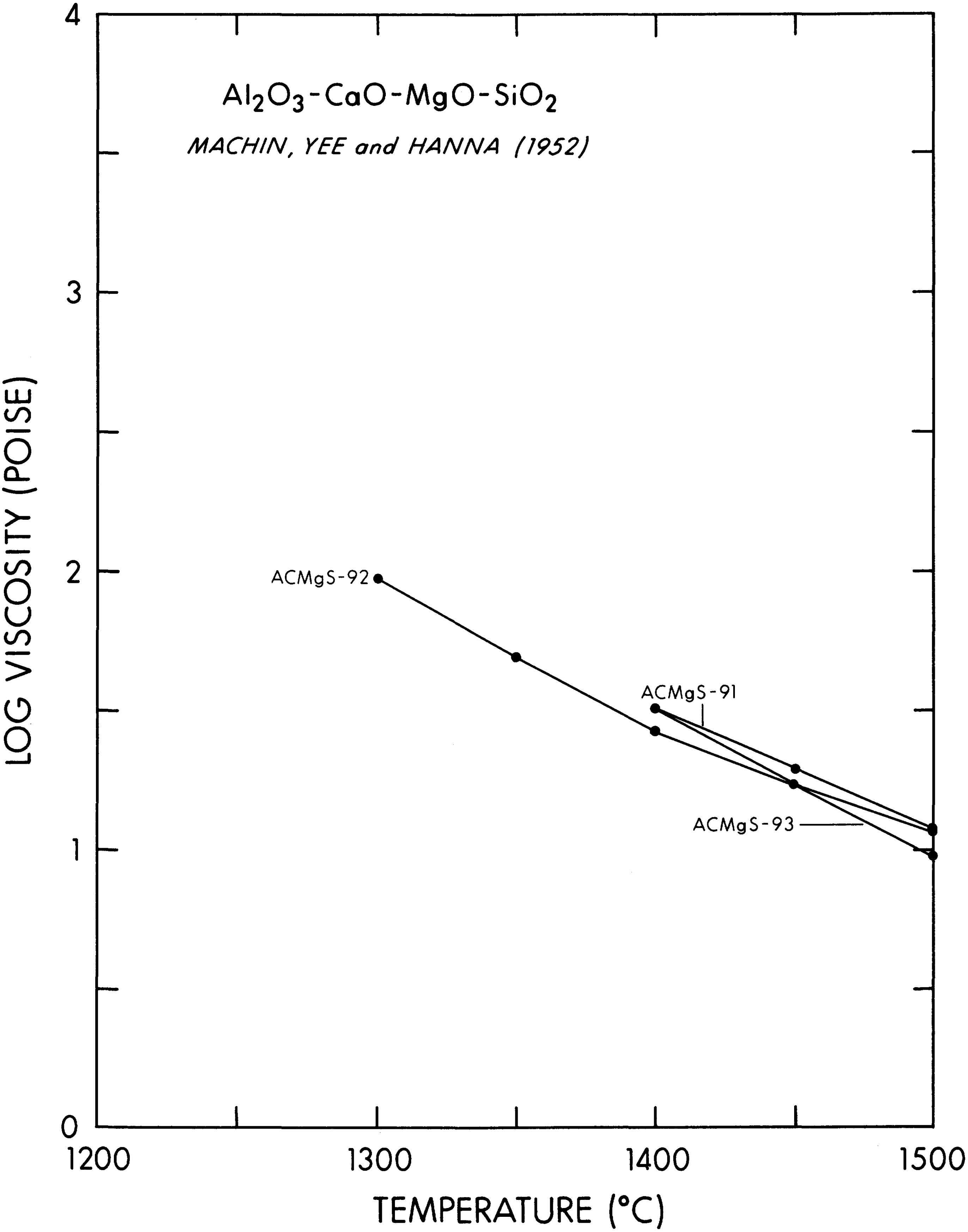


Al2O3-CaO-MgO-SiO2
MACHIN, YEE and HANNA (1952)
ACMgS-86
ACMgS-87
ACMgS-88
LOG VISCOSITY (POISE)
10 000/T (KELVINS-1)
0
1
2
3
4
4.5
5.5
6.5
7.5

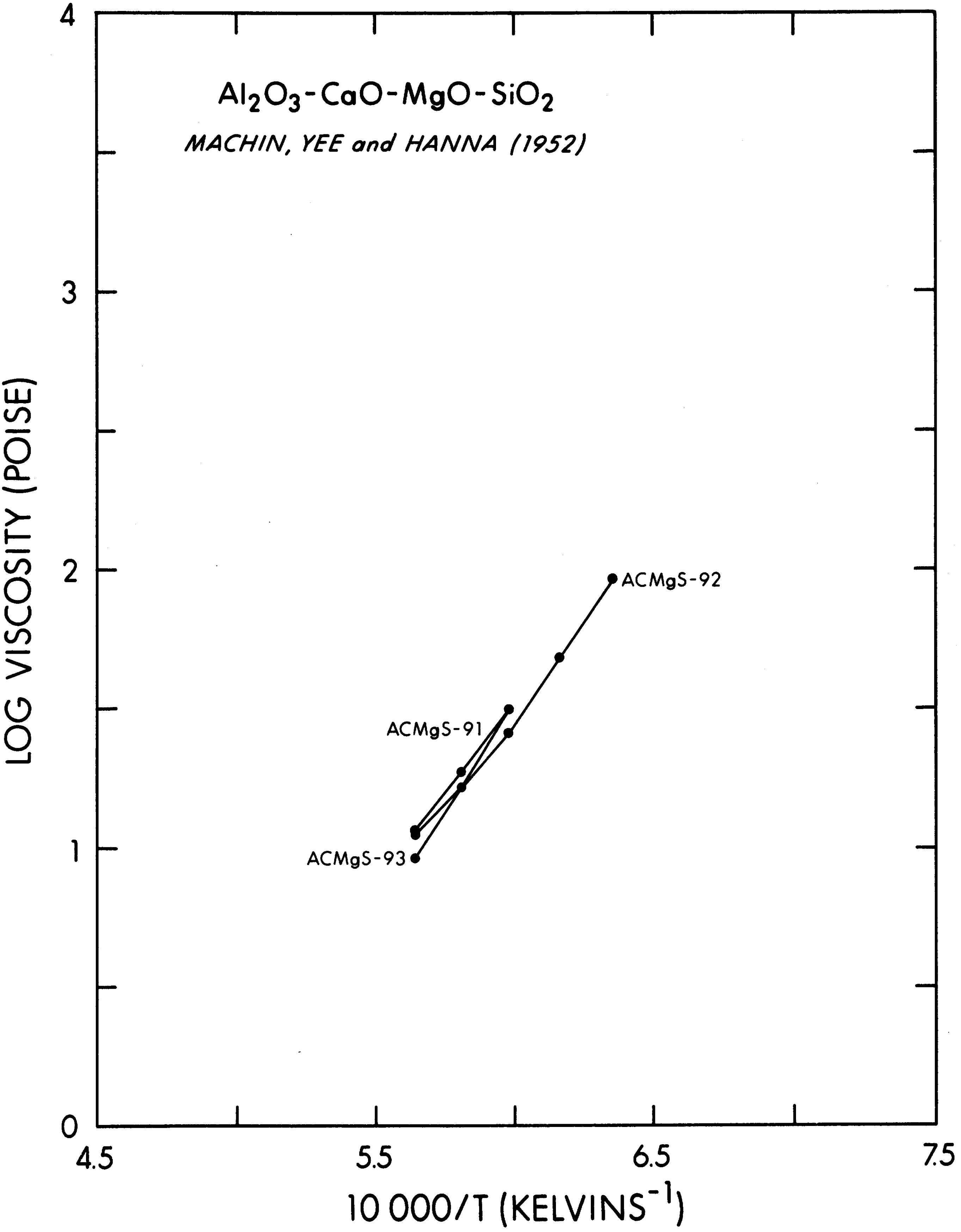

Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-90
ACMgS-89
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
4
3
2
1
0
1200
1300
1400
1500



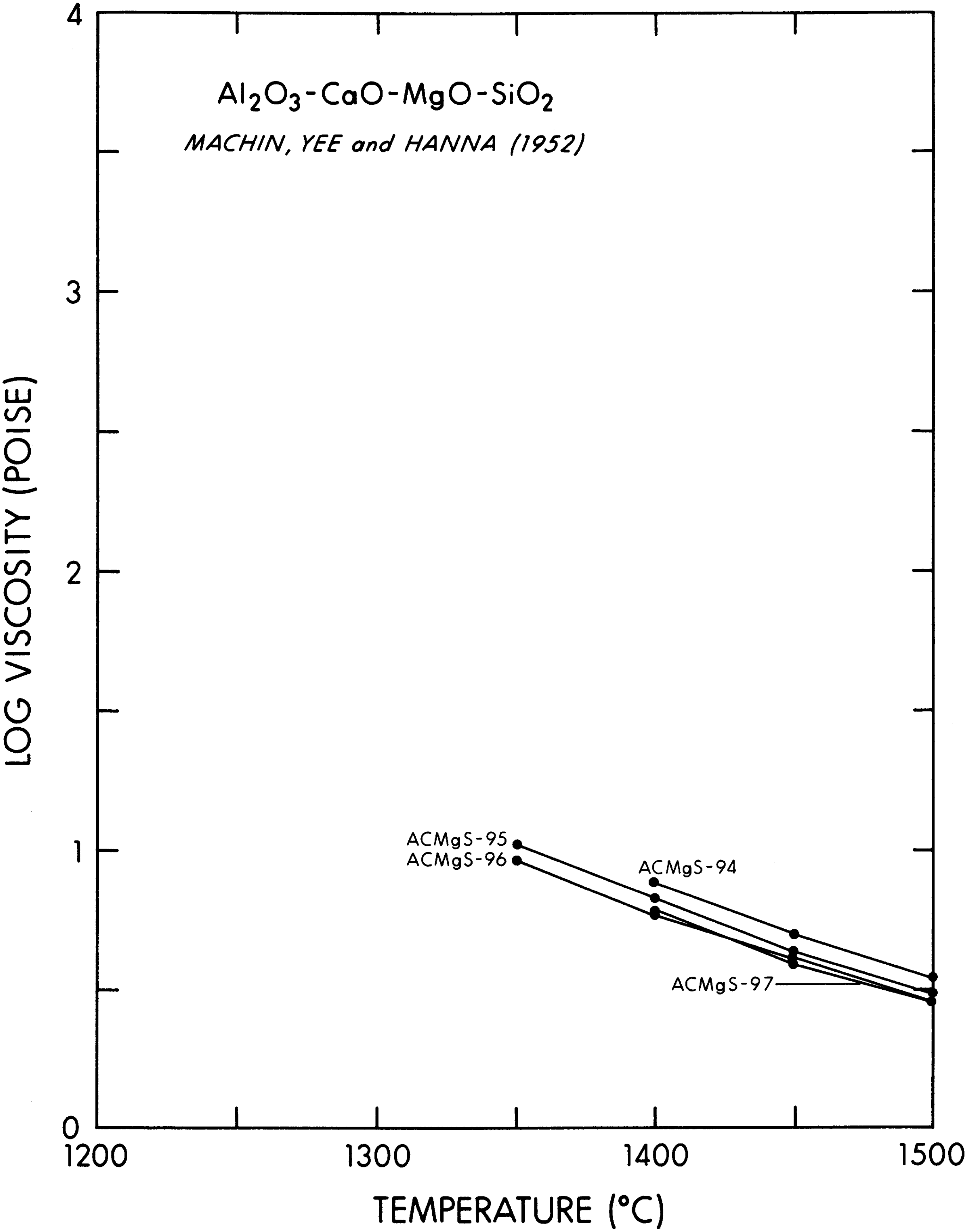
4
3
2
1
0
4.5
5.5
6.5
7.5
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-90
ACMgS-89



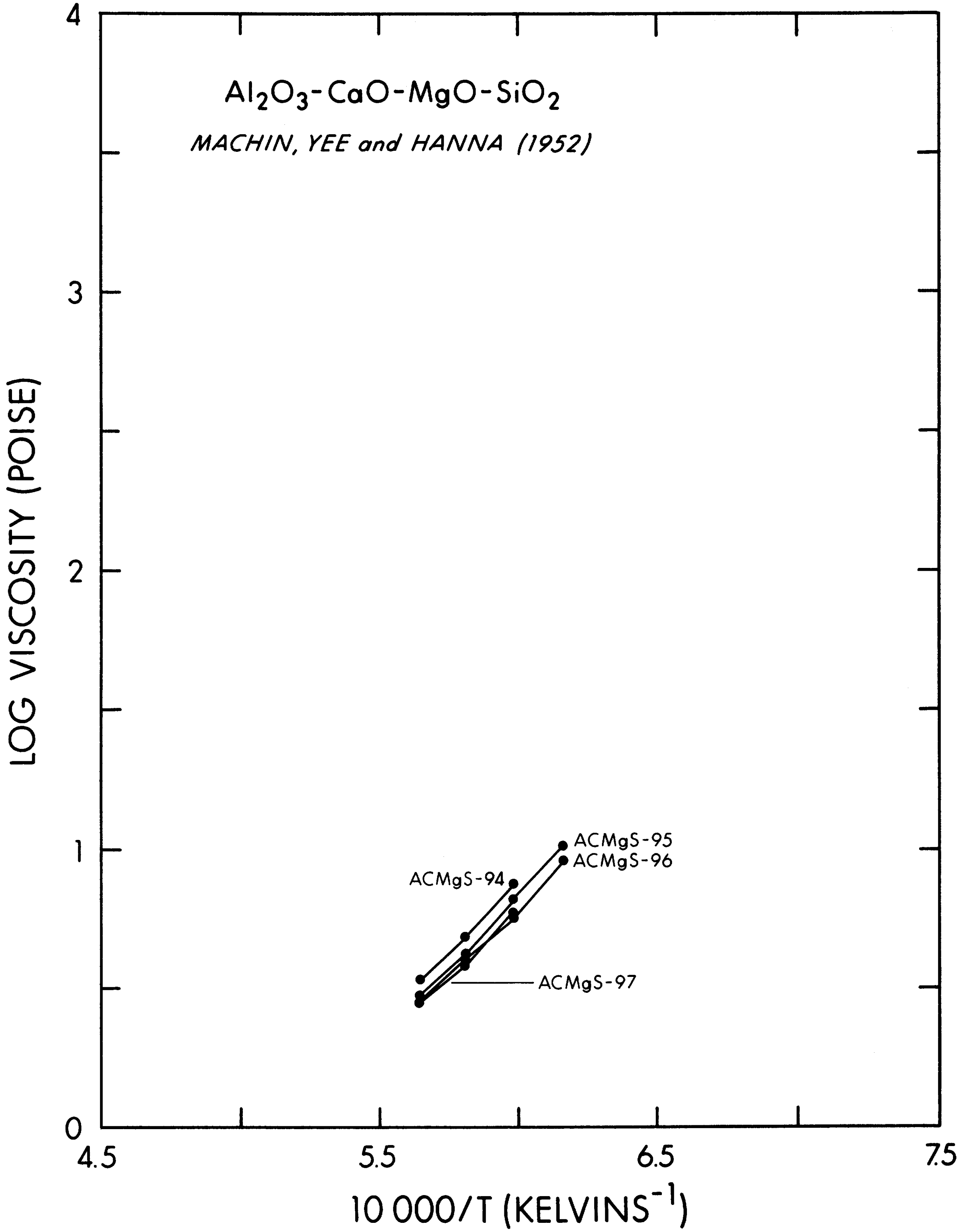
Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-92
ACMgS-91
ACMgS-93
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
4
3
2
1
0
1200
1300
1400
1500



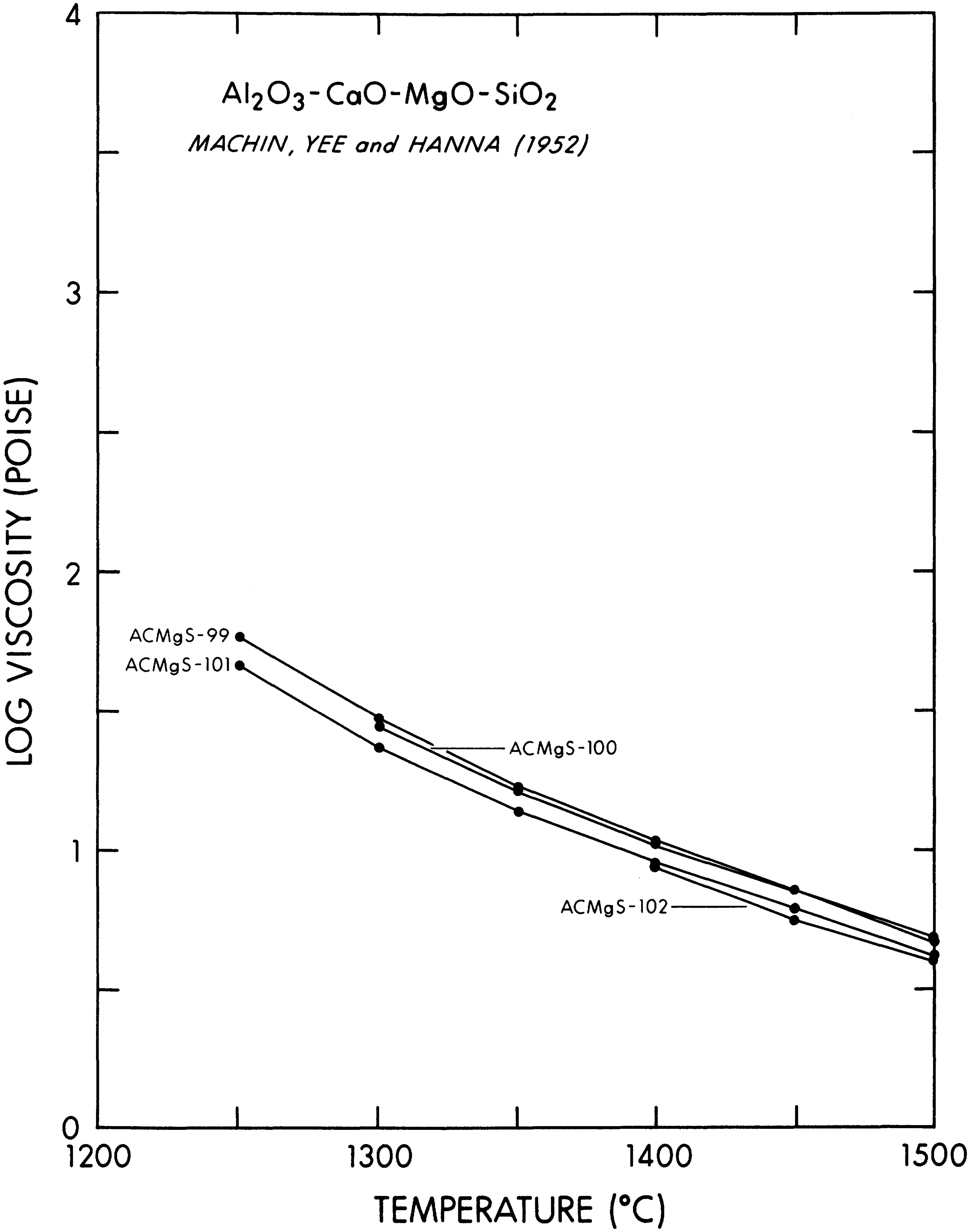
Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
LOG VISCOSITY (POISE)
4
3
2
1
0
ACMgS-92
ACMgS-91
ACMgS-93
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})



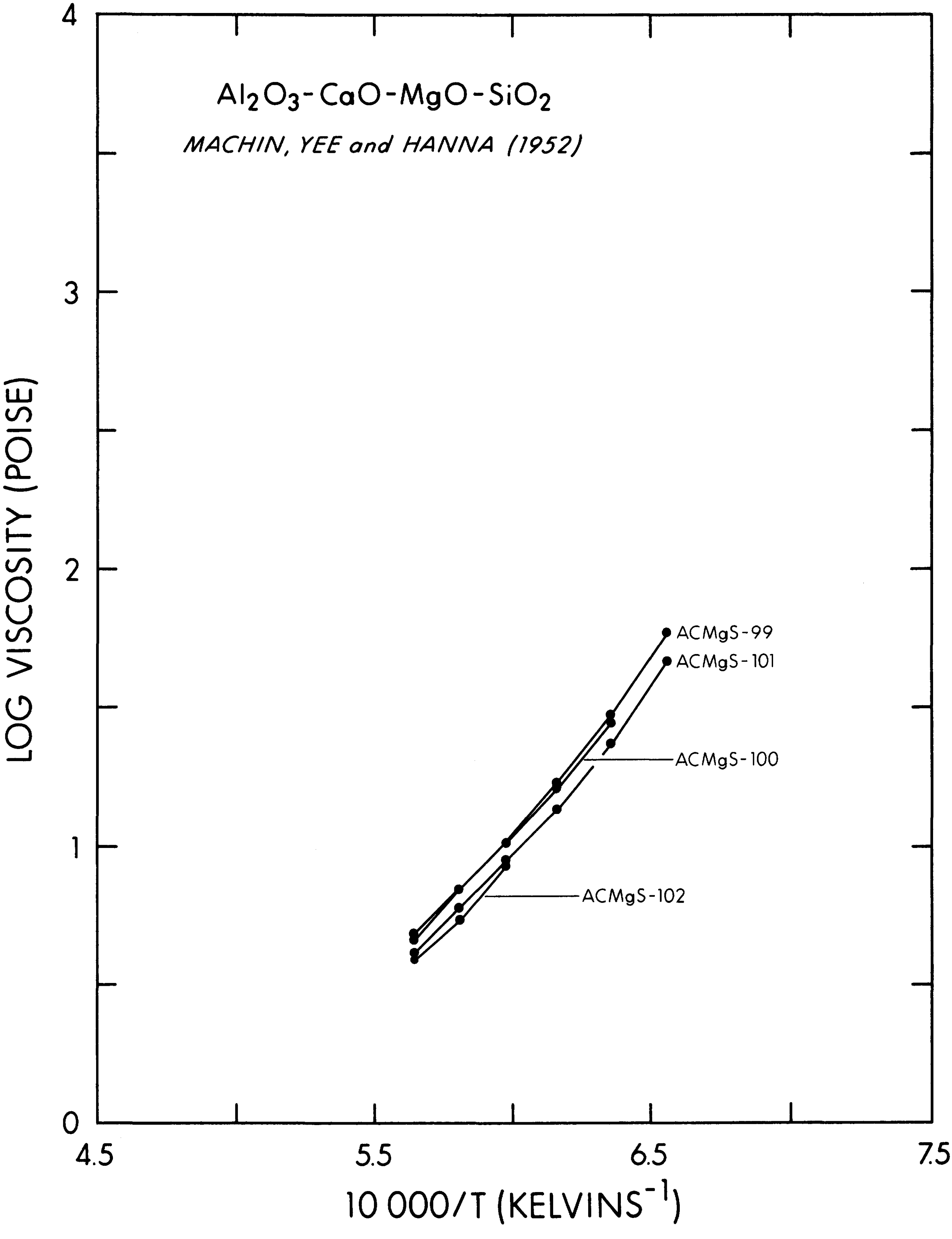
Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-95
ACMgS-96
ACMgS-94
ACMgS-97
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
4
3
2
1
0
1200
1300
1400
1500



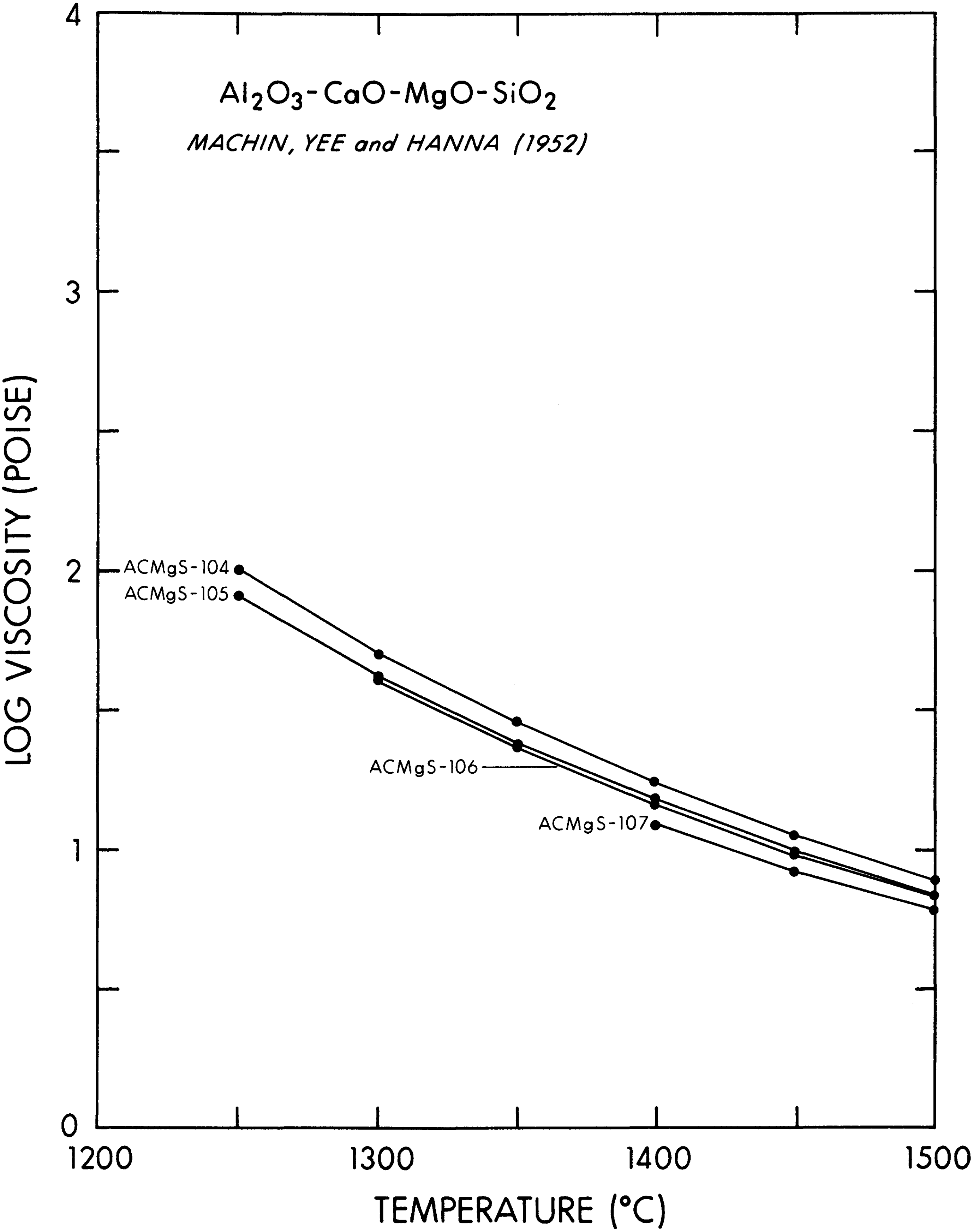
Al2O3-CaO-MgO-SiO2
MACHIN, YEE and HANNA (1952)
LOG VISCOSITY (POISE)
10 000/T (KELVINS-1)
4
3
2
1
0
4.5
5.5
6.5
7.5
ACMgS-95
ACMgS-96
ACMgS-94
ACMgS-97

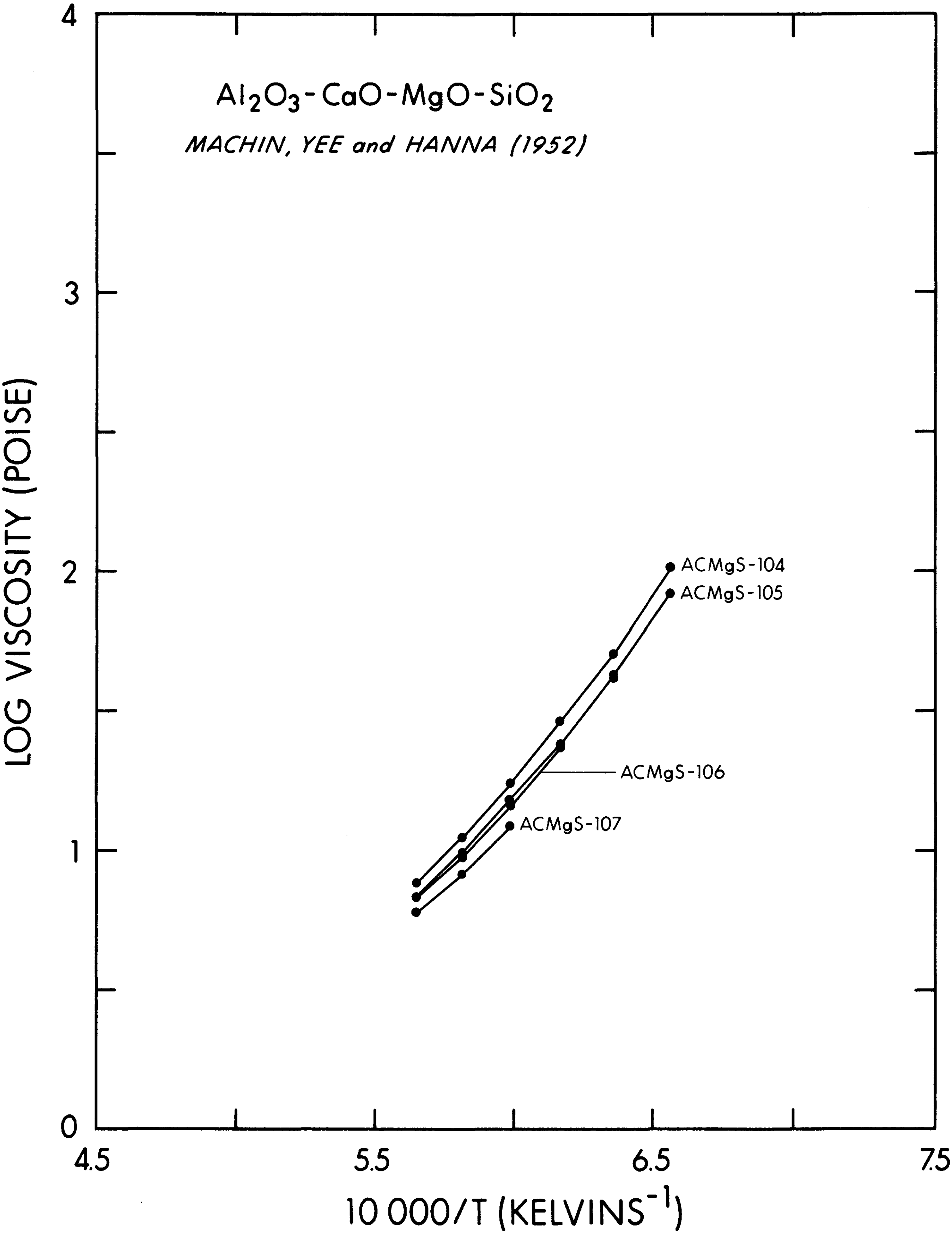


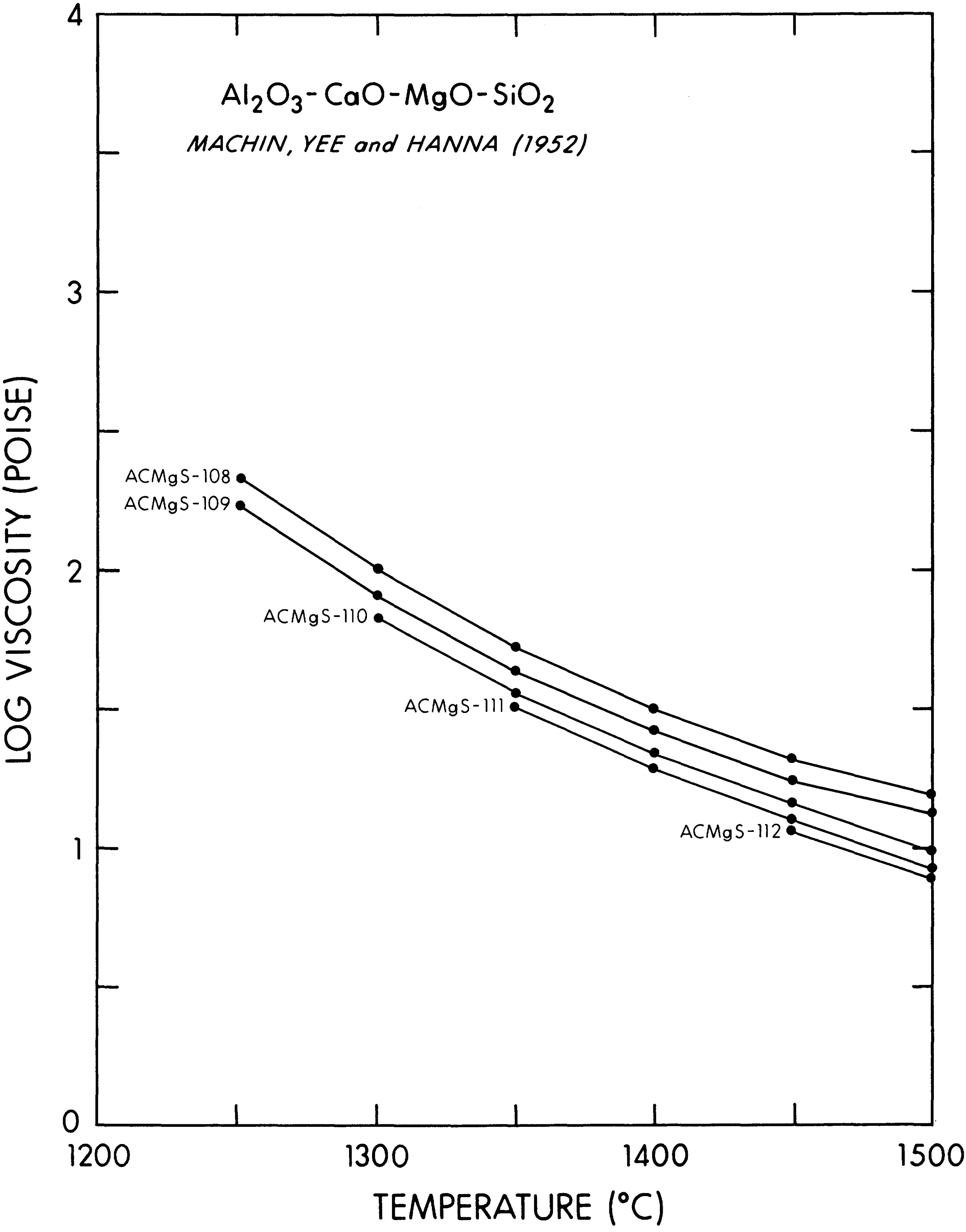
Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-99
ACMgS-101
ACMgS-100
ACMgS-102
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
4
3
2
1
0
1200
1300
1400
1500



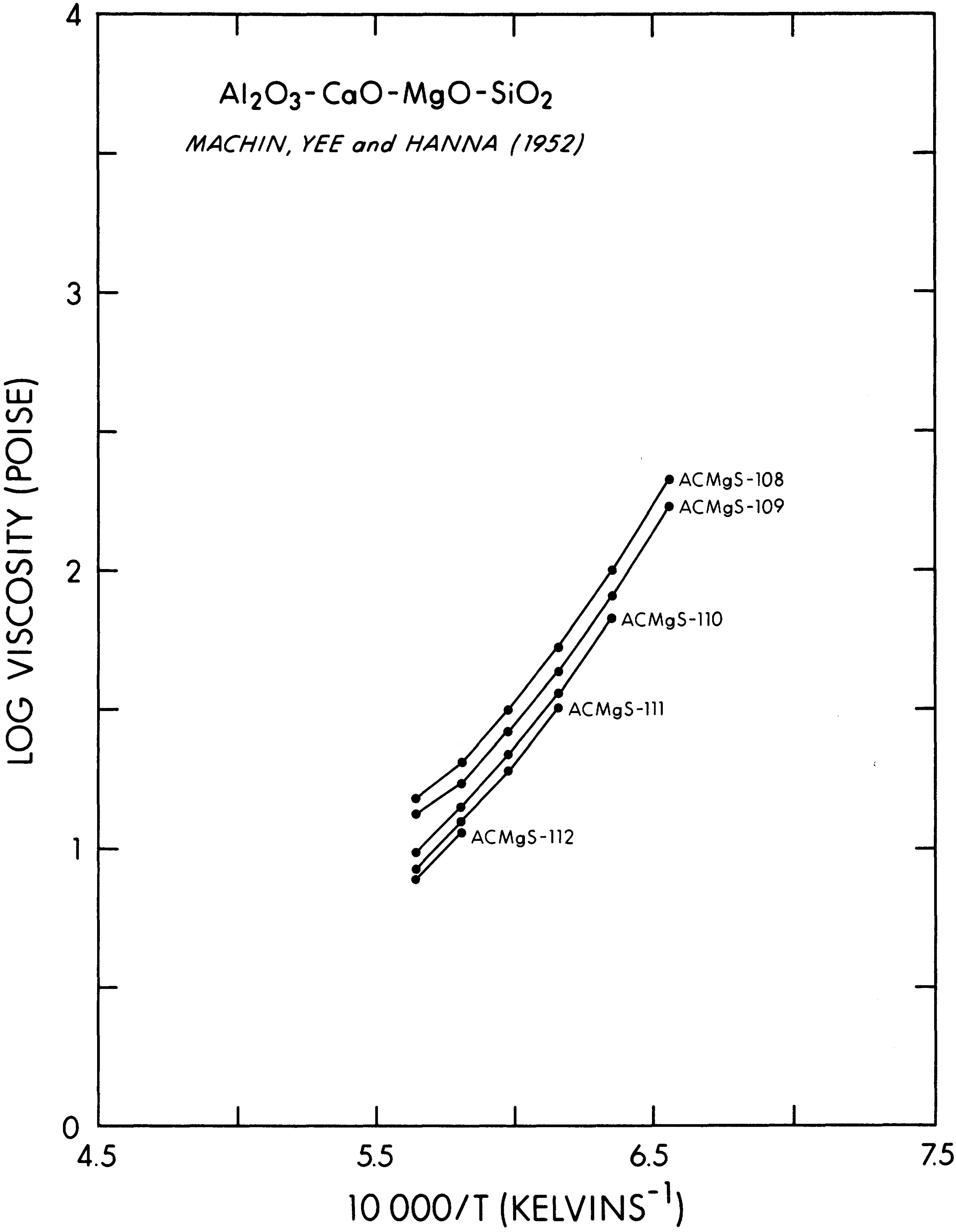
Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-99
ACMgS-101
ACMgS-100
ACMgS-102
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
4.5
5.5
6.5
7.5


Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-104
ACMgS-105
ACMgS-106
ACMgS-107
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500

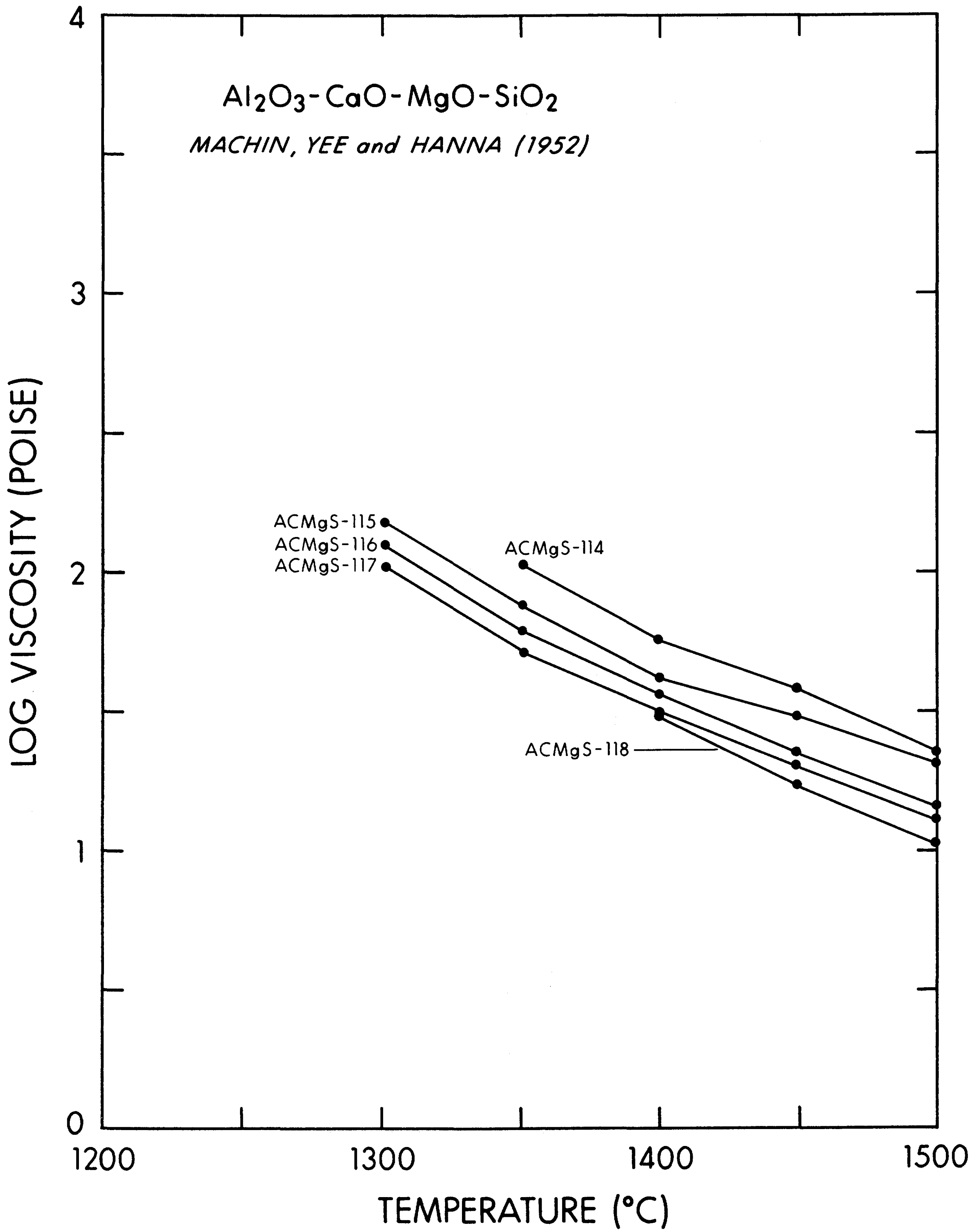

Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5
ACMgS-104
ACMgS-105
ACMgS-106
ACMgS-107



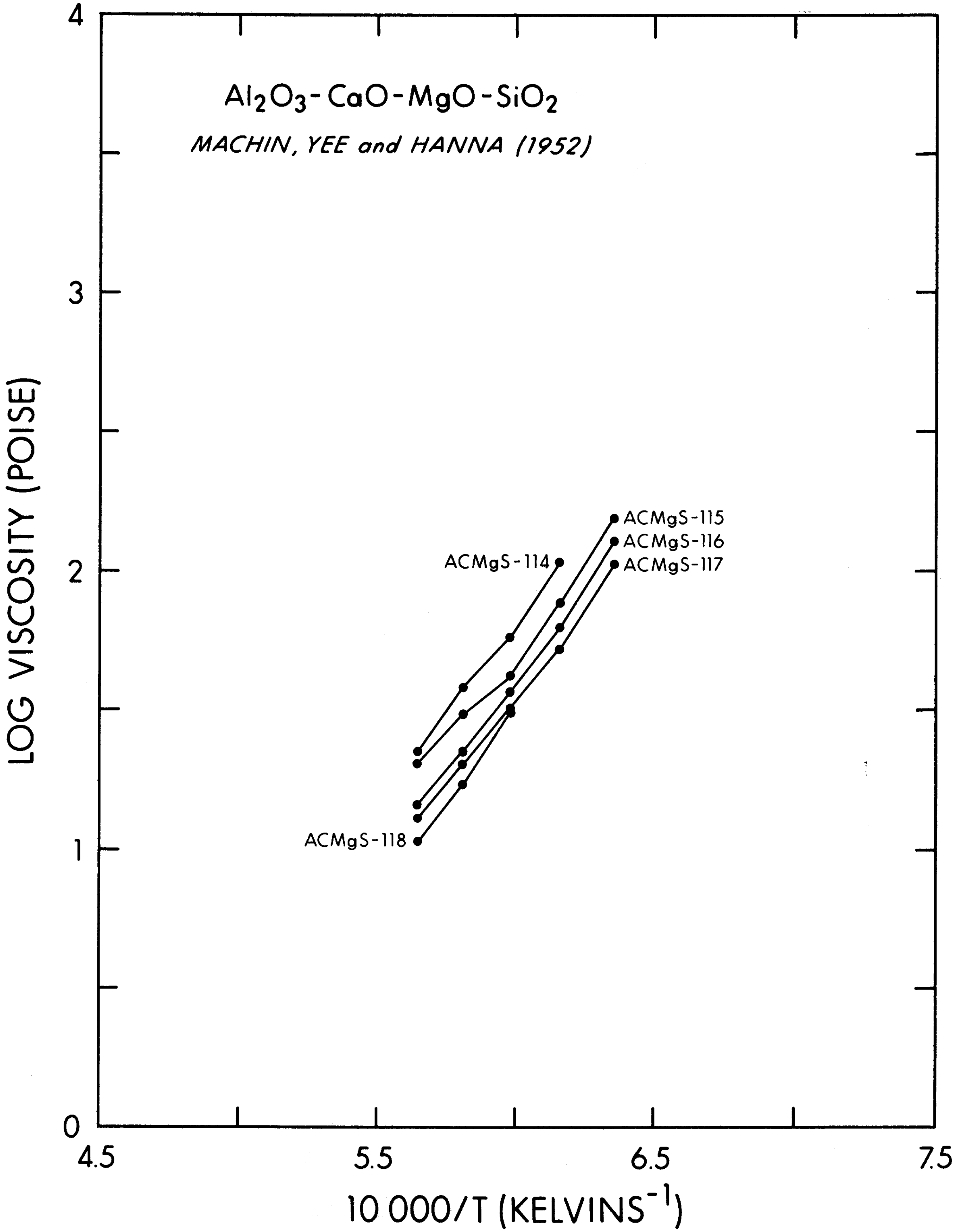
Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500
ACMgS-108
ACMgS-109
ACMgS-110
ACMgS-111
ACMgS-112

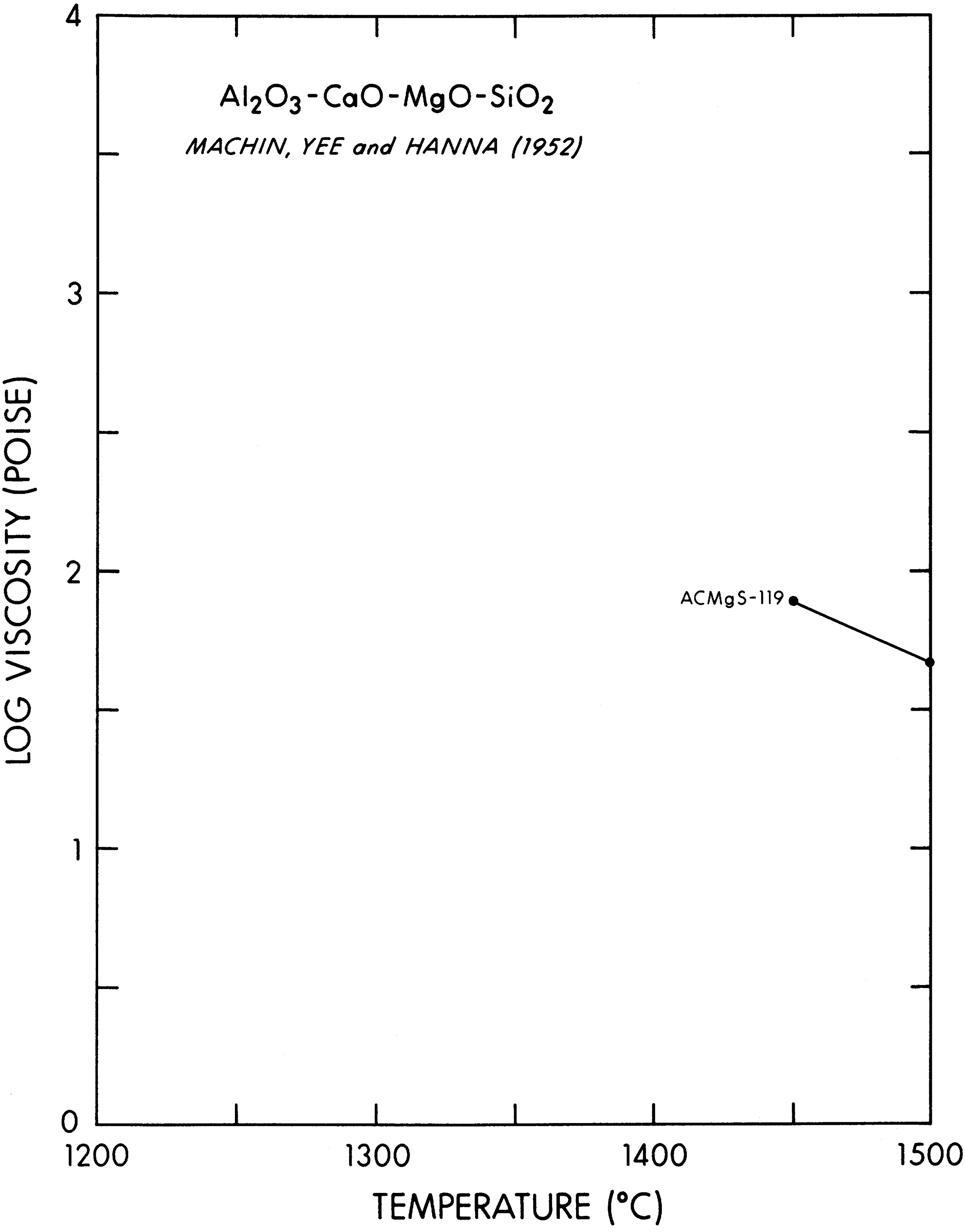


Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-108
ACMgS-109
ACMgS-110
ACMgS-111
ACMgS-112
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
4.5
5.5
6.5
7.5

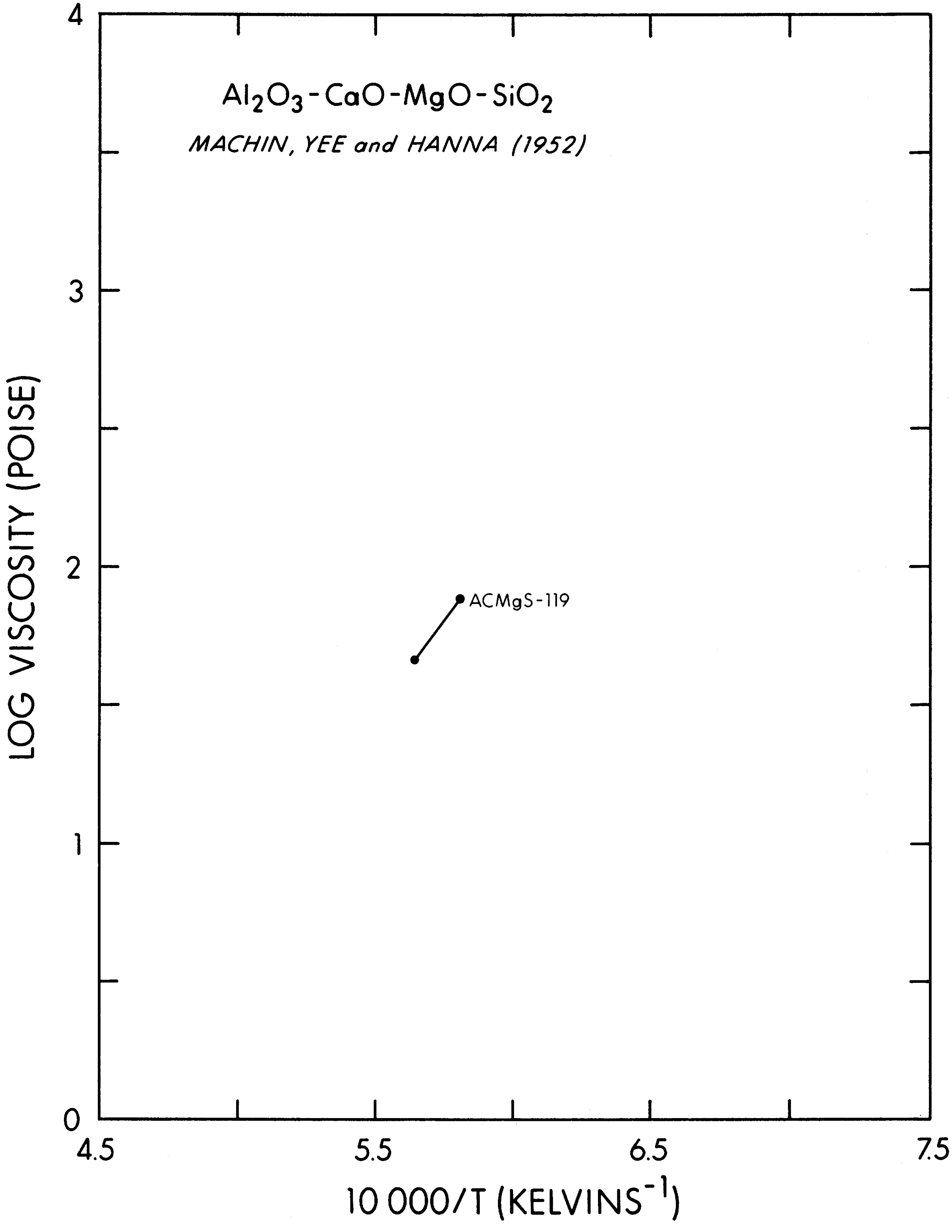


Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-115
ACMgS-116
ACMgS-117
ACMgS-114
ACMgS-118
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500

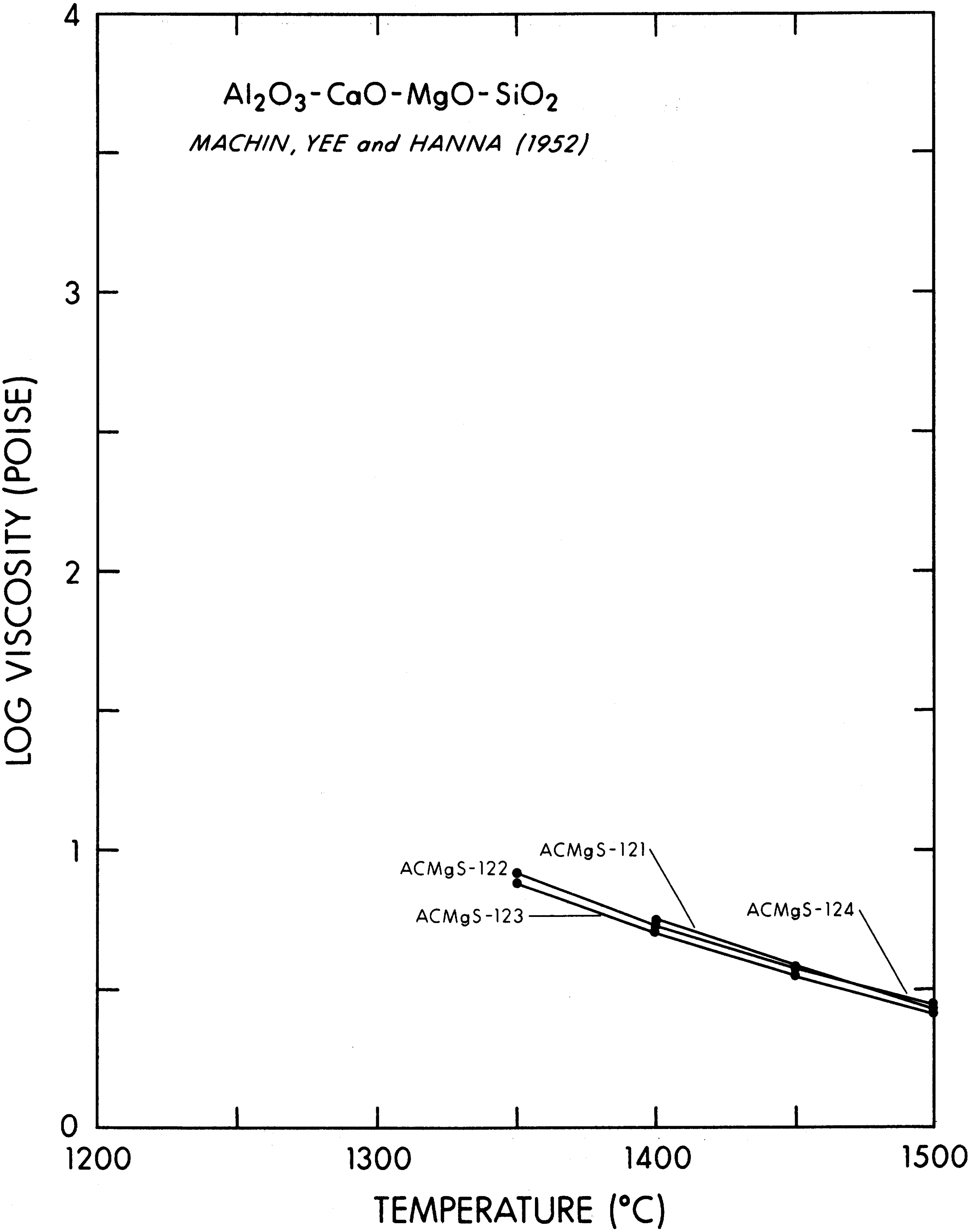

Al_2O_3 - CaO - MgO - SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-114
ACMgS-115
ACMgS-116
ACMgS-117
ACMgS-118
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5



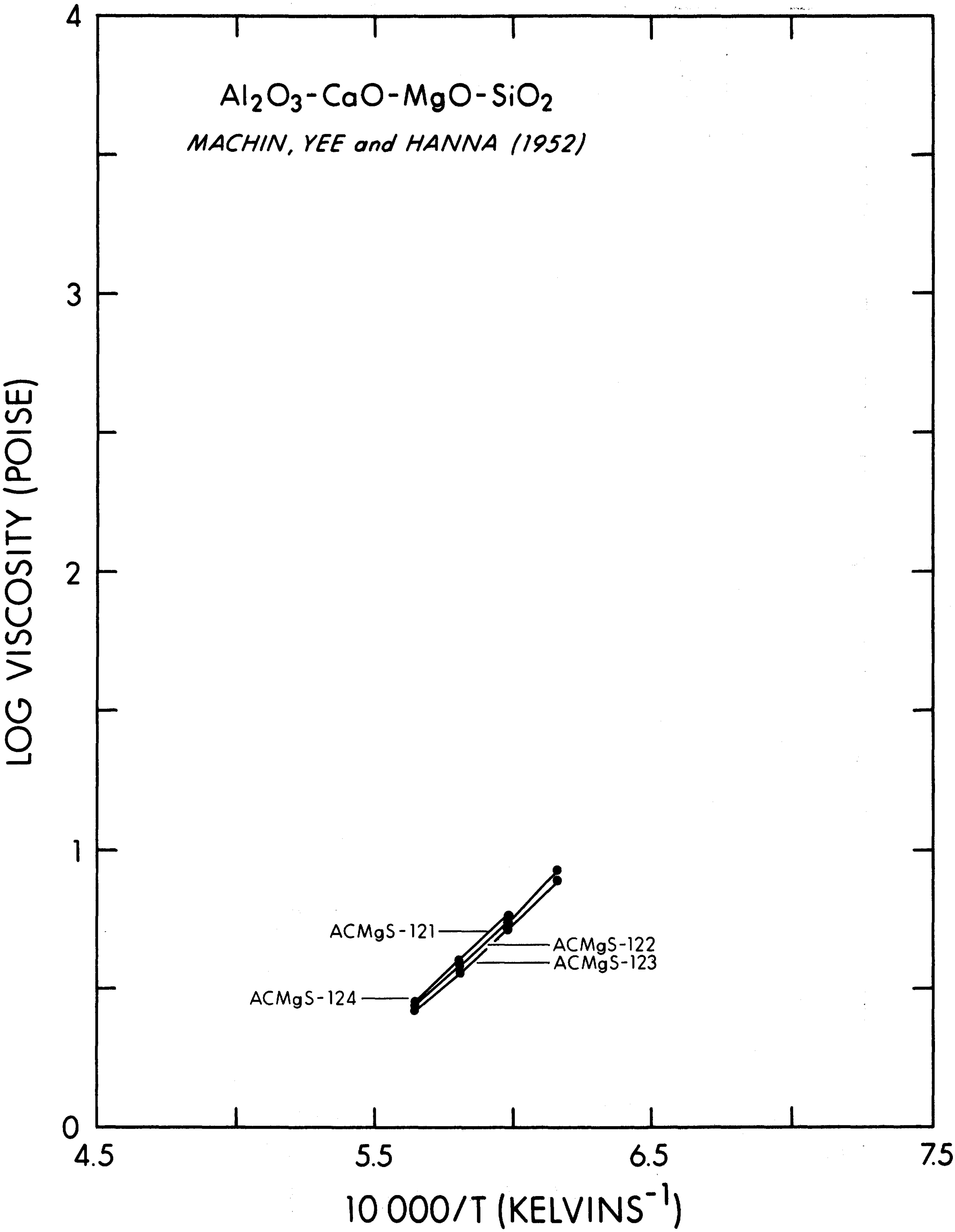
Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-119
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500

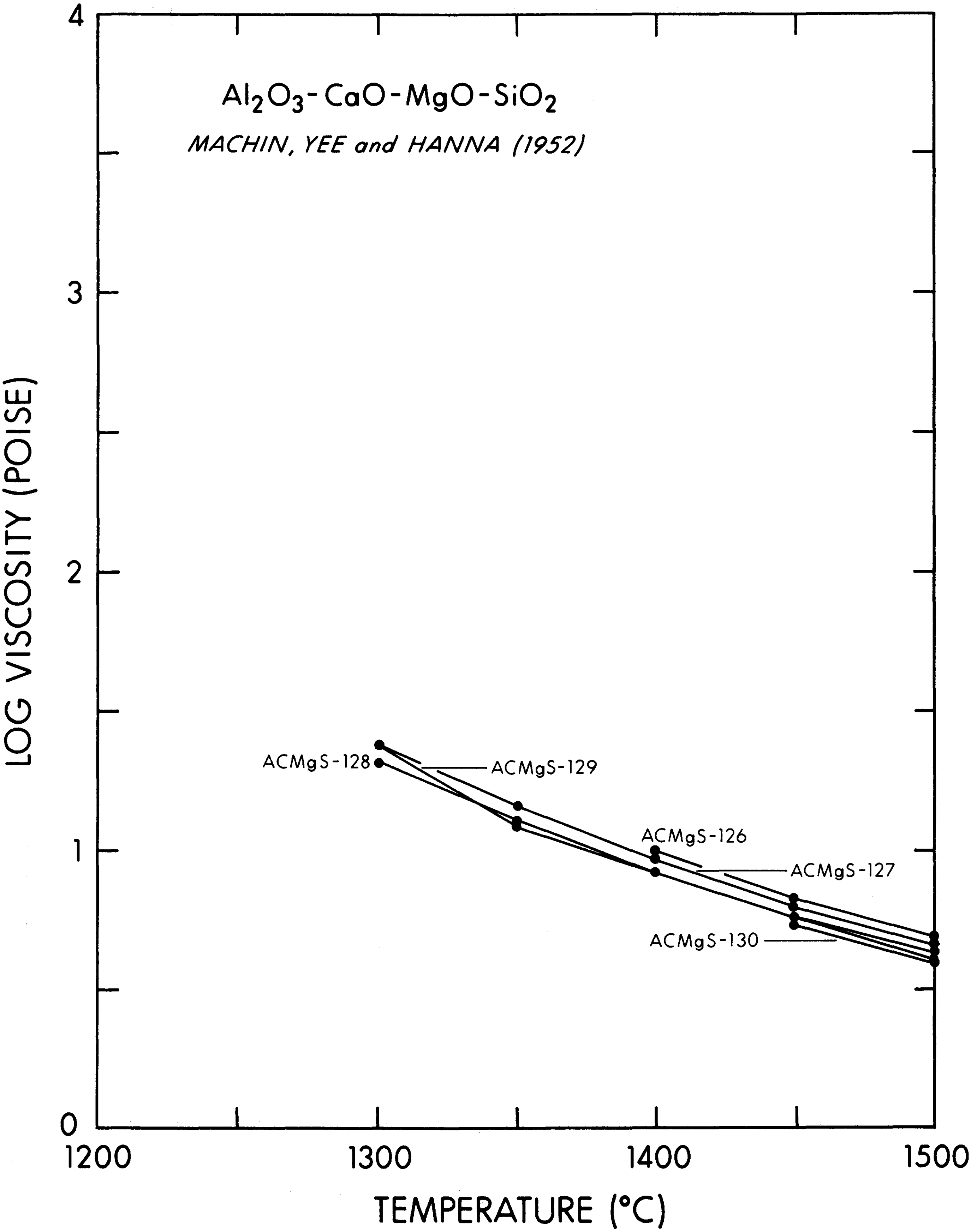


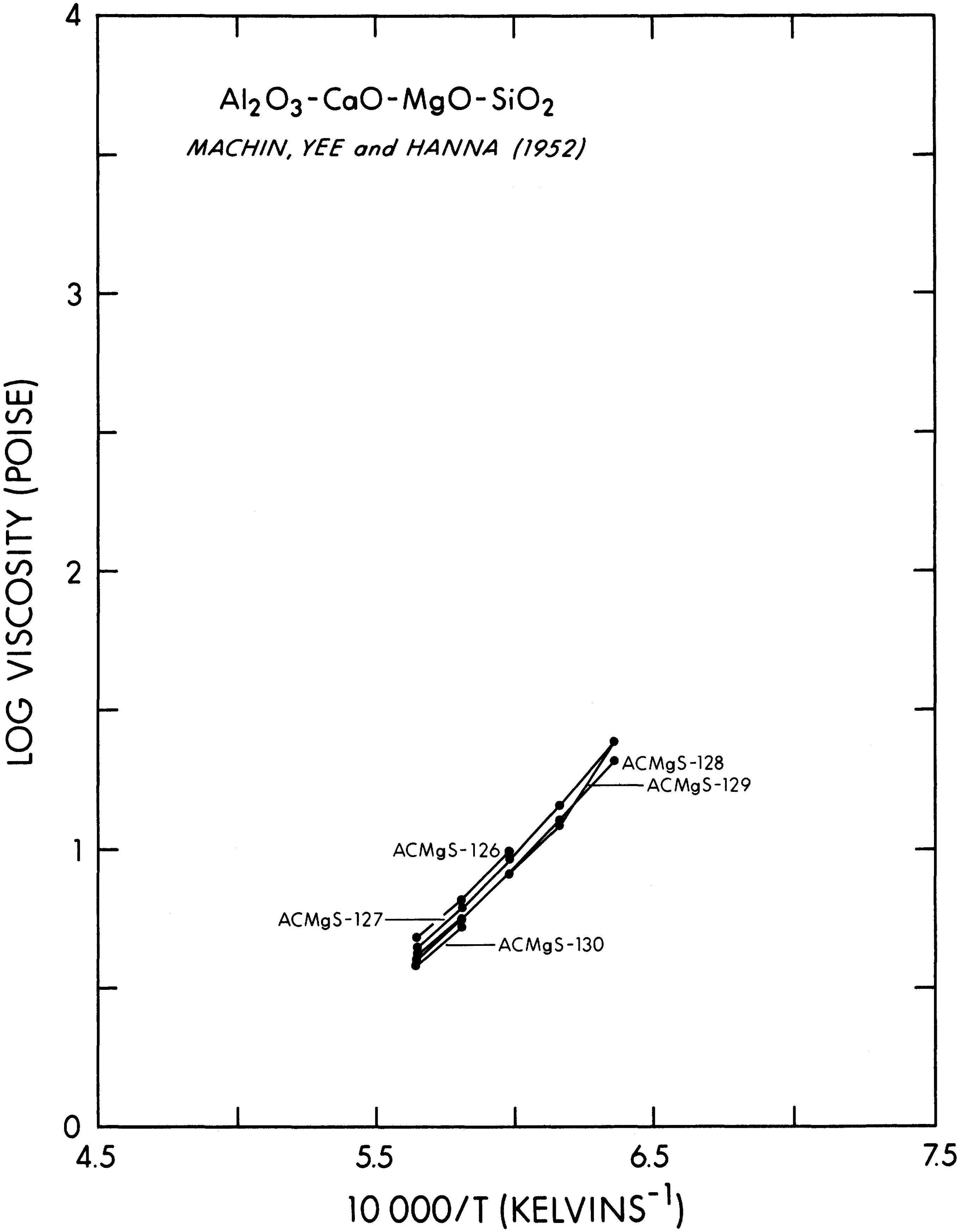
Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-119
LOG VISCOSITY (POISE)
4
3
2
1
0
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})

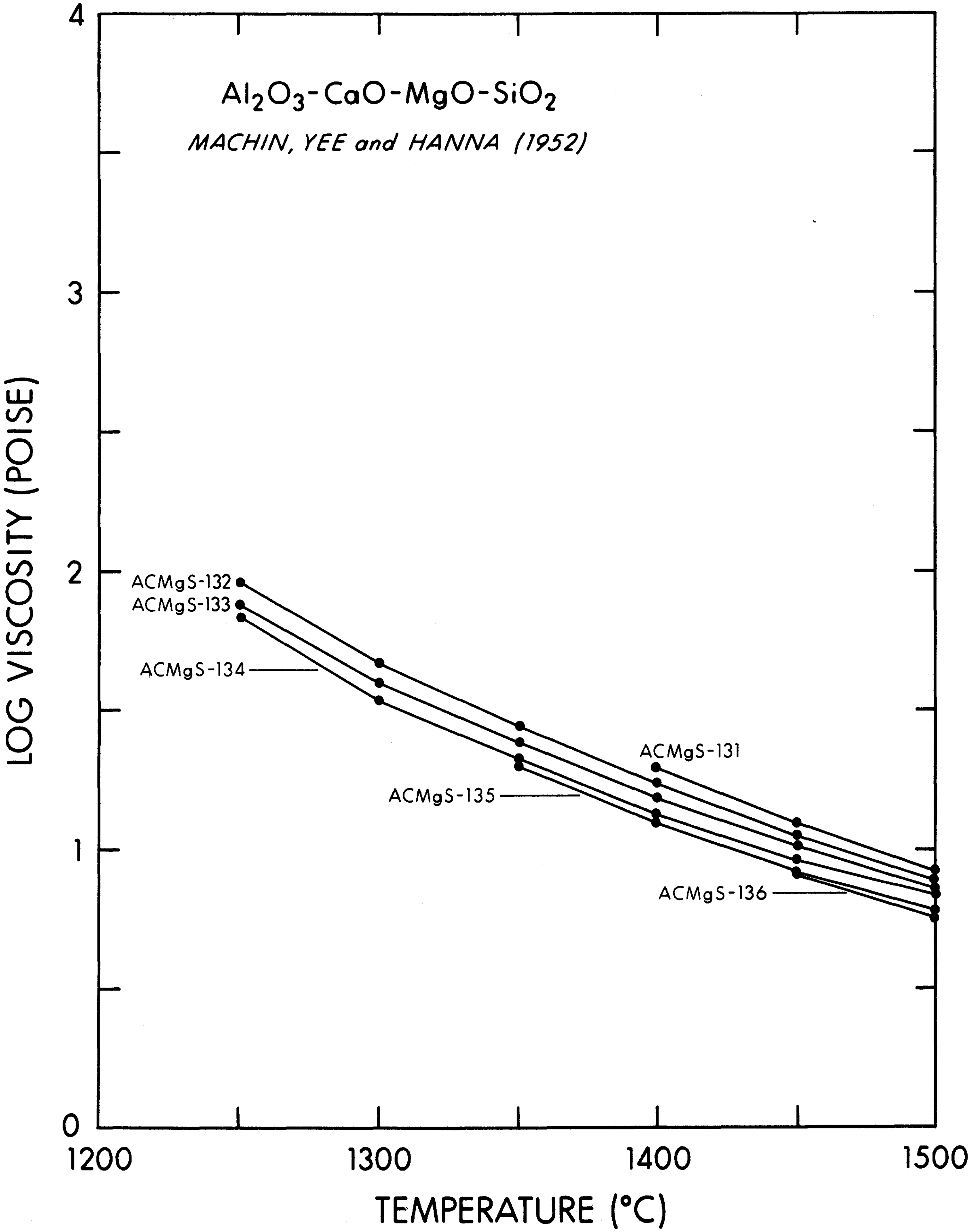


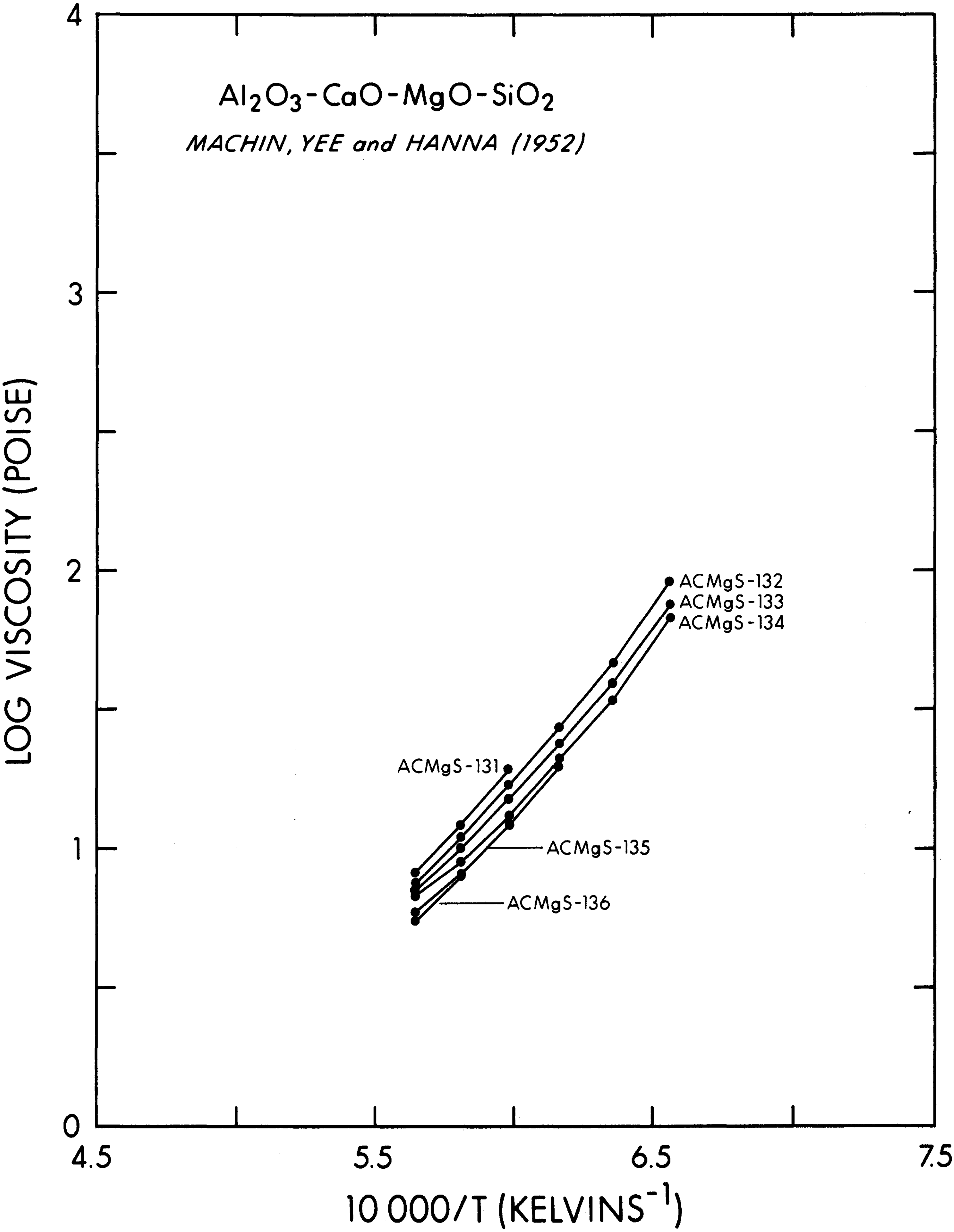
Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-121
ACMgS-122
ACMgS-123
ACMgS-124
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500


Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
ACMgS-121
ACMgS-122
ACMgS-123
ACMgS-124
0
1
2
3
4
4.5
5.5
6.5
7.5

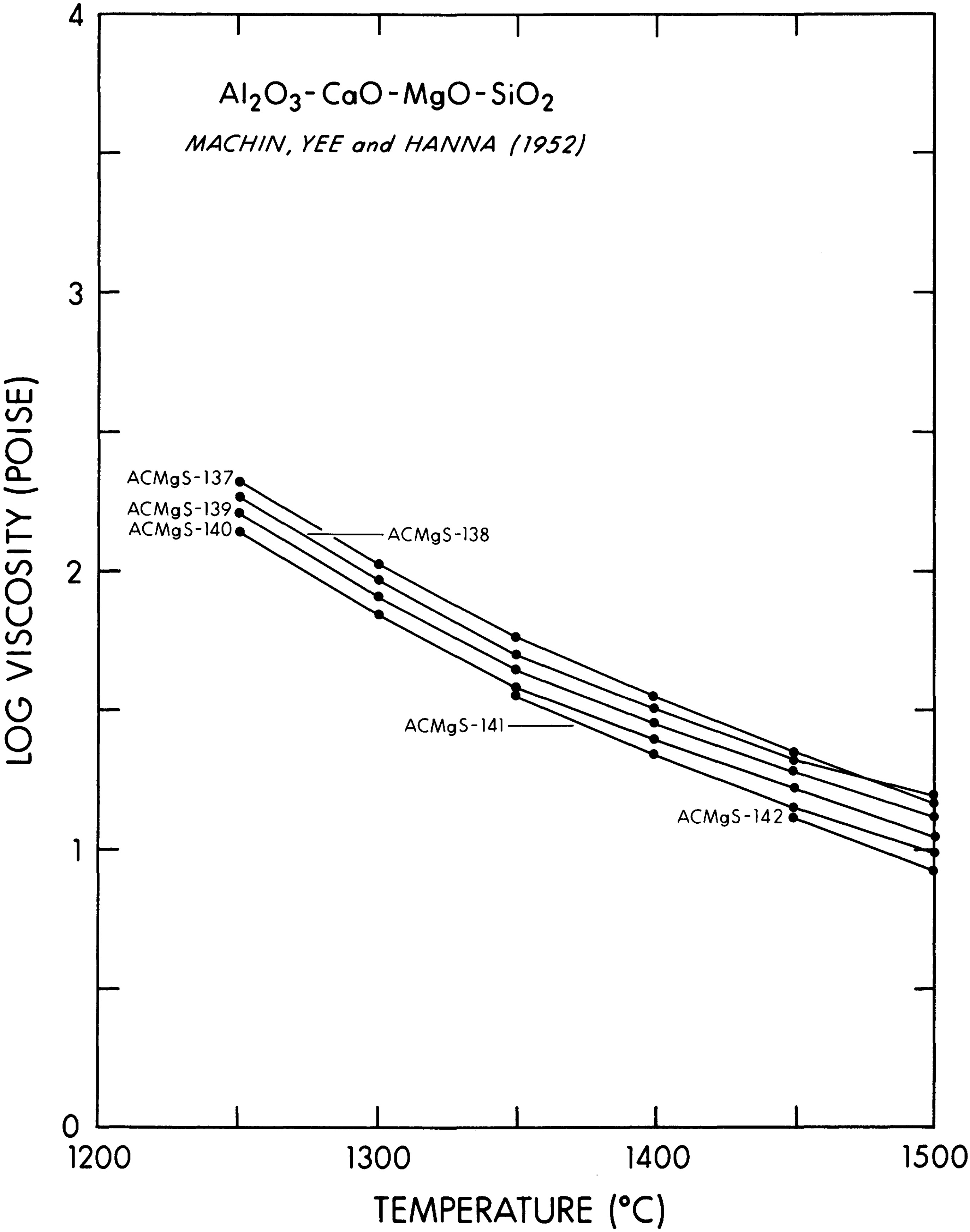

Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-128
ACMgS-129
ACMgS-126
ACMgS-127
ACMgS-130
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500

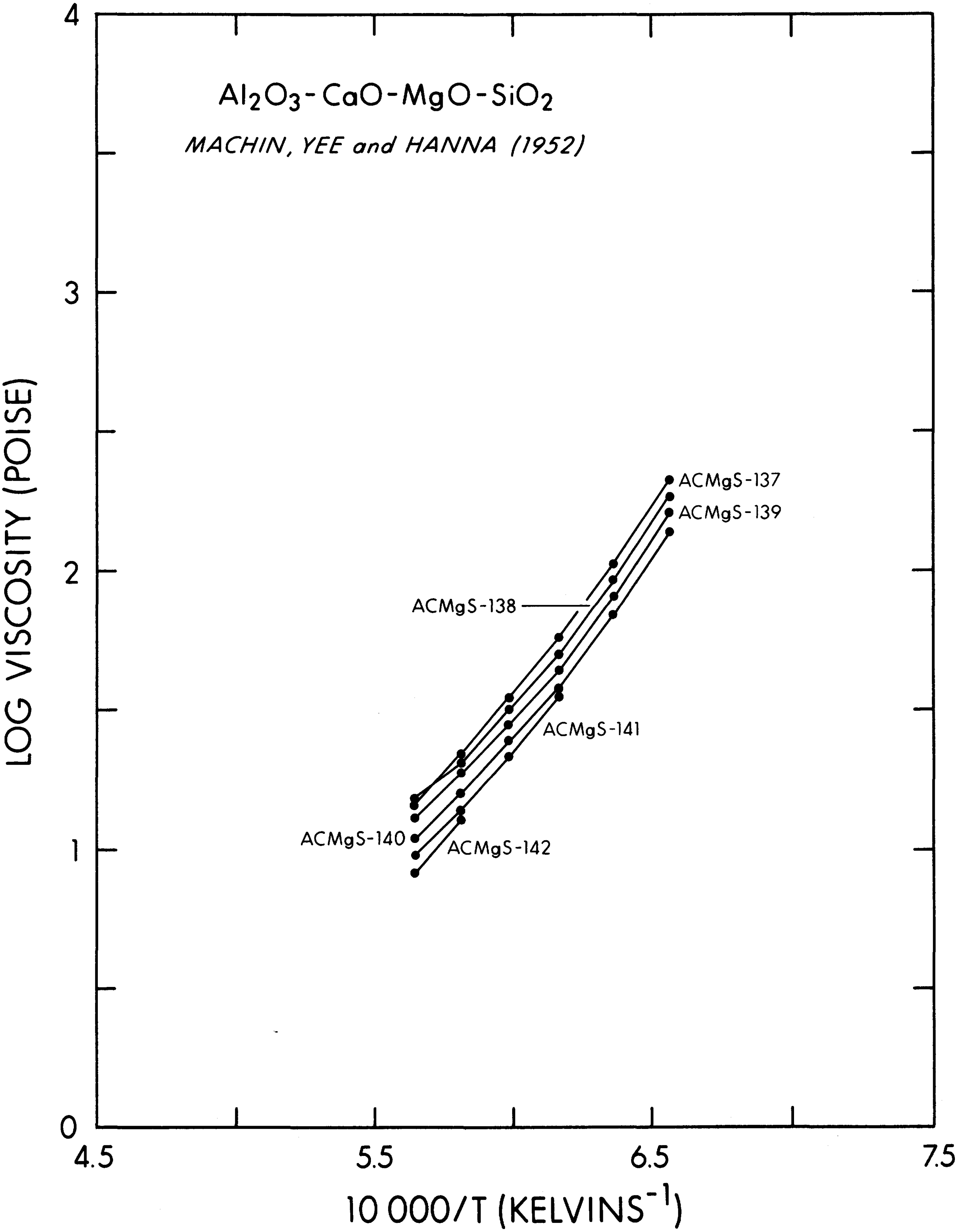

Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5
ACMgS-128
ACMgS-129
ACMgS-126
ACMgS-127
ACMgS-130

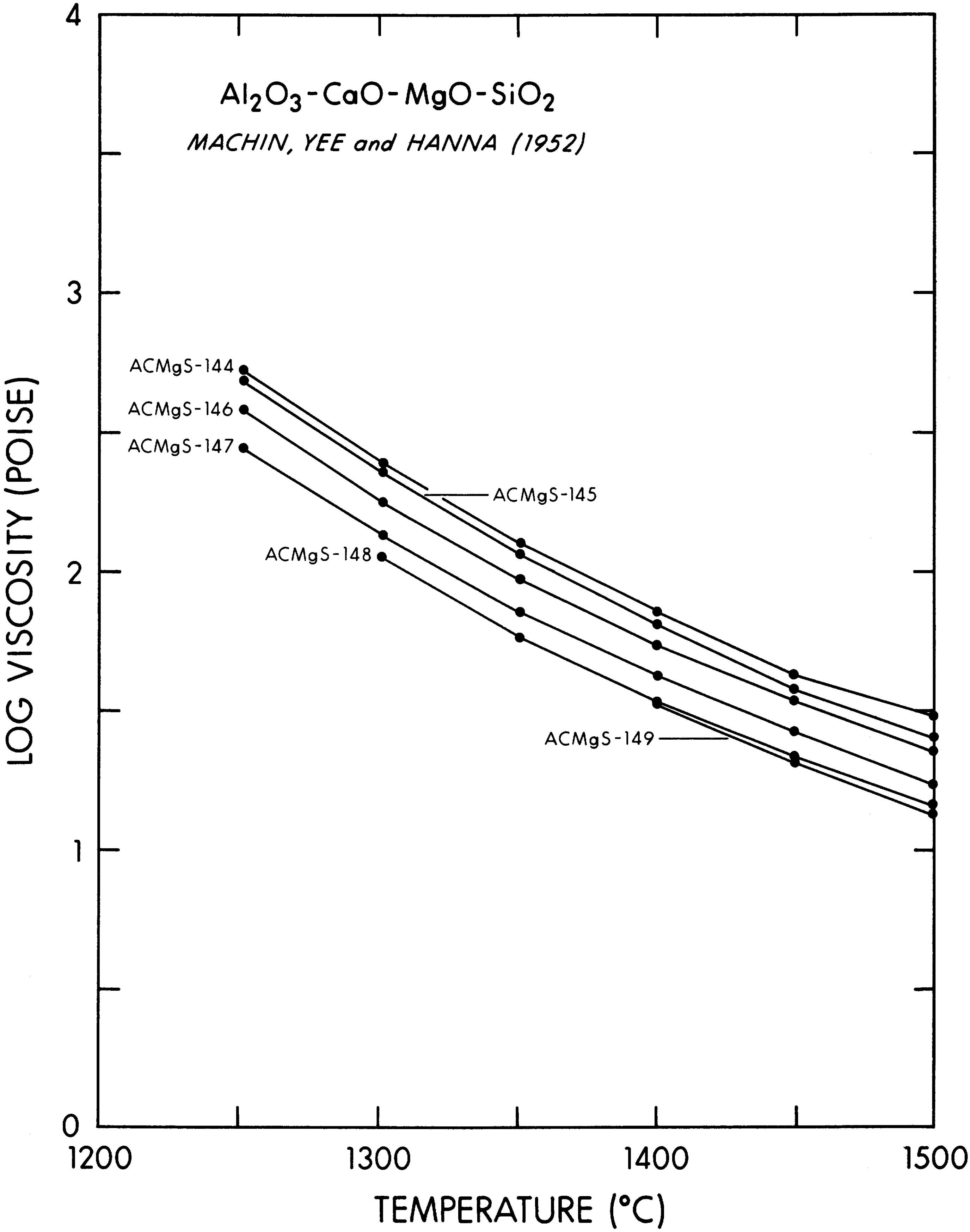

Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-132
ACMgS-133
ACMgS-134
ACMgS-131
ACMgS-135
ACMgS-136
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500



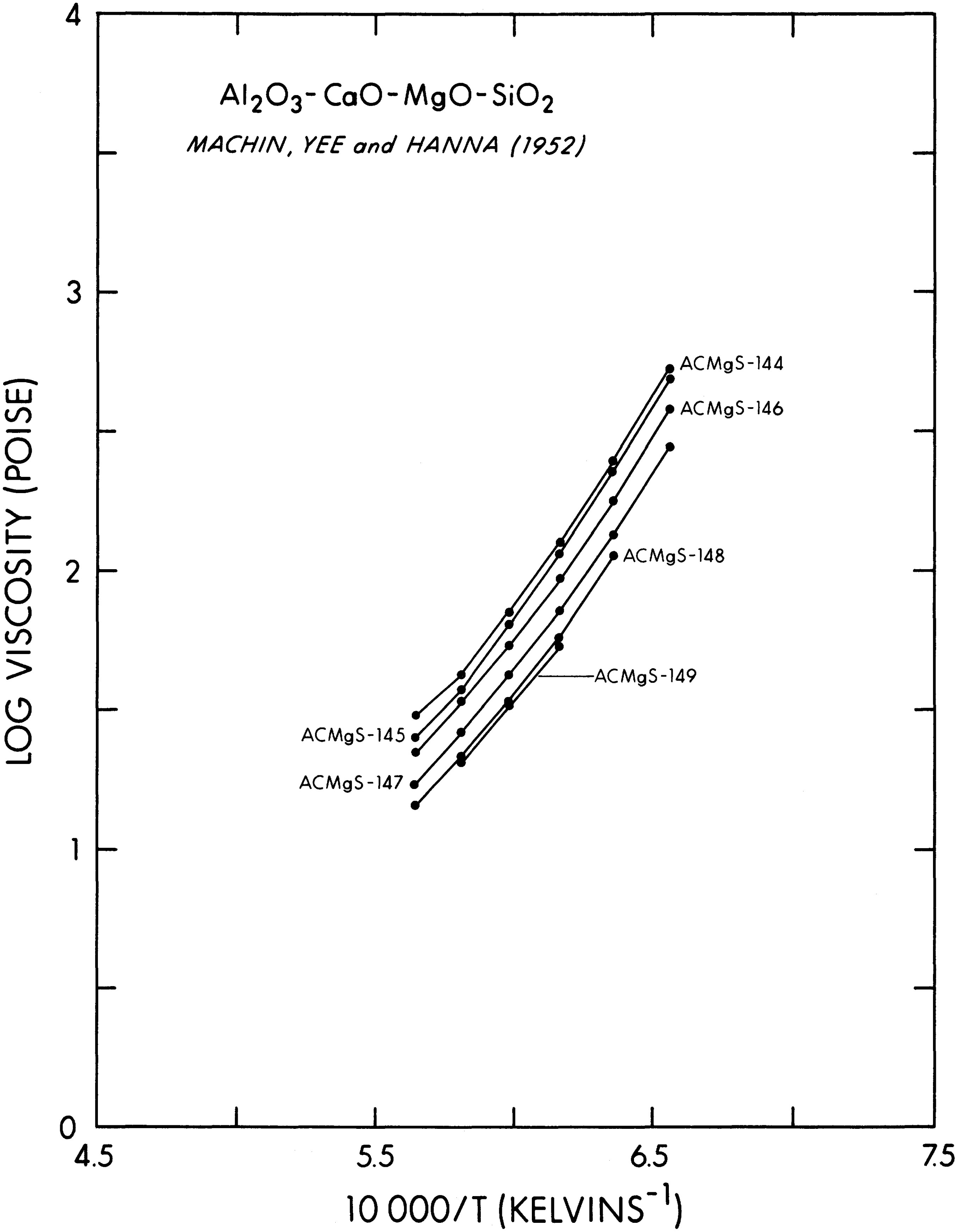
$Al_2O_3-CaO-MgO-SiO_2$
MACHIN, YEE and HANNA (1952)
ACMgS-131
ACMgS-132
ACMgS-133
ACMgS-134
ACMgS-135
ACMgS-136
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
4.5
5.5
6.5
7.5

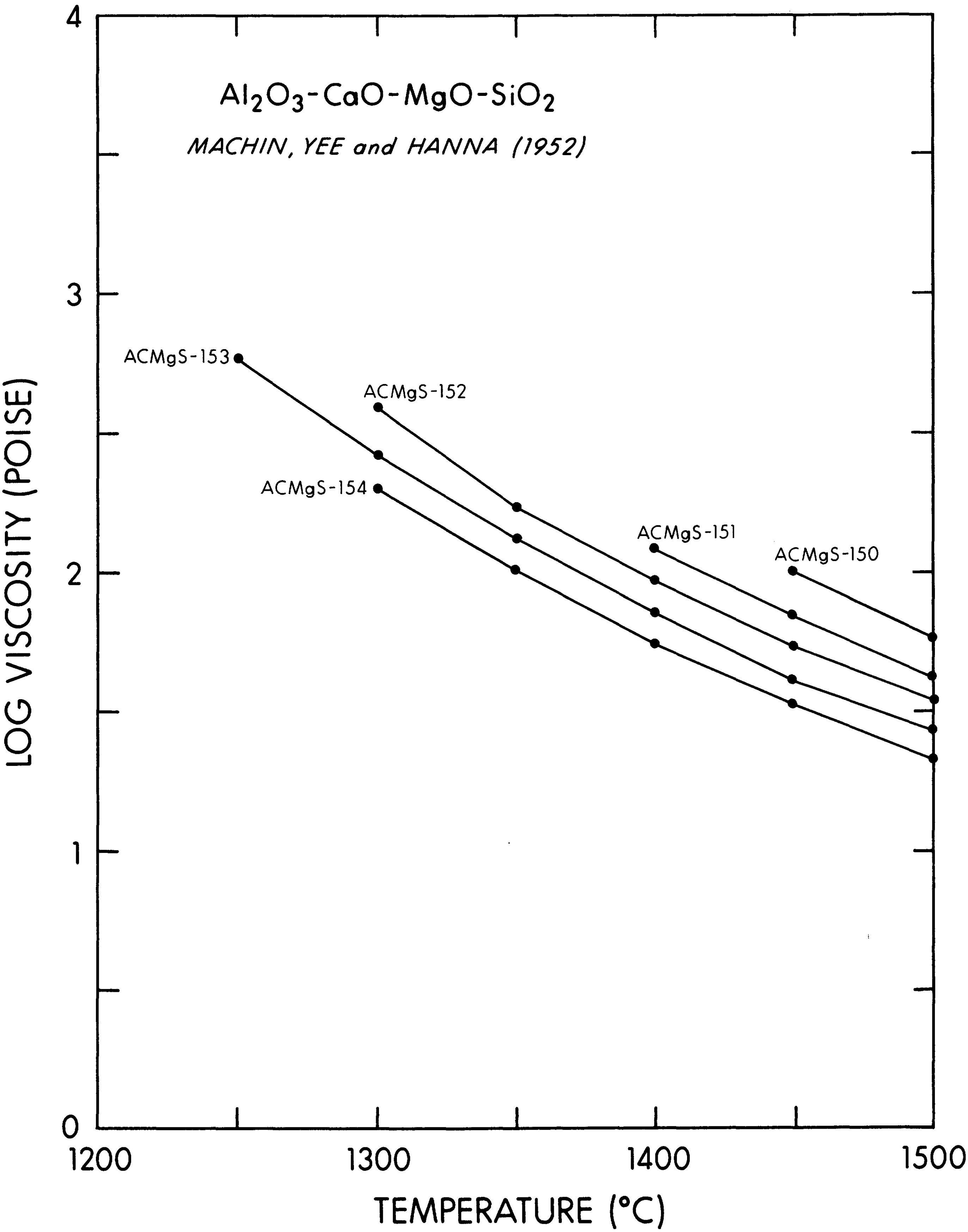

Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-137
ACMgS-139
ACMgS-140
ACMgS-138
ACMgS-141
ACMgS-142
LOG VISCOSITY (POISE)
4
3
2
1
0
1200
1300
1400
1500
TEMPERATURE (°C)

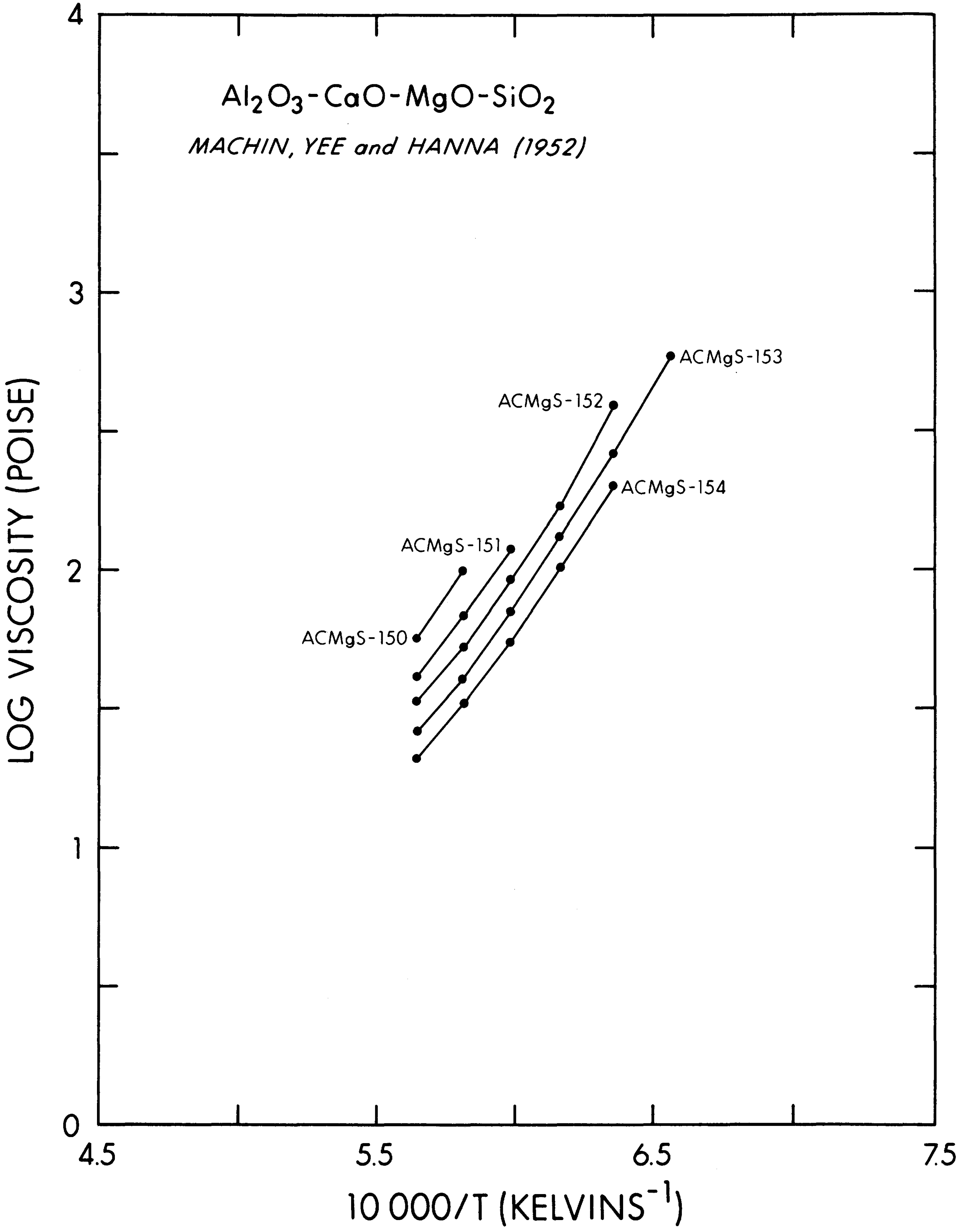

Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-137
ACMgS-139
ACMgS-138
ACMgS-141
ACMgS-140
ACMgS-142
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5



Al$_2$O$_3$-CaO-MgO-SiO$_2$
MACHIN, YEE and HANNA (1952)
ACMgS-144
ACMgS-146
ACMgS-147
ACMgS-145
ACMgS-148
ACMgS-149
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
4
3
2
1
0
1200
1300
1400
1500


Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-144
ACMgS-146
ACMgS-148
ACMgS-149
ACMgS-145
ACMgS-147
LOG VISCOSITY (POISE)
0
1
2
3
4
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})


Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-153
ACMgS-152
ACMgS-154
ACMgS-151
ACMgS-150
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
4
3
2
1
0
1200
1300
1400
1500



Al_2O_3-CaO-MgO-SiO_2
MACHIN, YEE and HANNA (1952)
ACMgS-150
ACMgS-151
ACMgS-152
ACMgS-153
ACMgS-154
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
4.5
5.5
6.5
7.5

SYSTEM

$Al_2O_3(.13)K_2O(.04)Na_2O(.09)SiO_2(.75)$ (X)

AUTHOR

N'DALA et al. (1984)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

AKNS-1

T	Z	LN(N)	LOG(N)	N
1523.	5.567	9.04	3.92	8433.
1535.	5.530	8.96	3.89	7785.
1547.	5.494	8.63	3.74	5597.
1566.	5.437	8.59	3.73	5377.
1578.	5.402	8.40	3.64	4447.
1585.	5.382	8.06	3.50	3165.
1611.	5.307	7.93	3.44	2779.
1629.	5.257	7.64	3.17	2079.
1632.	5.249	7.65	3.32	2100.
1634.	5.243	7.59	3.29	1978.

SYSTEM

$Al_2O_3(.13)K_2O(.06)Na_2O(.06)SiO_2(.75)$ (X)

AUTHOR

N'DALA et al. (1984)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

AKNS-2

T	Z	LN(N)	LOG(N)	N
1513.	5.599	11.02	4.78	61083.
1530.	5.546	11.00	4.77	59874.
1595.	5.353	10.16	4.41	25848.
1600.	5.339	10.17	4.41	26108.
1601.	5.336	10.17	4.41	26108.
1613.	5.302	9.93	4.31	20537.
1616.	5.293	9.93	4.31	20537.
1617.	5.291	9.76	4.23	17326.
1621.	5.279	9.79	4.25	17854.
1628.	5.260	9.77	4.24	17500.
1630.	5.254	9.66	4.19	15677.

Five-Component Systems

SYSTEM
AL2O3(5.69),CAO(46.53),BAO(1.99),
MGO(7.19),SIO2(38.60) (X)
AL2O3(9.5),CAO(42.75),BAO(5.0),
MGO(4.75),SIO2(38.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

A C B M g S – 1

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.332	1.013	10.3
1450.00	5.804	2.028	0.881	7.6
1500.00	5.640	1.686	0.732	5.4
1550.00	5.485	1.411	0.613	4.1

SYSTEM
AL2O3(5.71),CAO(41.50),BAO(2.0),
MGO(7.22),SIO2(43.58) (X)
AL2O3(9.5),CAO(38.0),BAO(5.0),
MGO(4.75),SIO2(42.75) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

A C B M g S – 2

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.425	1.053	11.3
1450.00	5.804	2.028	0.881	7.6
1500.00	5.640	1.723	0.748	5.6
1550.00	5.485	1.411	0.613	4.1

SYSTEM
AL2O3(5.73),CAO(36.44),BAO(2.00),
MGO(7.24),SIO2(48.59) (X)
AL2O3(9.5),CAO(33.25),BAO(5.0),
MGO(4.75),SIO2(47.5) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS–3

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	3.250	1.412	25.8
1450.00	5.804	2.398	1.041	11.0
1500.00	5.640	1.988	0.863	7.3
1550.00	5.485	1.548	0.672	4.7

SYSTEM
AL2O3(5.67),CAO(51.52),BAO(1.98),
MGO(7.17),SIO2(33.66) (X)
AL2O3(9.5),CAO(47.5),BAO(5.0),
MGO(4.75),SIO2(33.25) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)

P = 1.0 ATM.

T (DEGREES C)

Z = 10000.0/T(K) (1/K)

A C B M g S – 4

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.390	1.033	10.8
1500.00	5.640	2.186	0.949	8.9
1550.00	5.485	2.015	0.875	7.5

SYSTEM
AL2O3(5.61),CAO(30.61),BAO(1.96),
MGO(14.20),SIO2(47.61) (X)
AL2O3(9.5),CAO(28.5),BAO(5.0),
MGO(9.5),SIO2(47.5) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-5

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	3.157	1.371	23.5
1450.00	5.804	2.342	1.017	10.4
1500.00	5.640	1.668	0.724	5.3
1550.00	5.485	0.693	0.301	2.0

SYSTEM
AL2O3(5.59),CAO(35.59),BAO(1.96),
MGO(14.15),SIO2(42.71) (X)
AL2O3(9.5),CAO(33.25),BAO(5.0),
MGO(9.5),SIO2(42.75) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-6

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.262	0.982	9.6
1450.00	5.804	1.808	0.785	6.1
1500.00	5.640	1.411	0.613	4.1
1550.00	5.485	0.993	0.431	2.7

SYSTEM
AL2O3(5.57),CAO(40.54),BAO(1.95),
MGO(14.10),SIO2(37.83) (X)
AL2O3(9.5),CAO(38.0),BAO(5.0),
MGO(9.5),SIO2(38.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-7

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.128	0.924	8.4
1450.00	5.804	1.723	0.748	5.6
1500.00	5.640	1.253	0.544	3.5
1550.00	5.485	0.788	0.342	2.2

SYSTEM
AL2O3(5.56),CAO(45.45),BAO(1.94),
MGO(14.10),SIO2(37.83) (X)
AL2O3(9.5),CAO(42.75),BAO(5.0),
MGO(9.5),SIO2(33.25) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-8

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	1.526	0.663	4.6
1500.00	5.640	1.281	0.556	3.6
1550.00	5.485	1.099	0.477	3.0

SYSTEM
AL2O3(5.48),CAO(29.91),BAO(1.92),
MGO(20.81),SIO2(41.88) (X)
AL2O3(9.5),CAO(28.5),BAO(5.0),
MGO(14.25),SIO2(42.75) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-9

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.668	0.724	5.3
1450.00	5.804	1.386	0.602	4.0
1500.00	5.640	0.993	0.431	2.7
1550.00	5.485	0.788	0.342	2.2

SYSTEM
AL2O3(5.47),CAO(34.78),BAO(1.91),
MGO(20.74),SIO2(37.10) (X)
AL2O3(9.5),CAO(33.25),BAO(5.0),
MGO(14.25),SIO2(38.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-10

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.370	1.029	10.7
1450.00	5.804	1.335	0.580	3.8
1500.00	5.640	0.993	0.431	2.7
1550.00	5.485	0.588	0.255	1.8

SYSTEM
AL2O3(5.45),CAO(39.62),BAO(1.91),
MGO(20.67),SIO2(32.36) (X)
AL2O3(9.5),CAO(38.0),BAO(5.0),
MGO(14.25),SIO2(33.25) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-11

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	1.131	0.491	3.1
1500.00	5.640	0.742	0.322	2.1
1550.00	5.485	0.405	0.176	1.5

SYSTEM
AL2O3(5.43),CAO(44.43),BAO(1.90),
MGO(20.60),SIO2(27.64) (X)
AL2O3(9.5),CAO(42.75),BAO(5.0),
MGO(14.25),SIO2(28.5) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-12

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	3.270	1.420	26.3
1500.00	5.640	1.872	0.813	6.5
1550.00	5.485	1.526	0.663	4.6

SYSTEM
AL2O3(11.40),CAO(31.10),BAO(2.0),
MGO(21.63),SIO2(33.87) (X)
AL2O3(19.0),CAO(28.5),BAO(5.0),
MGO(14.25),SIO2(33.25) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-13

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.322	1.009	10.2
1450.00	5.804	1.629	0.708	5.1
1500.00	5.460	1.308	0.568	3.7
1550.00	5.485	1.030	0.447	2.8

SYSTEM
AL2O3(11.32),CAO(41.18),BAO(1.98),
MGO(21.49),SIO2(24.03) (X)
AL2O3(19.0),CAO(38.0),BAO(5.0),
MGO(14.25),SIO2(23.75) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-14

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.230	0.968	9.3
1450.00	5.804	1.435	0.623	4.2
1500.00	5.640	1.253	0.544	3.5
1550.00	5.485	1.030	0.447	2.8

SYSTEM
AL2O3(11.52),CAO(52.36),BAO(2.02),
MGO(14.57),SIO2(19.55) (X)
AL2O3(19.0),CAO(47.5),BAO(5.0),
MGO(9.5),SIO2(19.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-15

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	3.235	1.405	25.4
1500.00	5.640	1.825	0.792	6.2
1550.00	5.485	1.548	0.672	4.7

SYSTEM
AL2O3(5.60),CAO(35.65),BAO(4.14),
MGO(7.08),SIO2(47.53) (X)
AL2O3(9.0),CAO(31.5),BAO(10.0),
MGO(4.5),SIO2(45.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-16

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.785	1.210	16.2
1450.00	5.804	2.332	1.013	10.3
1500.00	5.640	1.856	0.806	6.4
1550.00	5.485	1.411	0.613	4.1

SYSTEM
AL2O3(5.58),CAO(40.60),BAO(4.12),
MGO(7.06),SIO2(42.63) (X)
AL2O3(9.0),CAO(36.0),BAO(10.0),
MGO(4.5),SIO2(40.5) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-17

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.518	1.093	12.4
1450.00	5.804	2.079	0.903	8.0
1500.00	5.640	1.758	0.763	5.8
1550.00	5.485	1.482	0.643	4.4

SYSTEM
AL2O3(5.56),CAO(45.52),BAO(4.11),
MGO(7.03),SIO2(37.77) (X)
AL2O3(9.0),CAO(40.5),BAO(10.0),
MGO(4.5),SIO2(36.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-18

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.653	1.152	14.2
1450.00	5.804	2.303	1.000	10.0
1500.00	5.640	1.917	0.833	6.8
1550.00	5.485	1.548	0.672	4.7

SYSTEM
AL2O3(5.55),CAO(50.41),BAO(4.10),
MGO(7.01),SIO2(32.93) (X)
AL2O3(9.0),CAO(45.0),BAO(10.0),
MGO(4.5),SIO2(31.5) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-19

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.728	1.185	15.3
1500.00	5.640	2.518	1.093	12.4
1550.00	5.485	2.322	1.009	10.2

SYSTEM
AL2O3(9.46),CAO(51.60),BAO(6.99),
MGO(23.93),SIO2(8.03) (X)
AL2O3(9.0),CAO(27.0),BAO(10.0),
MGO(9.0),SIO2(45.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-20

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.674	1.161	14.5
1450.00	5.804	2.163	0.940	8.7
1500.00	5.640	1.569	0.681	4.8
1550.00	5.485	0.788	0.342	2.2

SYSTEM
AL2O3(5.47),CAO(34.83),BAO(4.04),
MGO(13.85),SIO2(41.8) (X)
AL2O3(9.0),CAO(31.5),BAO(10.0),
MGO(9.0),SIO2(40.5) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-21

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.370	1.029	10.7
1450.00	5.804	1.856	0.806	6.4
1500.00	5.640	1.482	0.643	4.4
1550.00	5.485	1.030	0.447	2.8

SYSTEM
AL2O3(5.46),CAO(39.67),BAO(4.03),
MGO(13.8),SIO2(37.04) (X)
AL2O3(9.0),CAO(36.0),BAO(10.0),
MGO(9.0),SIO2(36.0) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-22

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.442	1.061	11.5
1450.00	5.804	1.974	0.857	7.2
1500.00	5.640	1.411	0.613	4.1
1550.00	5.485	0.693	0.301	2.0

SYSTEM
AL2O3(5.44),CAO(44.49),BAO(4.02),
MGO(13.76),SIO2(32.29) (X)
AL2O3(9.0),CAO(40.5),BAO(10.0),
MGO(9.0),SIO2(31.5) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-23

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	1.872	0.813	6.5
1500.00	5.640	1.609	0.699	5.0
1550.00	5.485	1.435	0.623	4.2

SYSTEM
AL2O3(5.37),CAO(29.29),BAO(3.97),
MGO(20.37),SIO2(41.0) (X)
AL2O3(9.0),CAO(27.0),BAO(10.0),
MGO(13.5),SIO2(40.5) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-24

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.649	0.716	5.2
1450.00	5.804	1.308	0.568	3.7
1500.00	5.640	0.916	0.398	2.5
1550.00	5.485	0.788	0.342	2.2

SYSTEM
AL2O3(5.35),CAO(34.06),BAO(3.95),
MGO(20.31),SIO2(36.33) (X)
AL2O3(9.0),CAO(31.5),BAO(10.0),
MGO(13.5),SIO2(36.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-25

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.872	0.813	6.5
1450.00	5.804	1.435	0.623	4.2
1500.00	5.640	1.099	0.477	3.0
1550.00	5.485	0.742	0.322	2.1

SYSTEM
AL2O3(5.34),CAO(38.8),BAO(3.94),
MGO(20.24),SIO2(31.68) (X)
AL2O3(9.0),CAO(36.0),BAO(10.0),
MGO(13.5),SIO2(31.5) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-26

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	1.411	0.613	4.1
1500.00	5.640	0.916	0.398	2.5
1550.00	5.485	0.588	0.255	1.8

SYSTEM
AL2O3(5.32),CAO(43.51),BAO(3.93),
MGO(20.17),SIO2(27.07) (X)
AL2O3(9.0),CAO(40.5),BAO(10.0),
MGO(13.5),SIO2(27.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-27

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.639	1.146	14.0
1500.00	5.640	2.380	1.033	10.8
1550.00	5.485	2.054	0.892	7.8

SYSTEM
AL2O3(11.15),CAO(30.43),BAO(4.12),
MGO(21.17),SIO2(33.13) (X)
AL2O3(18.0),CAO(27.0),BAO(10.0),
MGO(13.5),SIO2(31.5) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-28

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.434	1.057	11.4
1450.00	5.804	1.917	0.833	6.8
1500.00	5.640	1.435	0.623	4.2
1550.00	5.485	0.993	0.431	2.7

SYSTEM
AL2O3(11.08),CAO(40.3),BAO(4.09),
MGO(21.02),SIO2(23.51) (X)
AL2O3(18.0),CAO(36.0),BAO(10.0),
MGO(13.5),SIO2(22.5) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-29

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.303	1.000	10.0
1450.00	5.804	1.548	0.672	4.7
1500.00	5.640	1.361	0.591	3.9
1550.00	5.485	1.065	0.462	2.9

SYSTEM
AL2O3(11.26),CAO(51.21),BAO(4.16),
MGO(14.25),SIO2(19.12) (X)
AL2O3(18.0),CAO(45.0),BAO(10.0),
MGO(9.0),SIO2(18.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-30

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	1.946	0.845	7.0
1550.00	5.485	1.649	0.716	5.2

SYSTEM
AL2O3(5.47),CAO(34.80),BAO(6.42),
MGO(6.91),SIO2(46.40) (X)
AL2O3(8.5),CAO(29.75),BAO(15.0),
MGO(4.25),SIO2(42.5) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-31

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	3.011	1.307	20.3
1450.00	5.804	2.251	0.978	9.5
1500.00	5.640	1.758	0.763	5.8
1550.00	5.485	1.308	0.568	3.7

SYSTEM
AL2O3(5.45),CAO(39.64),BAO(6.4),
MGO(6.89),SIO2(41.62) (X)
AL2O3(8.5),CAO(34.0),BAO(15.0),
MGO(4.25),SIO2(38.25) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-32

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.603	1.130	13.5
1450.00	5.804	2.140	0.929	8.5
1500.00	5.640	1.792	0.778	6.0
1550.00	5.485	1.504	0.653	4.5

SYSTEM
AL2O3(5.43),CAO(44.45),BAO(6.37),
MGO(6.87),SIO2(36.88) (X)
AL2O3(8.5),CAO(38.25),BAO(15.0),
MGO(4.25),SIO2(34.0) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-33

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.890	1.255	18.0
1450.00	5.804	2.549	1.107	12.8
1500.00	5.640	2.140	0.929	8.5
1550.00	5.485	1.758	0.763	5.8

SYSTEM
AL2O3(5.36),CAO(29.26),BAO(6.29),
MGO(13.57),SIO2(45.51) (X)
AL2O3(8.5),CAO(25.5),BAO(15.0),
MGO(8.5),SIO2(42.5) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-34

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.955	1.283	19.2
1450.00	5.804	2.092	0.908	8.1
1500.00	5.640	1.482	0.643	4.4
1550.00	5.485	0.742	0.322	2.1

SYSTEM
AL2O3(5.35),CAO(34.02),BAO(6.27),
MGO(13.53),SIO2(40.83) (X)
AL2O3(8.5),CAO(29.75),BAO(15.0),
MGO(8.5),SIO2(38.25) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-35

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.485	1.079	12.0
1450.00	5.804	1.946	0.845	7.0
1500.00	5.640	1.548	0.672	4.7
1550.00	5.485	1.099	0.477	3.0

SYSTEM
AL2O3(5.33),CAO(38.76),BAO(6.25),
MGO(13.48),SIO2(36.18) (X)
AL2O3(8.5),CAO(34.0),BAO(15.0),
MGO(8.5),SIO2(34.0) (%)
MEASUREMENT METHOD
TORSION VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
HOFMANN (1959)

DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-36

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.708	1.176	15.0
1450.00	5.804	2.241	0.973	9.4
1500.00	5.640	1.629	0.708	5.1
1550.00	5.485	0.833	0.362	2.3

SYSTEM
AL2O3(5.31),CAO(43.47),BAO(6.23),
MGO(13.44),SIO2(31.55) (X)
AL2O3(8.5),CAO(38.25),BAO(15.0),
MGO(8.5),SIO2(29.75) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-37

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	2.251	0.978	9.5
1500.00	5.640	1.988	0.863	7.3
1550.00	5.485	1.887	0.820	6.6

SYSTEM
AL2O3(5.25),CAO(28.62),BAO(6.16),
MGO(19.91),SIO2(40.07) (X)
AL2O3(8.5),CAO(25.5),BAO(15.0),
MGO(12.75),SIO2(38.25) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-38

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	1.569	0.681	4.8
1450.00	5.804	1.224	0.531	3.4
1500.00	5.640	0.875	0.380	2.4
1550.00	5.485	0.588	0.255	1.8

SYSTEM
AL2O3(5.23),CAO(33.28),BAO(6.14),
MGO(19.84),SIO2(35.5) (X)
AL2O3(8.5),CAO(29.75),BAO(15.0),
MGO(12.75),SIO2(34.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-39

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.028	0.881	7.6
1450.00	5.804	1.548	0.672	4.7
1500.00	5.640	1.194	0.519	3.3
1550.00	5.485	0.833	0.362	2.3

SYSTEM
AL2O3(5.21),CAO(37.92),BAO(6.12),
MGO(19.78),SIO2(30.97) (X)
AL2O3(8.5),CAO(34.0),BAO(15.0),
MGO(12.75),SIO2(29.75) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-40

T	Z	LN(N)	LOG(N)	N
1450.00	5.804	1.668	0.724	5.3
1500.00	5.640	1.099	0.477	3.0
1550.00	5.485	0.788	0.342	2.2

SYSTEM
AL2O3(5.2),CAO(42.52),BAO(6.1),
MGO(19.72),SIO2(26.46) (X)
AL2O3(8.5),CAO(38.25),BAO(15.0),
MGO(12.75),SIO2(25.5) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-41

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	2.773	1.204	16.0
1550.00	5.485	2.451	1.064	11.6

SYSTEM
AL2O3(10.89),CAO(29.71),BAO(6.39),
MGO(20.67),SIO2(32.35) (X)

AUTHOR
HOFMANN (1959)

AL2O3(17.0),CAO(25.5),BAO(15.0),
MGO(12.75),SIO2(29.75) (%)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-42

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.485	1.079	12.0
1450.00	5.804	1.988	0.863	7.3
1500.00	5.640	1.482	0.643	4.4
1550.00	5.485	1.030	0.447	2.8

SYSTEM
AL2O3(10.79),CAO(39.25),BAO(6.33),
MGO(20.47),SIO2(23.16) (X)
AL2O3(17.0),CAO(34.0),BAO(15.0),
MGO(12.75),SIO2(21.5) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

DERIVED FROM
TABLE II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACBMgS-43

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	2.485	1.079	12.0
1450.00	5.804	1.609	0.699	5.0
1500.00	5.640	1.459	0.633	4.3
1550.00	5.485	1.131	0.491	3.1

SYSTEM
AL2O3(10.99),CAO(49.99),BAO(6.45),
MGO(13.91),SIO2(18.66) (X)
AL2O3(17.0),CAO(42.5),BAO(15.0),
MGO(8.5),SIO2(17.0) (%)

AUTHOR
HOFMANN (1959)

MEASUREMENT METHOD
TORSION VISCOMETER

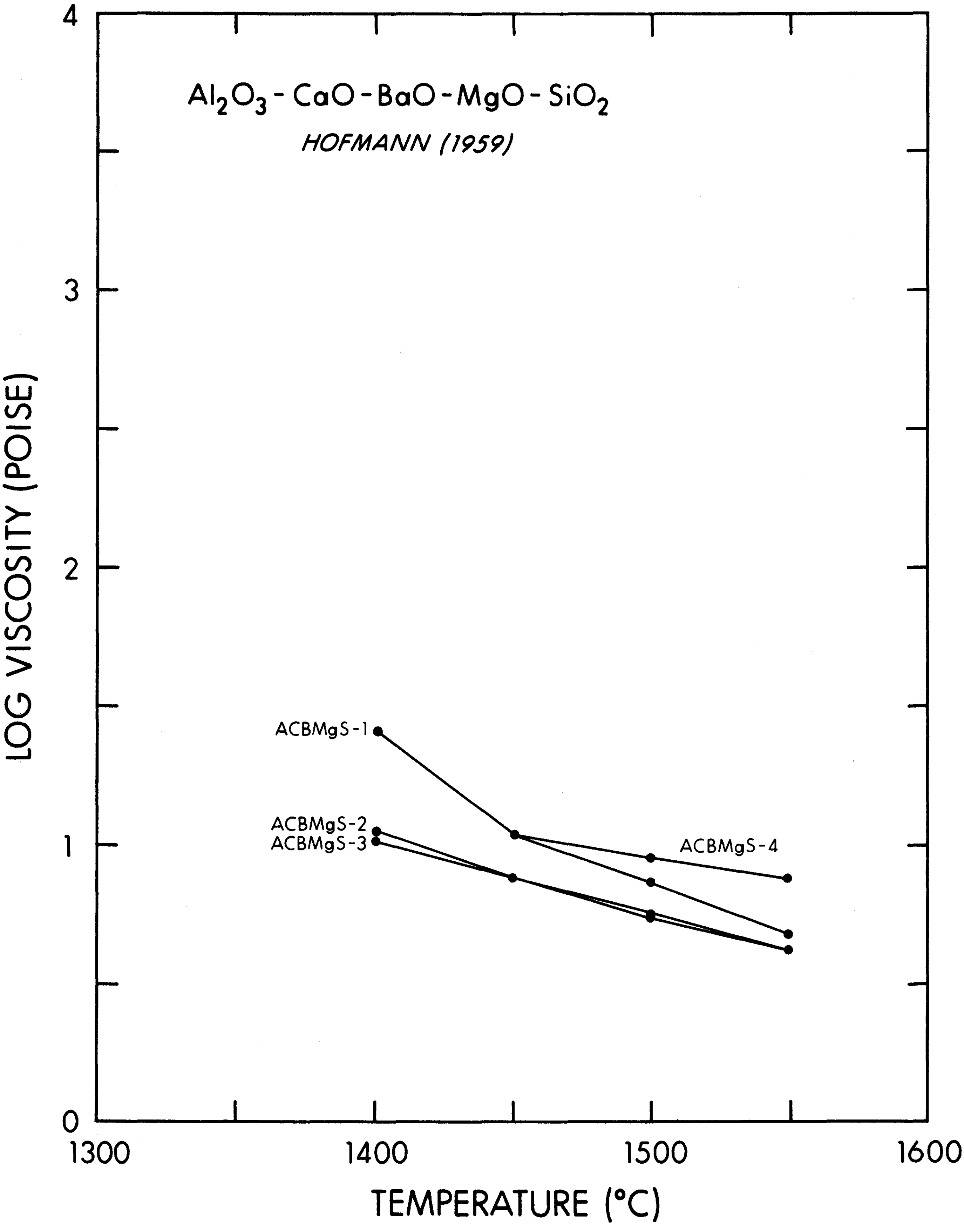
DERIVED FROM
TABLE II

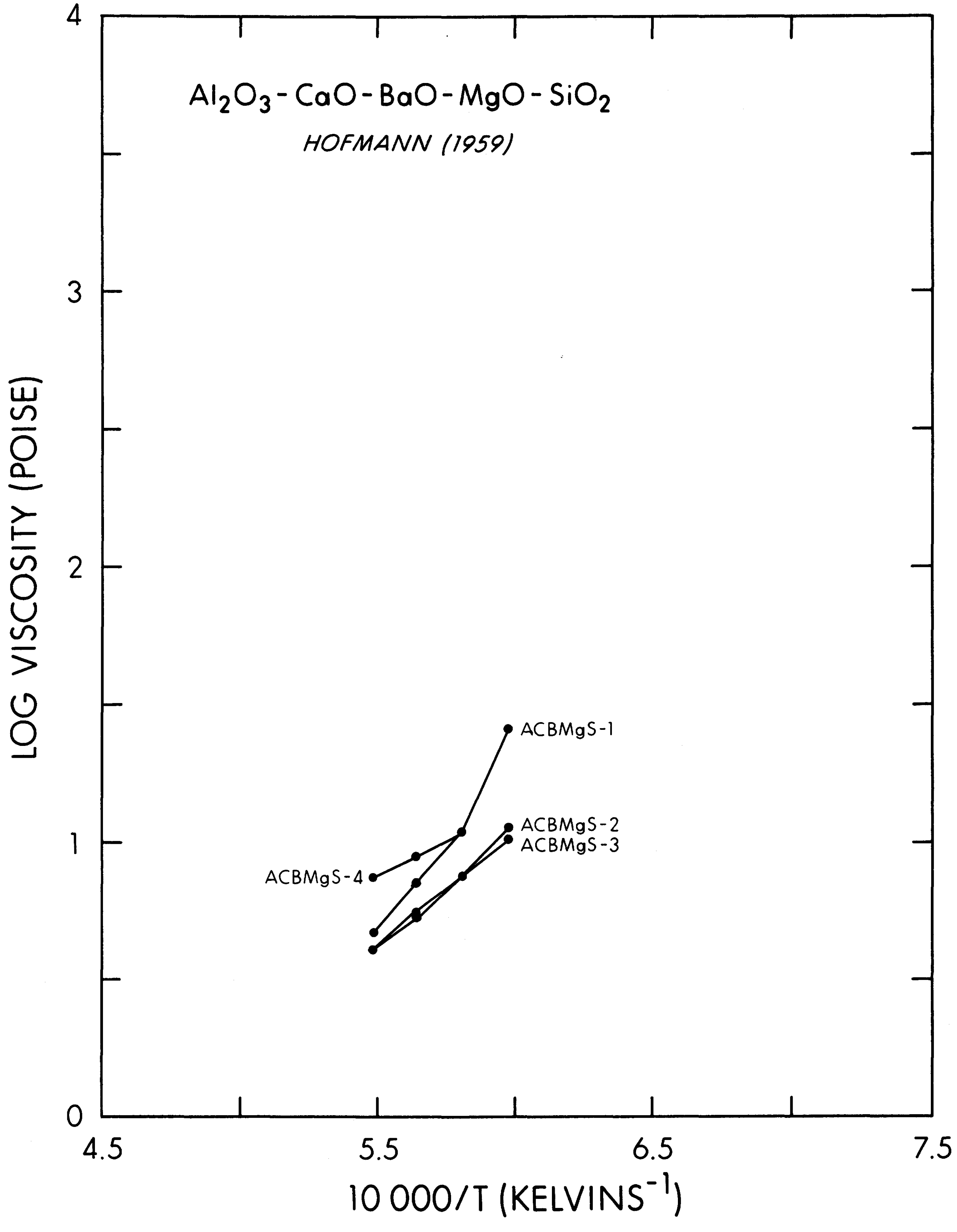
N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

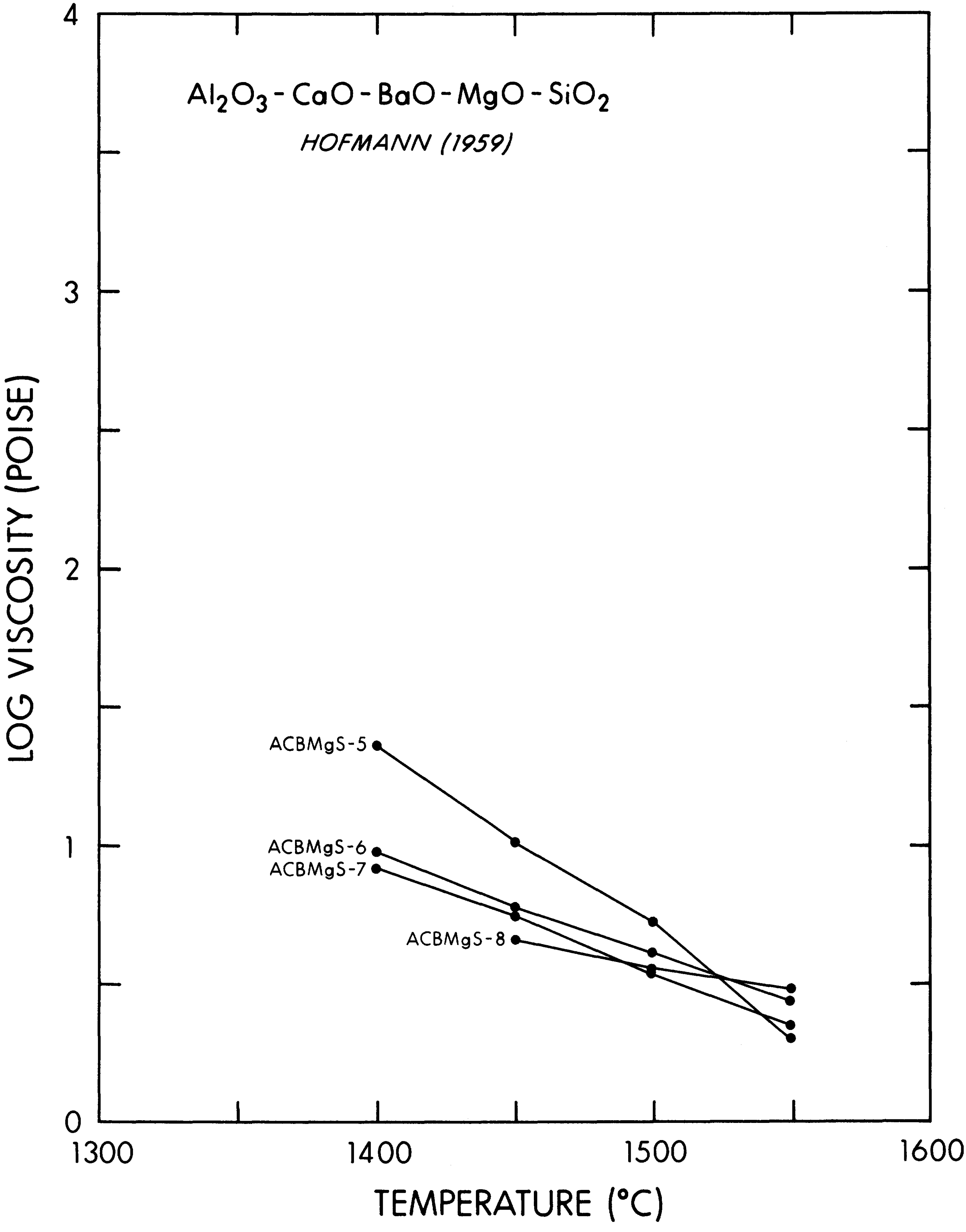
ACBMgS-44

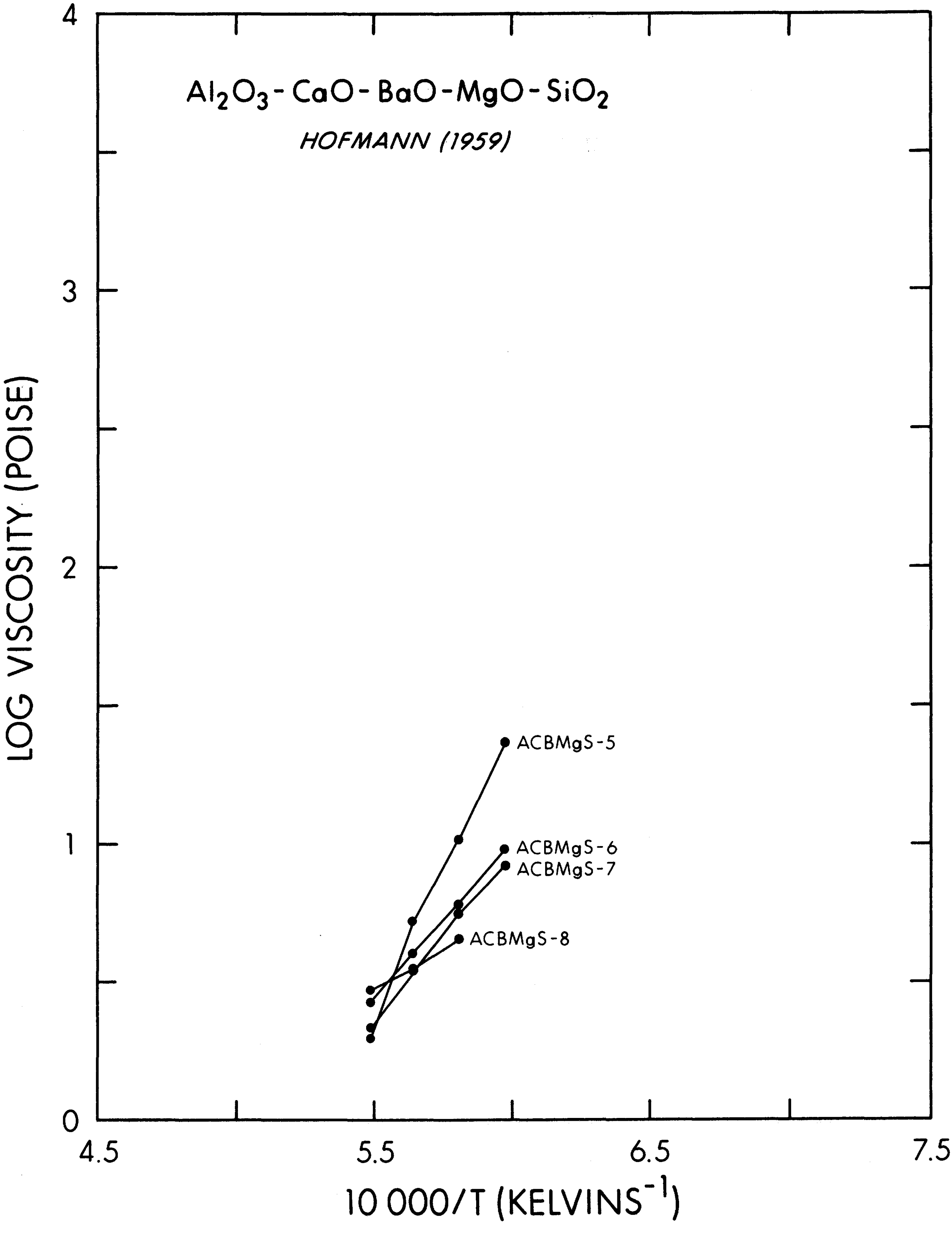
T	Z	LN(N)	LOG(N)	N
1500.00	5.640	2.197	0.954	9.0
1550.00	5.485	1.758	0.763	5.8

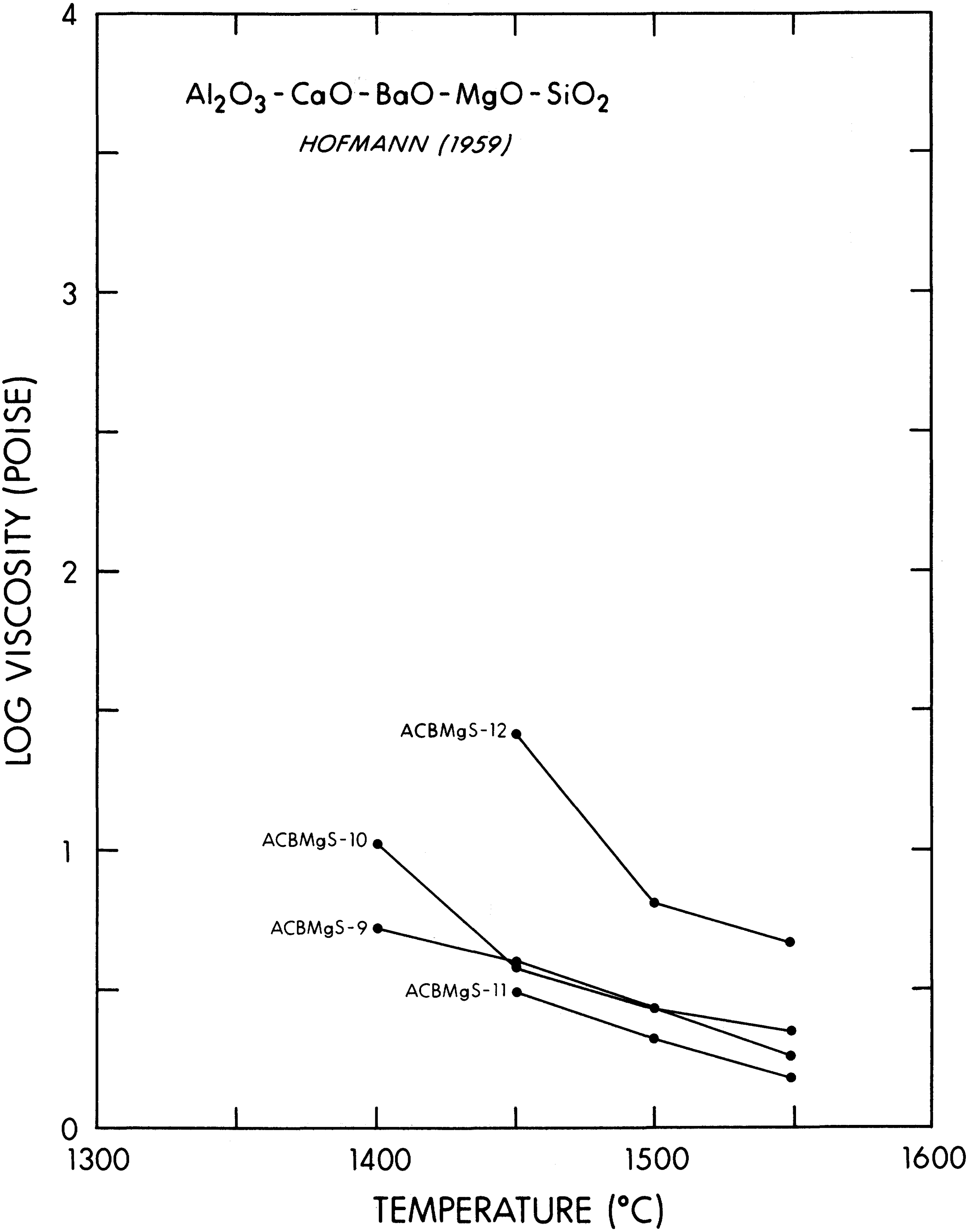

Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-1
ACBMgS-2
ACBMgS-3
ACBMgS-4
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1300
1400
1500
1600



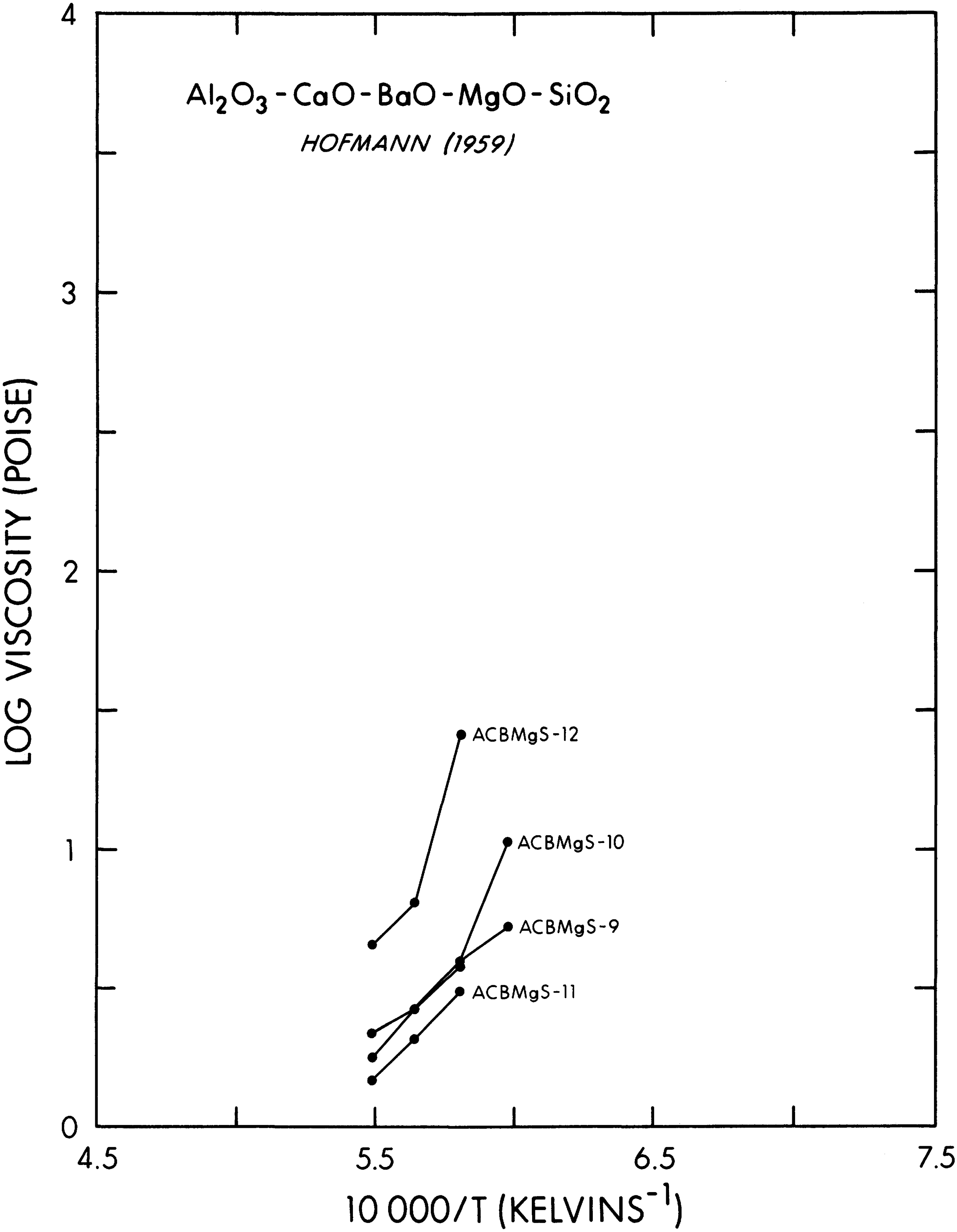
Al2O3 - CaO - BaO - MgO - SiO2
HOFMANN (1959)
ACBMgS-1
ACBMgS-2
ACBMgS-3
ACBMgS-4
LOG VISCOSITY (POISE)
10 000/T (KELVINS-1)
4
3
2
1
0
4.5
5.5
6.5
7.5

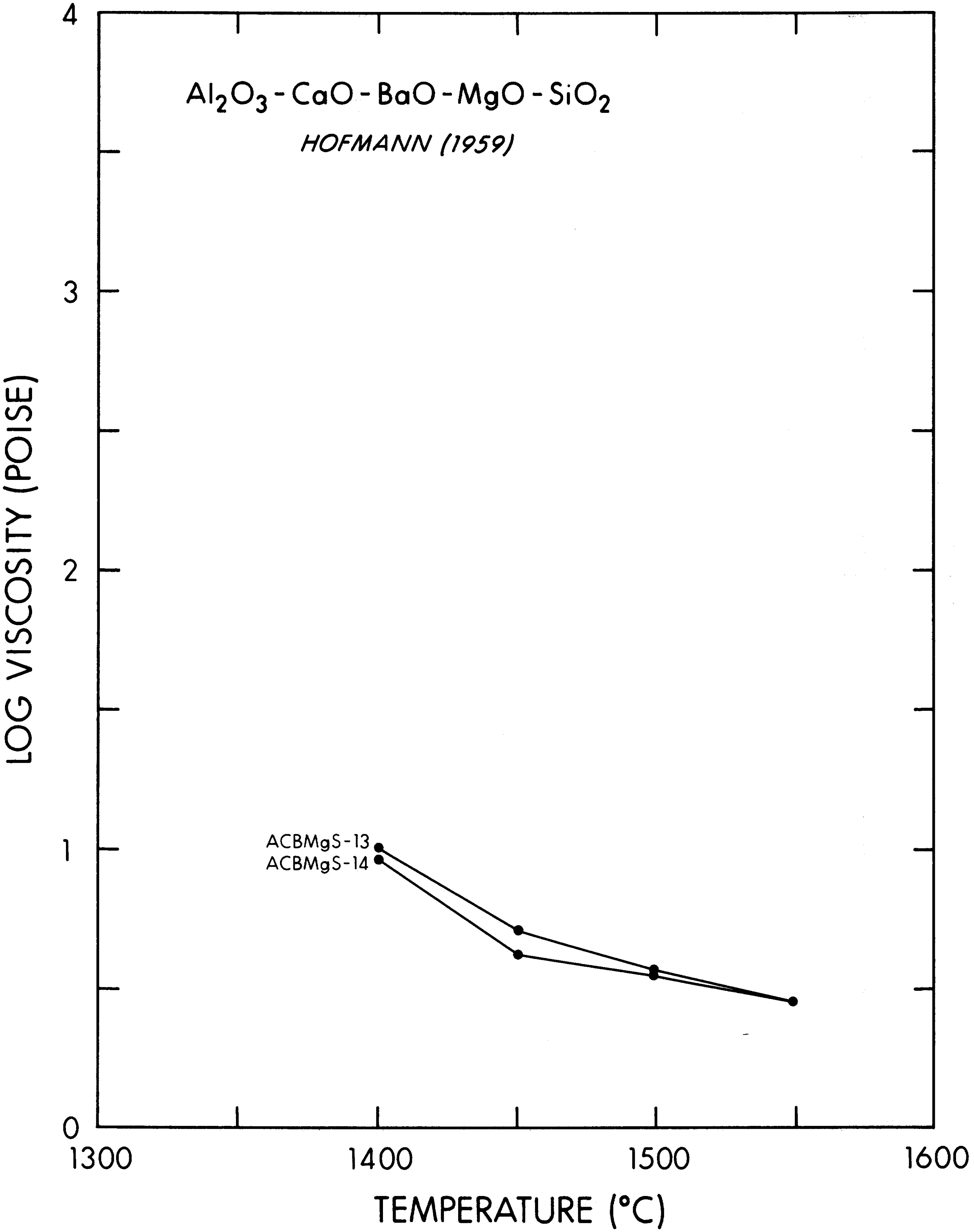

Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1300
1400
1500
1600
ACBMgS-5
ACBMgS-6
ACBMgS-7
ACBMgS-8


Al2O3-CaO-BaO-MgO-SiO2
HOFMANN (1959)
LOG VISCOSITY (POISE)
10 000/T (KELVINS-1)
ACBMgS-5
ACBMgS-6
ACBMgS-7
ACBMgS-8
0
1
2
3
4
4.5
5.5
6.5
7.5

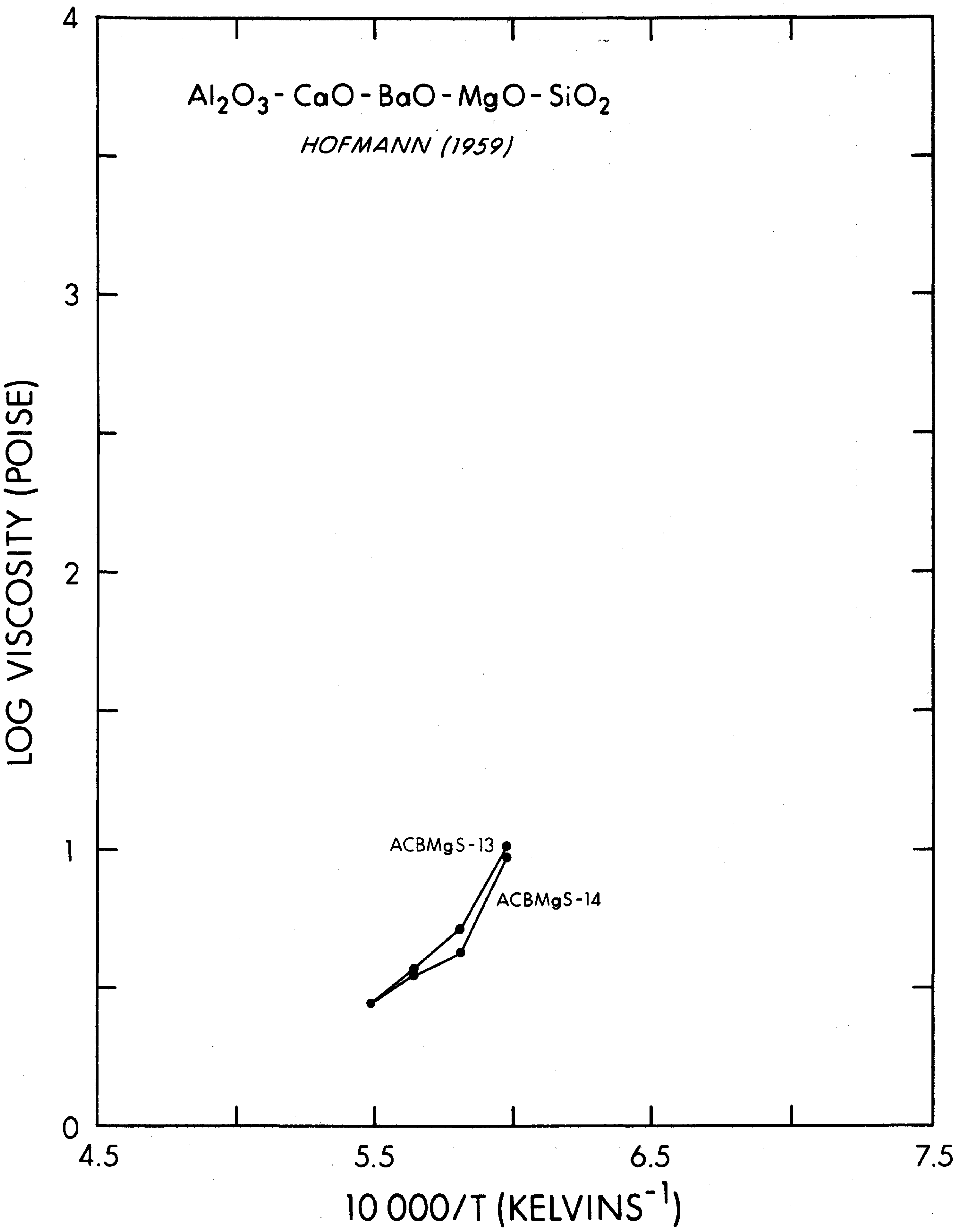


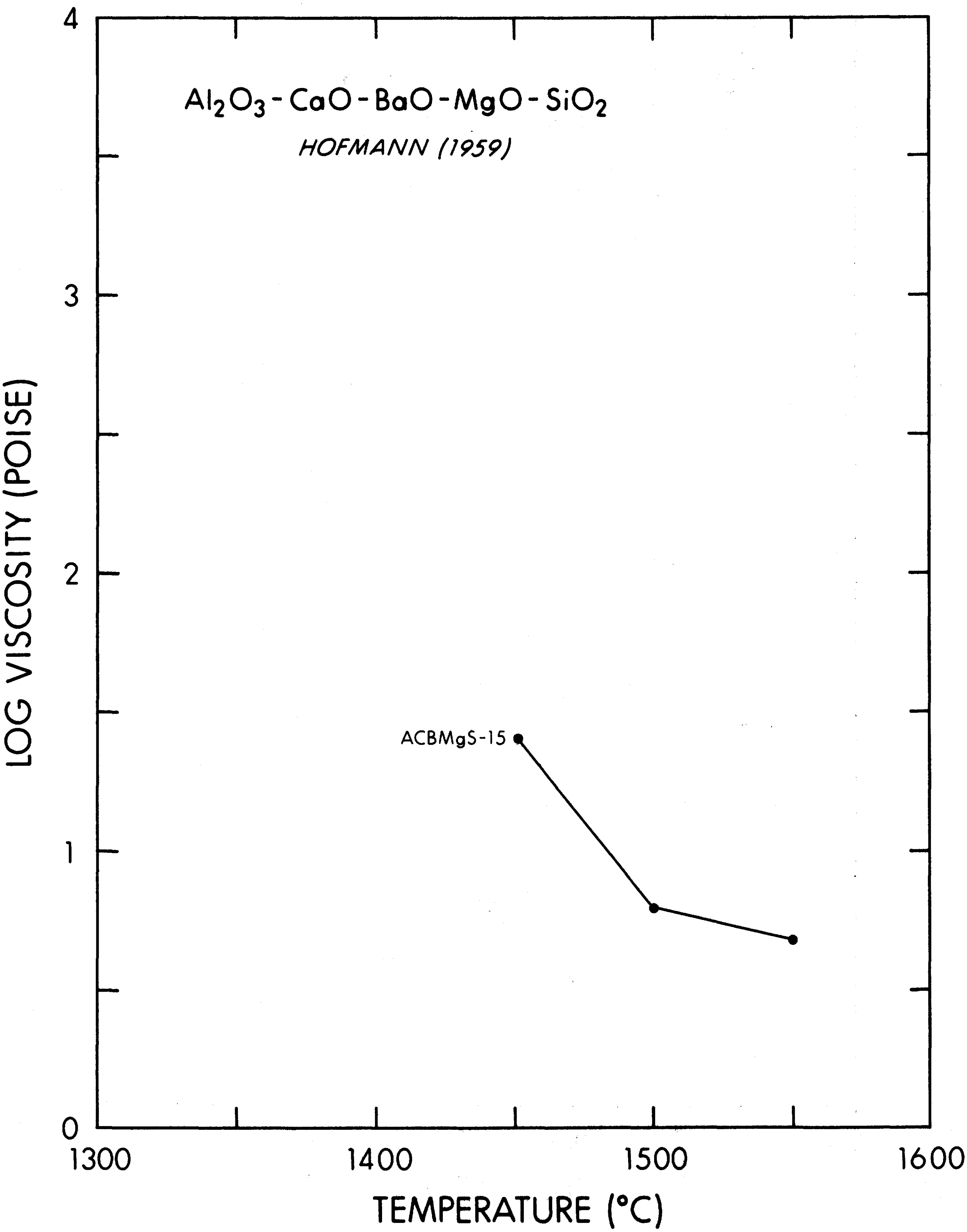
Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-12
ACBMgS-10
ACBMgS-9
ACBMgS-11
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1300
1400
1500
1600


Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-12
ACBMgS-10
ACBMgS-9
ACBMgS-11
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5

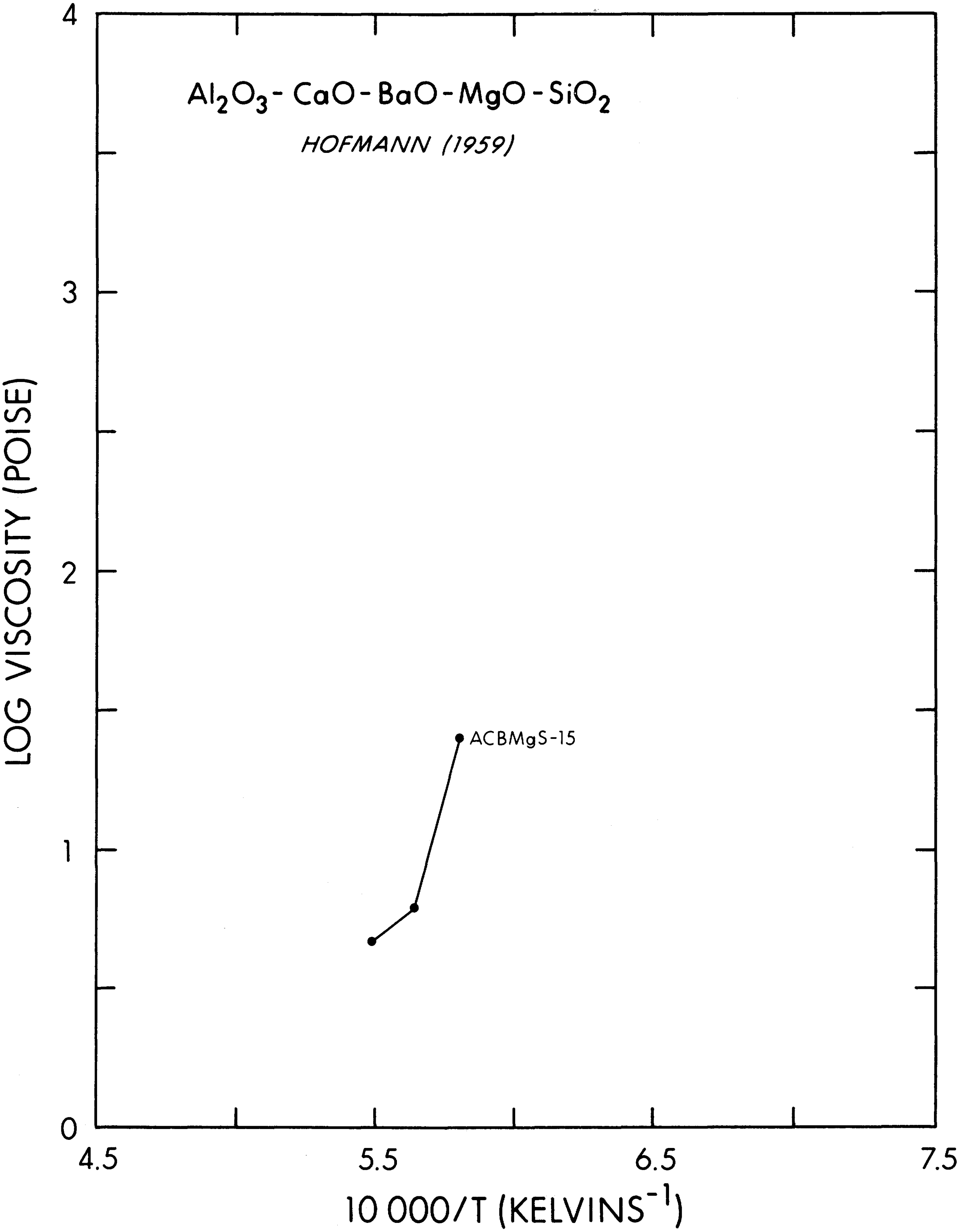


Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-13
ACBMgS-14
LOG VISCOSITY (POISE)
0
1
2
3
4
1300
1400
1500
1600
TEMPERATURE (°C)

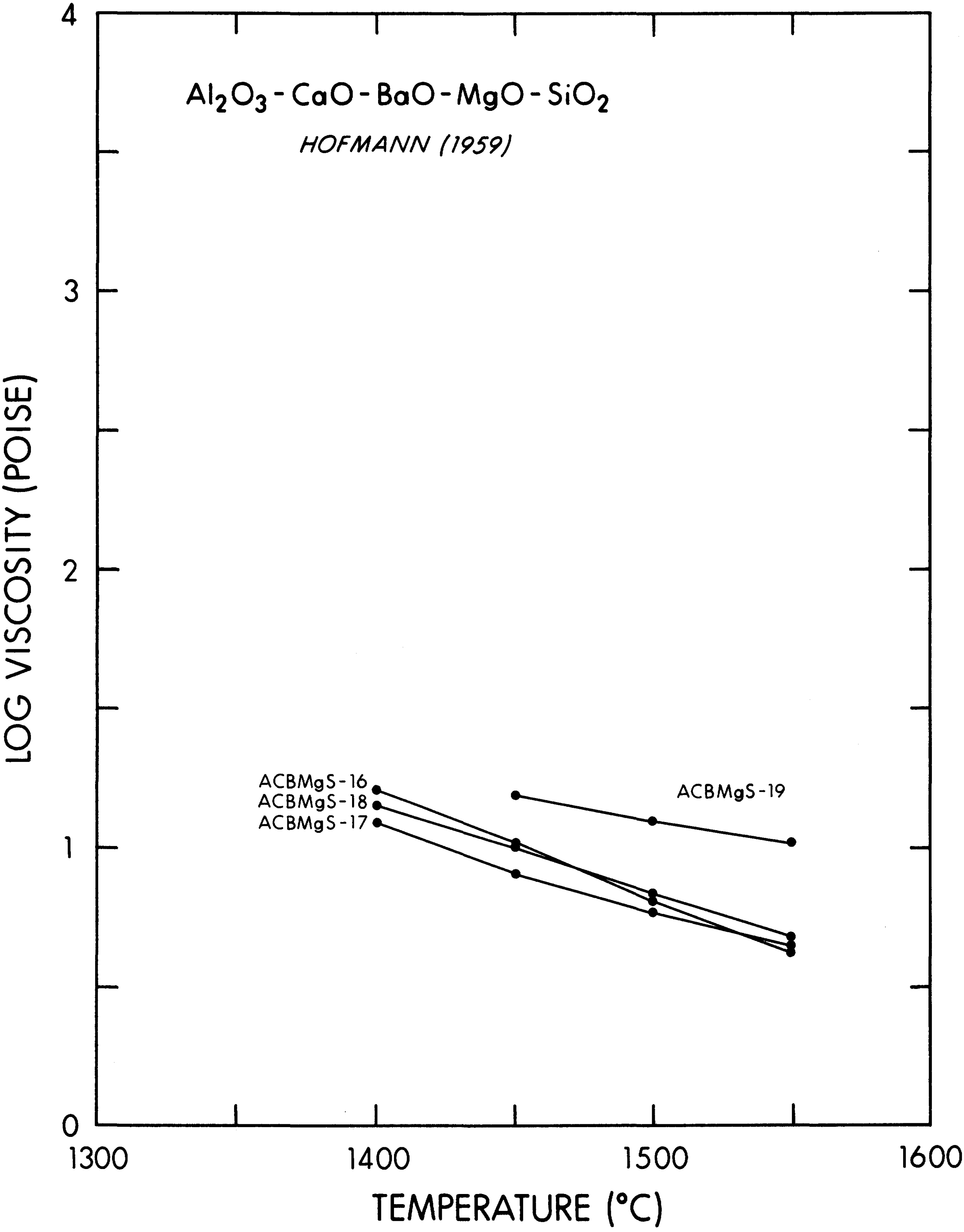

Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-13
ACBMgS-14
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
4.5
5.5
6.5
7.5



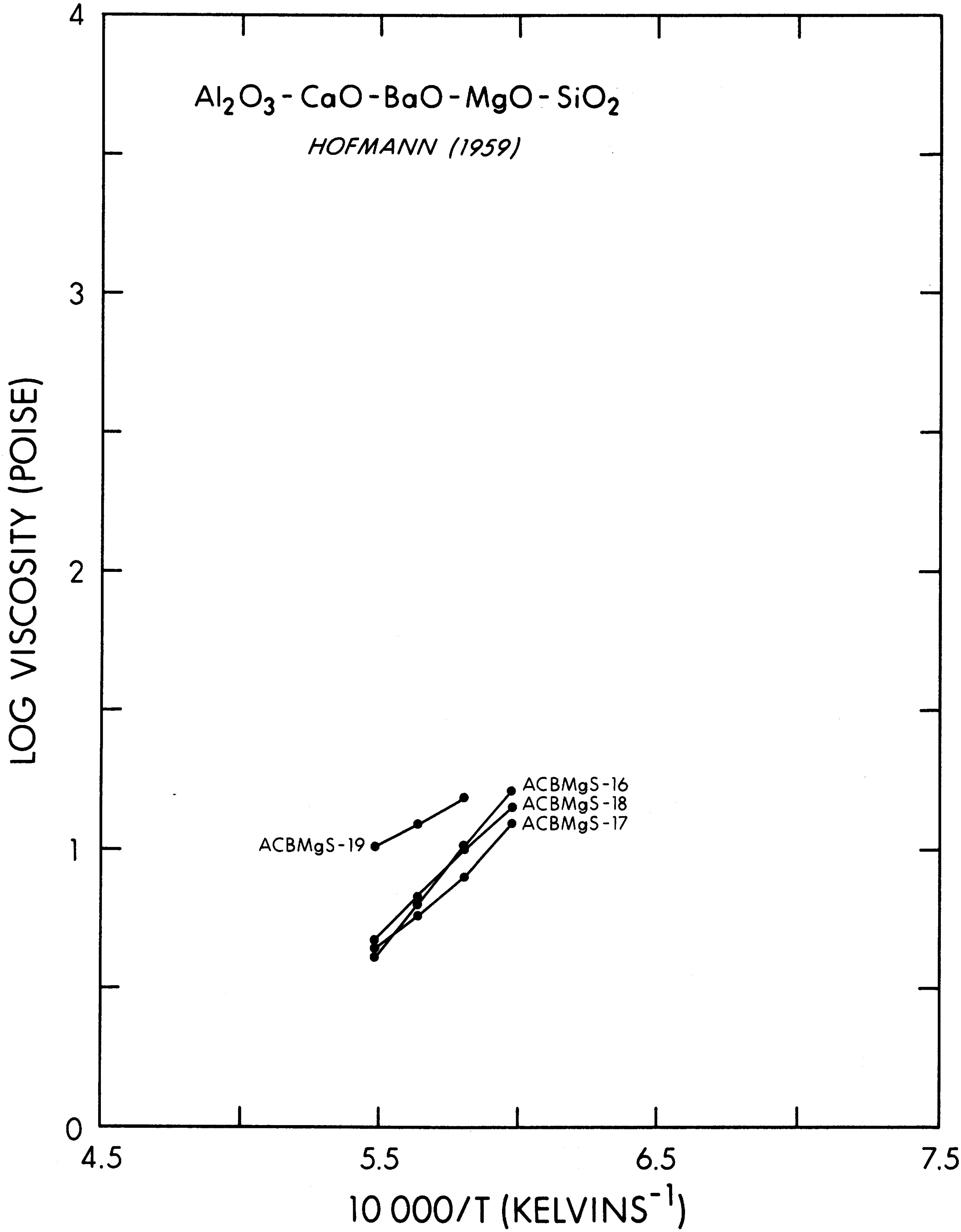
4
3
2
1
0
LOG VISCOSITY (POISE)
Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-15
1300
1400
1500
1600
TEMPERATURE (°C)

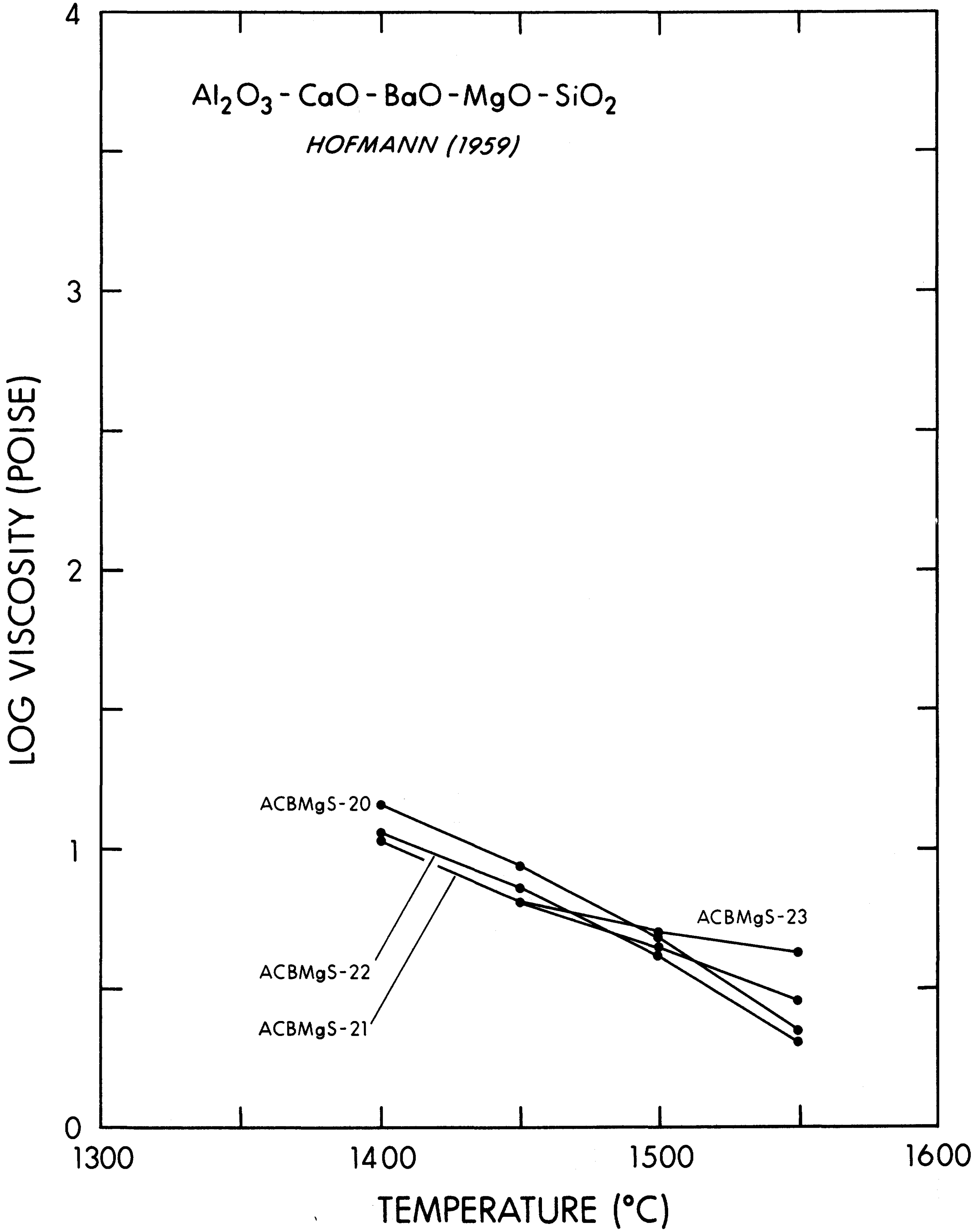


Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-15
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5

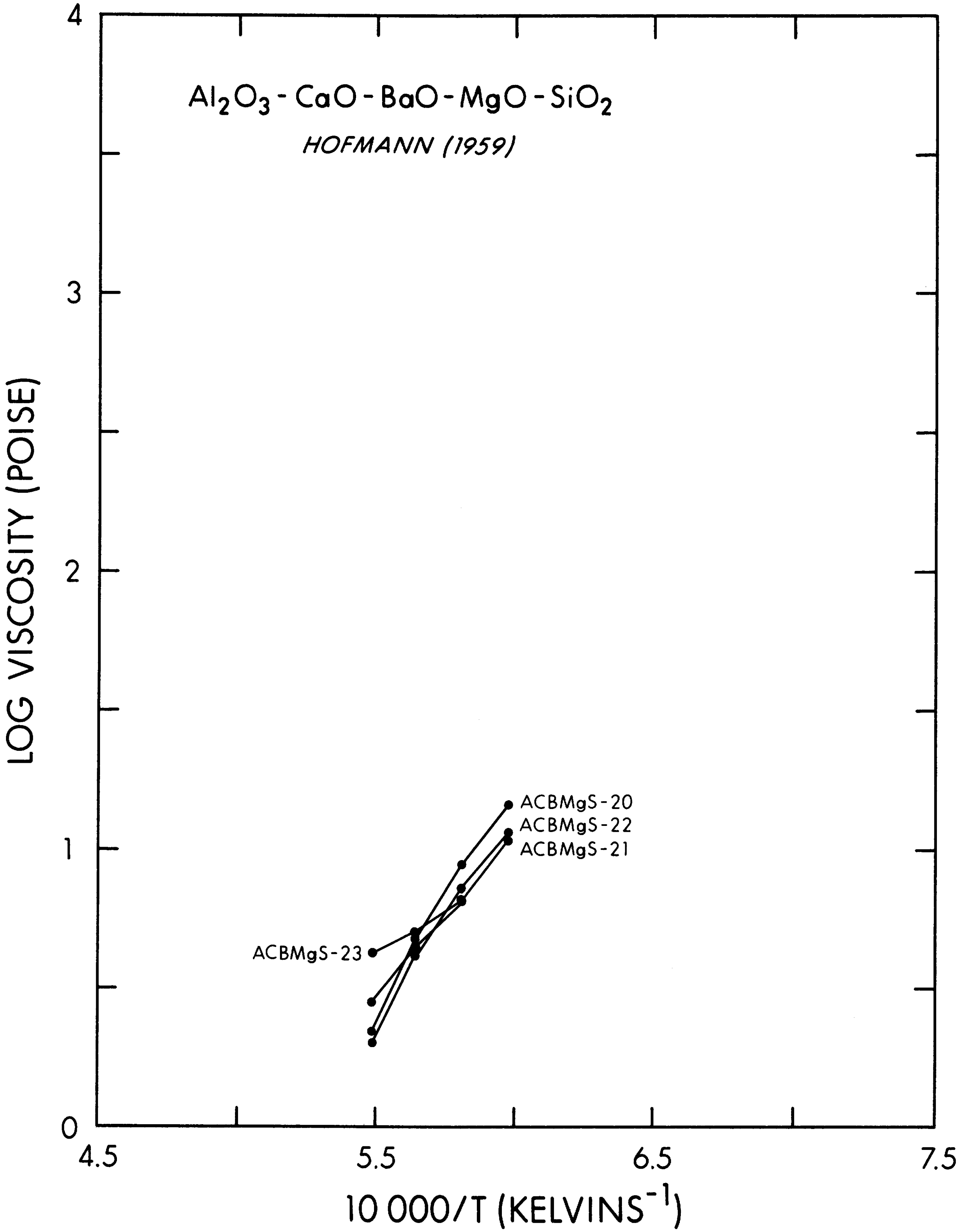


$Al_2O_3 - CaO - BaO - MgO - SiO_2$
HOFMANN (1959)
ACBMgS-16
ACBMgS-18
ACBMgS-17
ACBMgS-19
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1300
1400
1500
1600

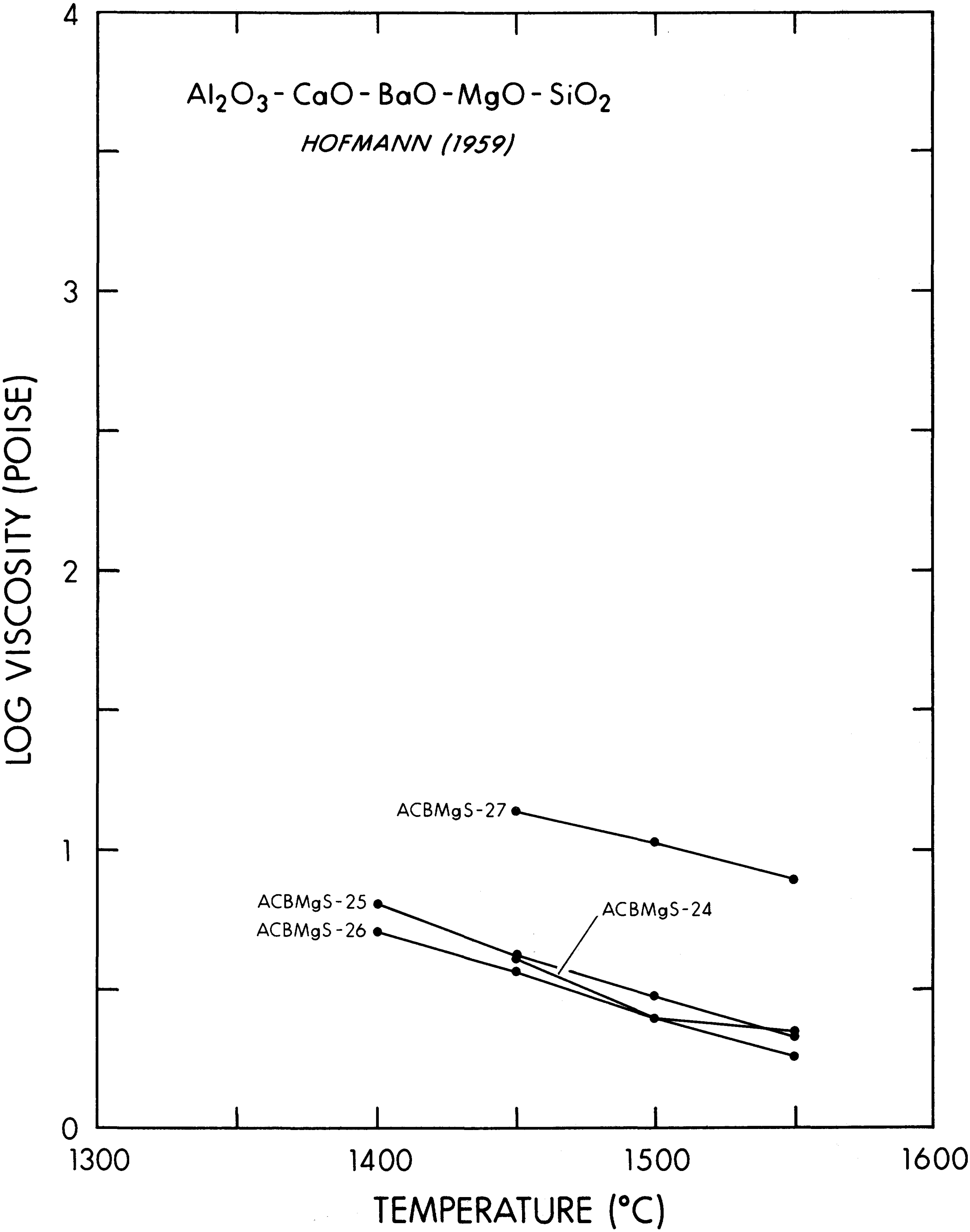

Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-16
ACBMgS-18
ACBMgS-17
ACBMgS-19
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
4.5
5.5
6.5
7.5



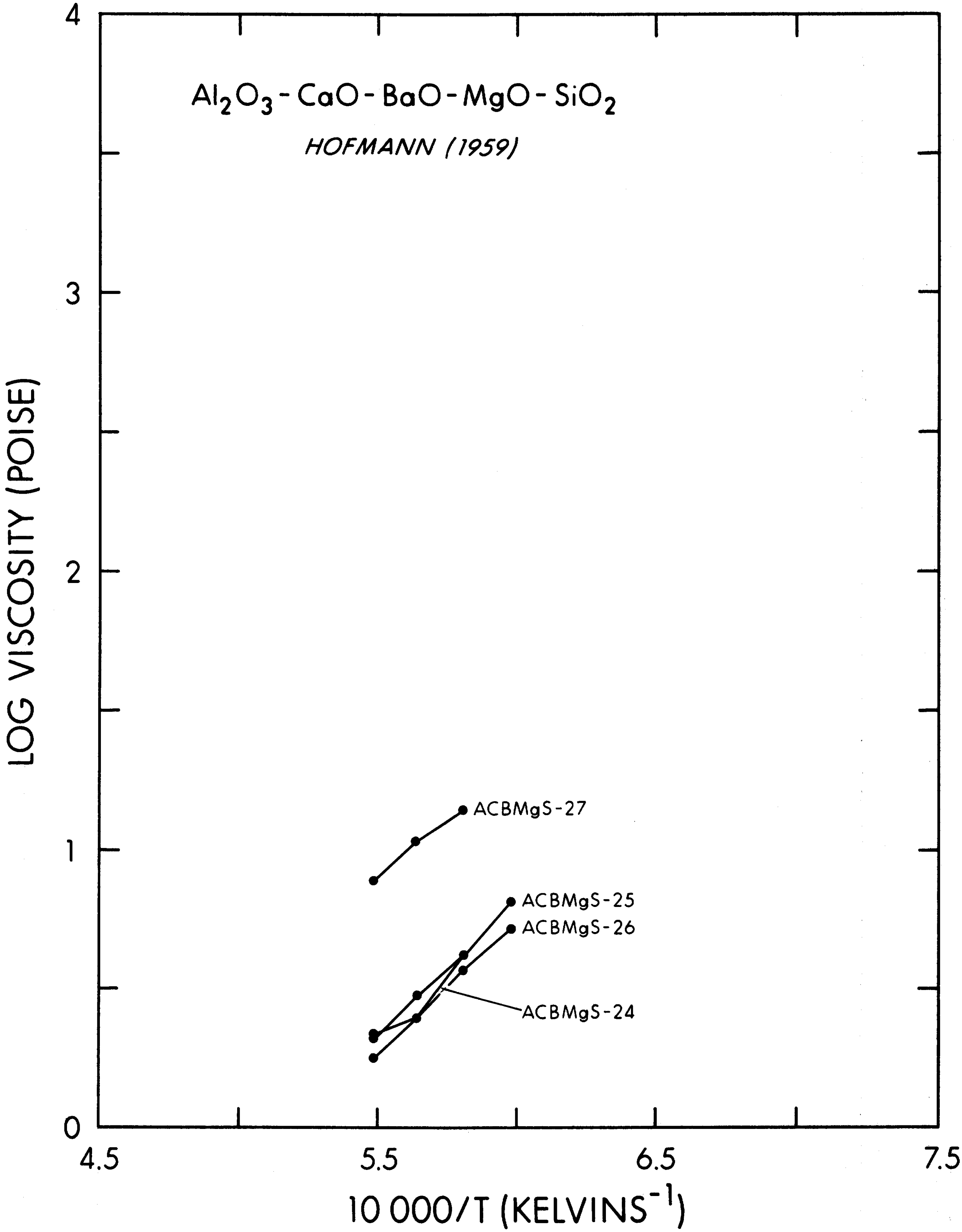
Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1300
1400
1500
1600
ACBMgS-20
ACBMgS-22
ACBMgS-21
ACBMgS-23



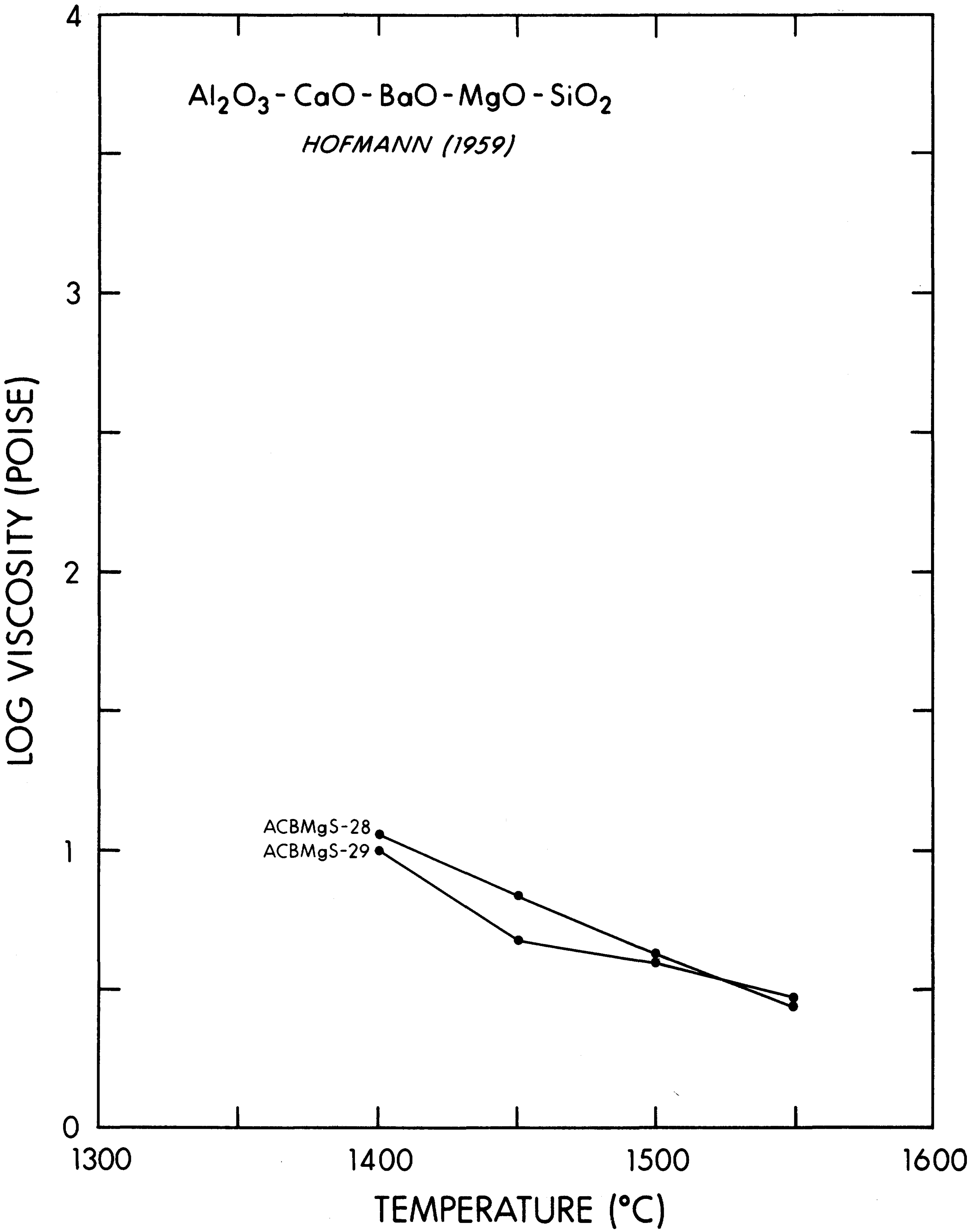
Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-20
ACBMgS-22
ACBMgS-21
ACBMgS-23
LOG VISCOSITY (POISE)
4
3
2
1
0
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})



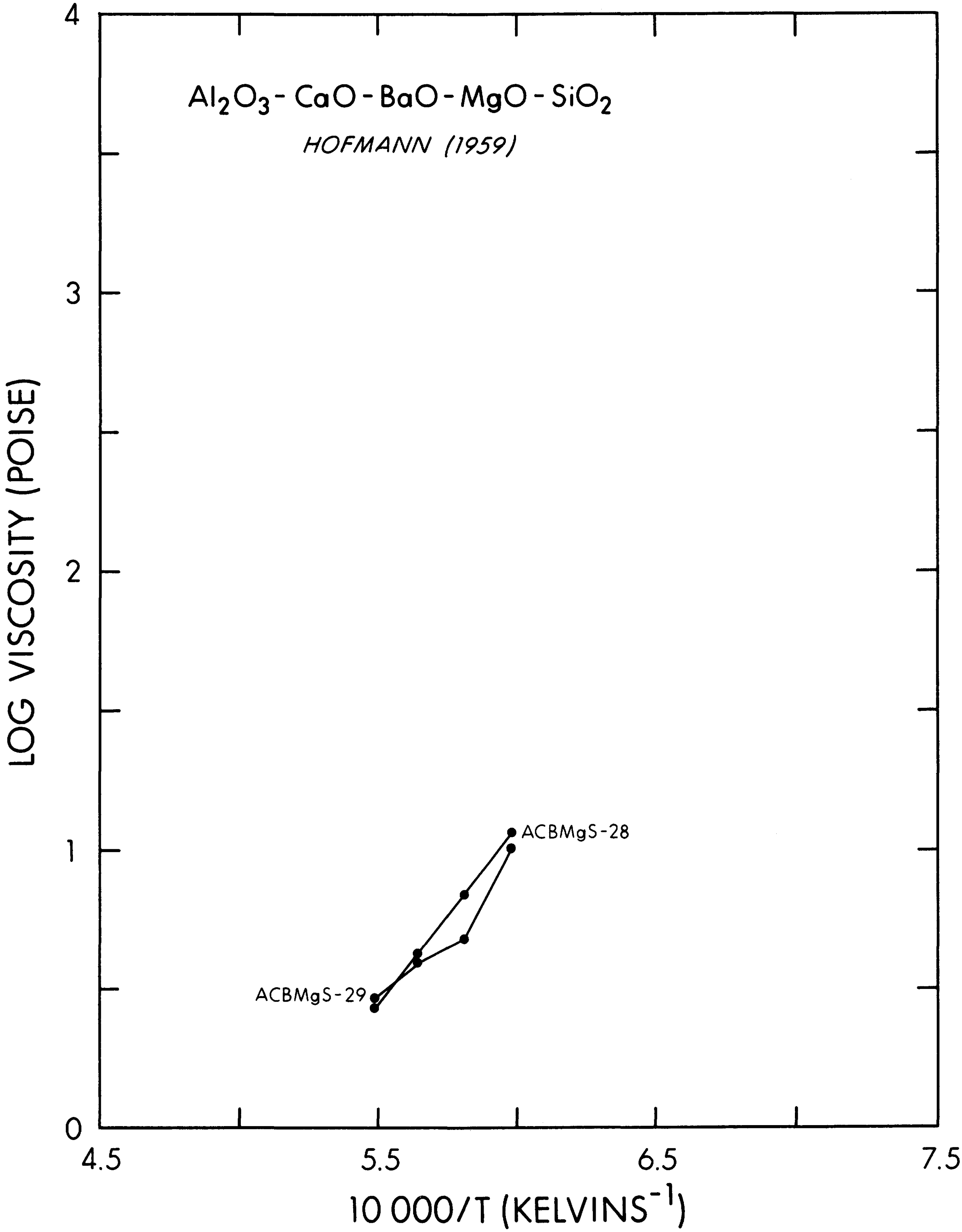
Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-27
ACBMgS-25
ACBMgS-26
ACBMgS-24
LOG VISCOSITY (POISE)
0
1
2
3
4
1300
1400
1500
1600
TEMPERATURE (°C)



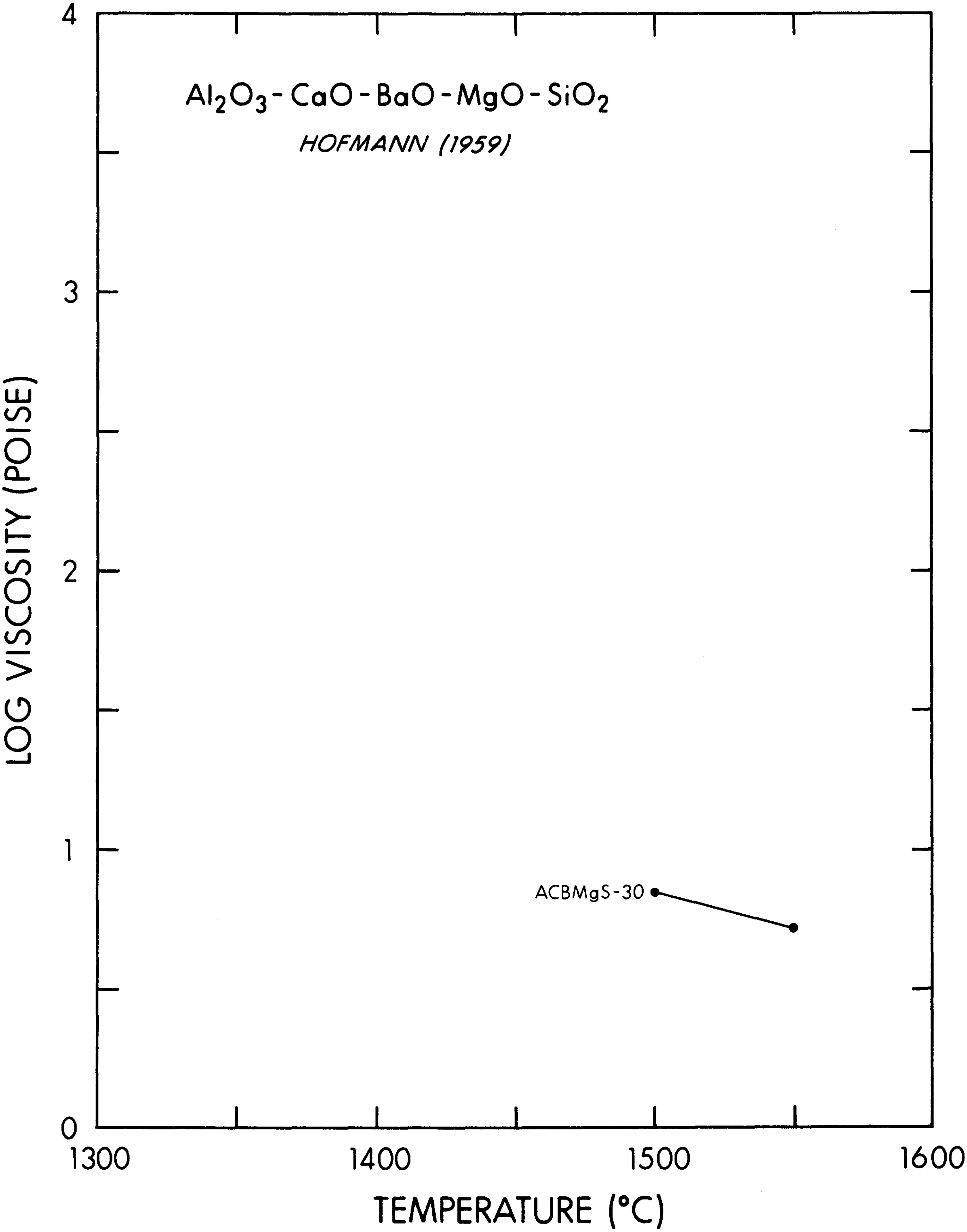
$Al_2O_3 - CaO - BaO - MgO - SiO_2$
HOFMANN (1959)
ACBMgS-27
ACBMgS-25
ACBMgS-26
ACBMgS-24
LOG VISCOSITY (POISE)
4
3
2
1
0
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})



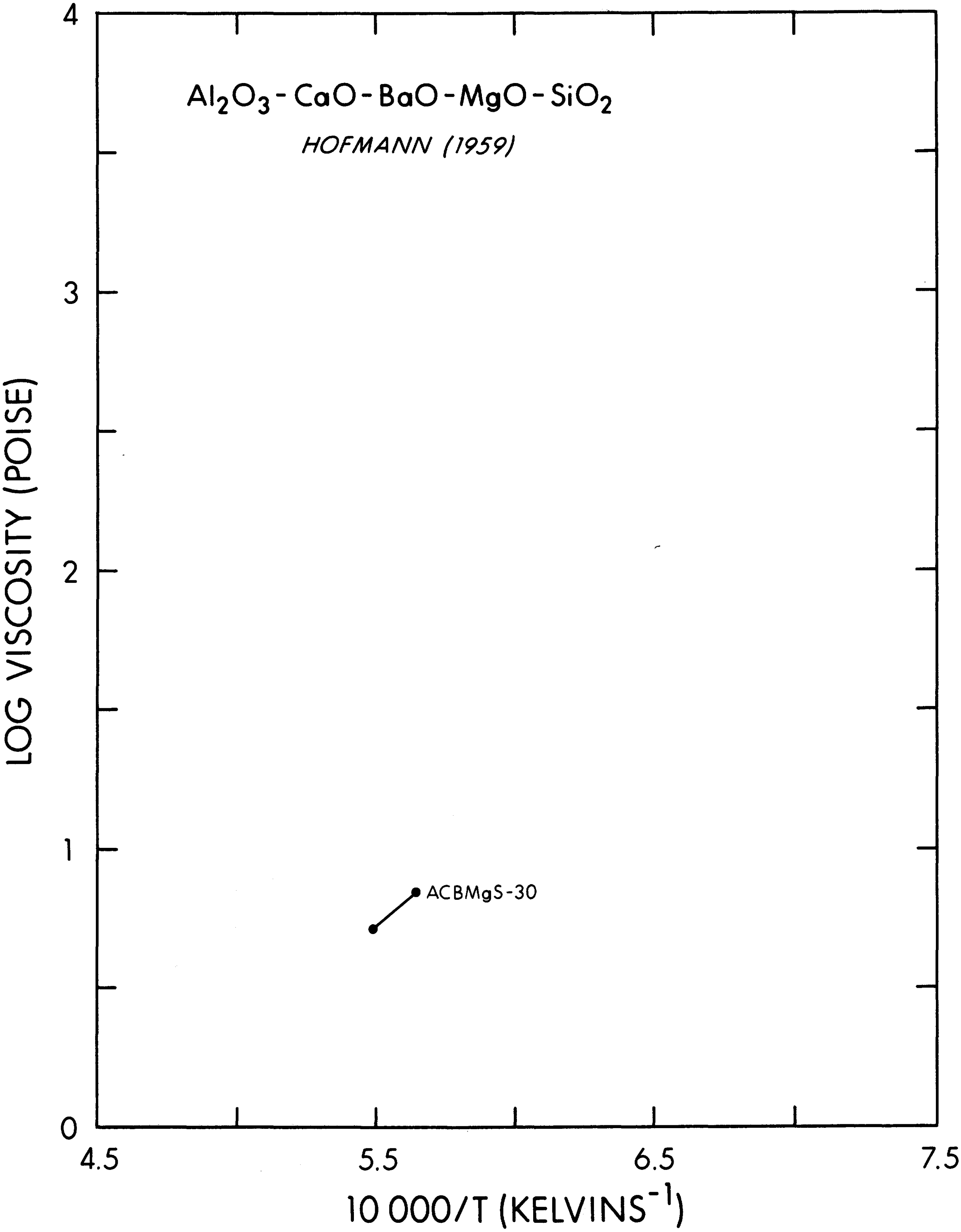
Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-28
ACBMgS-29
LOG VISCOSITY (POISE)
0
1
2
3
4
1300
1400
1500
1600
TEMPERATURE (°C)

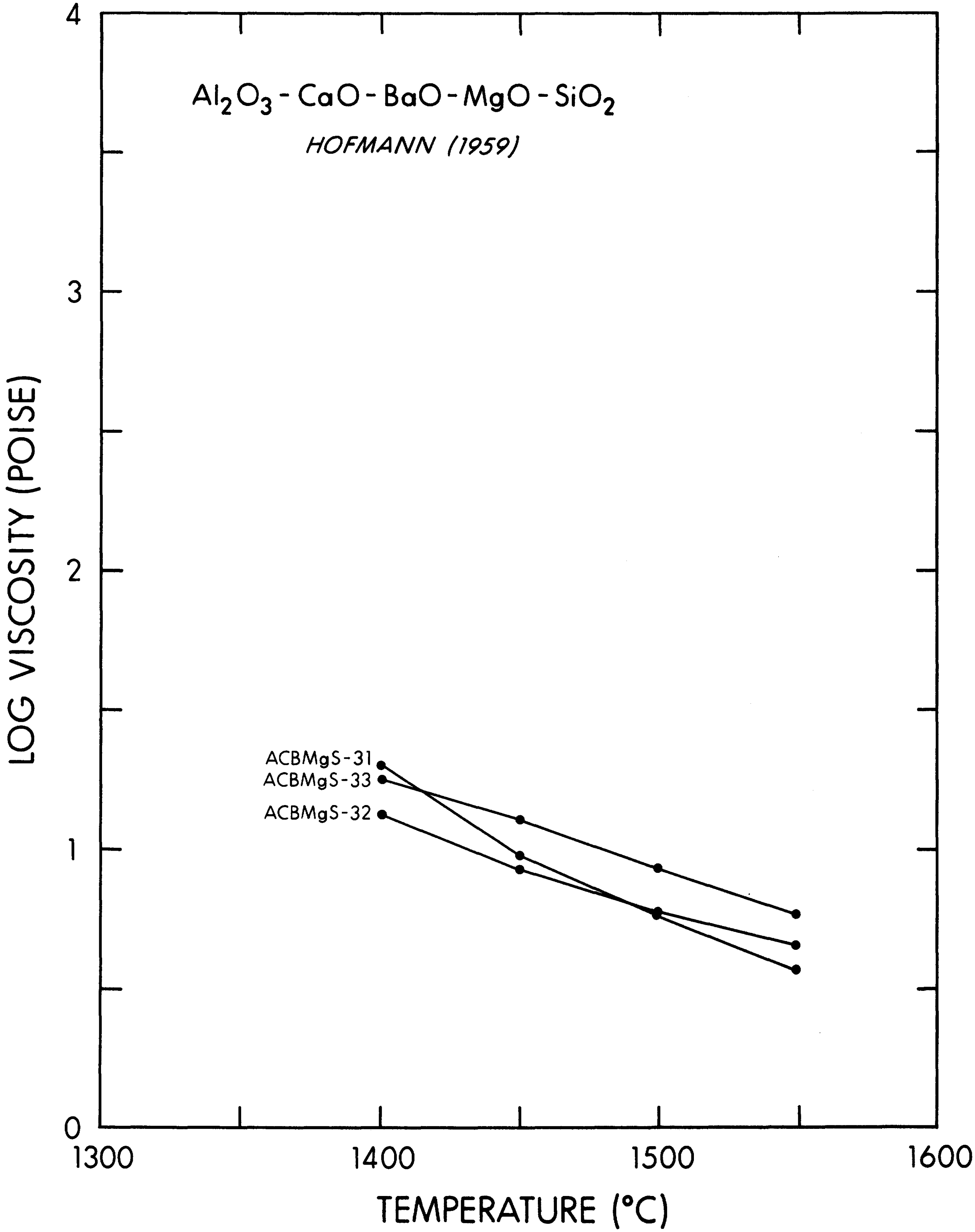


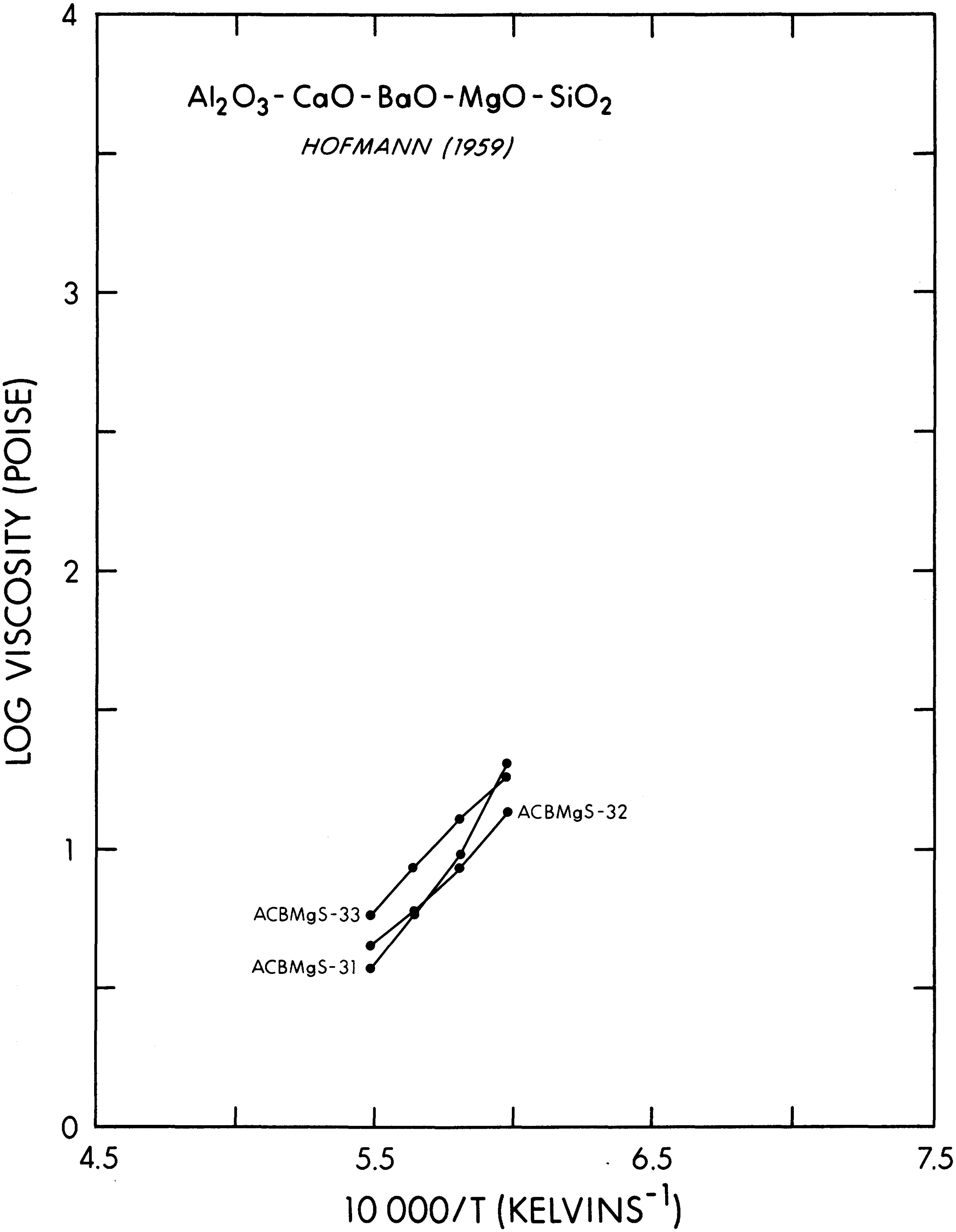
4
3
2
1
0
LOG VISCOSITY (POISE)
Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-28
ACBMgS-29
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})

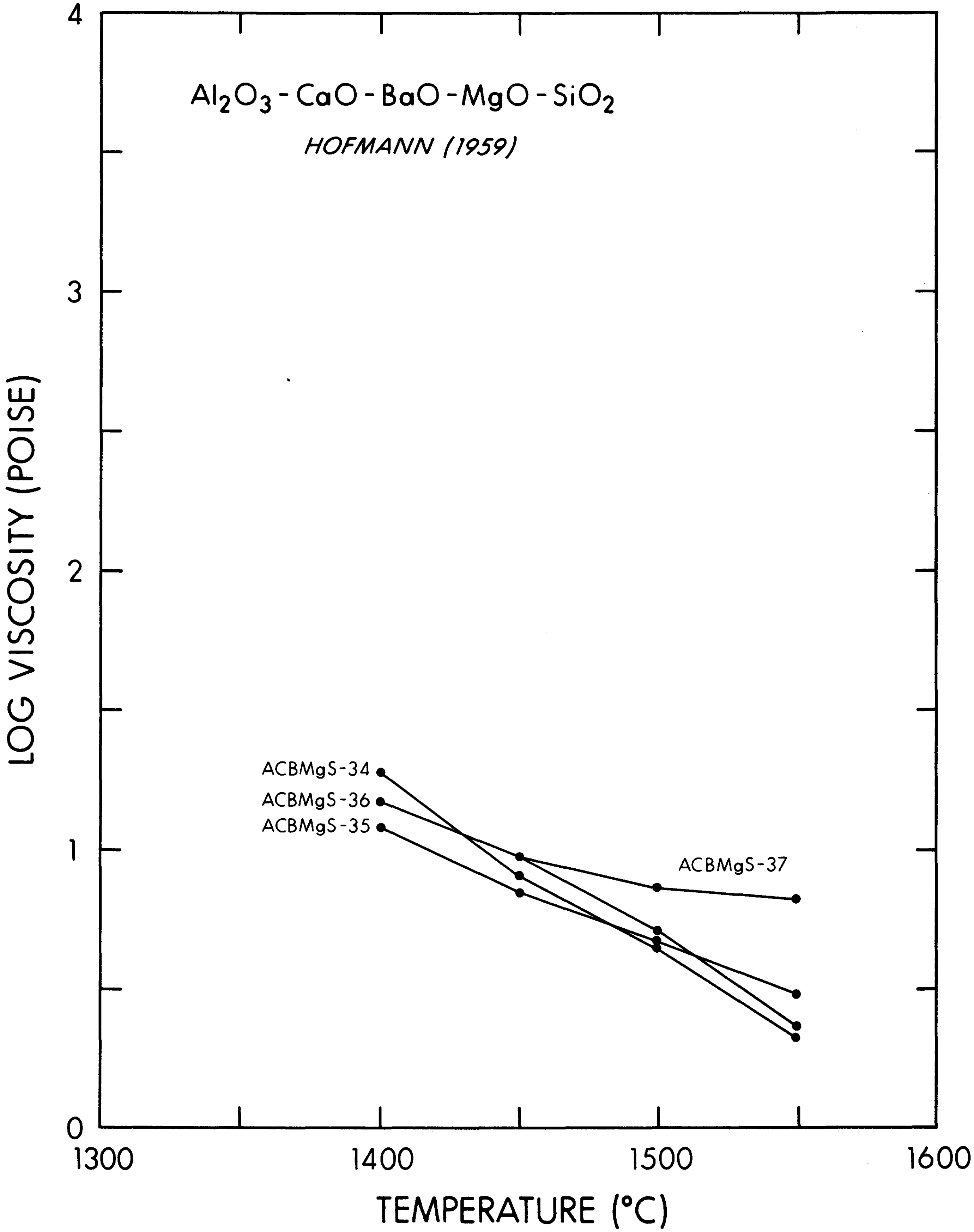


Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-30
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1300
1400
1500
1600

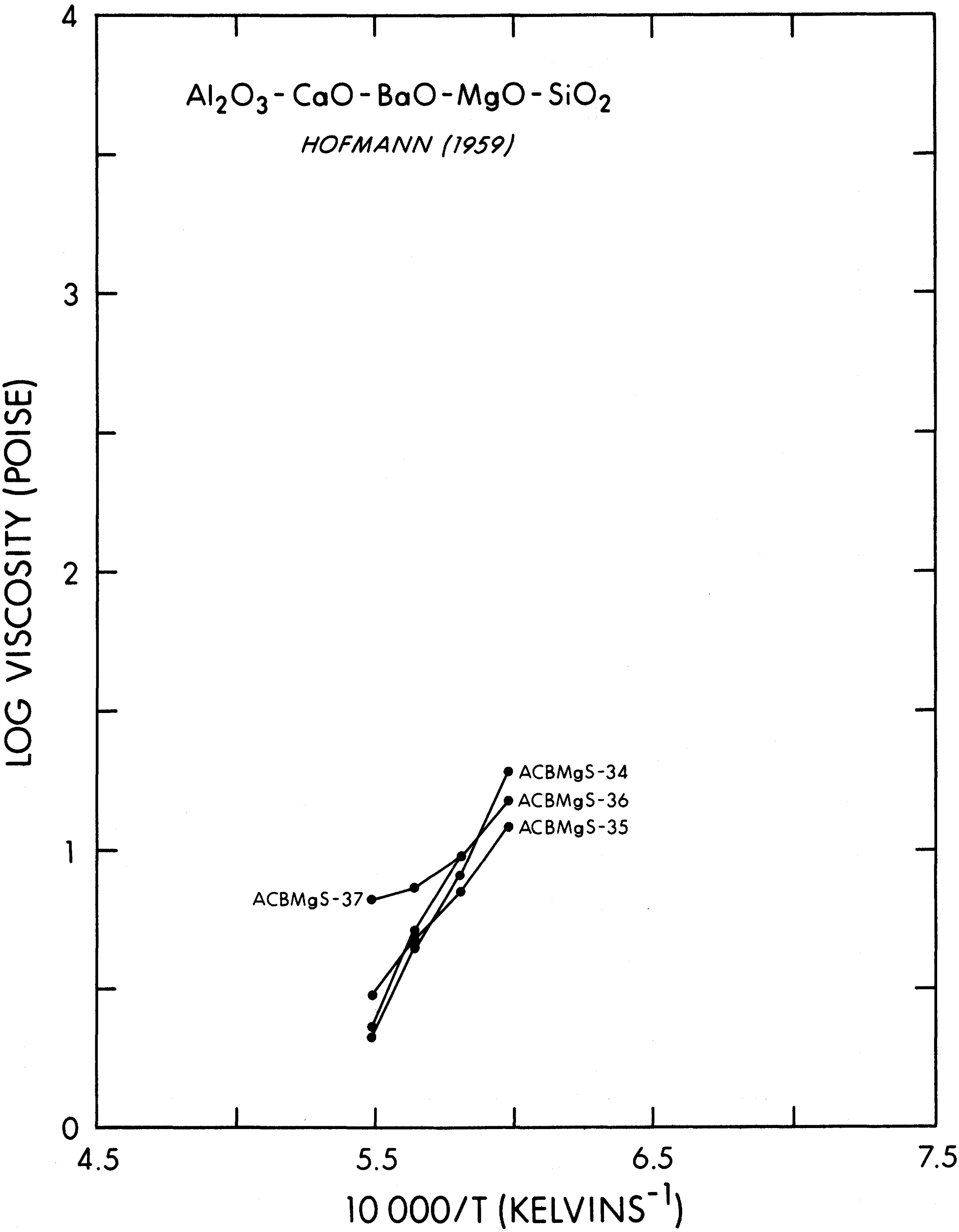

Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-30
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5


Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-31
ACBMgS-33
ACBMgS-32
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1300
1400
1500
1600

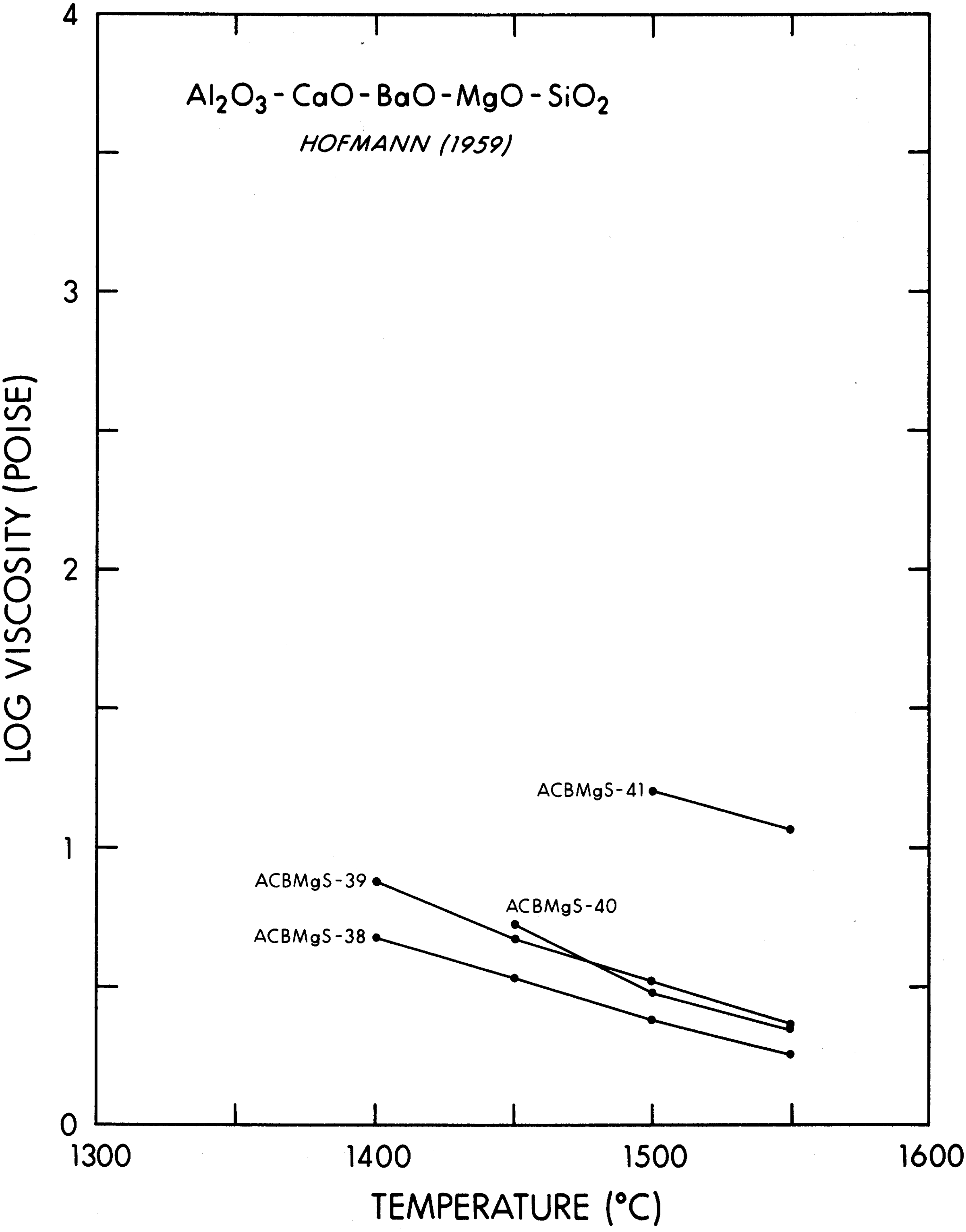

Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-32
ACBMgS-33
ACBMgS-31
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5

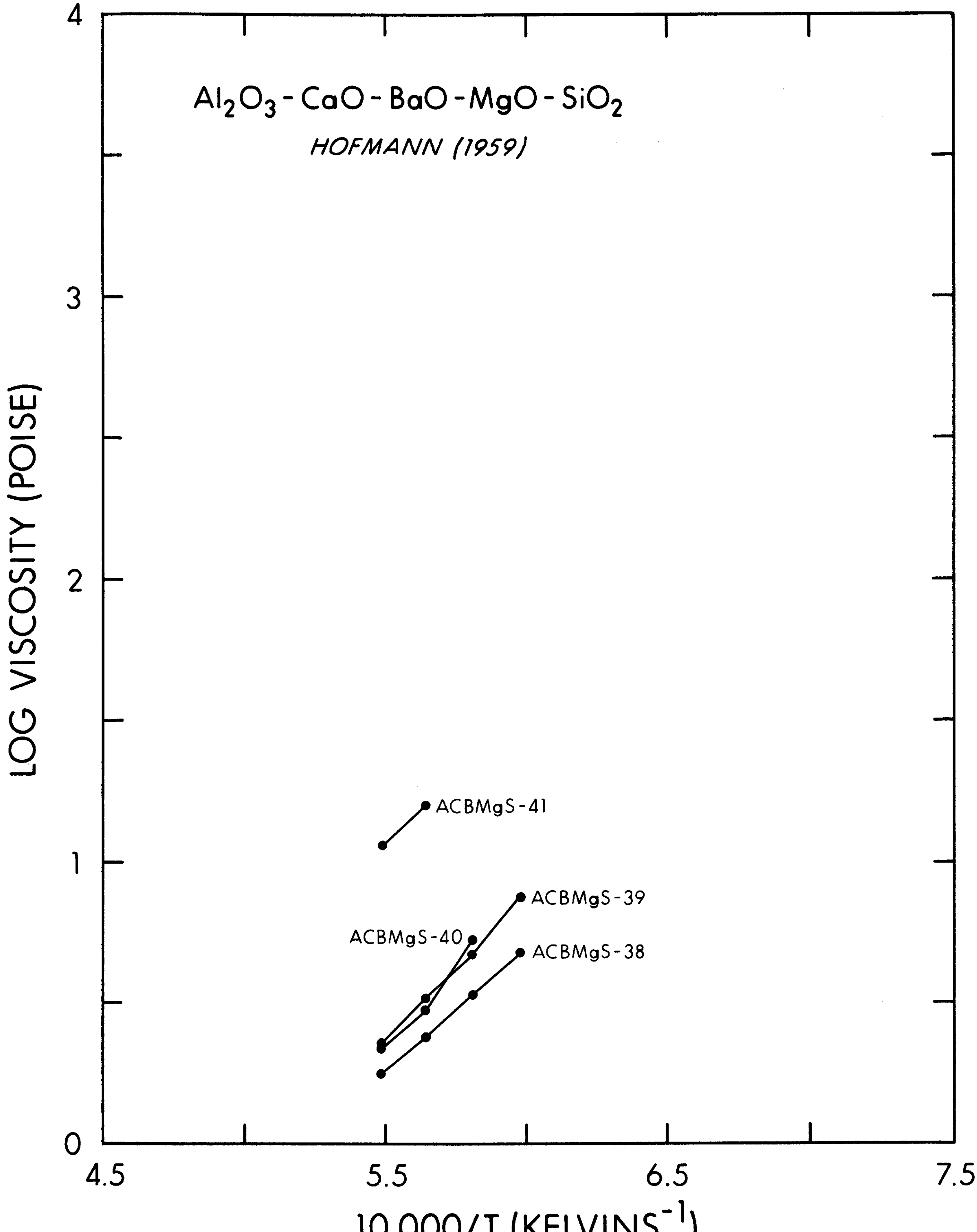


Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-34
ACBMgS-36
ACBMgS-35
ACBMgS-37
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
4
3
2
1
0
1300
1400
1500
1600

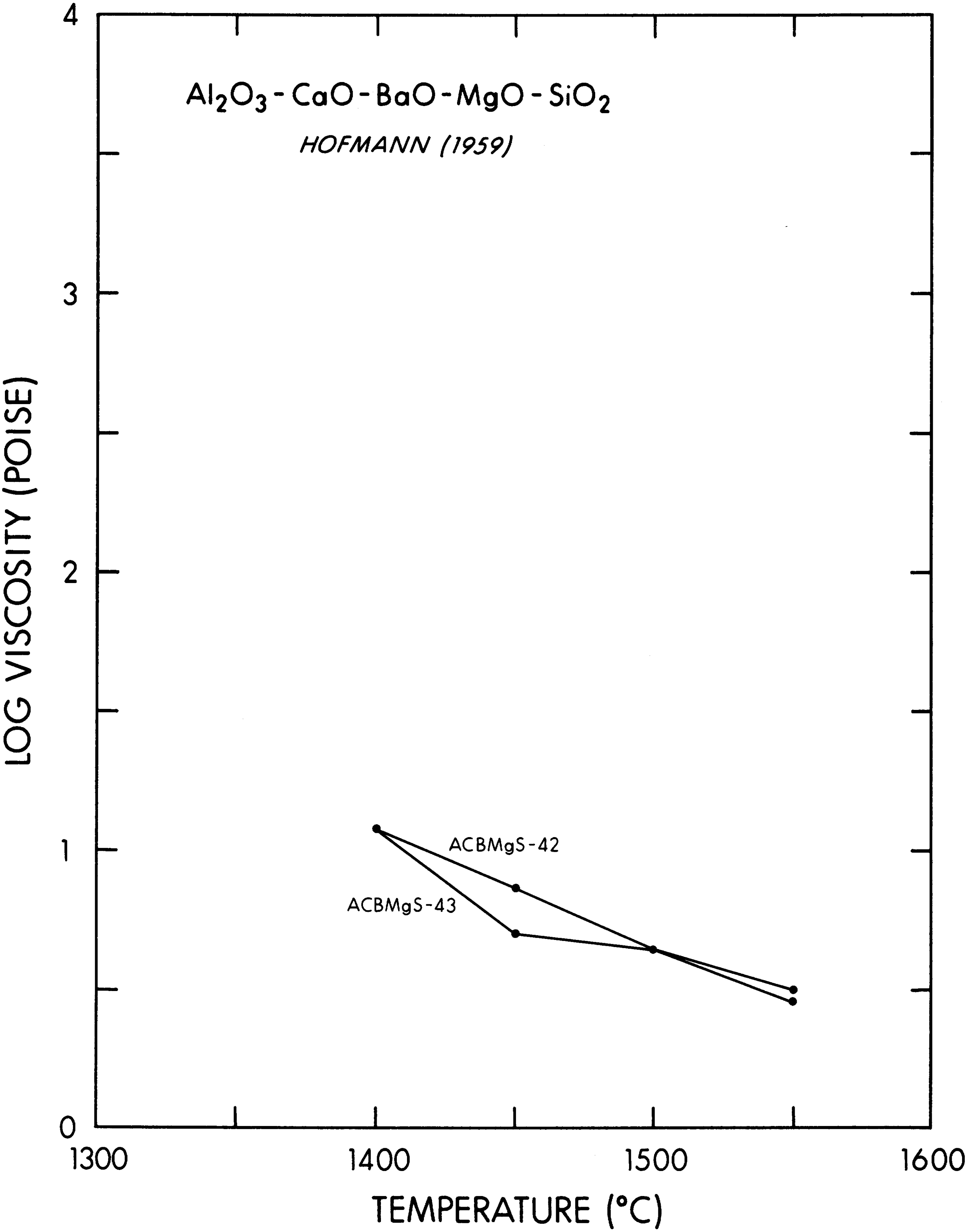


Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-34
ACBMgS-36
ACBMgS-35
ACBMgS-37
LOG VISCOSITY (POISE)
4
3
2
1
0
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})

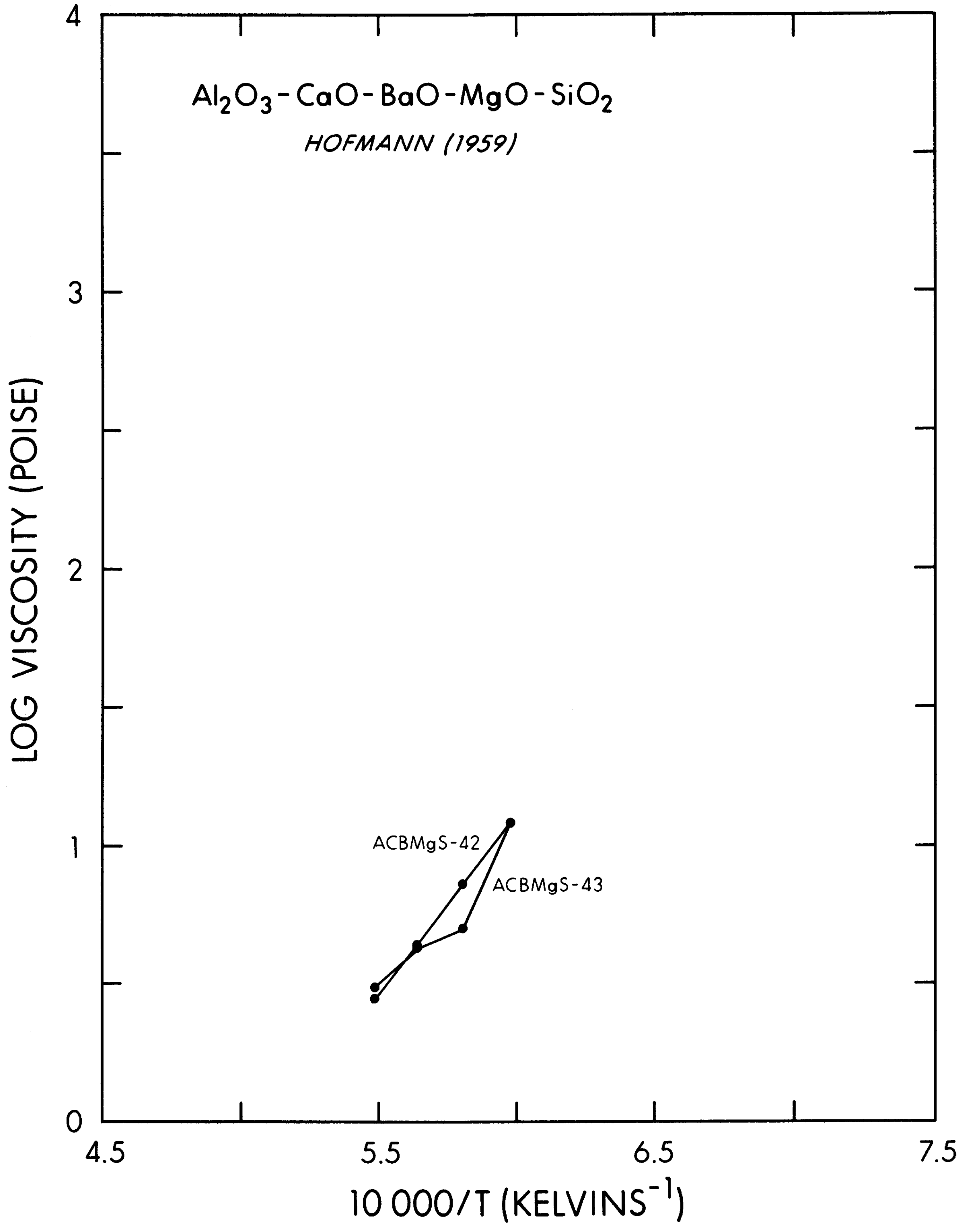

Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1300
1400
1500
1600
ACBMgS-41
ACBMgS-39
ACBMgS-40
ACBMgS-38

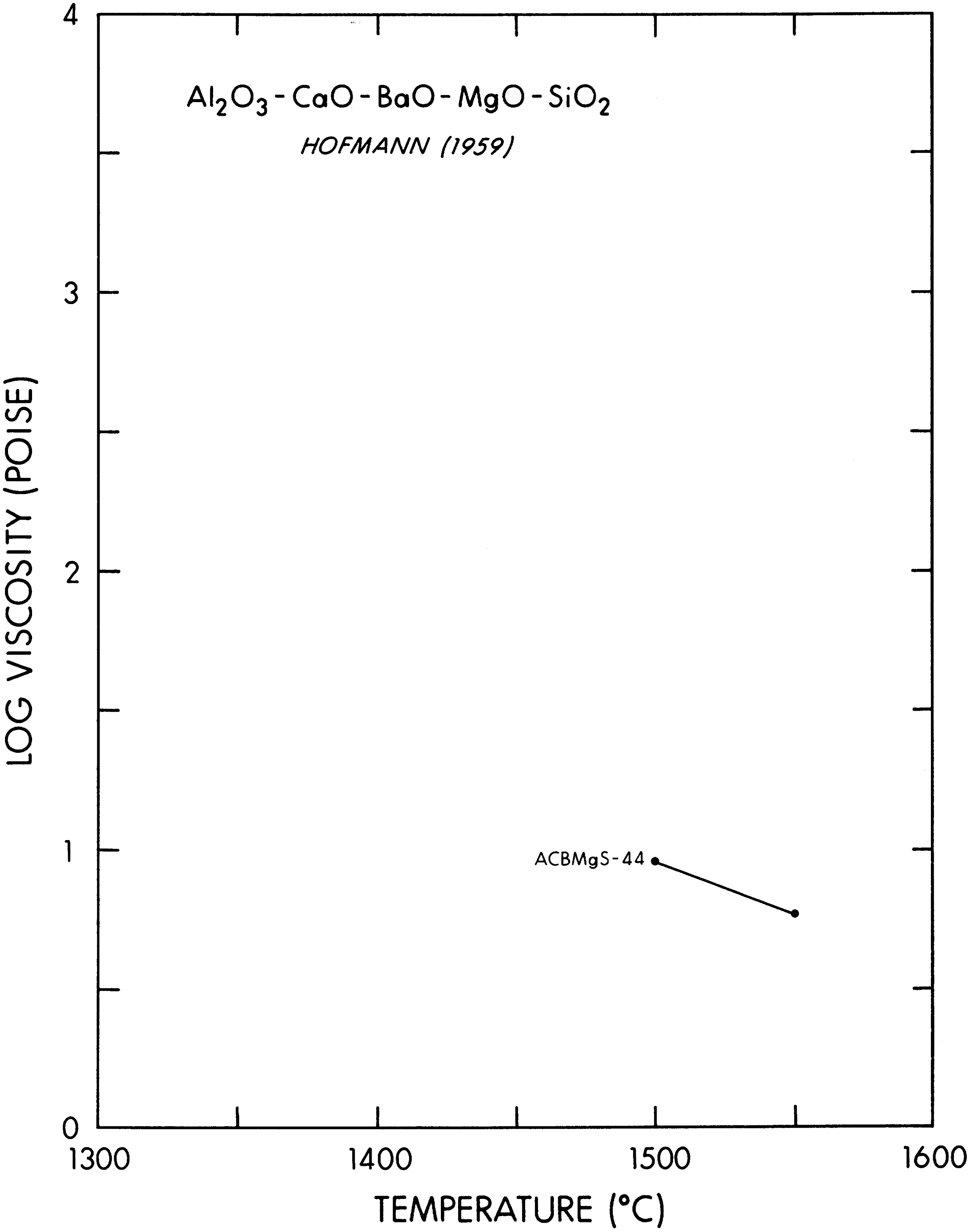


$Al_2O_3 - CaO - BaO - MgO - SiO_2$
HOFMANN (1959)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5
ACBMgS-41
ACBMgS-39
ACBMgS-40
ACBMgS-38

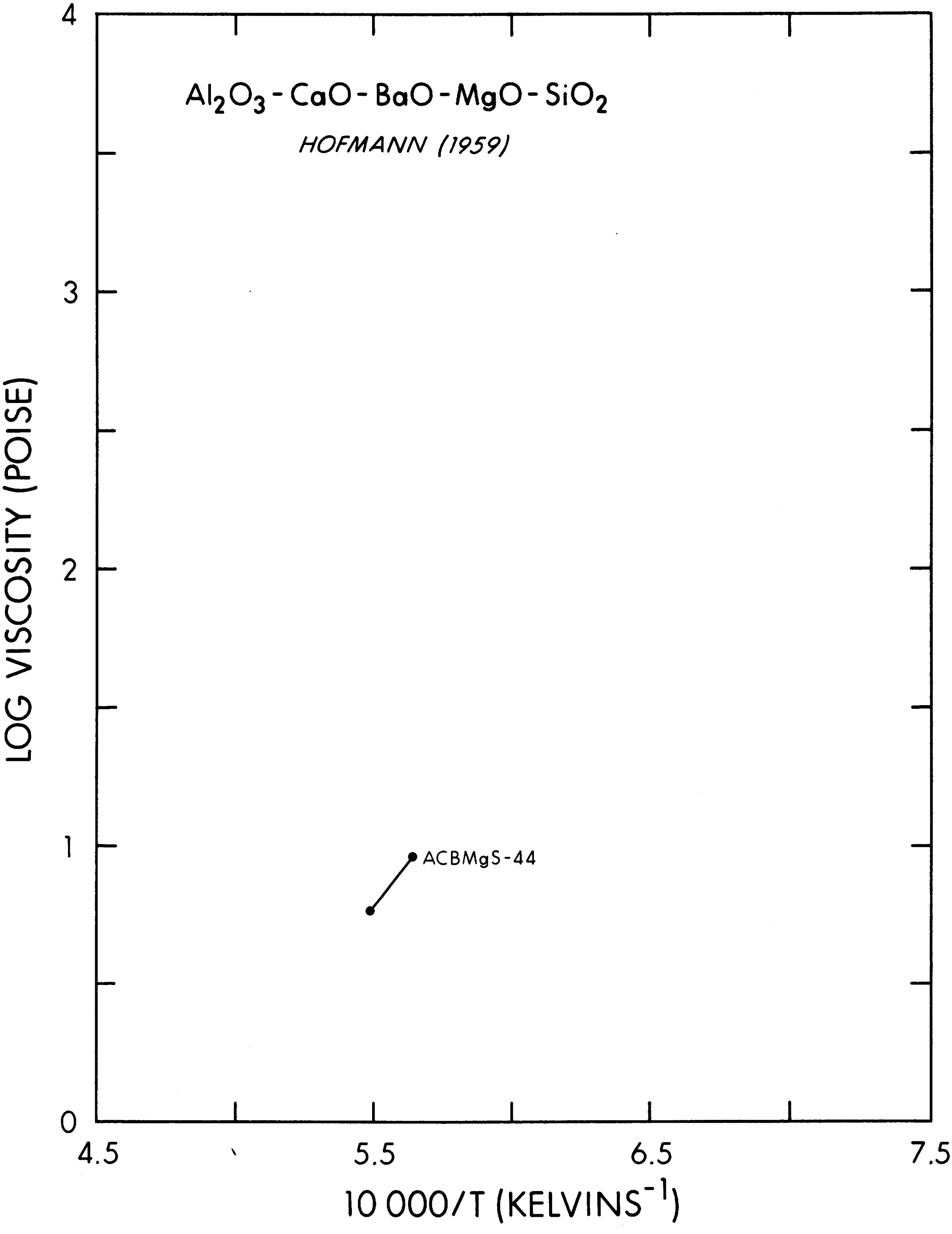


Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
ACBMgS - 42
ACBMgS - 43
0
1
2
3
4
1300
1400
1500
1600


Al2O3-CaO-BaO-MgO-SiO2
HOFMANN (1959)
ACBMgS-42
ACBMgS-43
LOG VISCOSITY (POISE)
0
1
2
3
4
4.5
5.5
6.5
7.5
10 000/T (KELVINS-1)



Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-44
LOG VISCOSITY (POISE)
0
1
2
3
4
1300
1400
1500
1600
TEMPERATURE (°C)


Al_2O_3 - CaO - BaO - MgO - SiO_2
HOFMANN (1959)
ACBMgS-44
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
4
3
2
1
0
4.5
5.5
6.5
7.5

SYSTEM

$Al_2O_3(.08)CaO(.07)K_2O(.02)Na_2O(.06)SiO_2(.77)$ (X)

AUTHOR

N'DALA et al. (1984)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

ACKNS-1

T	Z	LN(N)	LOG(N)	N
1376.	6.064	10.48	4.55	35596.
1417.	5.917	10.13	4.39	25084.
1472.	5.730	9.50	4.12	13359.
1475.	5.720	9.35	4.06	11498.
1516.	5.589	9.05	3.93	8518.
1520.	5.577	8.99	3.90	8022.
1577.	5.405	8.43	3.66	4582.
1604.	5.327	8.12	3.52	3361.
1607.	5.319	8.06	3.50	3165.
1609.	5.313	8.04	3.49	3102.
1625.	5.268	7.77	3.37	2368.
1632.	5.249	7.74	3.36	2298.
1636.	5.238	7.71	3.34	2230.

SYSTEM

$Al_2O_3(.18)CaO(.09)K_2O(.04)Na_2O(.03)SiO_2(.66)$ (X)

AUTHOR

N'DALA et al. (1984)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

ACKNS-2

T	Z	LN(N)	LOG(N)	N
1375.	6.060	9.91	4.30	20130.
1392.	6.006	9.66	4.19	15677.
1417.	5.917	9.31	4.04	11047.
1424.	5.892	9.12	3.96	9136.
1497.	5.649	8.35	3.62	4230.
1550.	5.485	7.56	3.28	1919.
1556.	5.467	7.49	3.25	1790.
1558.	5.461	7.47	3.24	1754.
1630.	5.254	6.63	2.87	757.
1632.	5.249	6.61	2.87	742.
1642.	5.221	6.41	2.78	607.
1651.	5.197	6.40	2.77	601.

Six-Component Systems

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SYSTEM
AL2O3(20.75),CAO(13.84),MGO(10.49),
BAO(1.84),SRO(6.13),SIO2(46.95) (X)
AL2O3(30.0),CAO(11.0),MGO(6.0),
BAO(4.0),SRO(9.0),SIO2(40.0) (%)

AUTHOR
HOFMAIER (1968)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

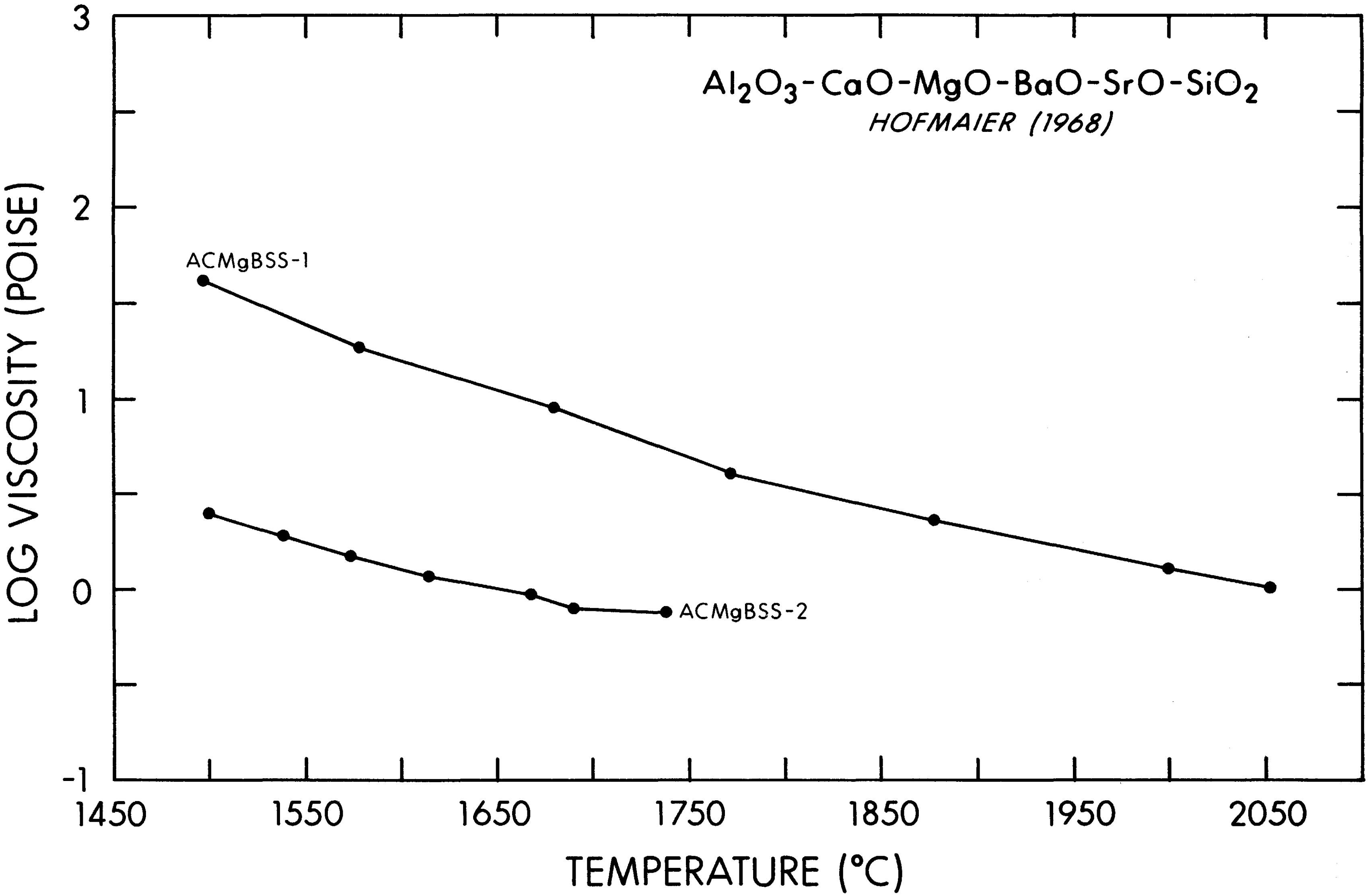
DERIVED FROM
ABB. 6

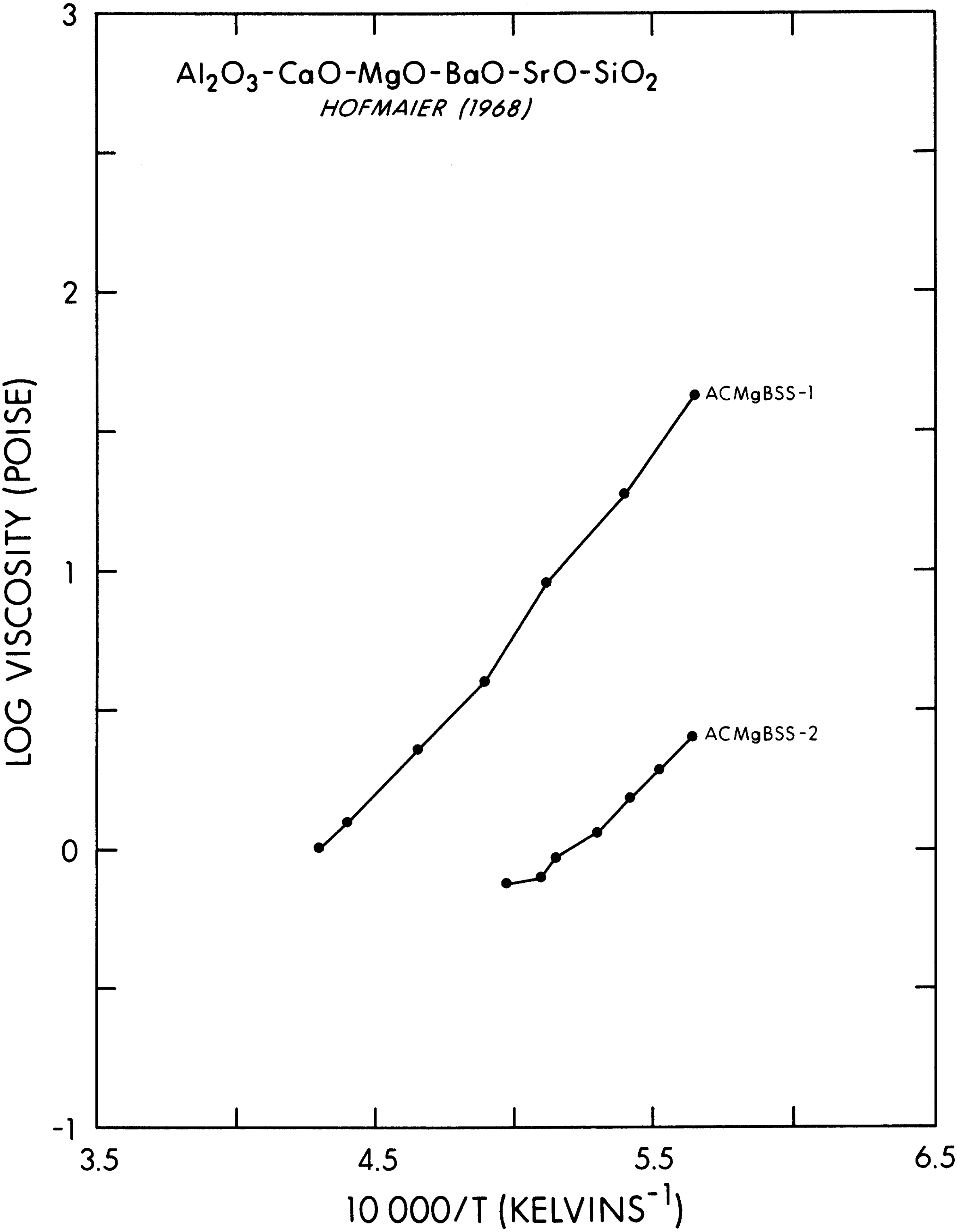
N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACMgBSS-1

T	Z	LN(N)	LOG(N)	N
1496.9	5.650	3.730	1.62	41.687
1578.9	5.400	2.924	1.27	18.621
1680.1	5.120	2.187	0.95	8.913
1772.0	4.890	1.382	0.60	3.981
1877.5	4.650	0.829	0.36	2.291
1999.7	4.400	0.230	0.1	1.259
2052.6	4.300	0.000	0.000	1.0


Al_2O_3-CaO-MgO-BaO-SrO-SiO_2
HOFMAIER (1968)
ACMgBSS-1
ACMgBSS-2
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
3
2
1
0
-1
1450
1550
1650
1750
1850
1950
2050


Al_2O_3-CaO-MgO-BaO-SrO-SiO_2
HOFMAIER (1968)
ACMgBSS-1
ACMgBSS-2
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
3
2
1
0
-1
3.5
4.5
5.5
6.5

SYSTEM
AL2O3(4.92),MGO(12.28),CAO(22.88),
FEO(4.64),FE2O3(0.02),SIO2(55.25) (X)
AL2O3(8.45),MGO(8.34),CAO(21.62),
FEO(5.61),FE2O3(0.06),SIO2(55.92) (%)

AUTHOR
BILLS (1963)

MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCFFS-1

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	5.158	2.240	173.8
1300.00	6.357	4.518	1.962	91.6
1350.00	6.161	3.806	1.653	44.98
1400.00	5.977	3.272	1.421	26.36
1450.00	5.804	2.908	1.263	18.32
1500.00	5.640	2.466	1.071	11.78

SYSTEM
AL2O3(4.71),MGO(11.77),CAO(21.92),
FEO(8.64),FE2O3(0.04),SIO2(52.92) (X)
AL2O3(8.02),MGO(7.92),CAO(20.53),
FEO(10.36),FE2O3(0.10),SIO2(53.10) (%)

AUTHOR
BILLS (1963)

MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCFFS-2

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.747	2.062	115.3
1300.00	6.357	4.004	1.739	54.83
1350.00	6.161	3.454	1.500	31.62
1400.00	5.977	2.977	1.293	19.63
1450.00	5.804	2.489	1.081	12.05

SYSTEM
AL2O3(6.55),MGO(9.20),CAO(29.70),
FEO(5.68),FE2O3(0.02),SIO2(48.85) (X)
AL2O3(11.04),MGO(6.13),CAO(27.53),
FEO(6.74),FE2O3(0.05),SIO2(48.51) (%)

AUTHOR
BILLS (1963)

MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCFFS-3

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.495	1.952	89.54
1300.00	6.357	3.850	1.672	46.99
1350.00	6.161	3.254	1.413	25.88
1400.00	5.977	2.772	1.204	16.00
1450.00	5.804	2.282	0.991	9.795

SYSTEM
AL2O3(11.03),MGO(11.75),CAO(29.56),
FEO(3.30),FE2O3(0.02),SIO2(44.34) (X)
AL2O3(18.26),MGO(7.69),CAO(26.91),
FEO(3.85),FE2O3(0.05),SIO2(43.24) (%)

AUTHOR
BILLS (1963)

MEASUREMENT METHOD
RESTRAINED SPHERE

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCFFS-4

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.287	1.862	72.78
1300.00	6.357	3.691	1.603	40.09
1350.00	6.161	3.108	1.350	22.39
1400.00	5.977	2.636	1.145	13.96
1450.00	5.804	2.204	0.957	9.057

SYSTEM
AL2O3(5.61),MGO(14.02),CAO(26.13),
FEO(16.23),FE2O3(0.09),SIO2(37.91) (X)
AL2O3(7.57),MGO(7.47),CAO(19.37),
FEO(15.41),FE2O3(0.19),SIO2(30.10) (%)

AUTHOR
BILLS (1963)

MEASUREMENT METHOD
RESTRAINED SPHERE

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCFFS-5

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.283	1.860	72.44
1300.00	6.357	3.645	1.583	38.28
1350.00	6.161	2.959	1.285	19.28
1400.00	5.977	2.53	1.100	12.59
1450.00	5.804	2.077	0.902	7.980

SYSTEM
AL2O3(6.02),MGO(8.81),CAO(28.46),
FEO(9.60),FE2O3(0.04),SIO2(46.81) (X)
AL2O3(10.50),MGO(5.83),CAO(26.18),
FEO(11.31),FE2O3(0.11),SIO2(46.13) (%)

AUTHOR
BILLS (1963)

MEASUREMENT METHOD
RESTRAINED SPHERE

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCFFS-6

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	4.048	1.758	57.28
1300.00	6.357	3.465	1.505	31.99
1350.00	6.161	2.927	1.271	18.66
1400.00	5.977	2.464	1.070	11.75
1450.00	5.804	1.950	0.847	7.031
1500.00	5.640	1.596	0.693	4.932

SYSTEM AUTHOR
AL2O3(10.55),MGO(11.23),CAO(28.24), BILLS (1963)
FEO(7.58),FE2O3(0.04),SIO2(42.36) (X)
AL2O3(17.33),MGO(7.30),CAO(25.53),
FEO(8.78),FE2O3(0.09),SIO2(41.03) (%)
MEASUREMENT METHOD DERIVED FROM
RESTRAINED SPHERE TABLE
N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

AMgCFFS-7

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	3.822	1.660	45.71
1300.00	6.357	3.288	1.428	26.79
1350.00	6.161	2.749	1.194	15.63
1400.00	5.977	2.270	0.986	9.683
1450.00	5.804	1.840	0.799	6.295

SYSTEM AUTHOR
AL2O3(6.02),MGO(8.44),CAO(27.27), BILLS (1963)
FEO(13.35),FE2O3(0.07),SIO2(44.85) (X)
AL2O3(9.99),MGO(5.54),CAO(24.90),
FEO(15.62),FE2O3(0.19),SIO2(43.88) (%)
MEASUREMENT METHOD DERIVED FROM
RESTRAINED SPHERE TABLE
N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

AMgCFFS-8

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	3.772	1.638	43.45
1300.00	6.357	3.033	1.317	20.75
1350.00	6.161	2.519	1.094	12.42
1400.00	5.977	2.164	0.940	8.710
1450.00	5.804	1.667	0.724	5.297

SYSTEM AUTHOR
AL2O3(10.00),MGO(10.66),CAO(26.79), BILLS (1963)
FEO(12.29),FE2O3(0.08),SIO2(40.18) (X)
AL2O3(16.30),MGO(7.64),CAO(24.03),
FEO(14.12),FE2O3(0.20),SIO2(38.61) (%)
MEASUREMENT METHOD DERIVED FROM
RESTRAINED SPHERE TABLE
N (POISES) P = 1.0 ATM.
T (DEGREES C) Z = 10000.0/T(K) (1/K)

AMgCFFS-9

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	3.594	1.561	36.39
1300.00	6.357	2.959	1.285	19.28
1350.00	6.161	2.413	1.048	11.17
1400.00	5.977	2.077	0.902	7.980
1450.00	5.804	1.664	0.732	5.284
1500.00	5.640	1.317	0.572	3.733

SYSTEM AL2O3(4.25),MGO(10.63),CAO(19.79),
FEO(17.44),FE2O3(0.11),SIO2(47.78) (X)
AL2O3(7.11),MGO(7.02),CAO(18.19),
FEO(20.53),FE2O3(0.28),SIO2(47.05) (%)

AUTHOR BILLS (1963)

MEASUREMENT METHOD RESTRAINED SPHERE

DERIVED FROM TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCFFS-10

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	3.795	1.648	44.46
1300.00	6.357	3.136	1.362	23.01
1350.00	6.161	2.487	1.080	12.02
1400.00	5.977	1.840	0.799	6.295
1450.00	5.804	1.338	0.581	3.811

SYSTEM AL2O3(5.65),MGO(7.94),CAO(25.63),
FEO(18.52),FE2O3(0.10),SIO2(42.16) (X)
AL2O3(9.29),MGO(5.16),CAO(23.18),
FEO(21.45),FE2O3(0.26),SIO2(40.84) (%)

AUTHOR BILLS (1963)

MEASUREMENT METHOD RESTRAINED SPHERE

DERIVED FROM TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCFFS-11

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	3.325	1.444	27.80
1300.00	6.357	2.650	1.151	14.16
1350.00	6.161	1.992	0.865	7.328
1400.00	5.977	1.593	0.692	4.920
1450.00	5.804	1.121	0.487	3.069

SYSTEM AL2O3(9.49),MGO(10.11),CAO(26.79),
FEO(16.69),FE2O3(0.11),SIO2(38.16) (X)
AL2O3(15.37),MGO(6.47),CAO(22.65),
FEO(19.03),FE2O3(0.28),SIO2(36.40) (%)

AUTHOR BILLS (1963)

MEASUREMENT METHOD RESTRAINED SPHERE

DERIVED FROM TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCFFS-12

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	3.178	1.380	23.99
1300.00	6.357	2.540	1.103	12.68
1350.00	6.161	1.945	0.835	6.998
1400.00	5.977	1.621	0.704	5.058
1450.00	5.804	1.156	0.502	3.177

SYSTEM
AL2O3(3.96),MGO(9.90),CAO(18.45),
FEO(23.01),FE2O3(0.14),SIO2(44.54) (X)
AL2O3(6.55),MGO(6.46),CAO(16.76),
FEO(26.78),FE2O3(0.37),SIO2(43.35) (%)

AUTHOR
BILLS (1963)

MEASUREMENT METHOD
RESTRAINED SPHERE

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCFFS-13

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	3.357	1.458	28.71
1300.00	6.357	2.632	1.143	13.90
1350.00	6.161	1.980	0.860	7.244
1400.00	5.977	1.423	0.618	4.150
1450.00	5.804	0.880	0.382	2.410

SYSTEM
AL2O3(8.86),MGO(9.44),CAO(25.44),
FEO(22.16),FE2O3(0.17),SIO2(35.62) (X)
AL2O3(14.22),MGO(5.99),CAO(20.96),
FEO(25.06),FE2O3(0.41),SIO2(33.68) (%)

AUTHOR
BILLS (1963)

MEASUREMENT METHOD
RESTRAINED SPHERE

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCFFS-14

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	2.754	1.196	1 15.70
1300.00	6.357	2.160	0.938	8.670
1350.00	6.161	1.669	0.725	5.309
1400.00	5.977	1.204	0.523	3.334
1450.00	5.804	0.734	0.321	2.094

SYSTEM
AL2O3(5.41),MGO(7.09),CAO(24.50),
FEO(22.05),FE2O3(0.15),SIO2(40.30) (X)
AL2O3(8.83),MGO(4.90),CAO(22.01),
FEO(25.38),FE2O3(0.36),SIO2(38.78) (%)

AUTHOR
BILLS (1963)

MEASUREMENT METHOD
RESTRAINED SPHERE

DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCFFS-15

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	3.021	1.312	20.51
1300.00	6.357	2.217	0.963	9.18
1350.00	6.161	1.547	0.672	4.699
1400.00	5.977	0.914	0.397	2.495
1450.00	5.804	0.368	0.16	1.445

SYSTEM

AL2O3(5.05),MGO(7.09),CAO(22.90),
FEO(27.07),FE2O3(0.22),SIO2(37.67) (X)

AUTHOR
BILLS (1963)

AL2O3(8.17),MGO(4.54),CAO(20.39),
FEO(30.87),FE2O3(0.56),SIO2(35.92) (%)

MEASUREMENT METHOD
RESTRAINED SPHERE

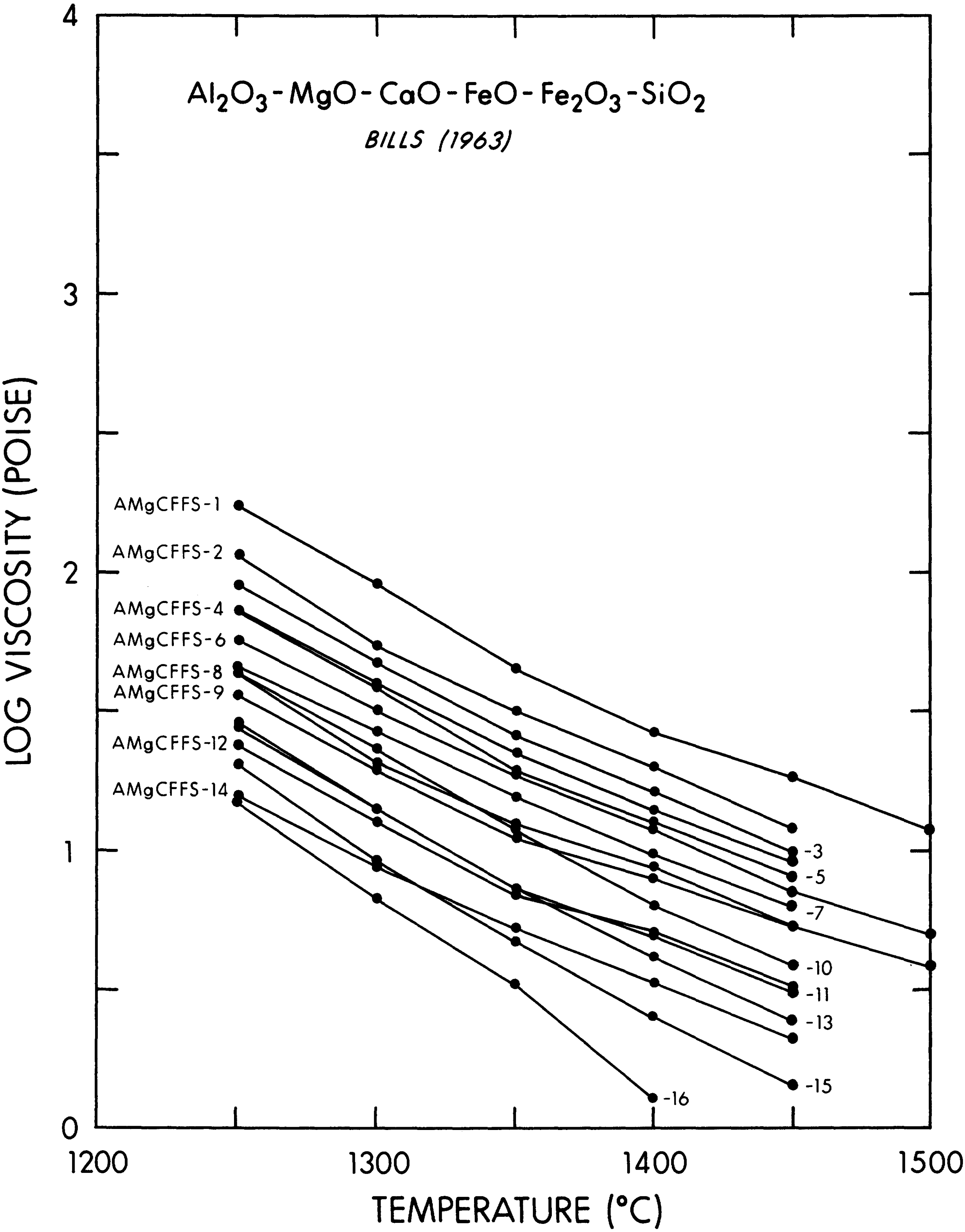
DERIVED FROM
TABLE

N (POISES)
T (DEGREES C)

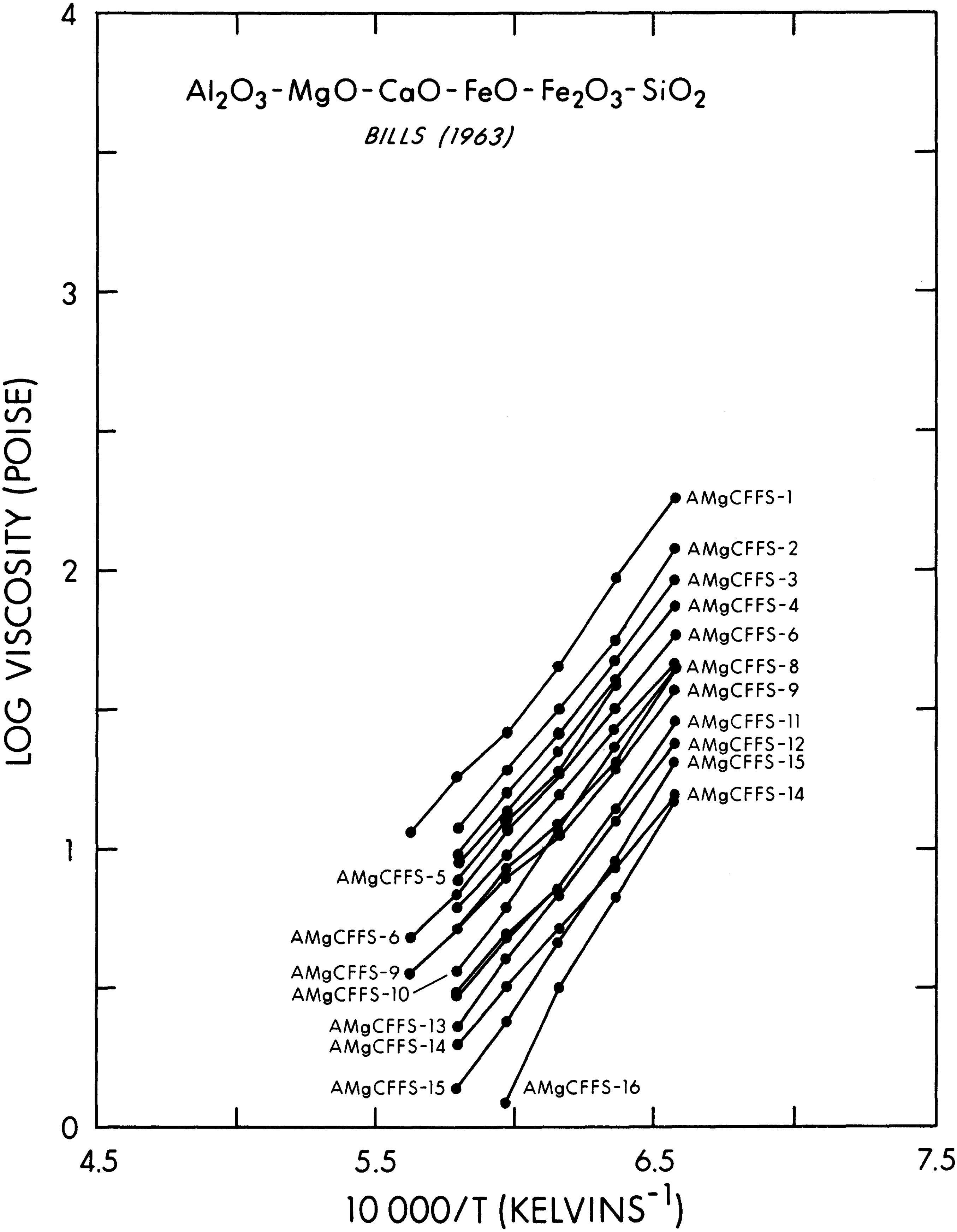
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

AMgCFFS-16

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	2.689	1.168	14.72
1300.00	6.357	1.913	0.831	6.776
1350.00	6.161	1.193	0.518	3.296
1400.00	5.977	0.260	0.113	1.297



Al_2O_3 - MgO - CaO - FeO - Fe_2O_3 - SiO_2
BILLS (1963)
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
4
3
2
1
0
1200
1300
1400
1500
AMgCFFS-1
AMgCFFS-2
AMgCFFS-4
AMgCFFS-6
AMgCFFS-8
AMgCFFS-9
AMgCFFS-12
AMgCFFS-14
-3
-5
-7
-10
-11
-13
-15
-16



Al_2O_3-MgO-CaO-FeO-Fe_2O_3-SiO_2
BILLS (1963)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
4.5
5.5
6.5
7.5
AMgCFFS-1
AMgCFFS-2
AMgCFFS-3
AMgCFFS-4
AMgCFFS-6
AMgCFFS-8
AMgCFFS-9
AMgCFFS-11
AMgCFFS-12
AMgCFFS-15
AMgCFFS-14
AMgCFFS-5
AMgCFFS-6
AMgCFFS-9
AMgCFFS-10
AMgCFFS-13
AMgCFFS-14
AMgCFFS-15
AMgCFFS-16

Seven-Component Systems

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SYSTEM
AL2O3(9.04),CAO(49.55),MGO(5.58),
MNO(0.34),FE(0.11),S(2.09),
SIO2(33.30) (X)
AL2O3(15.15),CAO(45.70),MGO(3.70),
MNO(0.4),FE(0.1),S(1.1),
SIO2(32.9) (%)

AUTHOR
HOFMAIER (1968)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
ABB. 13

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

ACMgMnFSS-1

T	Z	LN(N)	LOG(N)	N
1500.00	5.640	0.916	0.398	2.5
1538.00	5.522	0.652	0.283	1.92
1574.00	5.414	0.405	0.176	1.5
1615.00	5.297	0.140	0.061	1.15
1668.00	5.152	-0.073	-0.032	0.93
1690.00	5.094	-0.236	-0.102	0.79
1738.00	4.973	-0.288	-0.125	0.75

SYSTEM
(AL2O3 + FE2O3) (0.38), CAO (9.61),
MGO (0.23), (NA2O + K2O) (14.8),
SIO2 (74.98) (X)
(AL2O3 + FE2O3) (0.75), CAO (8.64),
MGO (0.15), (NA2O + K2O) (17.76),
SIO2 (72.27) (%)

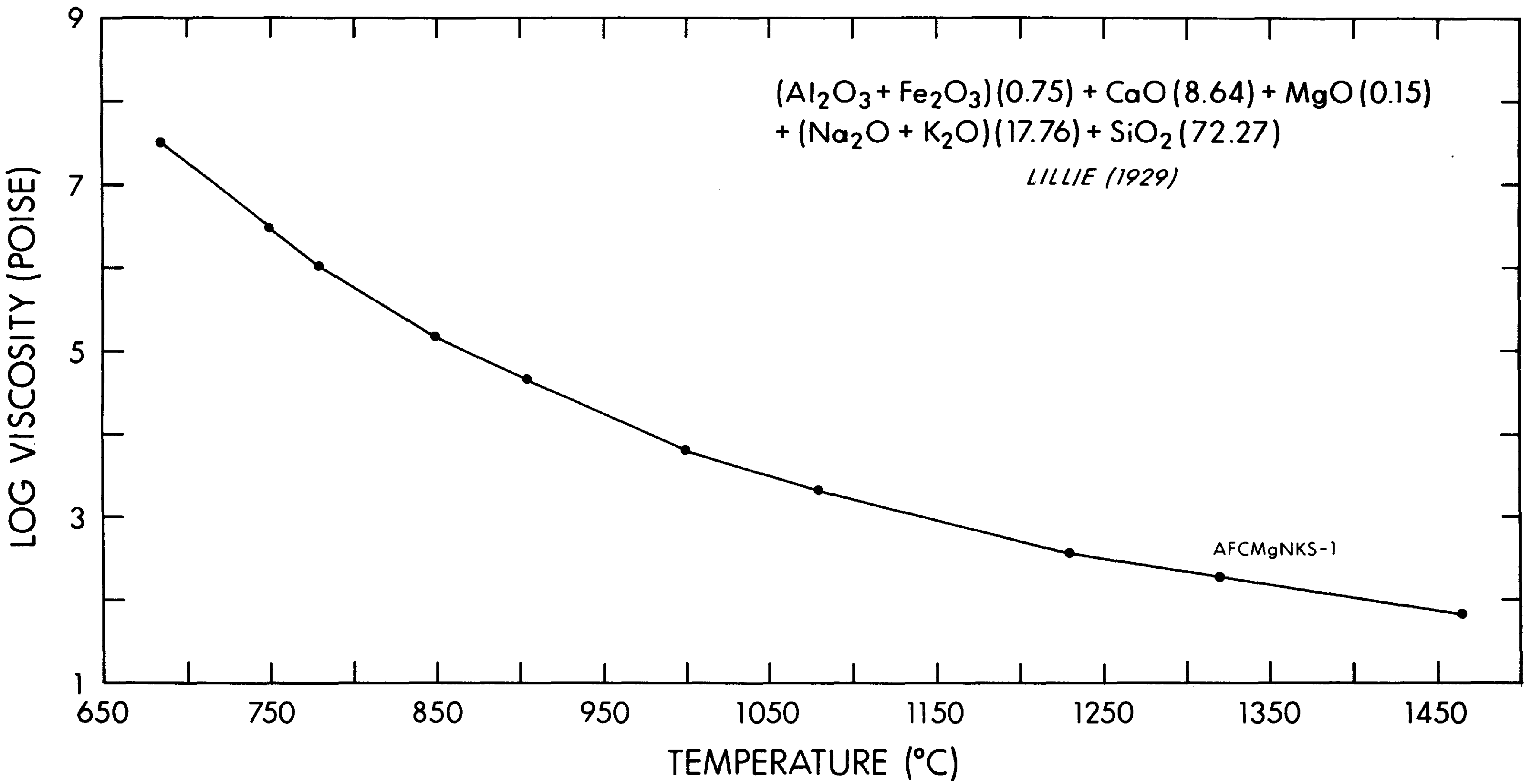
AUTHOR
LILLIE (1929)

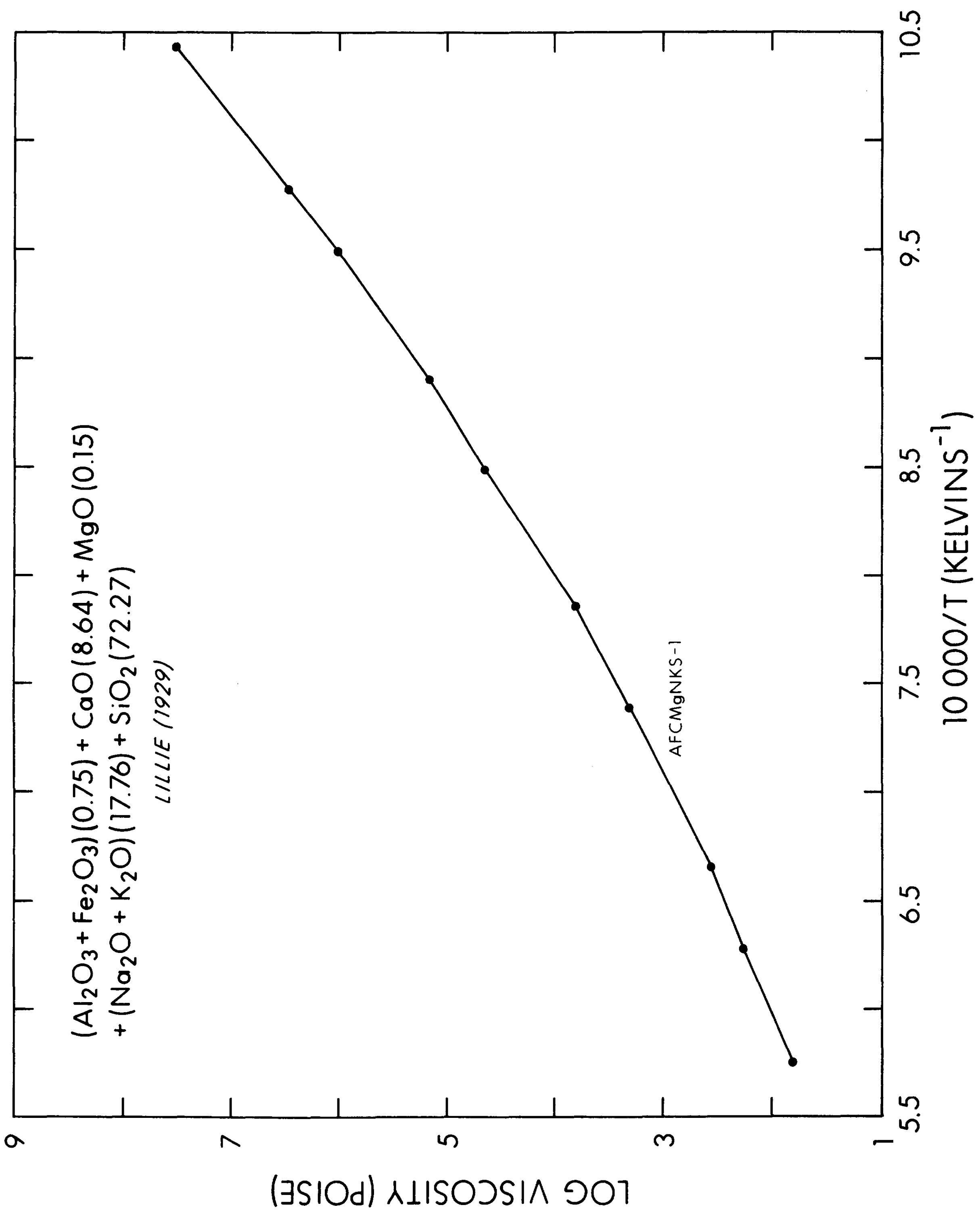
AFCMgNKS-1

MEASUREMENT METHOD
CONCENTRIC CYLINDER
N (POISES)
T (DEGREES C)

DERIVED FROM
FIG. 3
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

T	Z	LN(N)	LOG(N)	N (APPROX.)
685.00	10.438	17.269	7.50	3.16*10E7
750.00	9.775	14.852	6.45	2.82*10E6
780.00	9.497	13.816	6.00	1.00*10E6
850.00	8.905	11.858	5.15	1.41*10E5
905.00	8.489	10.707	4.65	4.47*10E4
1000.00	7.855	8.750	3.80	6309.57
1080.00	7.391	7.599	3.30	1995.26
1230.00	6.653	5.872	2.55	354.81
1320.00	6.277	5.181	2.25	177.83
1465.00	5.754	4.145	1.80	63.10


(Al2O3 + Fe2O3) (0.75) + CaO (8.64) + MgO (0.15)
+ (Na2O + K2O) (17.76) + SiO2 (72.27)
LILLIE (1929)
AFCMgNKS-1
LOG VISCOSITY (POISE)
9
7
5
3
1
650
750
850
950
1050
1150
1250
1350
1450
TEMPERATURE (°C)


$(Al_2O_3 + Fe_2O_3)(0.75) + CaO(8.64) + MgO(0.15)$
$+ (Na_2O + K_2O)(17.76) + SiO_2(72.27)$
LILLIE (1929)
AFCMgNKS-1
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
1
3
5
7
9
5.5
6.5
7.5
8.5
9.5
10.5

Minerals

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SYSTEM
NaAlSi2O6 (JADEITE)
MEASUREMENT METHOD
FALLING SPHERE VISCOMETRY
N (POISES)
T = 1350 C

AUTHOR
KUSHIRO (1976a)
DERIVED FROM
TABLE 2

Z = 10000.0/T(K) (1/K)

M-1

P (KBAR)	LN(N)	LOG(N)	N
1.	11.127	4.833	6.8*10E4
5.	10.571	4.591	3.9*10E4
5.	10.434	4.531	3.4*10E4
7.5	10.240	4.447	2.8*10E4
10.	9.547	4.146	1.4*10E4
15.	9.071	3.940	8.7*10E3
20.7	8.810	3.826	6.7*10E3
24.	8.575	3.724	5.3*10E3

--

SYSTEM
QUARTZ (SIO2)
MEASUREMENT METHOD
(FROM LITERATURE)
N (POISES)
T (DEGREES C)

AUTHOR
BIRCH AND DANE (1942)
DERIVED FROM
TABLE 10-1

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

M-2

T	Z	LN(N)	LOG(N)	N
1100.00	7.283	31.475	13.669	4.67*10E13
1220.00	6.698	29.633	12.869	7.40*10E12
1300.00	6.357	27.680	12.021	1.05*10E12
1400.00	5.977	24.556	10.665	4.62*10E10
1440.00	5.838	23.103	10.033	1.08*10E10

-

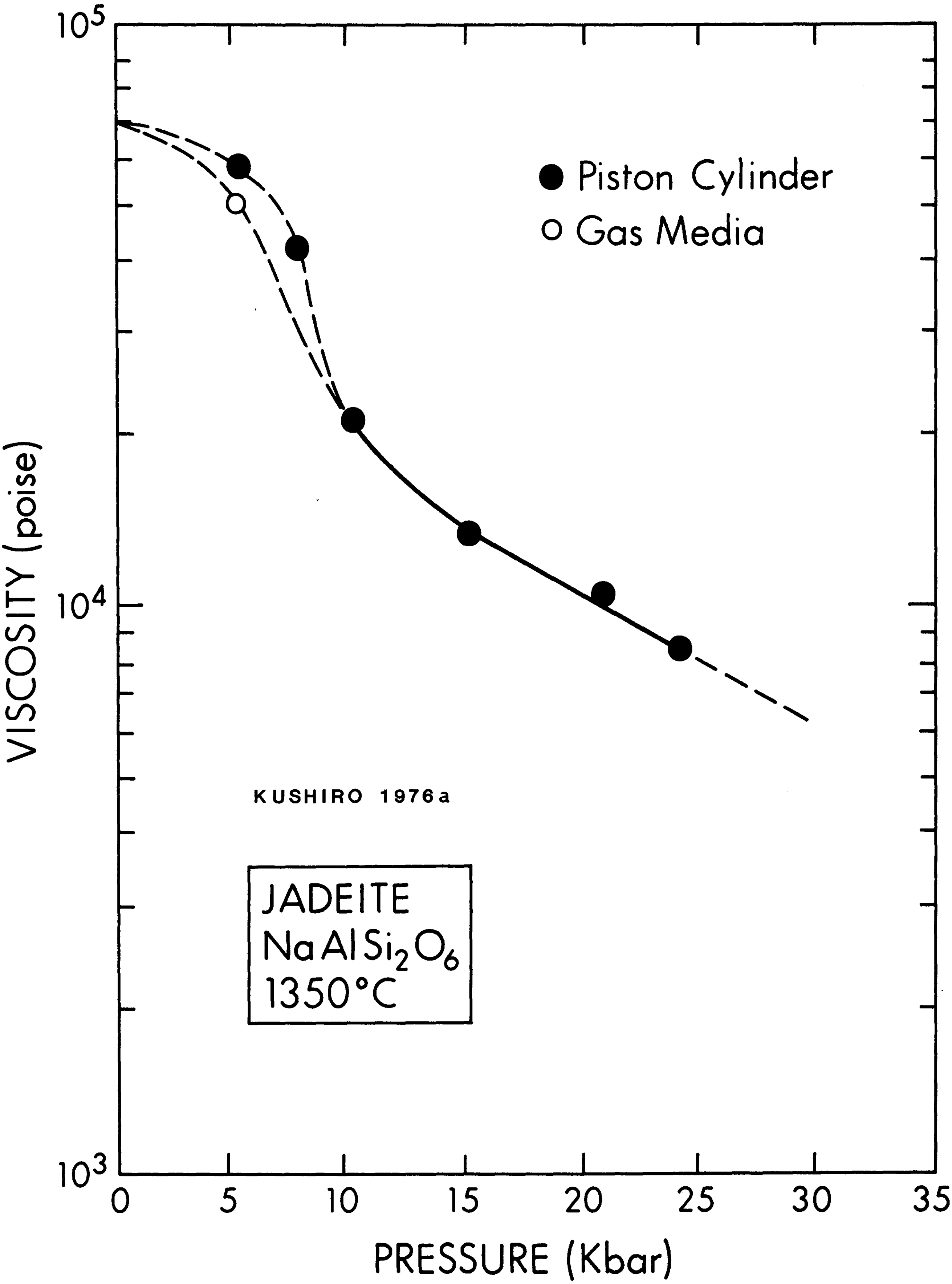
SYSTEM
WOLLASTONITE (CASIO3)
MEASUREMENT METHOD
(FROM LITERATURE)
N (POISES)
T (DEGREES C)

AUTHOR
BIRCH AND DANE (1942)
DERIVED FROM
TABLE 10-1

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

M-3

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	1.004	0.436	2.73
1600.00	5.339	0.875	0.380	2.40
1650.00	5.200	0.867	0.377	2.38



10^5
10^4
10^3
VISCOSITY (poise)
Piston Cylinder
Gas Media
KUSHIRO 1976a
JADEITE
NaAlSi2O6
1350°C
0
5
10
15
20
25
30
35
PRESSURE (Kbar)

SYSTEM
DIOPSIDE (CA MG (SIO3) 2)
MEASUREMENT METHOD
(FROM LITERATURE)
N (POISES)
T (DEGREES C)

AUTHOR
BIRCH AND DANE (1942)
DERIVED FROM
TABLE 10-1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

M-4

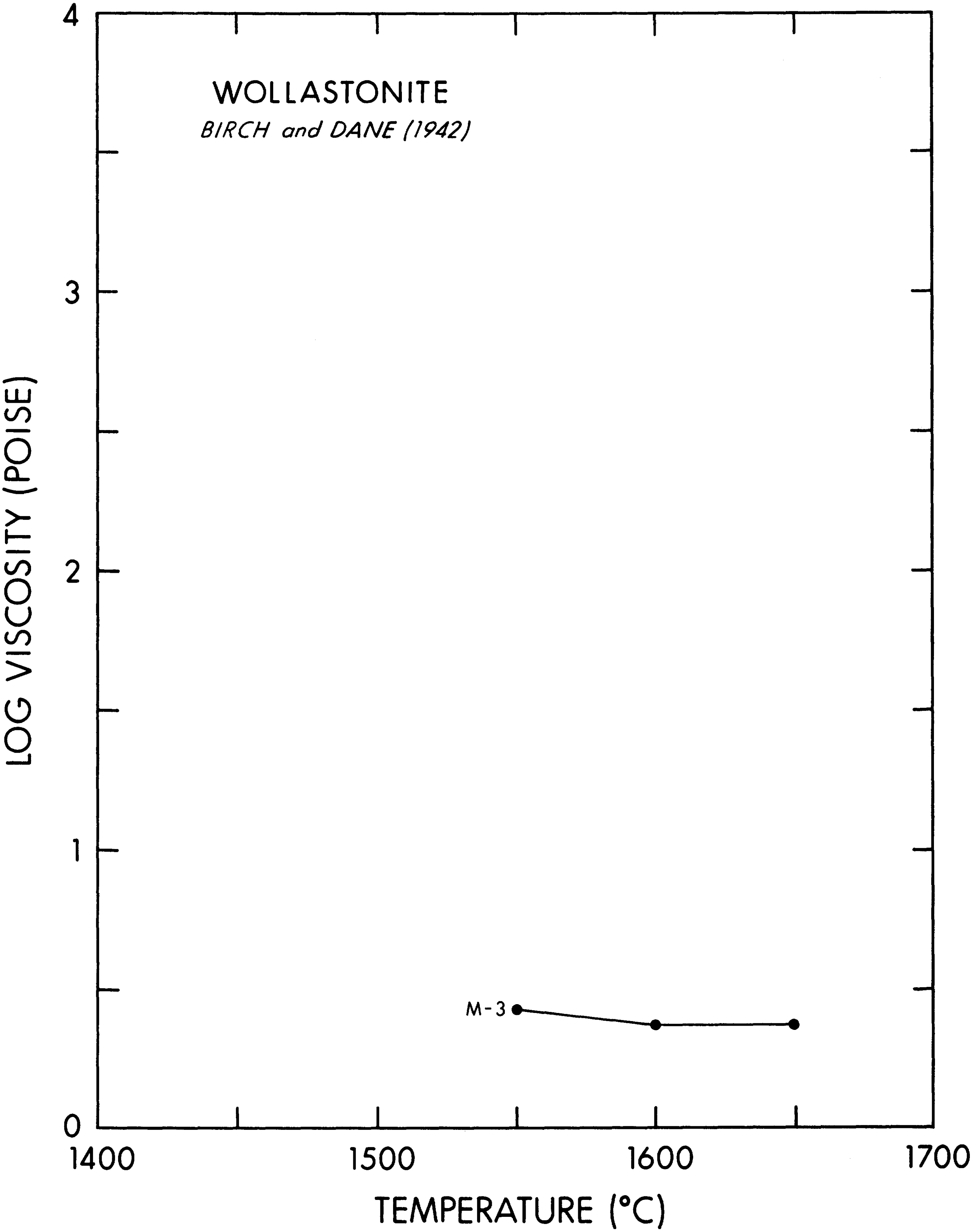
T	Z	LN(N)	LOG(N)	N
1280.00	6.439	4.663	2.025	106.
1300.00	6.357	3.497	1.519	33.
1400.00	5.977	3.258	1.415	26.
1500.00	5.640	0.615	0.267	1.85
1600.00	5.339	0.182	0.079	1.2

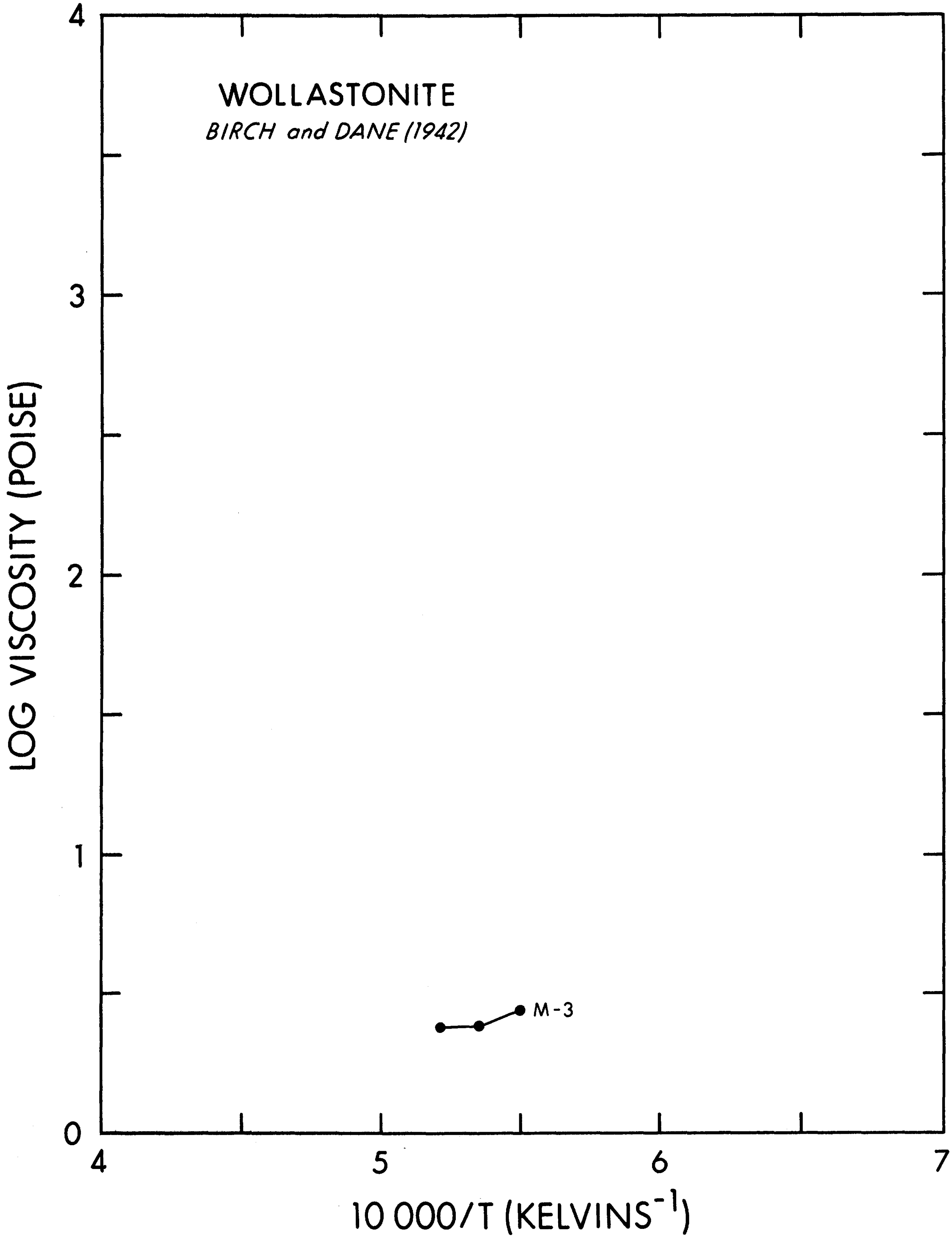
SYSTEM
ANORTHITE (CA AL2 SI2 O8)
MEASUREMENT METHOD
(FROM LITERATURE)
N (POISES)
T (DEGREES C)

AUTHOR
BIRCH AND DANE (1942)
DERIVED FROM
TABLE 10-1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

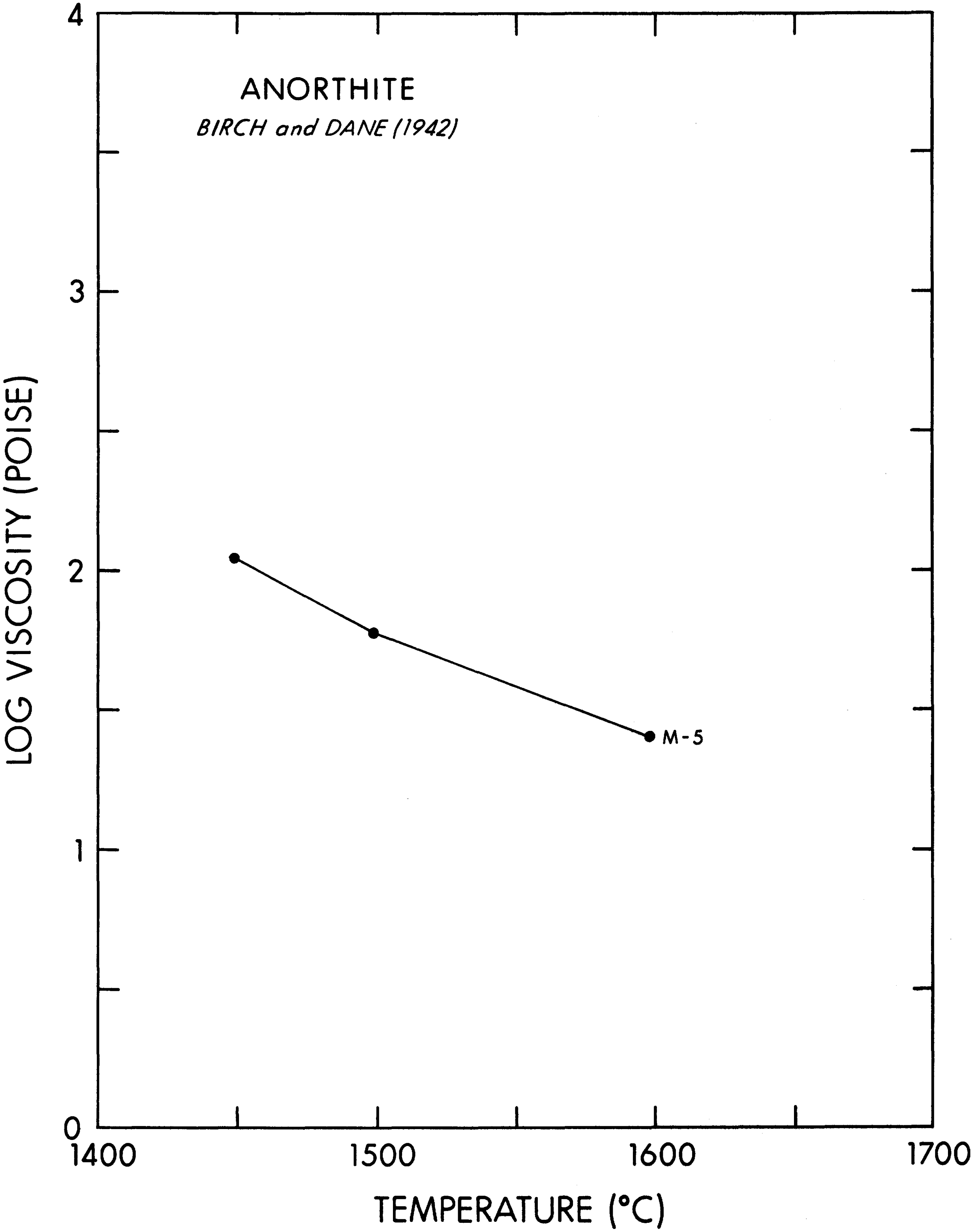
M-5a

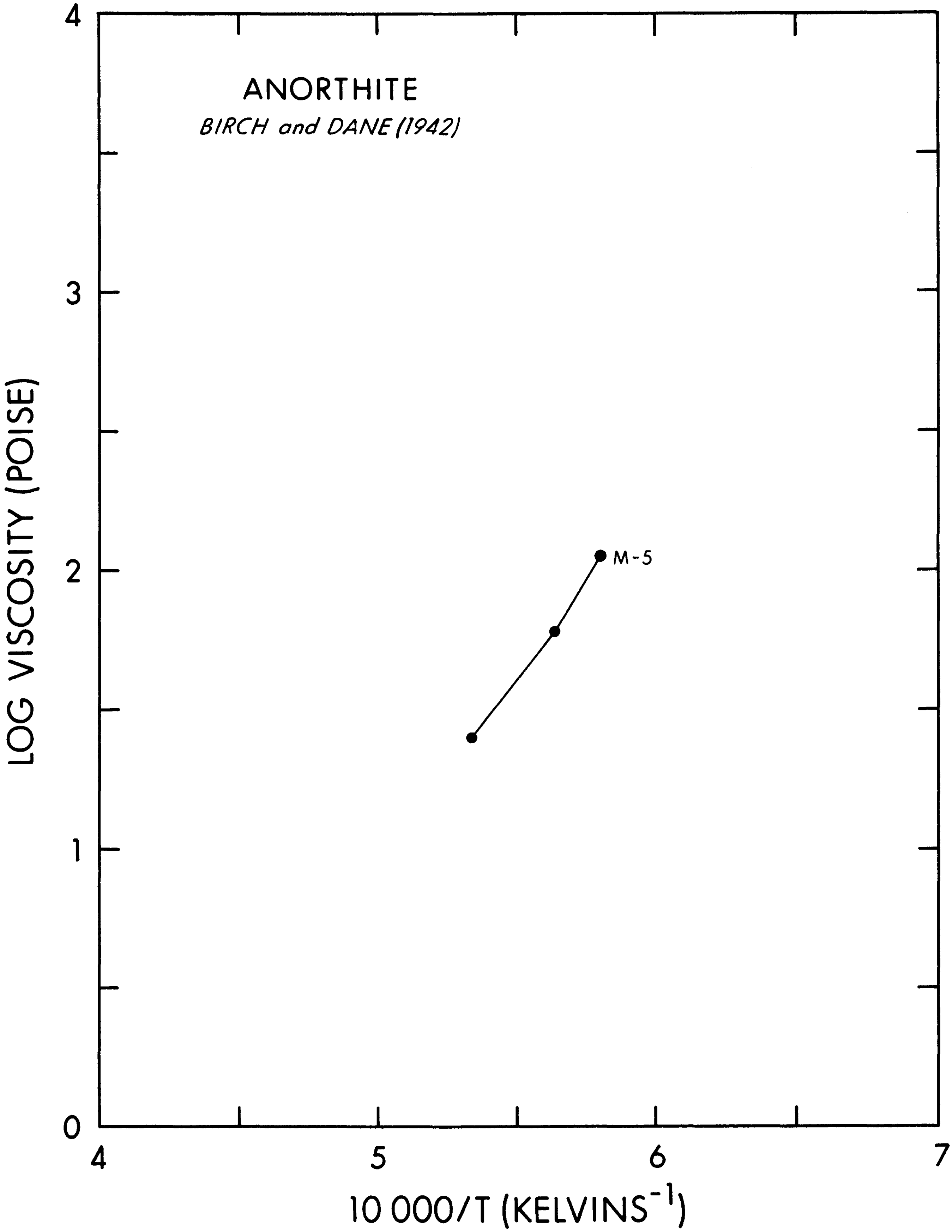
T	Z	LN(N)	LOG(N)	N
1450.00	5.804	4.710	2.045	111.
1500.00	5.640	4.094	1.778	60.
1600.00	5.339	3.219	1.398	25.


WOLLASTONITE
BIRCH and DANE (1942)
M-3
LOG VISCOSITY (POISE)
0
1
2
3
4
1400
1500
1600
1700
TEMPERATURE (°C)



WOLLASTONITE
BIRCH and DANE (1942)
M-3
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
4
5
6
7


ANORTHITE
BIRCH and DANE (1942)
M-5
LOG VISCOSITY (POISE)
0
1
2
3
4
1400
1500
1600
1700
TEMPERATURE (°C)



ANORTHITE
BIRCH and DANE (1942)
M-5
LOG VISCOSITY (POISE)
10 000/T (KELVINS^-1)
0
1
2
3
4
4
5
6
7

SYSTEM
K2 SIO3
MEASUREMENT METHOD
(FROM LITERATURE)
N (POISES)
T (DEGREES C)

AUTHOR
BIRCH AND DANE (1942)
DERIVED FROM
TABLE 10-1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

M-6

T	Z	LN(N)	LOG(N)	N
875.00	8.711	3.795	1.648	44.5
906.00	8.482	3.619	1.572	37.3

SYSTEM
ORTHOCLASE (K AL SI3 O8)
MEASUREMENT METHOD
(FROM LITERATURE)
N (POISES)
T (DEGREES C)

AUTHOR
BIRCH AND DANE (1942)
DERIVED FROM
TABLE 10-1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

M-7

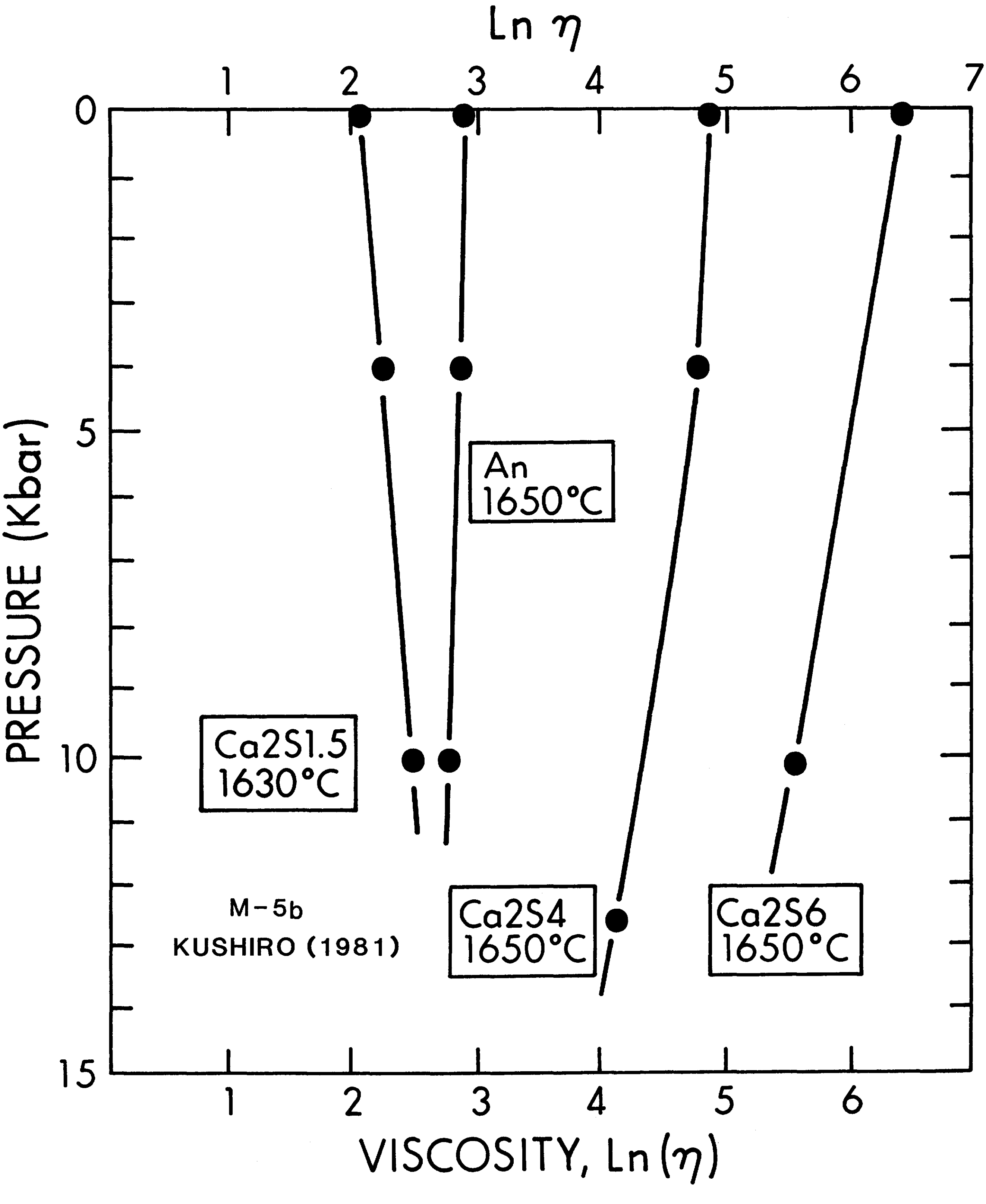
T	Z	LN(N)	LOG(N)	N
1250.00	6.566	20.723	9.000	1.0*10E9
1400.00	5.977	16.118	7.000	1.0*10E7
1450.00	5.804	15.202	6.602	4.0*10E6

SYSTEM
ALBITE (NA AL SI3 O8)
MEASUREMENT METHOD
(FROM LITERATURE)
N (POISES)
T (DEGREES C)

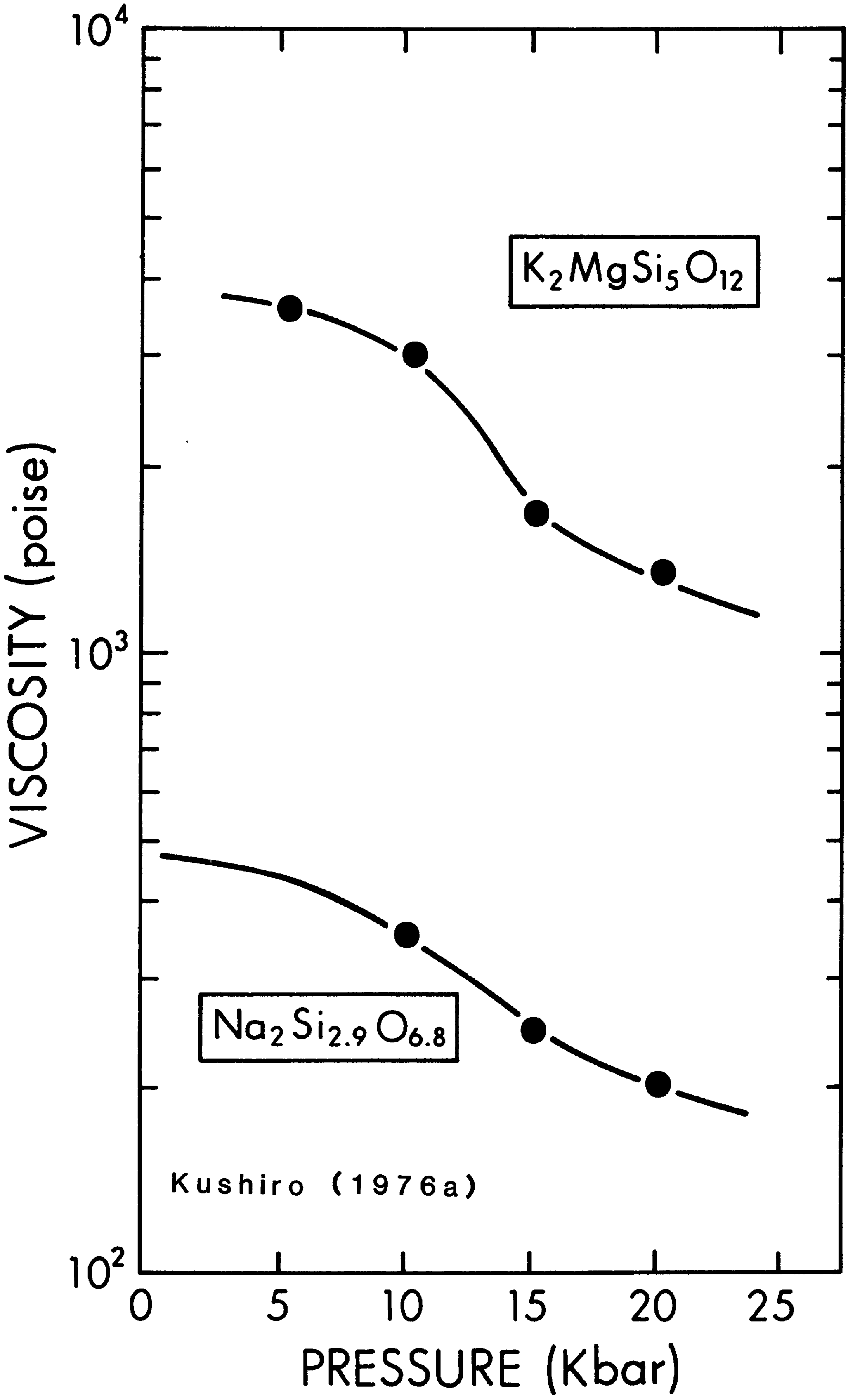
AUTHOR
BIRCH AND DANE (1942)
DERIVED FROM
TABLE 10-1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

M-8

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	20.723	9.000	1.0*10E9
1400.00	5.977	10.597	4.602	4.0*10E4



Ln η
1
2
3
4
5
6
7
0
5
10
15
PRESSURE (Kbar)
An
1650°C
Ca2S1.5
1630°C
M-5b
KUSHIRO (1981)
Ca2S4
1650°C
Ca2S6
1650°C
VISCOSITY, Ln (η)



10⁴
10³
10²
VISCOSITY (poise)
K2MgSi5O12
Na2Si2.9O6.8
Kushiro (1976a)
0
5
10
15
20
25
PRESSURE (Kbar)

Two-Component Mineral Systems

SYSTEM
DIOPSIDE(100.0),ALBITE(0.0) (X)
DIOPSIDE(100.0),ALBITE(0.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

DA-1

T	Z	LN(N)	LOG(N)	N
1391.00	6.010	4.421	1.92	83.2
1400.00	5.977	4.382	1.903	80.0
1415.00	5.924	4.298	1.867	73.6
1425.00	5.889	4.224	1.834	68.3

SYSTEM
DIOPSIDE(82.88),ALBITE(17.11) (X)
DIOPSIDE(80.0),ALBITE(20.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

DA-2

T	Z	LN(N)	LOG(N)	N
1354.00	6.146	4.628	2.01	102.3
1375.00	6.068	4.534	1.969	93.2
1400.00	5.977	4.449	1.932	85.5
1425.00	5.889	4.358	1.893	78.1

SYSTEM
DIOPSIDE(64.50),ALBITE(35.50) (X)
DIOPSIDE(60.0),ALBITE(40.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

DA-3

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	6.509	2.827	671.
1275.00	6.460	6.070	2.636	433.
1300.00	6.357	5.651	2.454	284.
1310.00	6.317	5.411	2.350	224.
1325.00	6.258	5.296	2.300	200.
1350.00	6.161	5.079	2.206	161.
1375.00	6.068	4.868	2.114	130.
1400.00	5.977	4.684	2.034	108.
1425.00	5.889	4.513	1.960	91.2

--

SYSTEM
DIOPSIDE(44.67),ALBITE(55.33) (X)
DIOPSIDE(40.0),ALBITE(60.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)

DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

DA-4

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	9.178	3.986	9680.
1225.00	6.676	8.581	3.727	5330.
1250.00	6.566	8.100	3.518	3300.
1260.00	6.523	7.898	3.430	2690.
1275.00	6.460	7.785	3.381	2400.
1300.00	6.357	7.404	3.215	1640.
1325.00	6.258	6.966	3.025	1060.
1350.00	6.161	6.621	2.876	751.
1375.00	6.068	6.370	2.767	584.
1400.00	5.977	6.093	2.646	443.
1425.00	5.889	5.743	2.494	312.

--

SYSTEM
DIOPSIDE(23.24),ALBITE(76.76) (X)
DIOPSIDE(20.0),ALBITE(80.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)

DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

DA-5

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	12.653	5.495	3.13*10E5
1175.00	6.906	12.177	5.288	1.94*10E5
1185.00	6.859	11.973	5.200	1.58*10E5
1200.00	6.789	11.670	5.068	1.17*10E5
1225.00	6.676	11.159	4.846	7.02*10E4
1250.00	6.566	10.652	4.626	4.23*10E4
1275.00	6.460	10.192	4.426	2.67*10E4
1300.00	6.357	9.921	4.309	2.04*10E4
1325.00	6.258	9.393	4.079	1.20*10E4
1350.00	6.161	9.092	3.949	8890.
1375.00	6.068	8.725	3.789	6150.
1400.00	5.977	8.376	3.638	4340.
1425.00	5.889	8.063	3.502	3180.

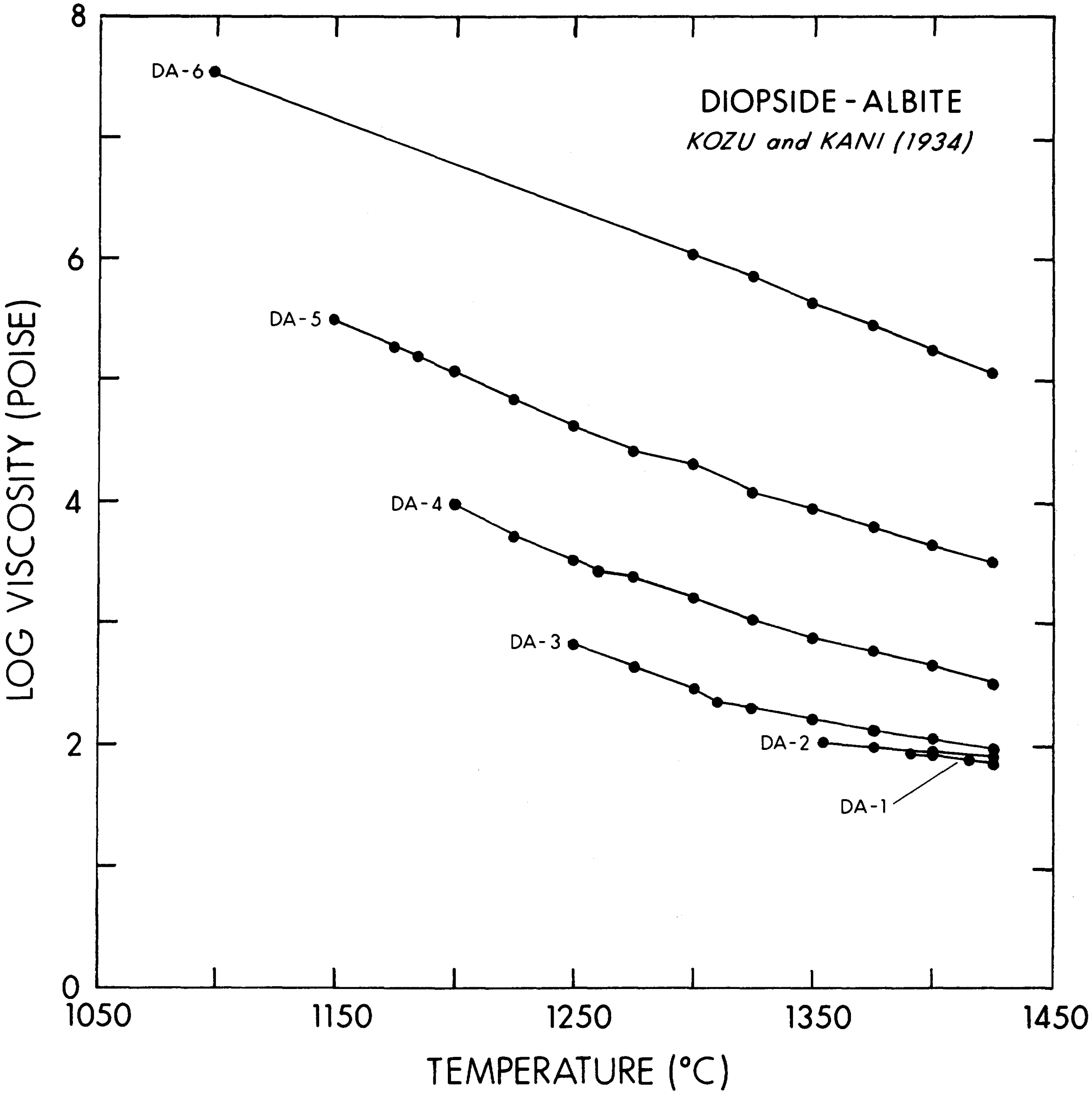
SYSTEM
DIOPSIDE(0.0),ALBITE(100.0) (X)
DIOPSIDE(0.0),ALBITE(100.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

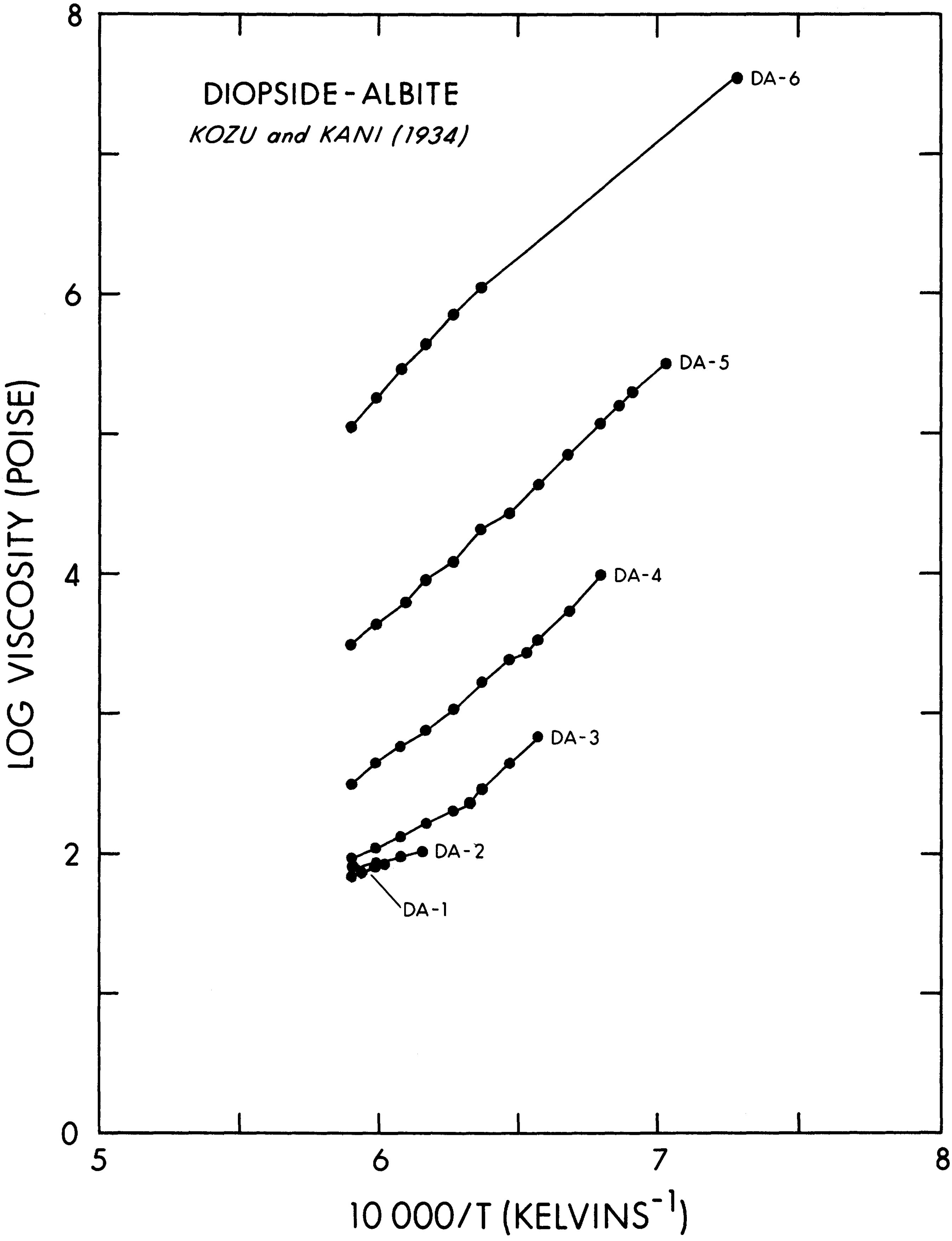
AUTHOR
KOZU AND KANI (1934)

DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

DA-6

T	Z	LN(N)	LOG(N)	N
1100.00	7.283	17.338	7.530	3.39*10E7
1300.00	6.357	13.908	6.040	1.10*10E6
1325.00	6.258	13.479	5.854	7.14*10E5
1350.00	6.161	12.982	5.638	4.35*10E5
1375.00	6.068	12.555	5.453	2.83*10E5
1400.00	5.977	12.087	5.249	1.78*10E5
1425.00	5.889	11.645	5.057	1.14*10E5


DIOPSIDE - ALBITE
KOZU and KANI (1934)
DA-6
DA-5
DA-4
DA-3
DA-2
DA-1
8
6
4
2
0
1050
1150
1250
1350
1450
LOG VISCOSITY (POISE)
TEMPERATURE (°C)


DIOPSIDE - ALBITE
KOZU and KANI (1934)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
DA-6
DA-5
DA-4
DA-3
DA-2
DA-1
0
2
4
6
8
5
6
7
8

--

SYSTEM
ALBITE(100.0),ANORTHITE(0.0) (X)
ALBITE(100.0),ANORTHITE(0.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Al-An-1

T	Z	LN(N)	LOG(N)	N
1100.00	7.283	17.338	7.530	3.39*10E7
1300.00	6.357	13.908	6.040	1.10*10E6
1325.00	6.258	13.479	5.854	7.14*10E5
1350.00	6.161	12.982	5.638	4.35*10E5
1375.00	6.068	12.555	5.453	2.83*10E5
1400.00	5.977	12.087	5.249	1.78*10E5
1425.00	5.889	11.645	5.057	1.14*10E5

--

SYSTEM
ALBITE(80.93),ANORTHITE(19.07) (X)
ALBITE(80.0),ANORTHITE(20.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Al-An-2

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	13.963	6.064	1.16*10E6
1275.00	6.460	13.253	5.756	5.70*10E5
1300.00	6.357	12.685	5.509	3.23*10E5
1325.00	6.258	12.120	5.264	1.84*10E5
1330.00	6.238	11.996	5.210	1.62*10E5
1350.00	6.161	11.650	5.060	1.15*10E5
1375.00	6.068	11.110	4.825	6.68*10E4
1400.00	5.977	10.676	4.637	4.33*10E4
1425.00	5.889	10.222	4.439	2.75*10E4

--

SYSTEM
ALBITE(61.41),ANORTHITE(38.59) (X)
ALBITE(60.0),ANORTHITE(40.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER

N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Al-An-3

T	Z	LN(N)	LOG(N)	N
1325.00	6.258	10.306	4.476	2.99*10E4
1350.00	6.161	9.854	4.280	1.90*10E4
1375.00	6.068	9.387	4.077	1.19*10E4
1400.00	5.977	8.961	3.892	7.79*10E3
1415.00	5.924	8.700	3.778	6.00*10E3
1425.00	5.889	8.532	3.706	5.08*10E3

-

SYSTEM
ALBITE(41.42),ANORTHITE(58.58) (X)
ALBITE(40.0),ANORTHITE(60.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Al-An-4

T	Z	LN(N)	LOG(N)	N
1425.00	5.889	7.373	3.202	1590.
1450.00	5.804	6.913	3.002	1010.
1470.00	5.737	6.585	2.860	724.
1480.00	5.705	6.474	2.812	648.
1500.00	5.640	6.127	2.661	458.

--

SYSTEM
ALBITE(20.96),ANORTHITE(79.03) (X)
ALBITE(20.0),ANORTHITE(80.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Al-An-5

T	Z	LN(N)	LOG(N)	N
1475.00	5.721	5.466	2.374	236.
1500.00	5.640	5.225	2.269	186.
1515.00	5.593	5.112	2.220	166.
1525.00	5.562	5.051	2.194	156.
1550.00	5.485	4.884	2.121	132.

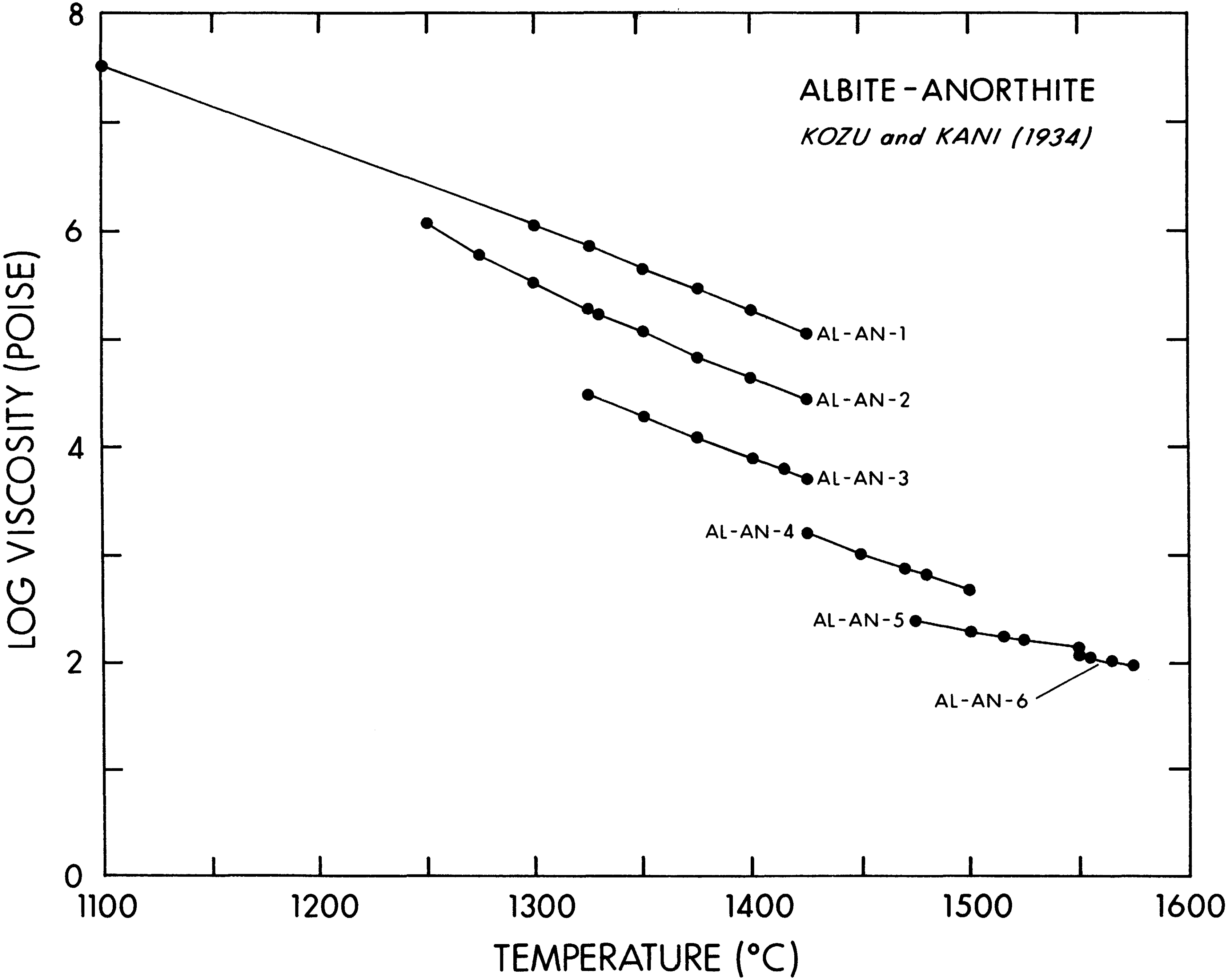
--

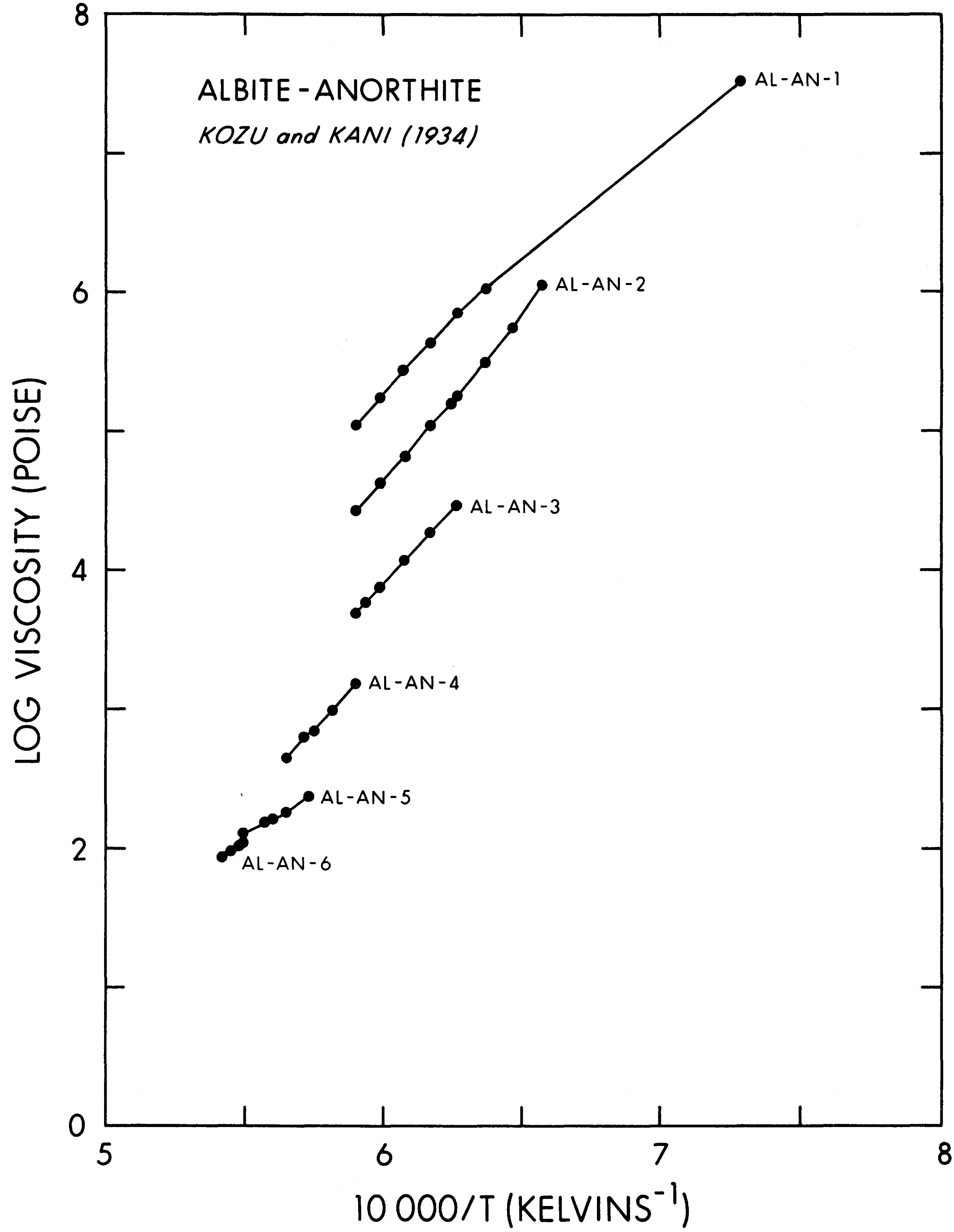
SYSTEM
ALBITE(0.0),ANORTHITE(100.0) (X)
ALBITE(0.0),ANORTHITE(100.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Al-An-6

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	4.720	2.05	112.
1555.00	5.470	4.672	2.029	107.
1565.00	5.441	4.578	1.988	97.3
1575.00	5.411	4.476	1.944	87.9


ALBITE-ANORTHITE
KOZU and KANI (1934)
AL-AN-1
AL-AN-2
AL-AN-3
AL-AN-4
AL-AN-5
AL-AN-6
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
2
4
6
8
1100
1200
1300
1400
1500
1600


ALBITE - ANORTHITE
KOZU and KANI (1934)
AL-AN-1
AL-AN-2
AL-AN-3
AL-AN-4
AL-AN-5
AL-AN-6
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
2
4
6
8
5
6
7
8

SYSTEM
ANORTHITE(100.0),DIOPSIDE(0.0) (X)
ANORTHITE(100.0),DIOPSIDE(0.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

An-Di-1

T	Z	LN(N)	LOG(N)	N
1550.00	5.485	4.720	2.05	112.
1555.00	5.470	4.672	2.029	107.
1565.00	5.441	4.578	1.988	97.3
1575.00	5.411	4.476	1.944	87.9

SYSTEM
ANORTHITE(75.69),DIOPSIDE(24.31) (X)
ANORTHITE(80.0),DIOPSIDE(20.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

An-Di-2

T	Z	LN(N)	LOG(N)	N
1425.00	5.889	5.132	2.229	169.
1450.00	5.804	4.966	2.157	143.
1475.00	5.721	4.800	2.085	122.
1480.00	5.705	4.789	2.080	120.
1500.00	5.640	4.689	2.037	109.
1525.00	5.562	4.584	1.991	97.9

SYSTEM
ANORTHITE(53.87),DIOPSIDE(46.13) (X)
ANORTHITE(60.0),DIOPSIDE(40.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

An-Di-3

T	Z	LN(N)	LOG(N)	N
1275.00	6.460	9.781	4.248	17700.
1300.00	6.357	8.679	3.769	5880.
1325.00	6.258	7.829	3.400	2510.
1350.00	6.161	5.745	2.495	313.
1375.00	6.068	4.902	2.129	134.
1390.00	6.013	4.674	2.030	107.
1400.00	5.977	4.645	2.018	104.
1425.00	5.889	4.555	1.978	95.1

--

SYSTEM
ANORTHITE(34.16),DIOPSIDE(65.84) (X)
ANORTHITE(40.0),DIOPSIDE(60.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

An-Di-4

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	6.011	2.611	408.
1275.00	6.460	5.153	2.238	173.
1278.00	6.447	5.020	2.180	151.
1300.00	6.357	4.999	2.171	148.
1325.00	6.258	4.817	2.092	124.
1350.00	6.161	4.724	2.052	113.
1375.00	6.068	4.608	2.001	100.
1400.00	5.977	4.509	1.958	90.8
1425.00	5.889	4.403	1.912	81.7

SYSTEM
ANORTHITE(16.29),DIOPSIDE(83.71) (X)
ANORTHITE(20.0),DIOPSIDE(80.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

An-Di-5

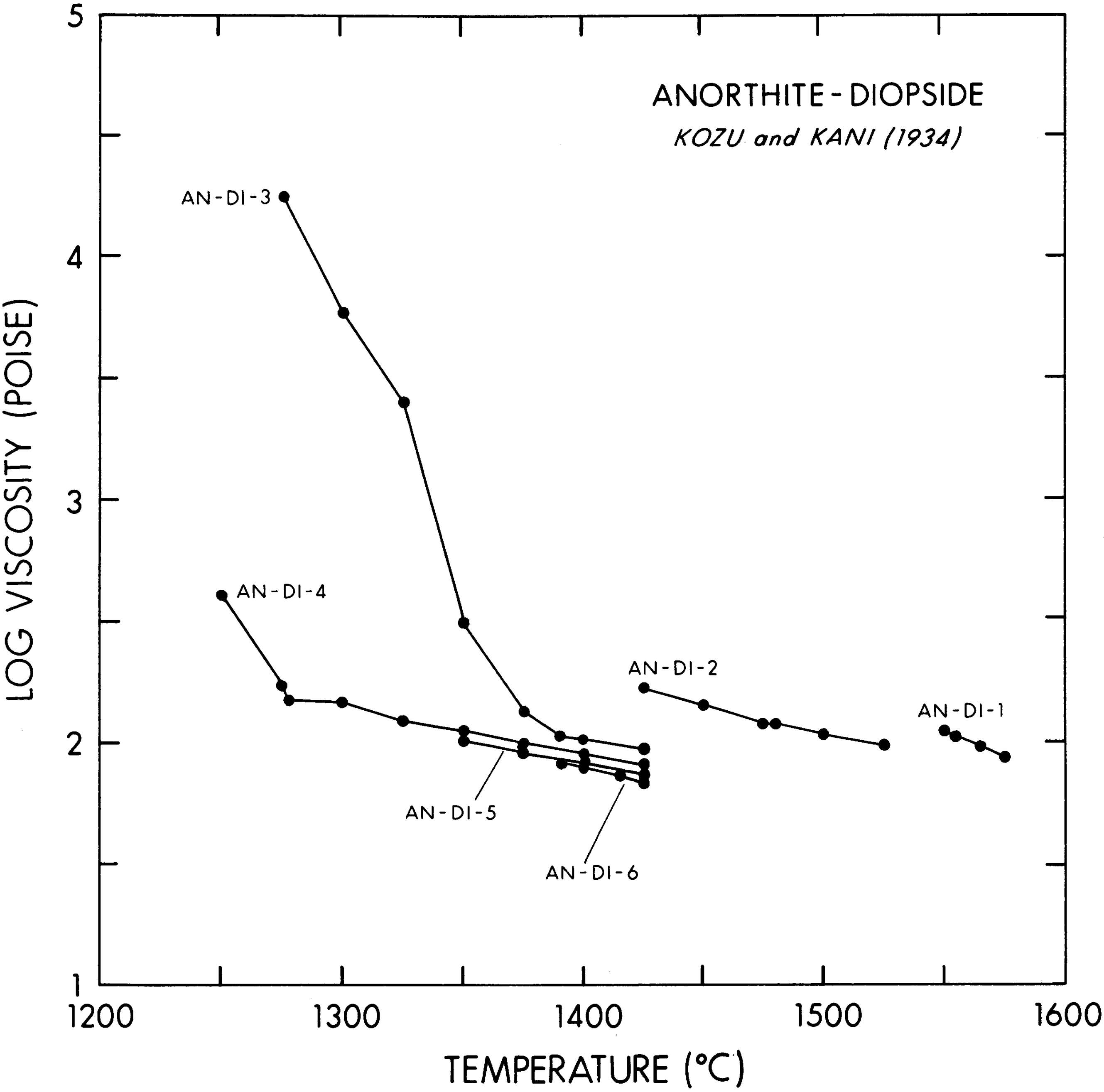
T	Z	LN(N)	LOG(N)	N
1350.00	6.161	4.628	2.010	102.
1375.00	6.068	4.512	1.960	91.1
1400.00	5.977	4.413	1.917	82.5
1425.00	5.889	4.306	1.870	74.1

SYSTEM
ANORTHITE(0.0),DIOPSIDE(100.0) (X)
ANORTHITE(0.0),DIOPSIDE(100.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

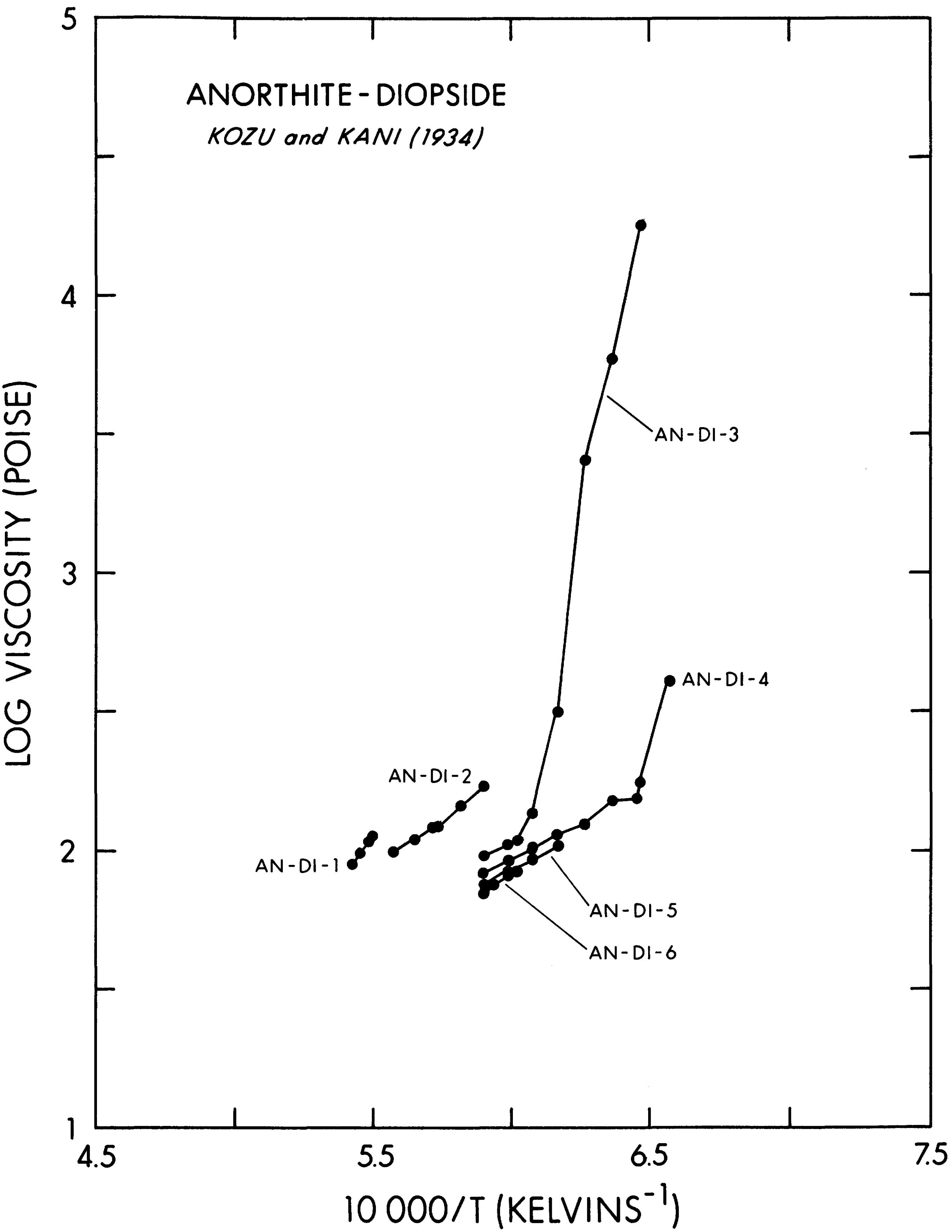
AUTHOR
KOZU AND KANI (1934)
DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

An-Di-6

T	Z	LN(N)	LOG(N)	N
1391.00	6.010	4.421	1.92	83.2
1400.00	5.977	4.382	1.903	80.0
1415.00	5.924	4.298	1.867	73.6
1425.00	5.889	4.224	1.834	68.3



ANORTHITE - DIOPSIDE
KOZU and KANI (1934)
AN-DI-3
AN-DI-4
AN-DI-2
AN-DI-1
AN-DI-5
AN-DI-6
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
5
4
3
2
1
1200
1300
1400
1500
1600


ANORTHITE - DIOPSIDE
KOZU and KANI (1934)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
5
4
3
2
1
4.5
5.5
6.5
7.5
AN - DI - 1
AN - DI - 2
AN - DI - 3
AN - DI - 4
AN - DI - 5
AN - DI - 6

--

SYSTEM
ORTHOCLASE(100.0),ALBITE(0.0) (%)
MEASUREMENT METHOD
(FROM LITERATURE)
N (POISES)
T (DEGREES C)

AUTHOR
BIRCH AND DANE (1942)
DERIVED FROM
TABLE 10-1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Or-Ab-1

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	18.421	8.00	1.0*10E8
1450.00	5.804	15.202	6.602	4.0*10E6

--

SYSTEM
ORTHOCLASE(80.0),ALBITE(20.0) (%)
MEASUREMENT METHOD
(FROM LITERATURE)
N (POISES)
T (DEGREES C)

AUTHOR
BIRCH AND DANE (1942)
DERIVED FROM
TABLE 10-1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Or-Ab-2

T	Z	LN(N)	LOG(N)	N
1400.00	5.977	14.346	6.230	1.7*10E6
1450.00	5.804	13.459	5.845	7.0*10E5

--

SYSTEM
ORTHOCLASE(60.0),ALBITE(40.0) (%)
MEASUREMENT METHOD
(FROM LITERATURE)
N (POISES)
T (DEGREES C)

AUTHOR
BIRCH AND DANE (1942)
DERIVED FROM
TABLE 10-1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Or-Ab-3

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	14.509	6.301	2.0*10E6
1400.00	5.977	13.541	5.881	7.6*10E5
1450.00	5.804	12.676	5.505	3.2*10E5

--

SYSTEM
ORTHOCLASE(40.0),ALBITE(60.0) (%)
MEASUREMENT METHOD
(FROM LITERATURE)
N (POISES)
T (DEGREES C)

AUTHOR
BIRCH AND DANE (1942)
DERIVED FROM
TABLE 10-1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Or-Ab-4

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	14.221	6.176	1.5*10E6
1400.00	5.977	13.369	5.806	6.4*10E5
1450.00	5.804	12.429	5.398	2.5*10E5

--

SYSTEM
ORTHOCLASE(20.0),ALBITE(80.0) (%)
MEASUREMENT METHOD
(FROM LITERATURE)
N (POISES)
T (DEGREES C)

AUTHOR
BIRCH AND DANE (1942)
DERIVED FROM
TABLE 10-1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Or-Ab-5

T	Z	LN(N)	LOG(N)	N
1350.00	6.161	16.118	7.000	1.0*10E7
1400.00	5.977	13.017	5.653	4.5*10E5
1450.00	5.804	12.101	5.255	1.8*10E5

--

SYSTEM
ORTHOCLASE(0.0),ALBITE(100.0) (%)
MEASUREMENT METHOD
(FROM LITERATURE)
N (POISES)
T (DEGREES C)

AUTHOR
BIRCH AND DANE (1942)
DERIVED FROM
TABLE 10-1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Or-Ab-6

T	Z	LN(N)	LOG(N)	N
1300.00	6.357	13.911	6.041	1.1*10E6
1350.00	6.161	12.972	5.633	4.3*10E5
1400.00	5.977	12.101	5.255	1.8*10E5

SYSTEM	AUTHOR

DIOPSIDE-ANORTHITE
DIOPSIDE(100) ANORTHITE(0) (WT.%)

SCARFE et al. (1983)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

Di–An–1

T	Z	LN(N)	LOG(N)	N
1375.	6.067	2.50	1.086	12.
1400.	5.977	2.28	0.992	9.
1450.	5.803	1.89	0.821	6.
1500.	5.640	1.56	0.678	4.
1550.	5.485	1.28	0.559	3.
1600.	5.339	1.07	0.465	2.

SYSTEM

AUTHOR

DIOPSIDE-ANORTHITE
DIOPSIDE(90) ANORTHITE(10) (WT.%)

SCARFE et al. (1983)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

Di–An–2

T	Z	LN(N)	LOG(N)	N
1300.	6.357	3.54	1.539	34.
1350.	6.161	3.05	1.327	21.
1400.	5.977	2.59	1.128	13.
1450.	5.803	2.20	0.957	9.
1500.	5.640	1.84	0.800	6.
1550.	5.485	1.49	0.648	4.

SYSTEM
DIOPSIDE-ANORTHITE
DIOPSIDE (80) ANORTHITE (20) (WT. %)

AUTHOR
SCARFE et al. (1983)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z =10000.0/T(K) (1/DEG K)

Di-An-3

T	Z	LN(N)	LOG(N)	N
1250.00	6.565	4.39	1.909	81.
1300.00	6.357	3.82	1.660	46.
1350.00	6.161	3.32	1.442	28.
1400.00	5.977	2.84	1.237	17.
1450.00	5.803	2.43	1.057	11.
1500.00	5.640	2.06	0.898	8.
1550. 00	5.485	1.74	0.759	6.
1600.00	5.339	1.46	0.636	4.

SYSTEM
DIOPSIDE-ANORTHITE
DIOPSIDE (58) ANORTHITE (42) (WT. %)

AUTHOR
SCARFE et al. (1983)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z =10000.0/T(K) (1/DEG K)

Di-An-4

T	Z	LN(N)	LOG(N)	N
1175.00	6.906	6.58	2.859	722.
1225.00	6.675	5.68	2.468	294.
1275.00	6.459	4.91	2.134	136.
1350.00	6.161	3.96	1.721	53.
1400.00	5.977	3.49	1.518	33.
1450.00	5.803	3.06	1.329	21.
1500. 00	5.640	2.63	1.146	14.
1550.00	5.485	2.27	0.990	10.
1600.00	5.339	1.95	0.851	7.

SYSTEM

AUTHOR

DIOPSIDE-ANORTHITE
DIOPSIDE(50) ANORTHITE(50) (WT.%)

SCARFE et al. (1983)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

Di-An-5

T	Z	LN(N)	LOG(N)	N
1200.	6.788	6.55	2.846	701.
1250.	6.565	5.65	2.457	286.
1300.	6.357	4.90	2.132	135.
1325.	6.257	4.57	1.989	97.
1350.	6.161	4.26	1.854	71.
1400.	5.977	3.75	1.630	43.
1450.	5.803	3.29	1.432	27.
1500.	5.640	2.85	1.240	17.
1550.	5.485	2.47	1.074	12.
1600.	5.339	2.20	0.956	9.

SYSTEM

AUTHOR

DIOPSIDE-ANORTHITE
DIOPSIDE(40) ANORTHITE(60) (WT.%)

SCARFE et al. (1983)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

Di-An-6

T	Z	LN(N)	LOG(N)	N
1350.	6.161	4.63	2.015	104.
1375.	6.067	4.33	1.883	76.
1400.	5.977	4.04	1.756	57.
1450.	5.803	3.57	1.553	36.
1500.	5.640	3.15	1.370	23.
1550.	5.485	2.74	1.194	16.
1600.	5.339	2.36	1.029	11.

SYSTEM

DIOPSIDE-ANORTHITE
DIOPSIDE(30) ANORTHITE(70) (WT.%)

AUTHOR

SCARFE et al. (1983)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

Di-An-7

T	Z	LN(N)	LOG(N)	N
1300.	6.357	5.929	2.575	376.
1350.	6.161	5.199	2.258	181.
1400.	5.977	4.559	1.980	95.
1425.	5.889	4.255	1.848	70.
1450.	5.803	3.983	1.730	54.
1500.	5.640	3.525	1.531	34.
1550.	5.485	3.126	1.358	23.
1600.	5.339	2.714	1.179	15.

SYSTEM

DIOPSIDE-ANORTHITE
DIOPSIDE(20) ANORTHITE(80) (WT.%)

AUTHOR

SCARFE et al. (1983)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

Di-An-8

T	Z	LN(N)	LOG(N)	N
1250.	6.565	7.23	3.140	1380.
1300.	6.357	6.28	2.730	537.
1350.	6.161	5.48	2.384	242.
1400.	5.977	4.83	2.098	125.
1450.	5.803	4.22	1.836	69.
1475.	5.720	4.00	1.738	55.
1500.	5.640	3.74	1.625	42.
1525.	5.561	3.50	1.522	33.
1550.	5.485	3.30	1.434	27.
1600.	5.339	2.88	1.252	18.

SYSTEM

DIOPSIDE-ANORTHITE
DIOPSIDE(0) ANORTHITE(100) (WT.%)

AUTHOR

SCARFE et al. (1983)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

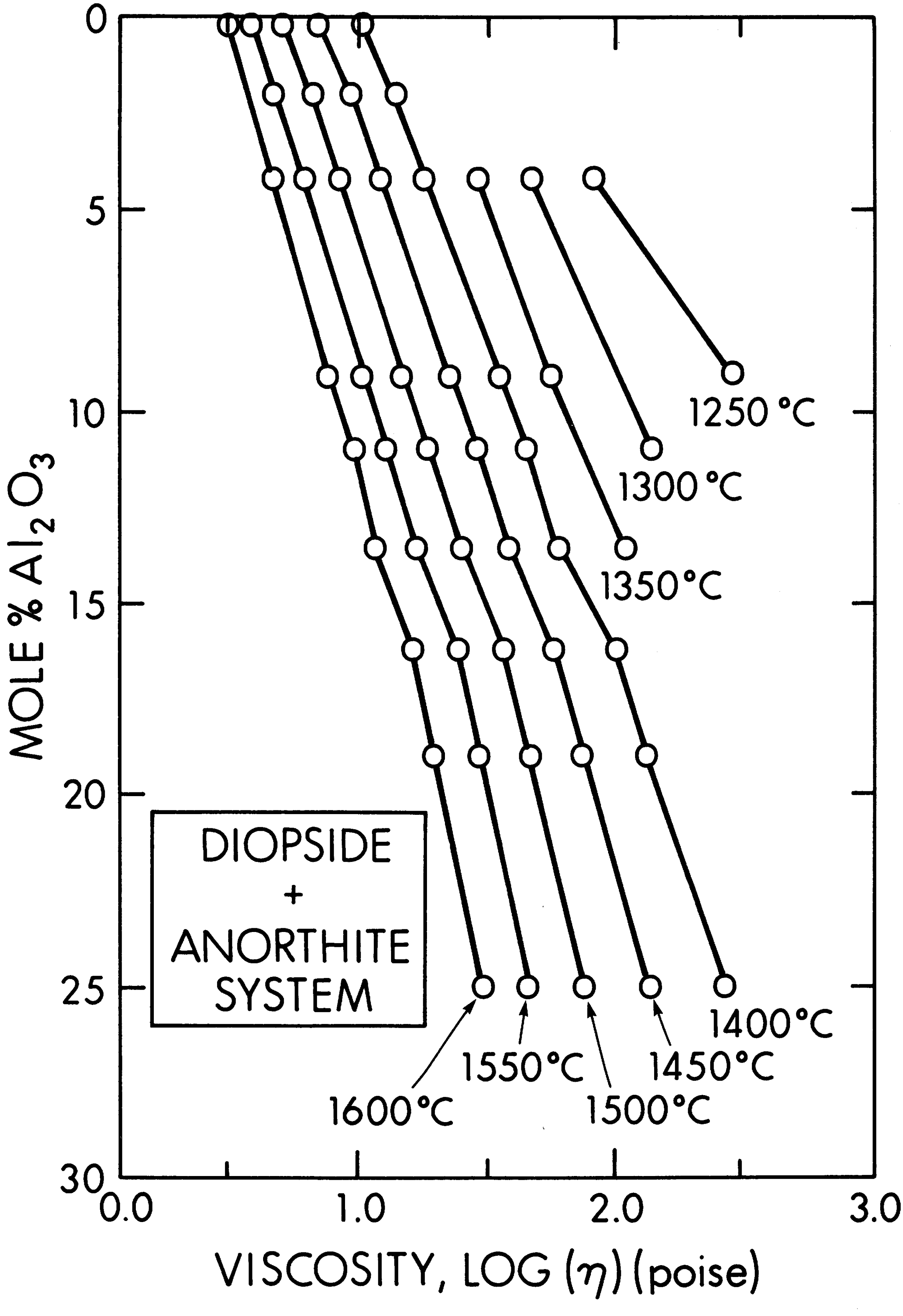
DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

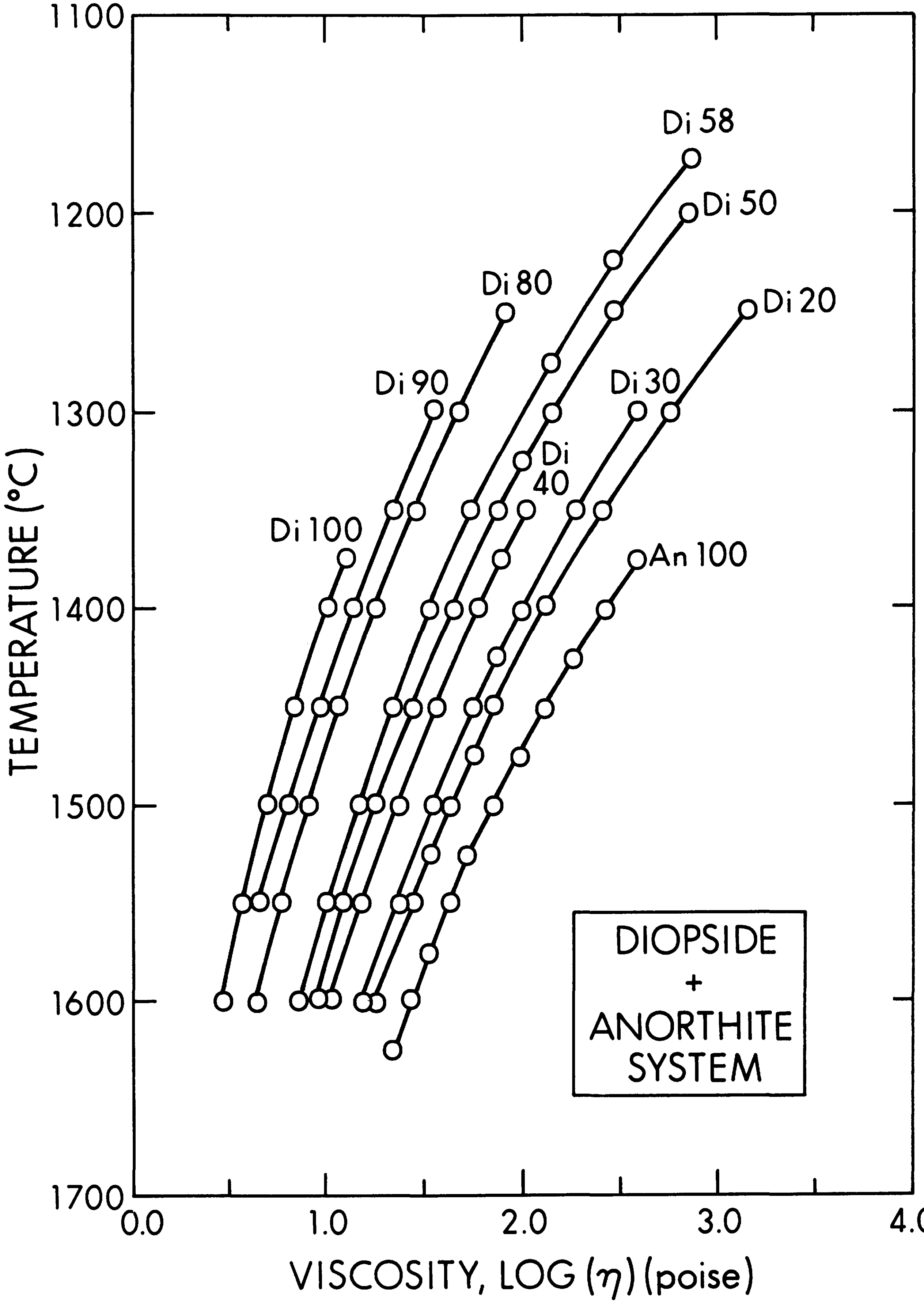
P = 1.0 ATM.
Z = 10000.0/T(K) (1/DEG. K)

Di-An-9

T	Z	LN(N)	LOG(N)	N
1375.	6.067	5.910	2.567	369.
1400.	5.977	5.530	2.402	252.
1425.	5.889	5.171	2.246	176.
1450.	5.803	4.837	2.101	126.
1475.	5.720	4.531	1.968	93.
1500.	5.640	4.239	1.841	69.
1525.	5.561	3.939	1.711	51.
1550.	5.485	3.741	1.625	42.
1575.	5.411	3.483	1.513	33.
1600.	5.339	3.299	1.433	27.
1625.	5.268	3.069	1.333	22.



DIOPSIDE
+
ANORTHITE
SYSTEM
1250 °C
1300 °C
1350°C
1400°C
1450°C
1500°C
1550°C
1600°C
MOLE % Al_2O_3
VISCOSITY, LOG (η) (poise)
0
5
10
15
20
25
30
0.0
1.0
2.0
3.0


1100
1200
1300
1400
1500
1600
1700
TEMPERATURE (°C)
0.0
1.0
2.0
3.0
4.0
VISCOSITY, LOG (η) (poise)
Di 58
Di 50
Di 80
Di 20
Di 90
Di 30
Di
40
Di 100
An 100
DIOPSIDE
+
ANORTHITE
SYSTEM

Three-Component Mineral Systems

SYSTEM
DIOPSIDE(65.15),ALBITE(17.93),
ANORTHITE(16.90) (X)
DIOPSIDE(60.0),ALBITE(20.0),
ANORTHITE(20.0) (%)

AUTHOR
KOZU AND KANI (1934)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE I,II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Di-Al-An-1

T	Z	LN(N)	LOG(N)	N
1225.00	6.676	6.258	2.718	522.
1250.00	6.566	5.880	2.554	358.
1275.00	6.460	5.499	2.388	245.
1300.00	6.357	5.131	2.228	169.
1325.00	6.258	4.931	2.141	138.
1350.00	6.161	4.790	2.080	120.
1375.00	6.068	4.676	2.031	107.
1400.00	5.977	4.579	1.989	97.4
1425.00	5.889	4.479	1.945	88.2

--

SYSTEM
DIOPSIDE(45.15),ALBITE(37.28),
ANORTHITE(17.57) (X)
DIOPSIDE(40.0),ALBITE(40.0),
ANORTHITE(20.0) (%)

AUTHOR
KOZU AND KANI (1934)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE I,II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Di-Al-An-2

T	Z	LN(N)	LOG(N)	N
1175.00	6.906	8.999	3.908	8100.
1200.00	6.789	8.418	3.656	4530.
1225.00	6.676	7.974	3.463	2900.
1250.00	6.566	7.481	3.106	1770.
1275.00	6.460	7.152	3.106	1276.
1300.00	6.357	6.722	2.919	830.
1325.00	6.258	6.376	2.769	587.
1350.00	6.161	6.032	2.620	417.
1375.00	6.068	5.726	2.487	307.
1400.00	5.977	5.446	2.365	232.
1425.00	5.889	5.162	2.242	174.

--

SYSTEM
DIOPSIDE(45.63),ALBITE(18.84),
ANORTHITE(35.52) (X)
DIOPSIDE(40.0),ALBITE(20.0),
ANORTHITE(40.0) (%)

AUTHOR
KOZU AND KANI (1934)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE I,II

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Di-Al-An-3

T	Z	LN(N)	LOG(N)	N
1250.00	6.566	7.476	3.247	1770.
1275.00	6.460	6.582	2.859	722.
1300.00	6.357	6.145	2.669	466.
1325.00	6.258	5.768	2.505	320.
1350.00	6.161	5.387	2.340	219.
1375.00	6.068	5.163	2.242	175.
1400.00	5.977	4.884	2.121	132.
1425.00	5.889	4.738	2.058	114.

SYSTEM
DIOPSIDE(23.50),ALBITE(58.22),
ANORTHITE(18.29) (X)
DIOPSIDE(20.0),ALBITE(60.0),
ANORTHITE(20.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)

DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Di-Al-An-4

T	Z	LN(N)	LOG(N)	N
1175.00	6.906	11.661	5.064	1.16*10E5
1200.00	6.789	11.121	4.830	6.76*10E4
1225.00	6.676	10.486	4.554	3.58*10E4
1250.00	6.566	9.844	4.275	1.88*10E4
1275.00	6.460	9.381	4.074	1.19*10E4
1300.00	6.357	8.926	3.876	7520.
1325.00	6.258	8.494	3.689	4880.
1350.00	6.161	8.086	3.512	3250.
1375.00	6.068	7.709	3.348	2230.
1400.00	5.977	7.326	3.182	1520.
1425.00	5.889	7.103	3.085	1220.

SYSTEM
DIOPSIDE(23.76),ALBITE(39.23),
ANORTHITE(37.00) (X)
DIOPSIDE(20.0),ALBITE(40.0),
ANORTHITE(40.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KOZU AND KANI (1934)

DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Di-Al-An-5

T	Z	LN(N)	LOG(N)	N
1275.00	6.460	9.449	4.104	1.27*10E4
1300.00	6.357	8.228	3.573	3740.
1325.00	6.258	7.593	3.298	1980.
1350.00	6.161	7.199	3.126	1340.
1375.00	6.068	6.773	2.941	874.
1400.00	5.977	6.433	2.794	622.
1425.00	5.889	5.996	2.604	402.

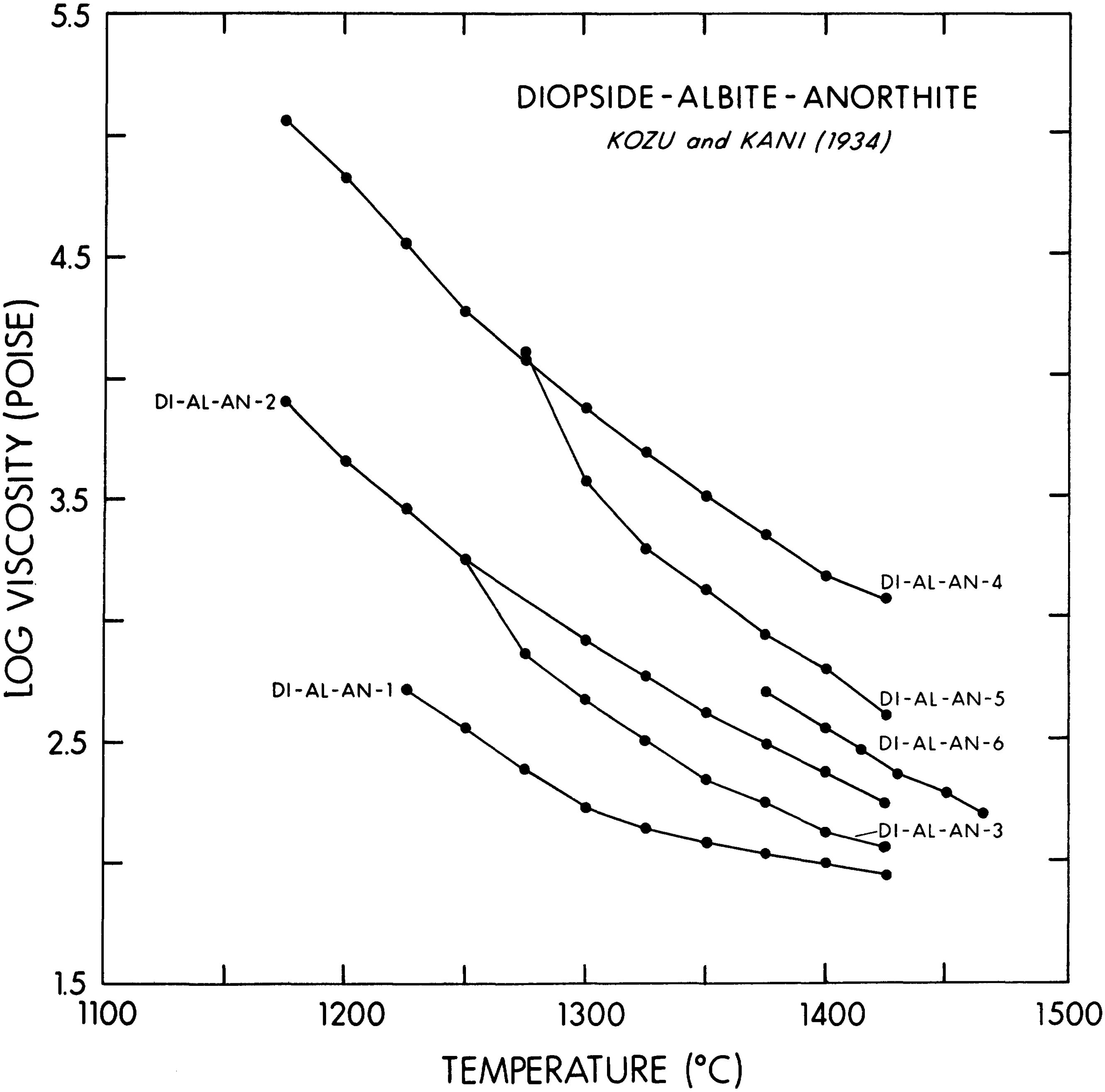
SYSTEM
DIOPSIDE(24.03),ALBITE(19.85),
ANORTHITE(56.13) (X)
DIOPSIDE(20.0),ALBITE(20.0),
ANORTHITE(60.0) (%)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

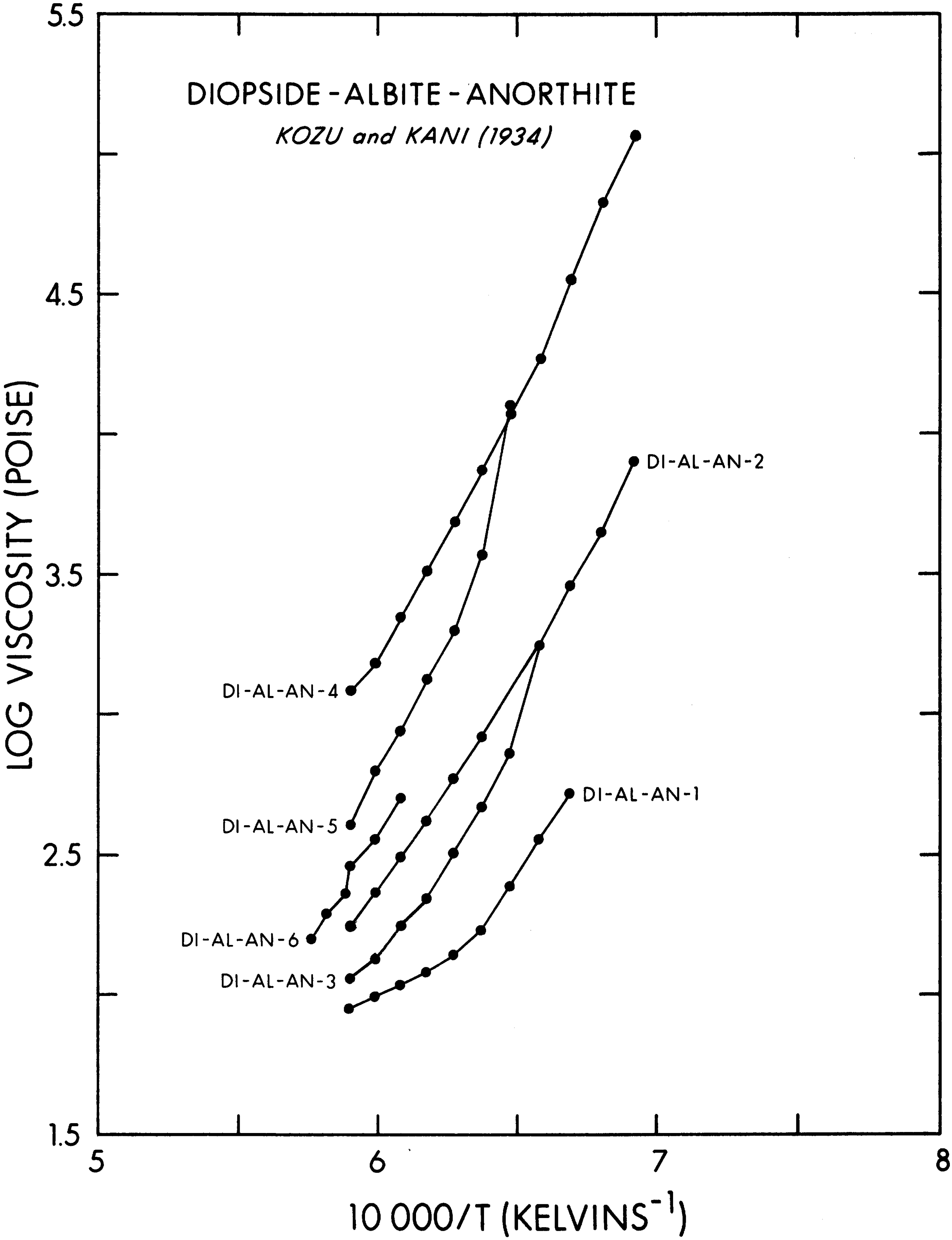
AUTHOR
KOZU AND KANI (1934)

DERIVED FROM
TABLE I,II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

Di-Al-An-6

T	Z	LN(N)	LOG(N)	N
1375.00	6.068	6.221	2.702	503.
1400.00	5.977	5.879	2.553	358.
1415.00	5.889	5.662	2.459	288.
1430.00	5.872	5.439	2.362	230.
1450.00	5.804	5.263	2.286	193.
1465.00	5.754	5.068	2.201	159.


DIOPSIDE - ALBITE - ANORTHITE
KOZU and KANI (1934)
DI-AL-AN-1
DI-AL-AN-2
DI-AL-AN-3
DI-AL-AN-4
DI-AL-AN-5
DI-AL-AN-6
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
5.5
4.5
3.5
2.5
1.5
1100
1200
1300
1400
1500


DIOPSIDE - ALBITE - ANORTHITE
KOZU and KANI (1934)
LOG VISCOSITY (POISE)
10 000/T (KELVINS⁻¹)
5.5
4.5
3.5
2.5
1.5
5
6
7
8
DI-AL-AN-1
DI-AL-AN-2
DI-AL-AN-3
DI-AL-AN-4
DI-AL-AN-5
DI-AL-AN-6

Basalts

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SYSTEM
OLIVINE BASALT
(VOGELSBURG, GERMANY)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
EULER AND WINKLER (1957)

DERIVED FROM
TABLE 2
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

B-1

T	Z	LN(N)	LOG(N)	N
1175.	6.906	7.224	3.146	1400.
1215.	6.720	5.704	2.477	300.
1253.	6.553	4.700	2.041	110.
1292.	6.390	3.496	1.519	33.
1330.	6.238	2.398	1.041	11.

--

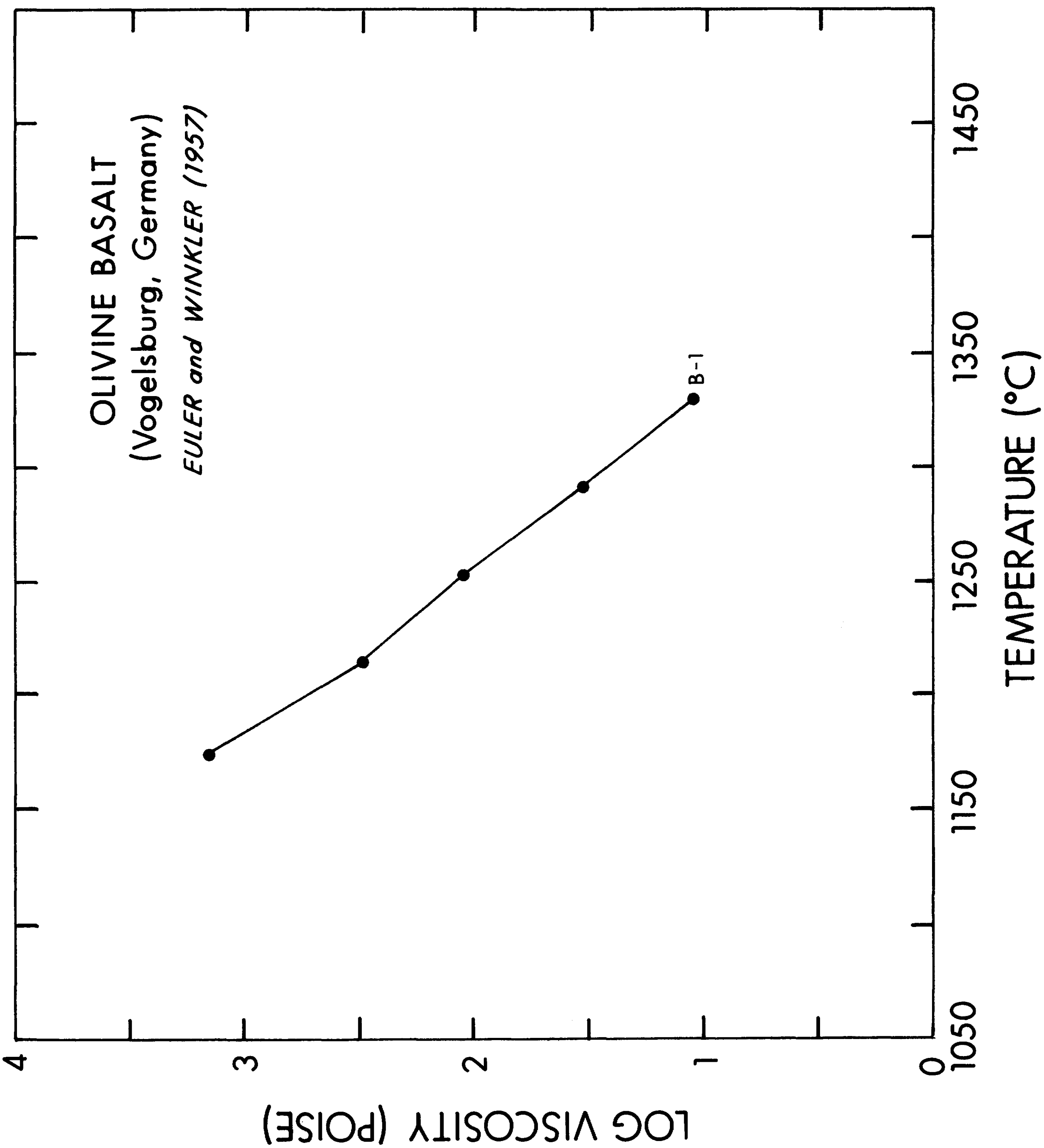
SYSTEM
OLIVINE BASALT
(AYRESHIRE, SCOTLAND)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

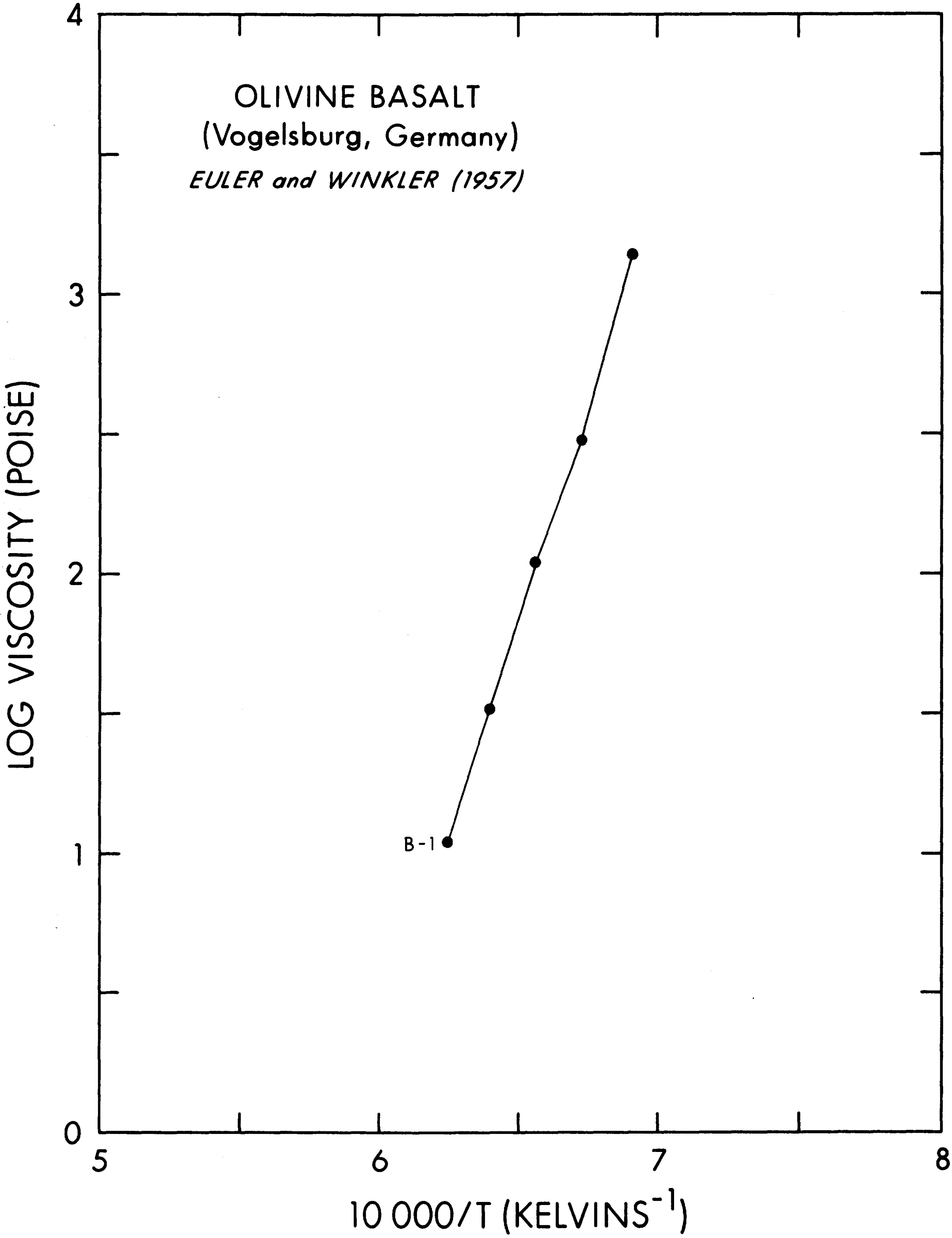
AUTHOR
EULER AND WINKLER (1957)

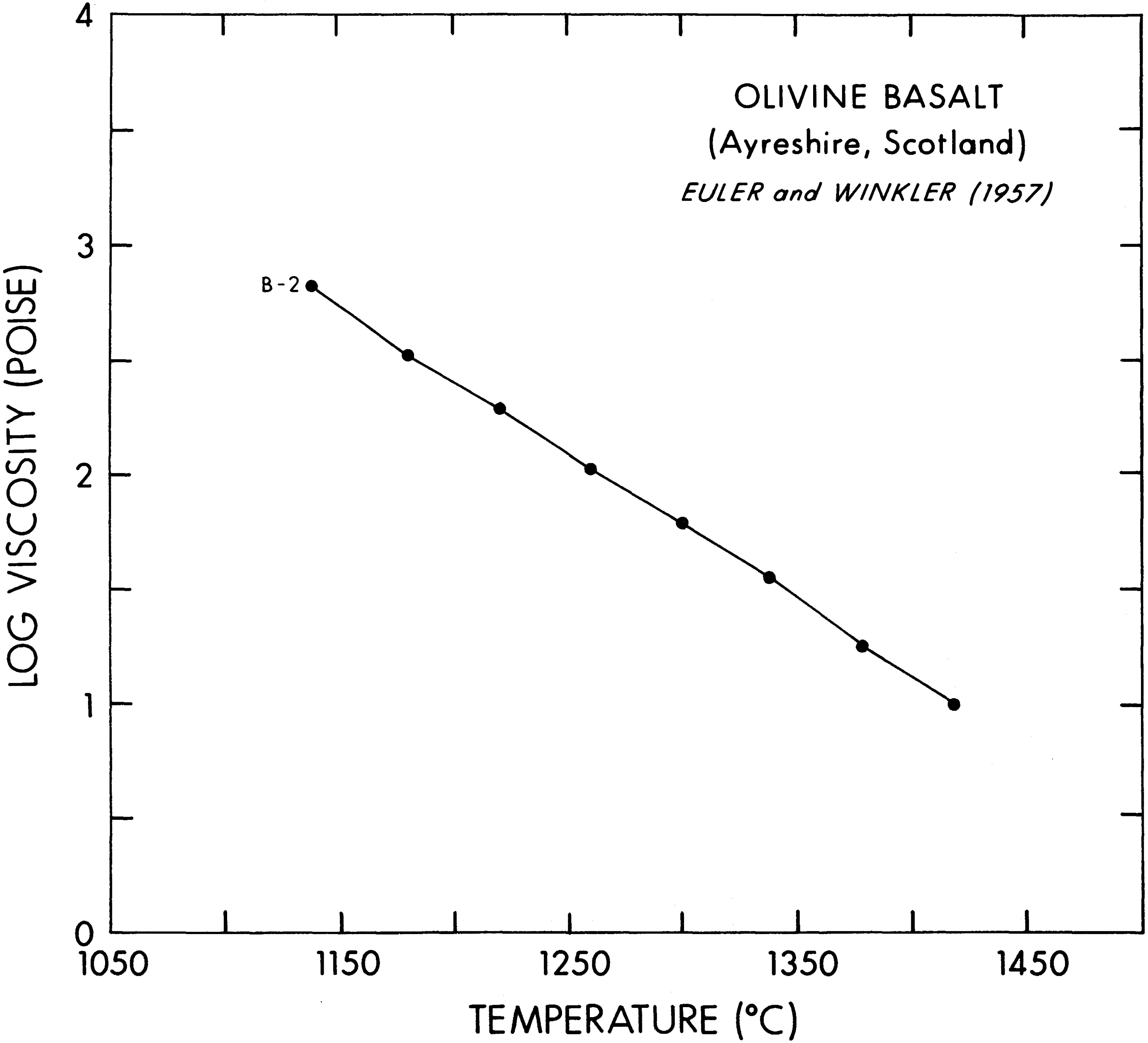
DERIVED FROM
TABLE 2
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

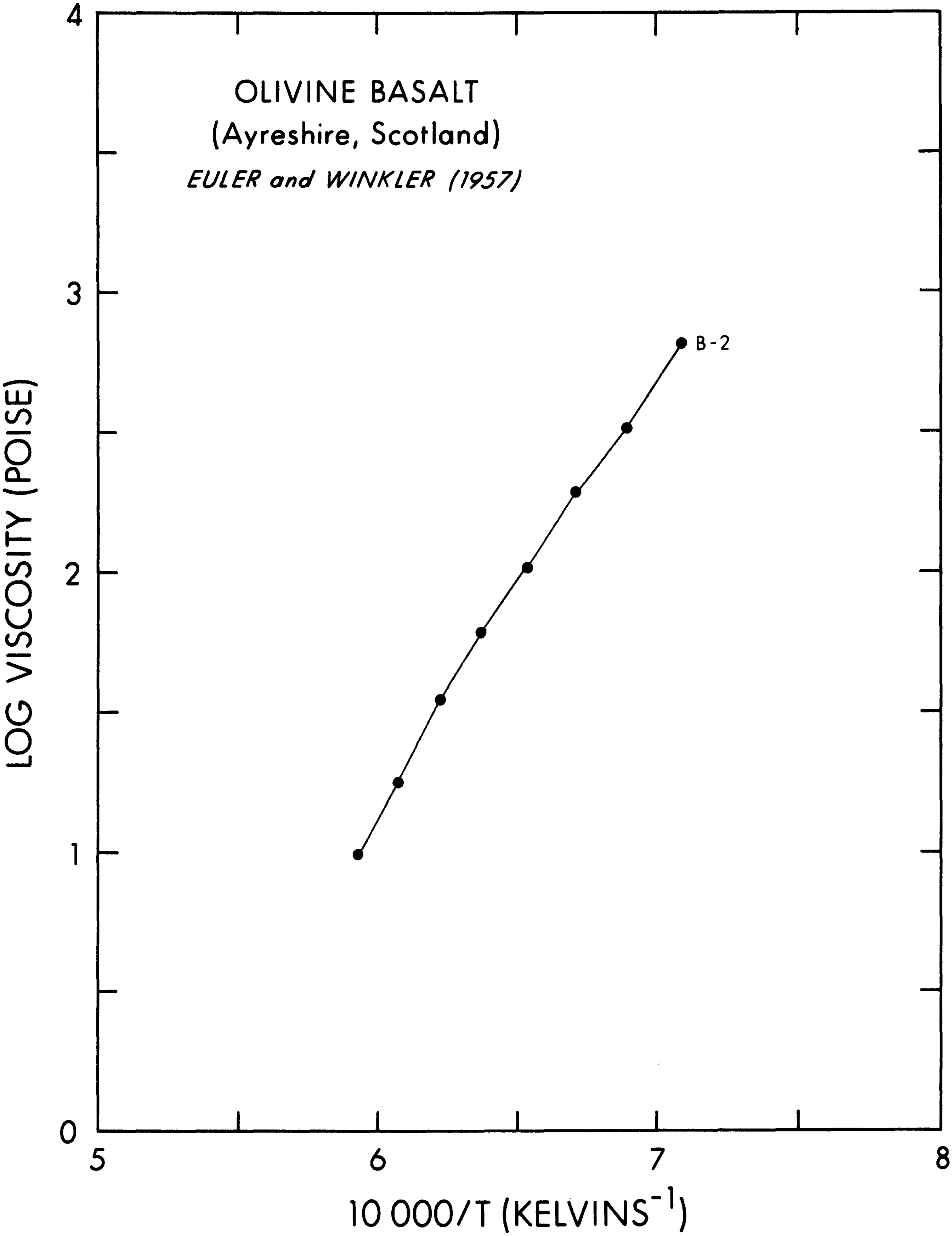
B-2

T	Z	LN(N)	LOG(N)	N
1138.	7.087	6.507	2.826	670.
1180.	6.882	5.799	2.519	330.
1220.	6.698	5.273	2.290	195.
1260.	6.523	4.663	2.025	106.
1300.	6.357	4.127	1.792	62.
1338.	6.207	3.584	1.556	36.
1378.	6.057	2.890	1.255	18.
1418.	5.914	2.303	1.000	10.


OLIVINE BASALT
(Vogelsburg, Germany)
EULER and WINKLER (1957)
B-1
LOG VISCOSITY (POISE)
0
1
2
3
4
TEMPERATURE (°C)
1050
1150
1250
1350
1450


OLIVINE BASALT
(Vogelsburg, Germany)
EULER and WINKLER (1957)
B-1
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
5
6
7
8


OLIVINE BASALT
(Ayreshire, Scotland)
EULER and WINKLER (1957)
B-2
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1050
1150
1250
1350
1450


OLIVINE BASALT
(Ayreshire, Scotland)
EULER and WINKLER (1957)
B-2
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
5
6
7
8

SYSTEM
BASALT (SCHONEN, SWEDEN)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
EULER AND WINKLER (1957)
DERIVED FROM
TABLE 2
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

B-3

T	Z	LN(N)	LOG(N)	N
1110.	7.231	7.409	3.217	1650.
1150.	7.027	6.620	2.875	750.
1190.	6.835	6.174	2.681	480.
1230.	6.653	5.784	2.512	325.
1264.	6.506	5.394	2.342	220.
1305.	6.337	4.852	2.107	128.
1342.	6.192	4.394	1.908	81.
1383.	6.039	3.850	1.672	47.
1421.	5.903	3.401	1.477	30.
1468.	5.744	2.996	1.301	20.

SYSTEM
OLIVINE-ANDESITE BASALT
(GOTTENBURG, GERMANY)
SAMPLE NO.1
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
EULER AND WINKLER (1957)
DERIVED FROM
TABLE 2
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

B-4

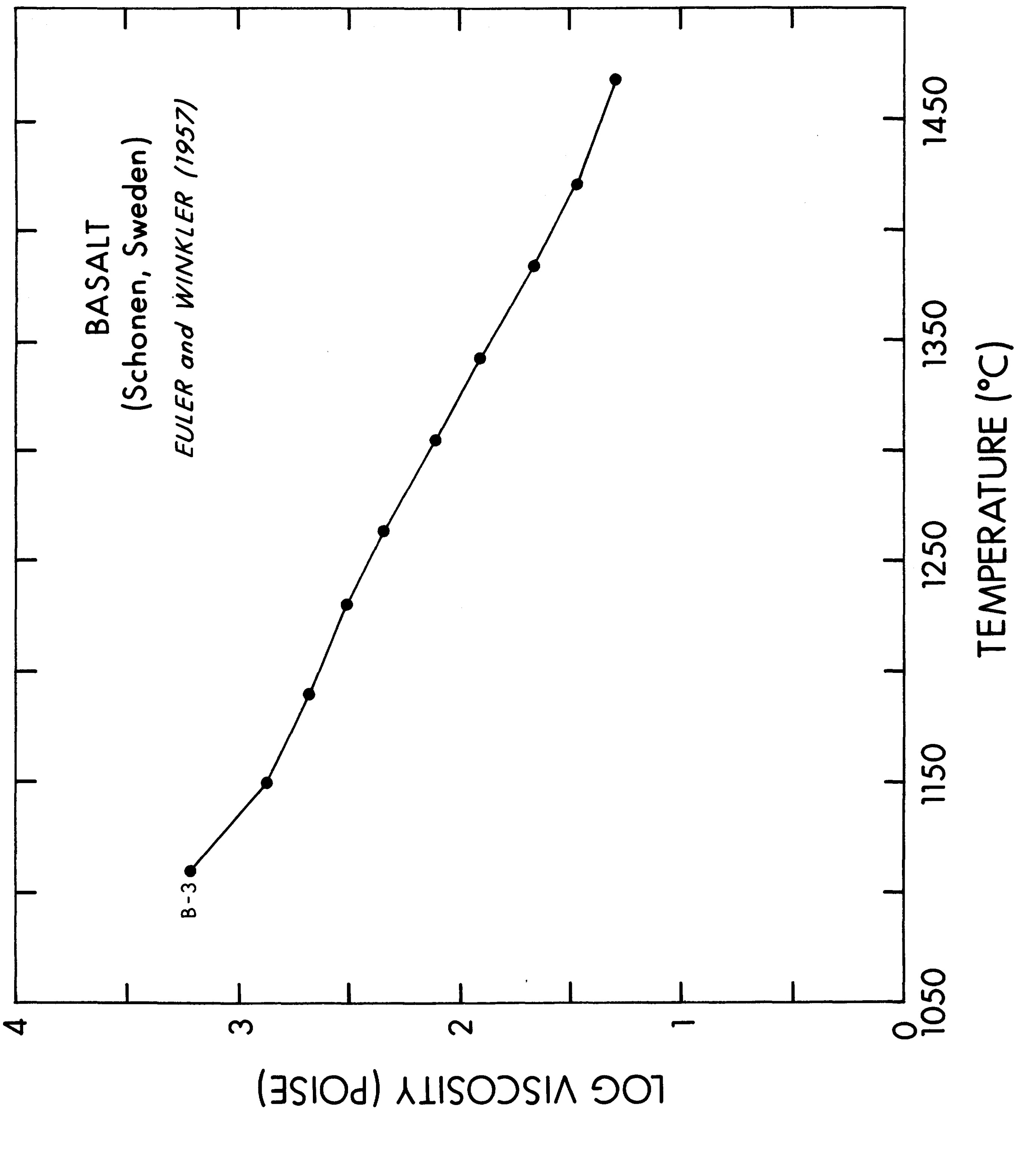
T	Z	LN(N)	LOG(N)	N
1225.	6.675	5.858	2.544	350.
1262.	6.515	5.459	2.371	235.
1300.	6.357	5.011	2.176	150.
1340.	6.200	4.585	1.991	98.
1380.	6.050	4.127	1.792	62.
1418.	5.914	3.496	1.519	33.
1462.	5.764	2.996	1.301	20.

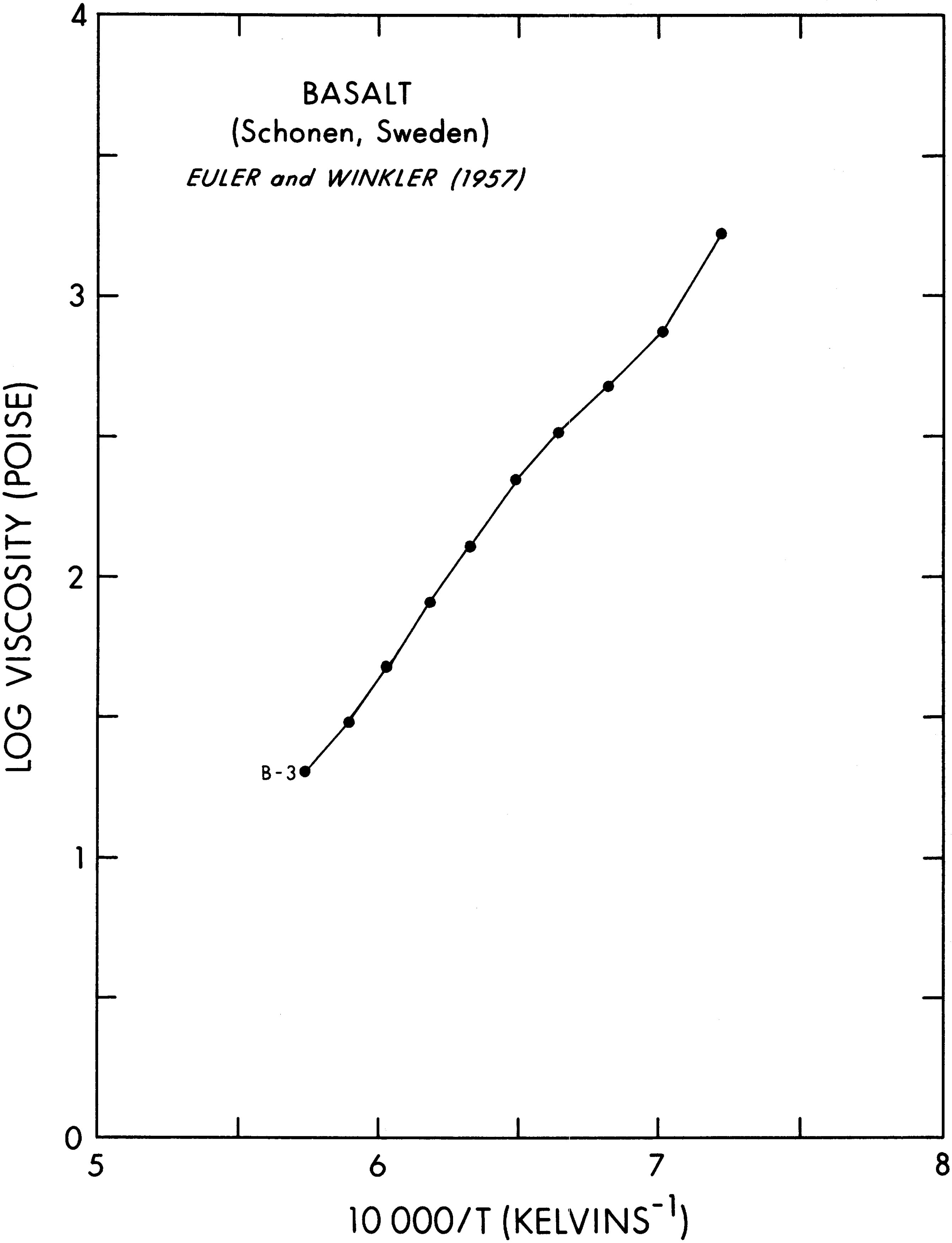
SYSTEM
OLIVINE-ANDESITE BASALT
(GOTTENBURG, GERMANY)
SAMPLE NO.2
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

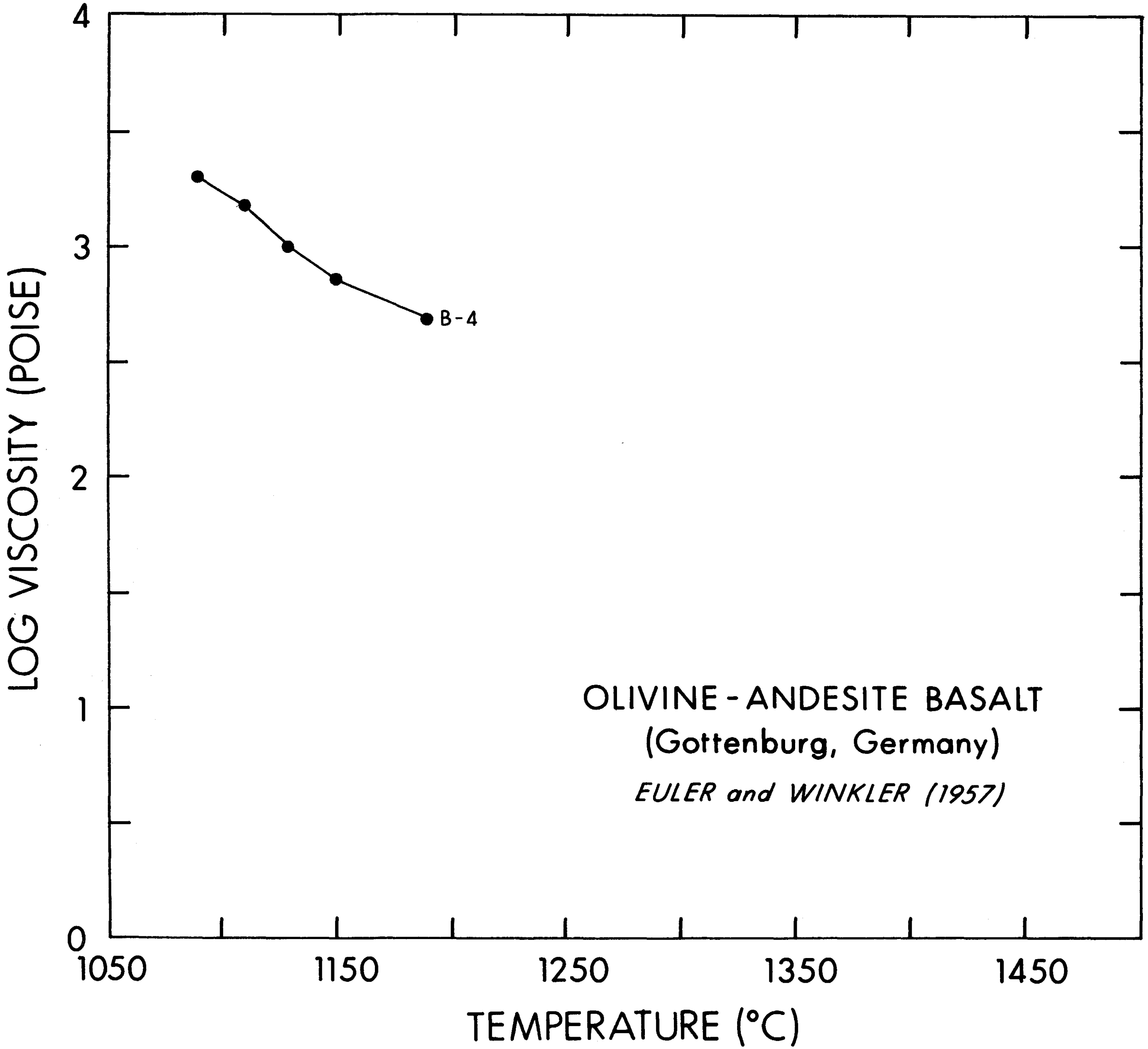
AUTHOR
EULER AND WINKLER (1957)
DERIVED FROM
TABLE 2
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

B-5

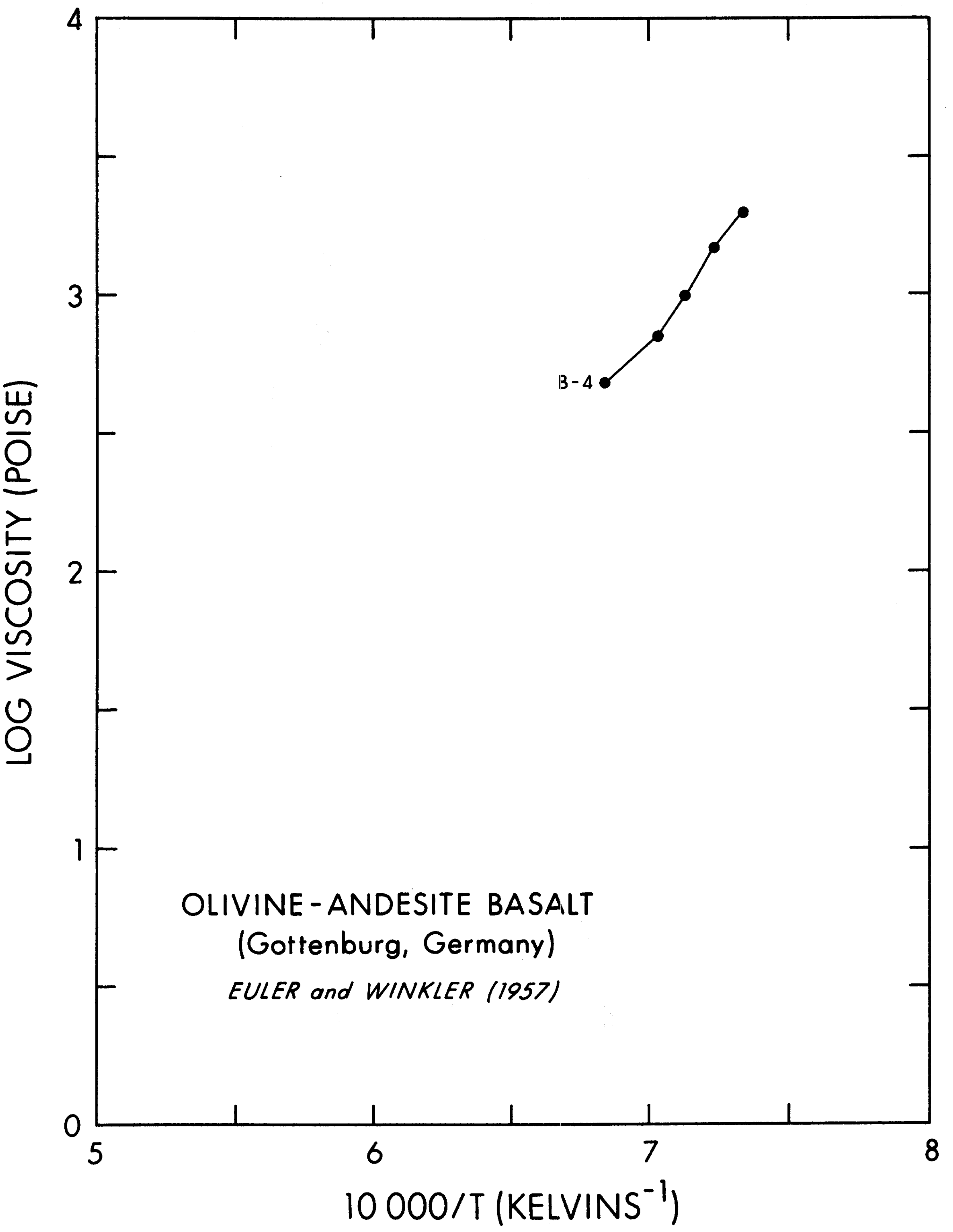
T	Z	LN(N)	LOG(N)	N
1090.	7.337	7.601	3.301	2000.
1110.	7.231	7.313	3.176	1500.
1130.	7.128	6.908	3.000	1000.
1150.	7.027	6.579	2.857	720.
1190.	6.835	6.194	2.690	490.

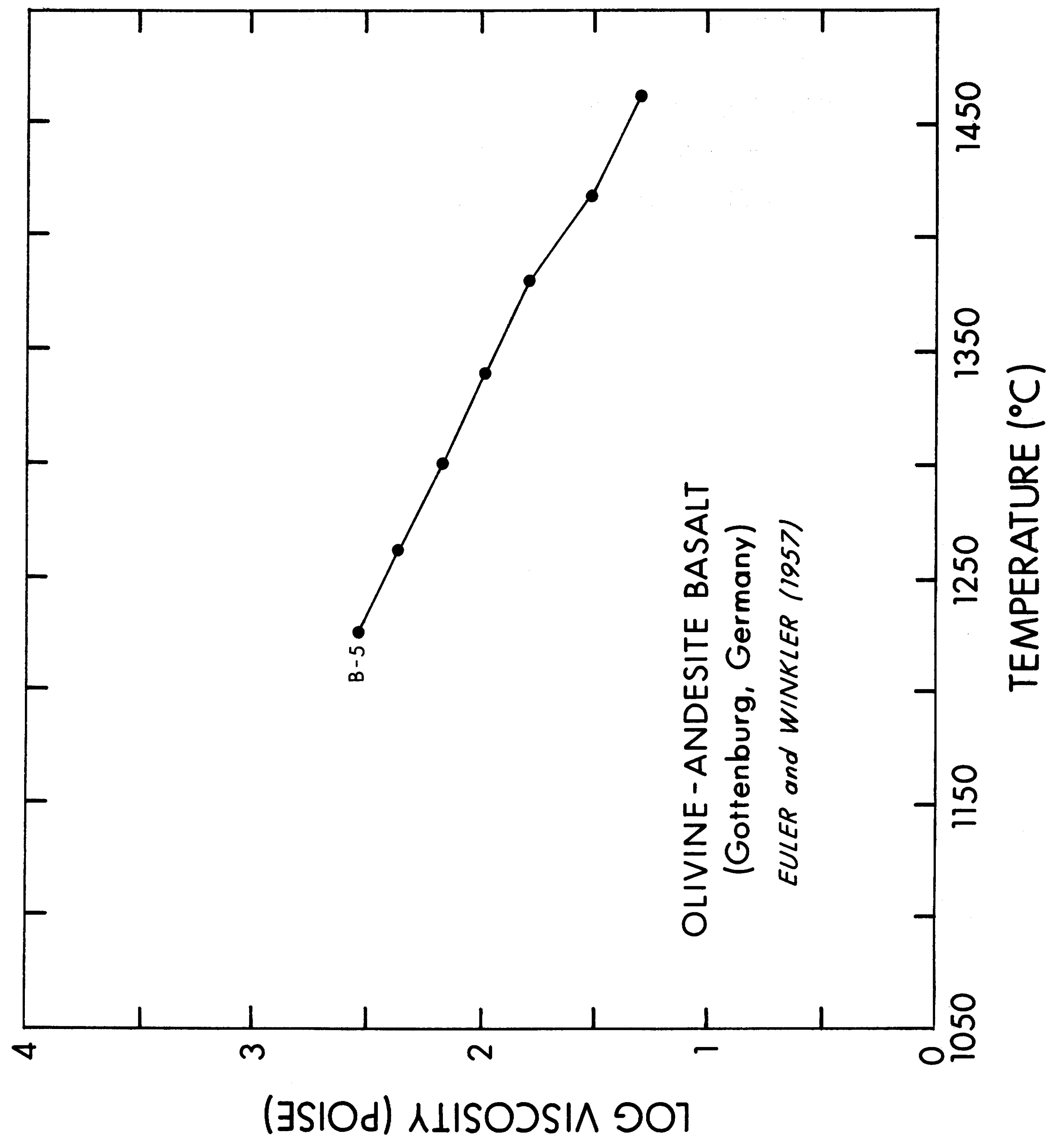

BASALT
(Schonen, Sweden)
EULER and WINKLER (1957)
B-3
TEMPERATURE (°C)
1050
1150
1250
1350
1450
LOG VISCOSITY (POISE)
0
1
2
3
4

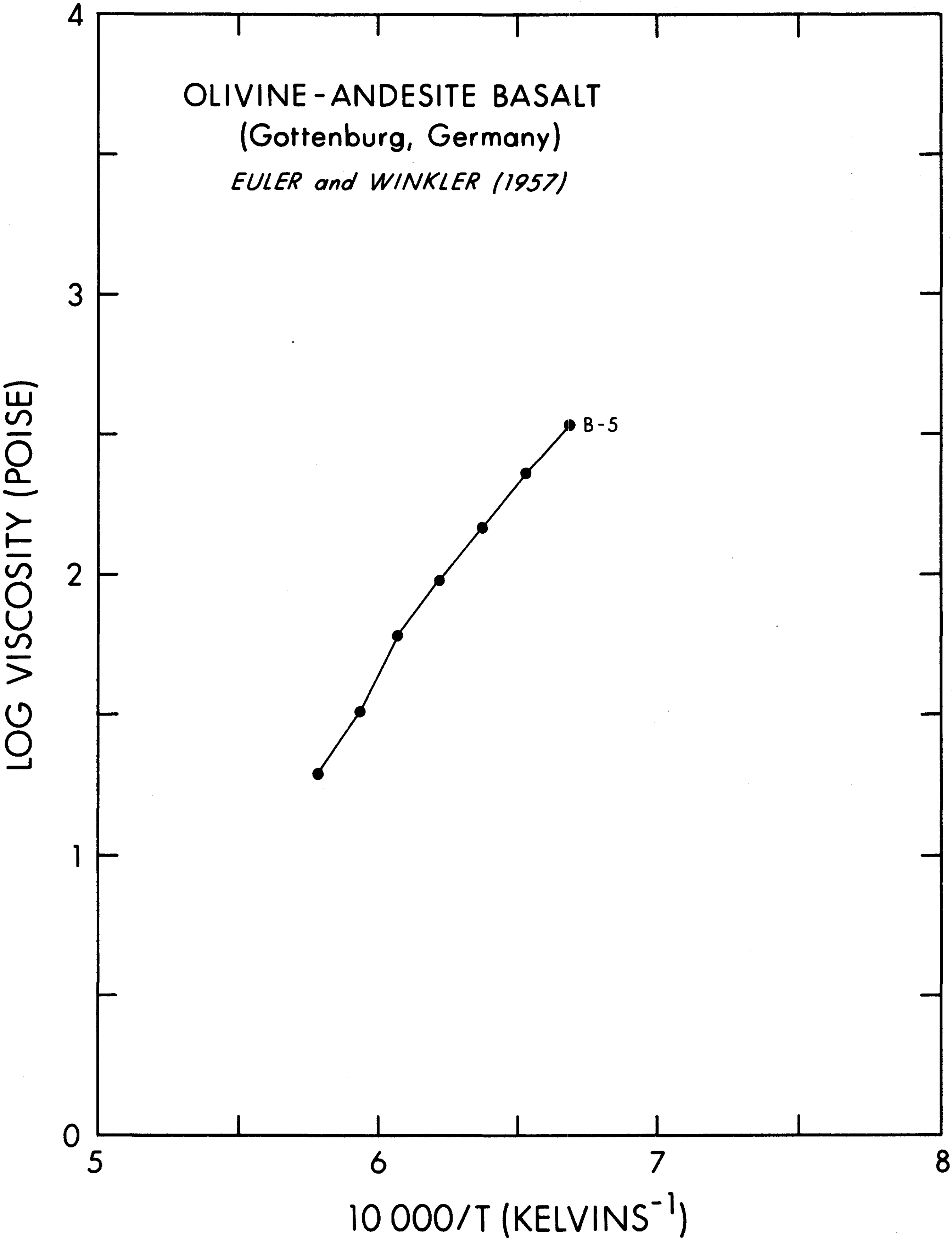

BASALT
(Schonen, Sweden)
EULER and WINKLER (1957)
B-3
LOG VISCOSITY (POISE)
10 000/T (KELVINS⁻¹)
0
1
2
3
4
5
6
7
8



LOG VISCOSITY (POISE)
0
1
2
3
4
1050
1150
1250
1350
1450
TEMPERATURE (°C)
B-4
OLIVINE-ANDESITE BASALT
(Gottenburg, Germany)
EULER and WINKLER (1957)


4
3
2
1
0
5
6
7
8
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
B-4
OLIVINE-ANDESITE BASALT
(Gottenburg, Germany)
EULER and WINKLER (1957)


OLIVINE-ANDESITE BASALT
(Gottenburg, Germany)
EULER and WINKLER (1957)
B-5
LOG VISCOSITY (POISE)
0
1
2
3
4
TEMPERATURE (°C)
1050
1150
1250
1350
1450



OLIVINE-ANDESITE BASALT
(Gottenburg, Germany)
EULER and WINKLER (1957)
B-5
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
5
6
7
8

SYSTEM
OLIVINE BASALT
(GEMBUDO)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KANI (1934b)

DERIVED FROM
TABLE VII
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

B-6

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	10.543	4.579	37897.00
1200.00	6.789	8.065	3.503	3180.60
1250.00	6.566	6.486	2.817	656.15
1300.00	6.357	5.691	2.472	296.15
1350.00	6.161	5.170	2.245	175.83
1400.00	5.977	4.918	2.136	136.68

SYSTEM
OLIVINE BASALT
(KONOURA)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KANI (1934b)

DERIVED FROM
TABLE VII
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

B-7

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	6.596	2.864	731.82
1250.00	6.566	5.819	2.527	336.59
1300.00	6.357	5.151	2.237	172.67
1350.00	6.161	4.915	2.135	136.37
1400.00	5.977	4.785	2.078	119.73

SYSTEM
ANDESITIC BASALT
(MOTOMURA)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
KANI (1934b)

DERIVED FROM
TABLE VII
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

B-8

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	11.283	4.900	79470.00
1200.00	6.789	10.347	4.494	31168.00
1250.00	6.566	6.294	2.734	541.51
1300.00	6.357	5.557	2.414	259.12
1350.00	6.161	5.209	2.262	182.94
1400.00	5.977	4.931	2.142	138.55

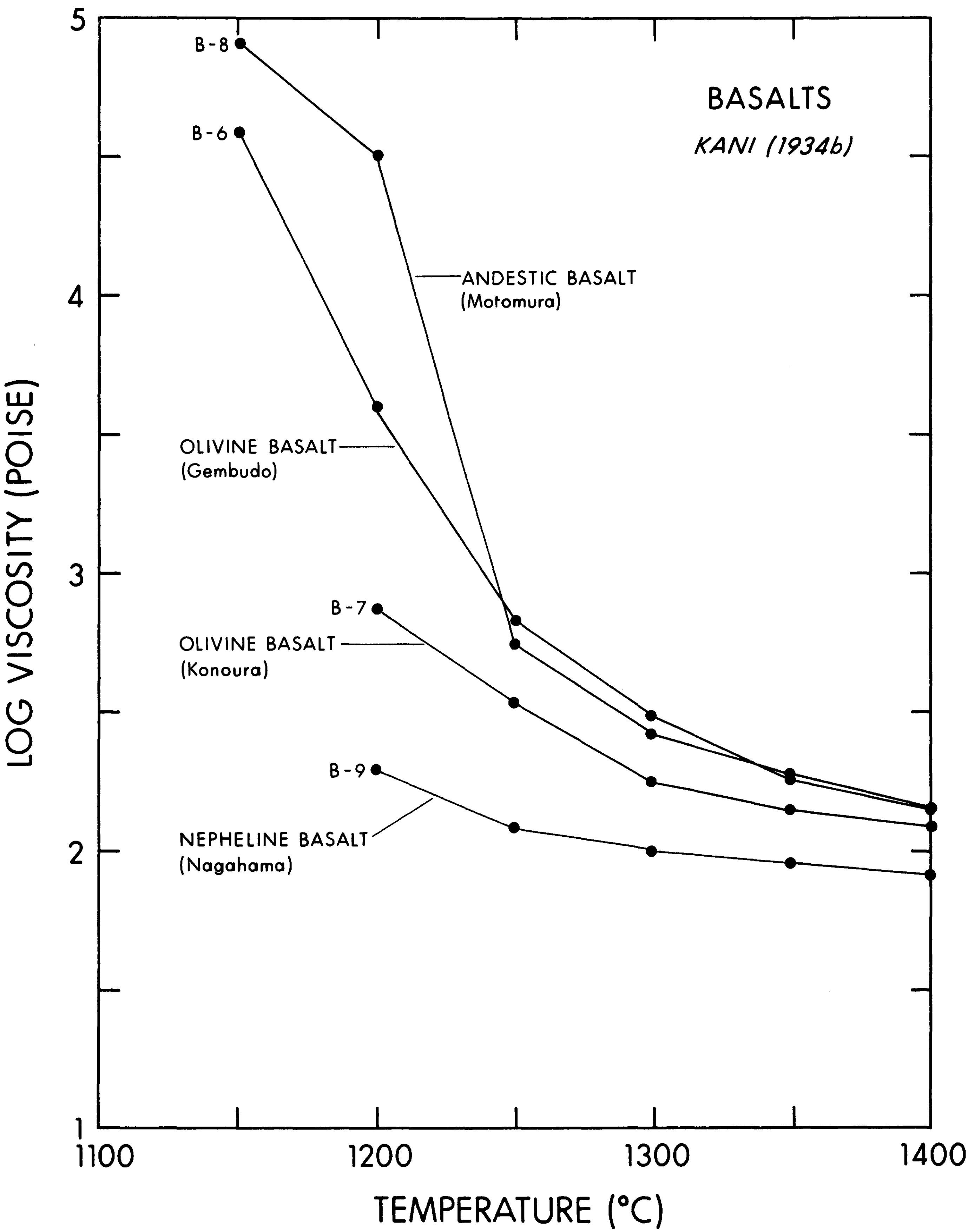
SYSTEM
NEPHELINE BASALT
(NAGAHAMA)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

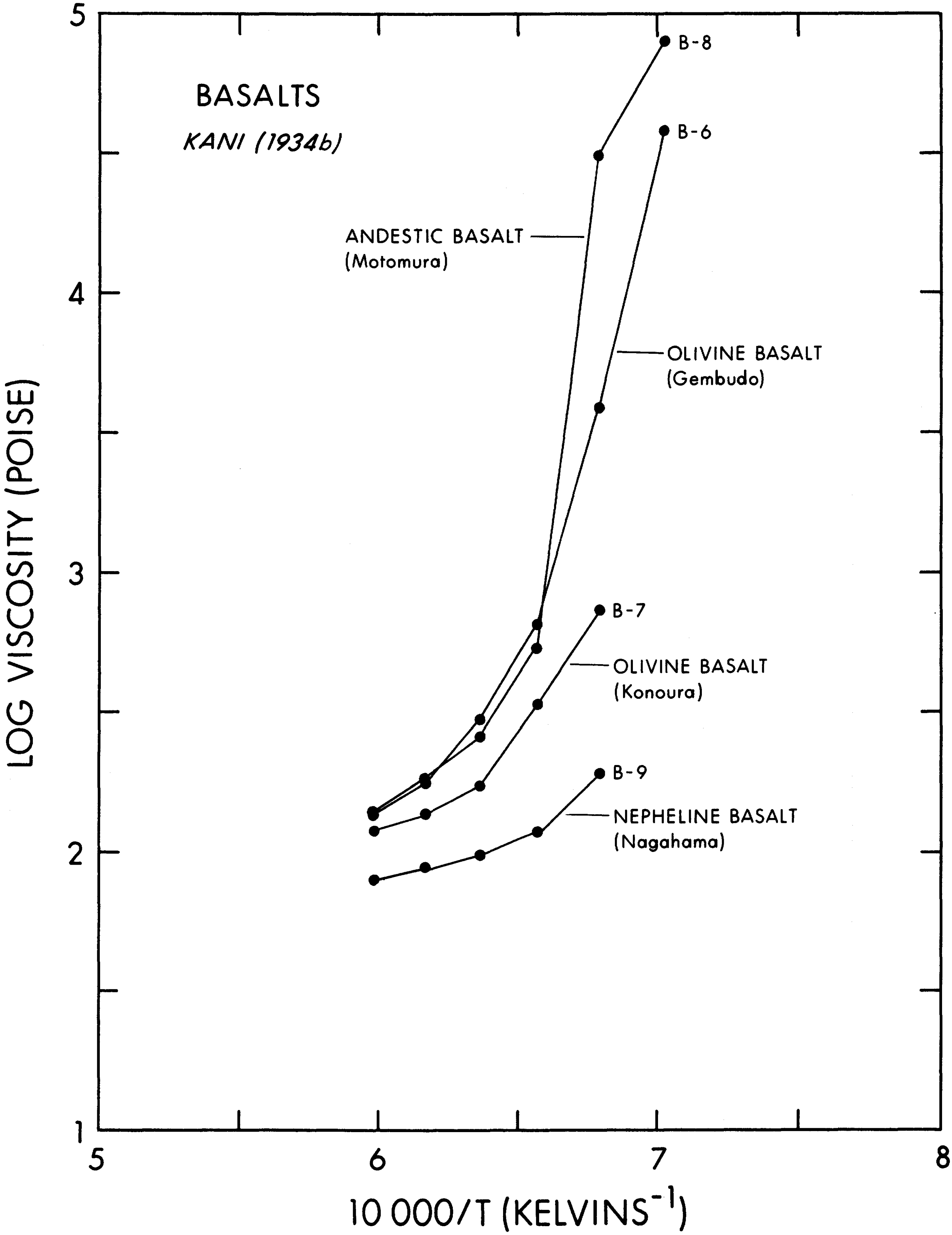
AUTHOR
KANI (1934b)

DERIVED FROM
TABLE VII
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

B-9

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	5.247	2.279	190.00
1250.00	6.566	4.763	2.069	117.14
1300.00	6.357	4.578	1.988	97.34
1350.00	6.161	4.479	1.945	88.11
1400.00	5.977	4.379	1.902	79.76


BASALTS
KANI (1934b)
B-8
B-6
B-7
B-9
ANDESTIC BASALT
(Motomura)
OLIVINE BASALT
(Gembudo)
OLIVINE BASALT
(Konoura)
NEPHELINE BASALT
(Nagahama)
LOG VISCOSITY (POISE)
1
2
3
4
5
1100
1200
1300
1400
TEMPERATURE (°C)


BASALTS
KANI (1934b)
B-8
B-6
ANDESTIC BASALT
(Motomura)
OLIVINE BASALT
(Gembudo)
B-7
OLIVINE BASALT
(Konoura)
B-9
NEPHELINE BASALT
(Nagahama)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
5
4
3
2
1
5
6
7
8

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SYSTEM
BASALT
MEASUREMENT METHOD
FALLING SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
KUSHIRO ET AL. (1976a)
DERIVED FROM
TABLE / GRAPH
P = 15.0 KBAR
Z = 10000.0/T(K) (1/K)

B-10a

T	Z	LN(N)	LOG(N)	N	
1350.	6.161	3.689	1.602	40.	10.
1375.	6.068	3.219	1.398	25.	7.

--

SYSTEM
BASALT
MEASUREMENT METHOD
FALLING SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
KUSHIRO ET AL. (1976a)
DERIVED FROM
TABLE / GRAPH
P = 20.0 KBAR
Z = 10000.0/T(K) (1/K)

B-10b

T	Z	LN(N)	LOG(N)	N	
1375.	6.068	3.219	1.398	25.	6.
1400.	5.977	2.708	1.176	15.	4.

--

SYSTEM
BASALT
MEASUREMENT METHOD
FALLING SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
KUSHIRO ET AL. (1976a)
DERIVED FROM
TABLE / GRAPH
P = 30.0 KBAR
Z = 10000.0/T(K) (1/K)

B-10c

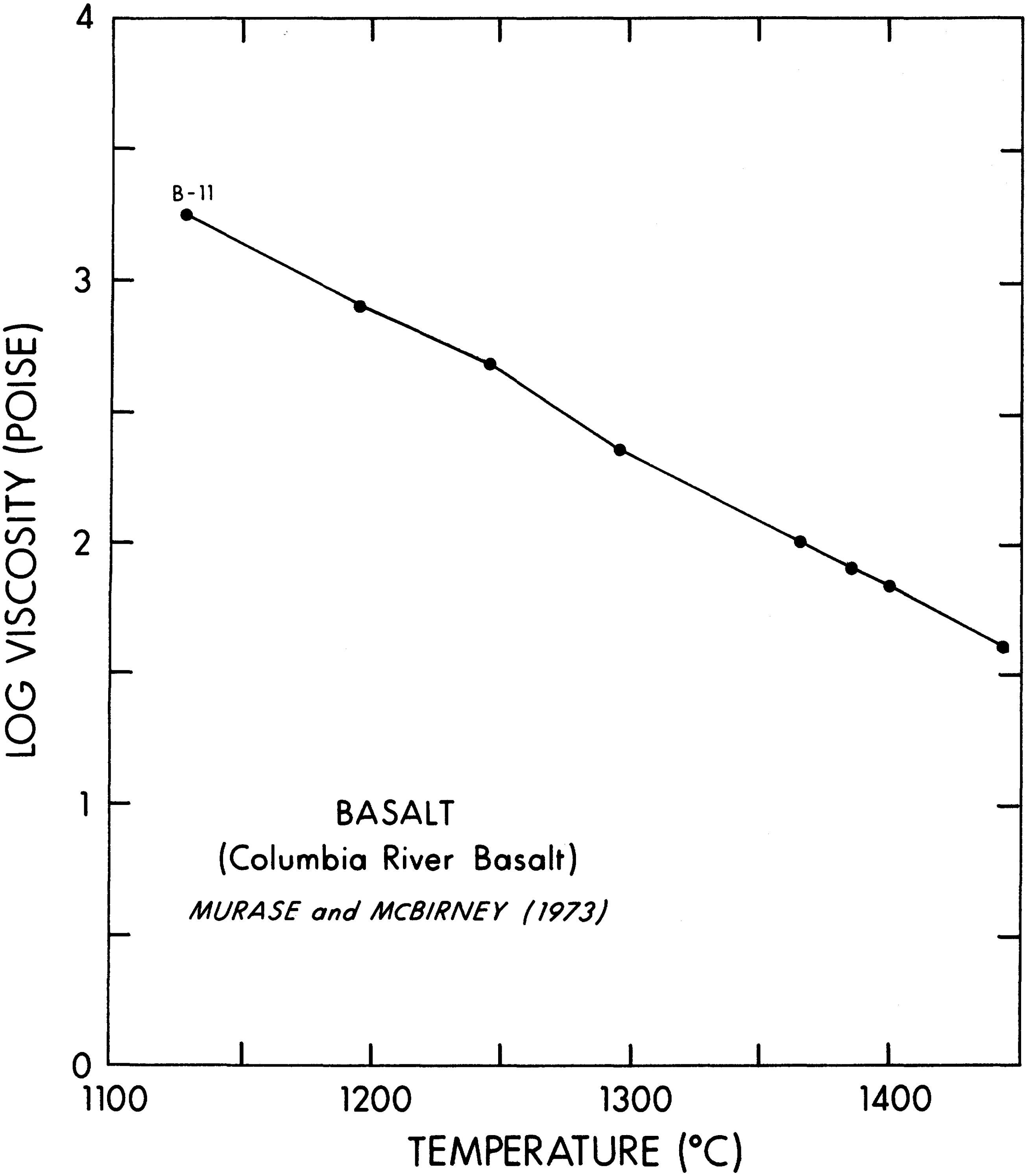
T	Z	LN(N)	LOG(N)	N	
1500.	5.640	2.079	0.903	8.	2.

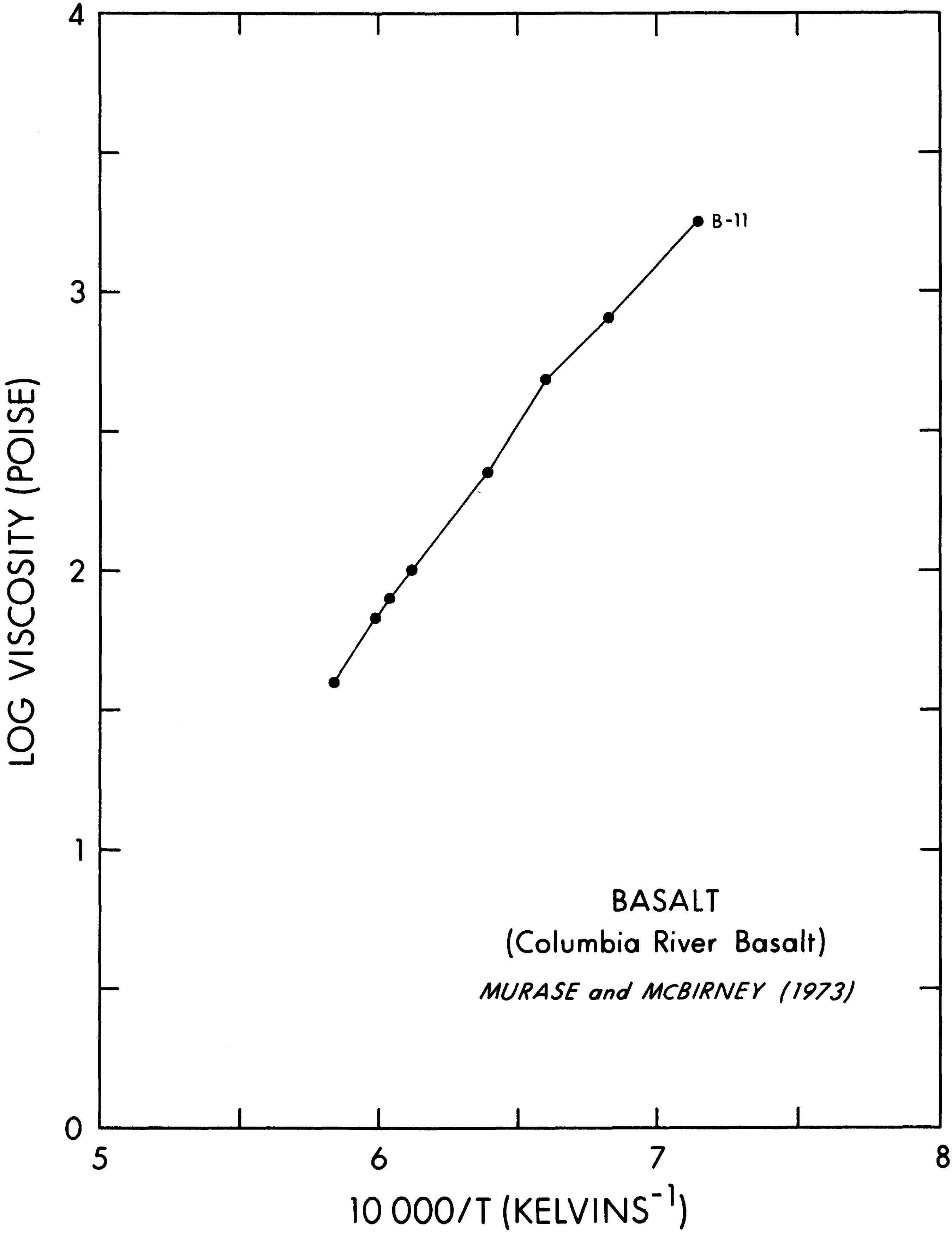
SYSTEM
COLUMBIA RIVER BASALT
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
MURASE AND MCBIRNEY (1973)
DERIVED FROM
GRAPH (D)
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

B-11

T	Z	LN(N)	LOG(N)	N
1130.00	7.128	7.483	3.25	1778.
1195.00	6.812	8.980	2.90	794.3
1240.00	6.609	6.171	2.68	478.
1295.00	6.378	5.411	2.35	223.9
1365.00	6.105	4.605	2.00	100.
1385.00	6.031	4.375	1.90	79.43
1400.00	5.977	4.214	1.83	67.61
1443.00	5.828	3.684	1.60	39.81


LOG VISCOSITY (POISE)
4
3
2
1
0
B-11
BASALT
(Columbia River Basalt)
MURASE and MCBIRNEY (1973)
1100
1200
1300
1400
TEMPERATURE (°C)



4
3
2
1
0
5
6
7
8
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
B-11
BASALT
(Columbia River Basalt)
MURASE and MCBIRNEY (1973)

SYSTEM
OLIVINE THOLEIITE
(KILAUEA 1961)
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

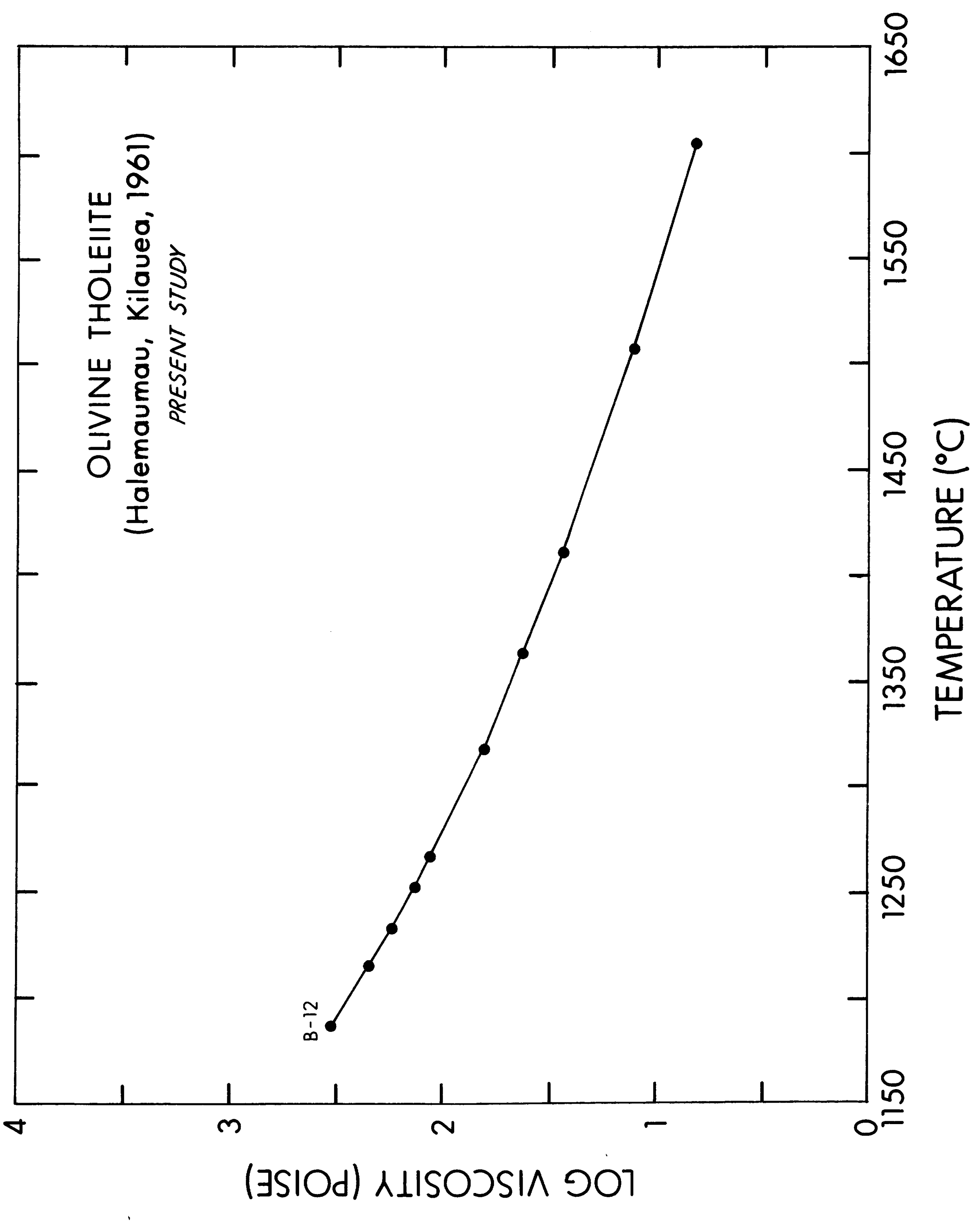
AUTHOR

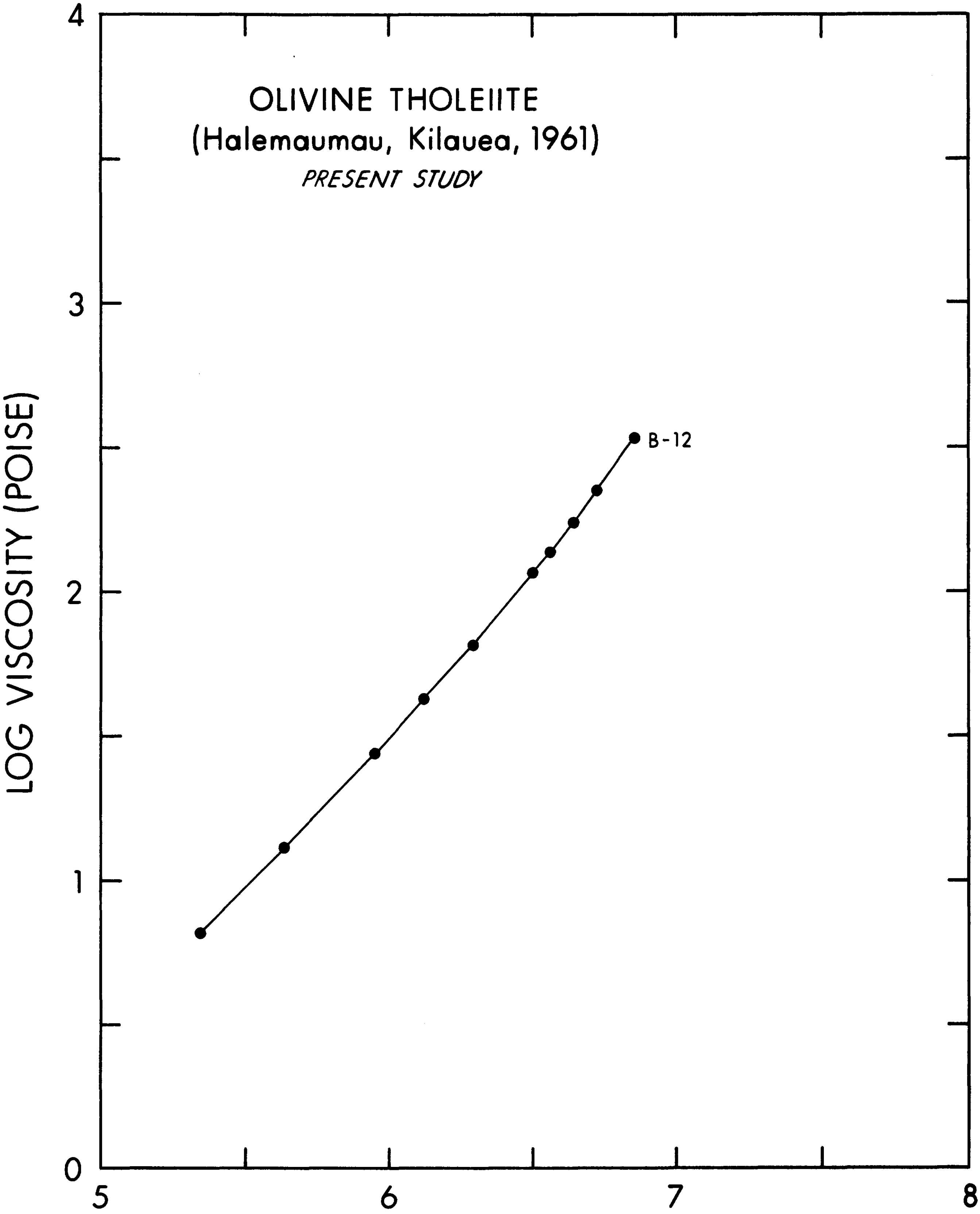
THIS REPORT

DERIVED FROM
DATA POINTS
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

B-12

T	Z	LN(N)	LOG(N)	N
1186.	6.854	5.819	2.527	336.7
1215.	6.720	5.408	2.348	223.1
1233.	6.640	5.153	2.238	172.9
1252.	6.557	4.914	2.134	136.2
1267.	6.494	4.749	2.063	115.5
1318.	6.285	4.174	1.813	64.97
1364.	6.109	3.745	1.627	42.32
1411.	5.938	3.304	1.435	27.22
1507.	5.618	2.552	1.108	12.83
1604.	5.328	1.883	0.818	6.57


OLIVINE THOLEIITE
(Halemaumau, Kilauea, 1961)
PRESENT STUDY
B-12
1150
1250
1350
1450
1550
1650
TEMPERATURE (°C)
0
1
2
3
4
LOG VISCOSITY (POISE)


OLIVINE THOLEIITE
(Halemaumau, Kilauea, 1961)
PRESENT STUDY
B-12
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
5
6
7
8

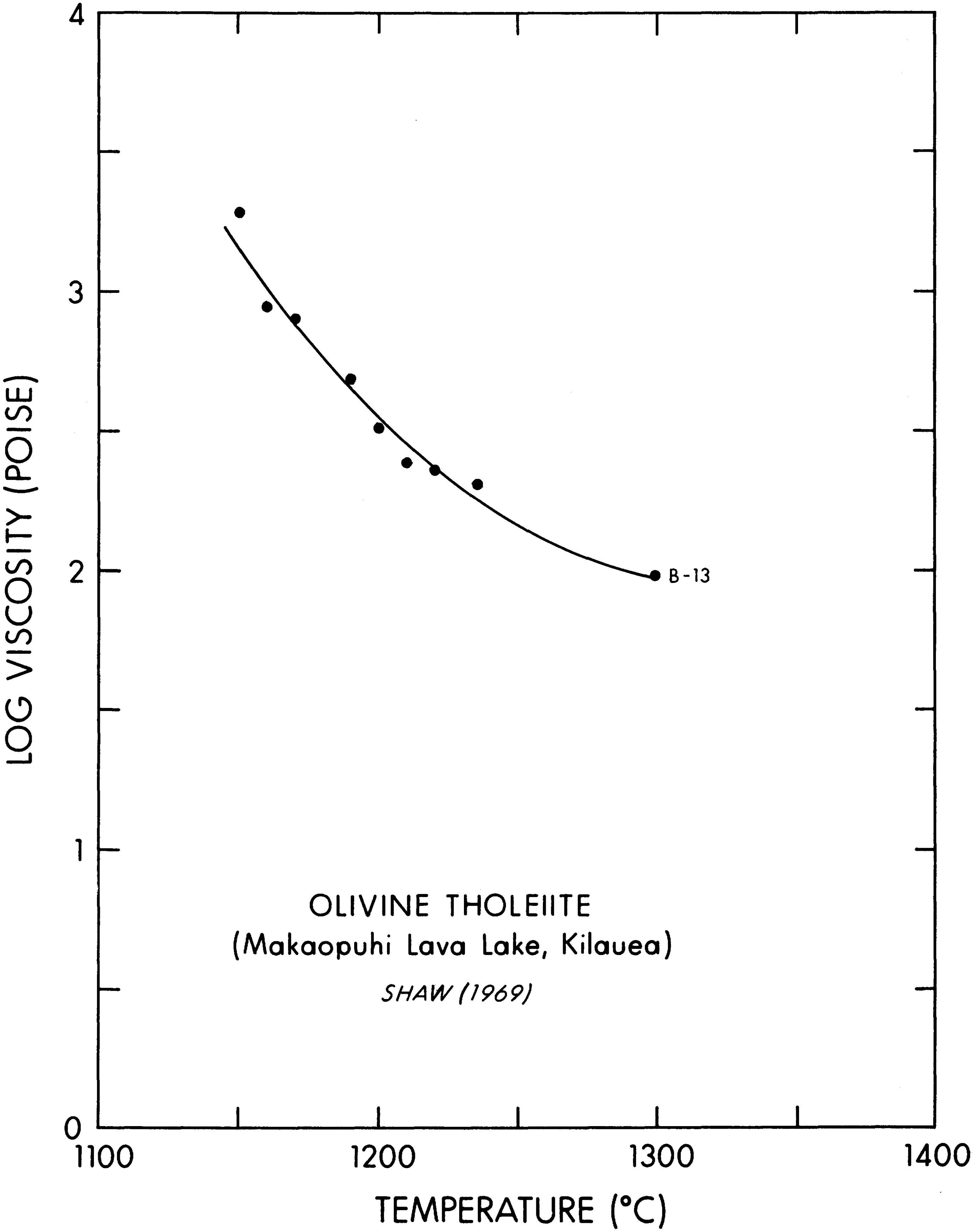
SYSTEM
HAWAIIAN THOLEIITIC BASALT
MAKAOPUHI LAVA LAKE
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

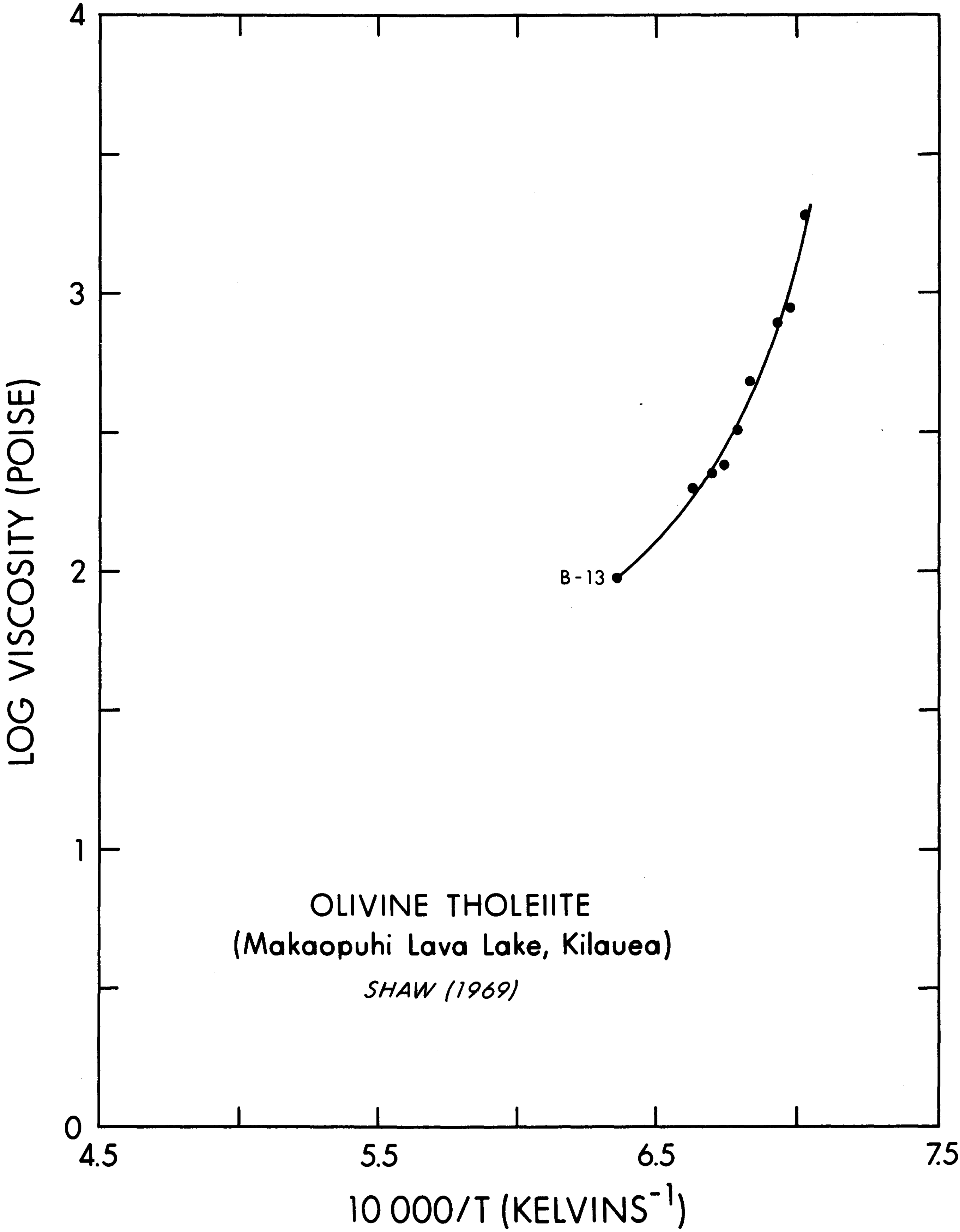
AUTHOR
SHAW (1969)

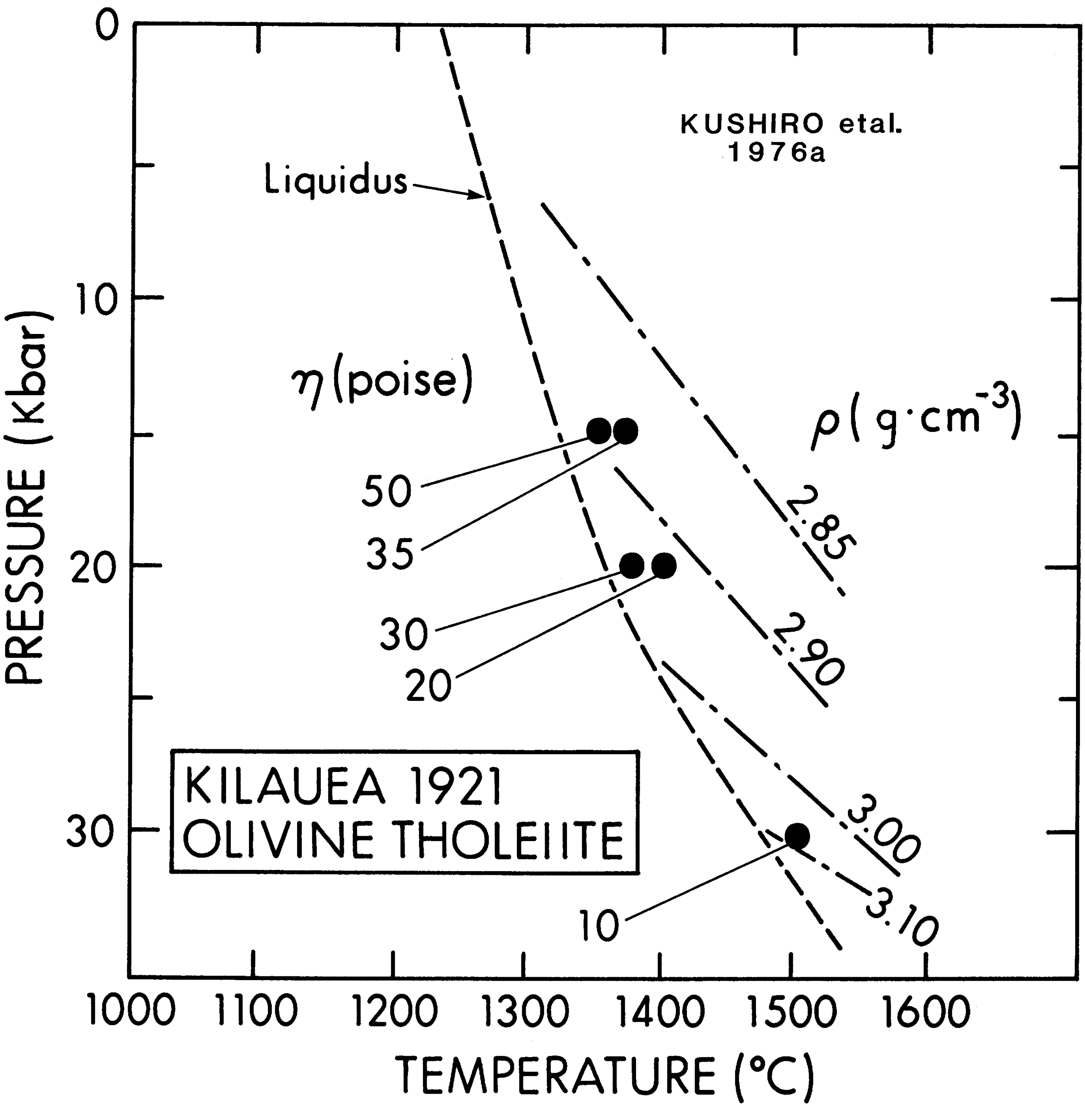
DERIVED FROM
GRAPH (D)
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

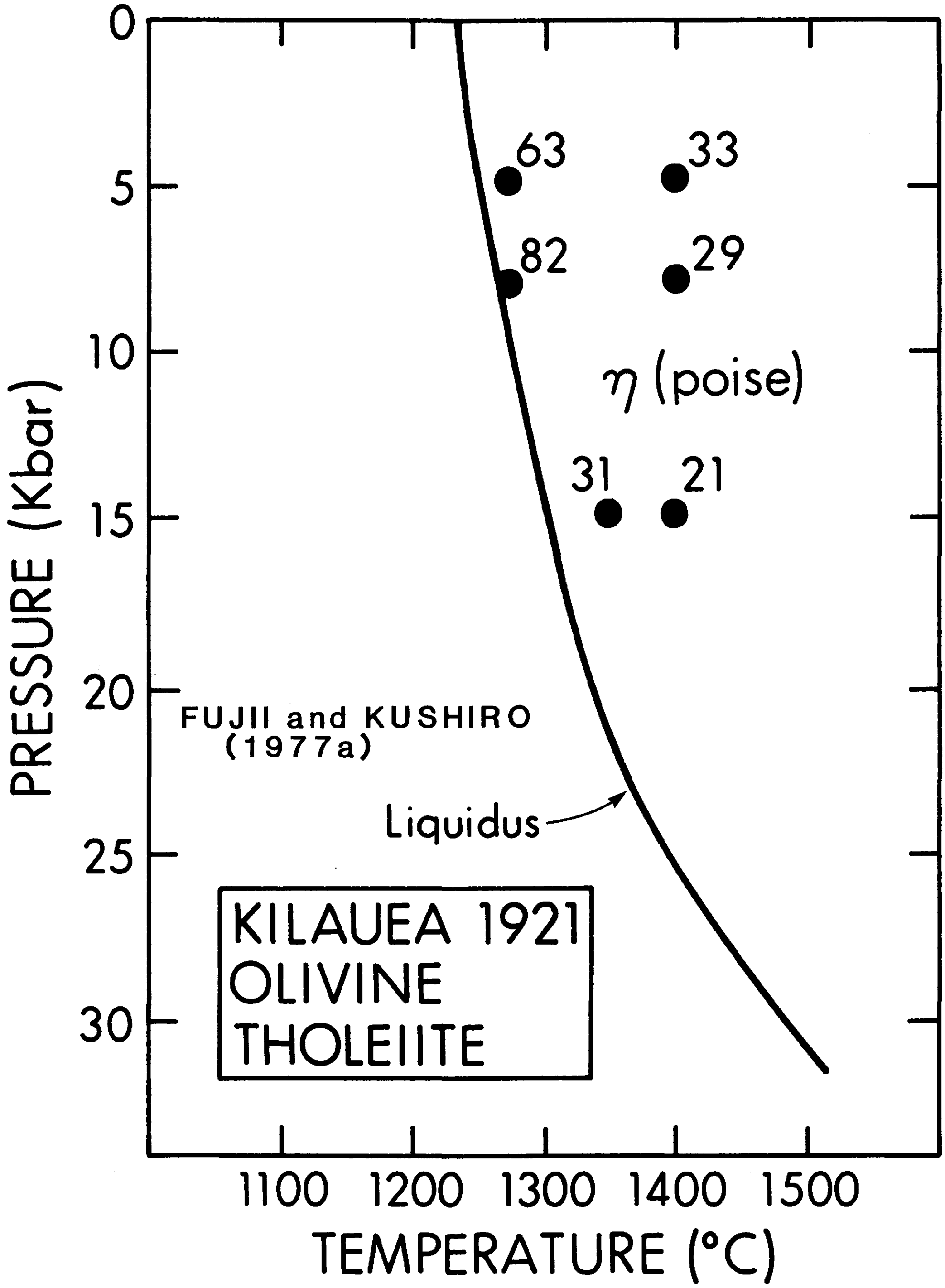
B-13

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	7.550	3.279	1900.
1160.00	6.978	6.768	2.940	870.
1165.00	6.954	6.565	2.851	810.
1170.00	6.930	6.659	2.892	780.
1190.00	6.835	6.174	2.681	480.
1200.00	6.789	5.768	2.505	320.
1210.00	6.743	5.481	2.380	240.
1220.00	6.698	5.416	2.352	225.
1235.00	6.631	5.298	2.301	200.
1300.00	6.357	4.554	1.978	95.

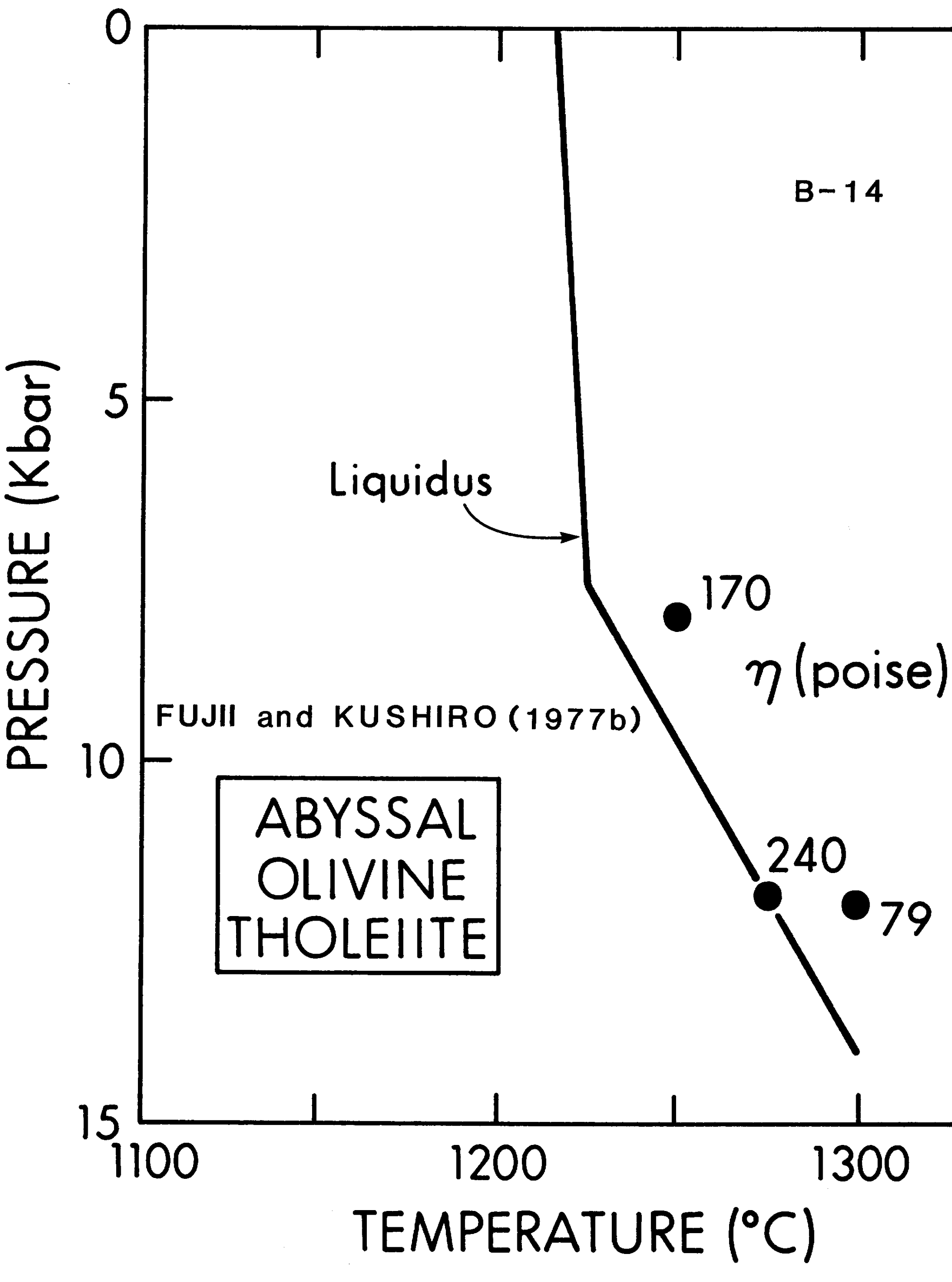

LOG VISCOSITY (POISE)
4
3
2
1
0
1100
1200
1300
1400
TEMPERATURE (°C)
B-13
OLIVINE THOLEIITE
(Makaopuhi Lava Lake, Kilauea)
SHAW (1969)


4
3
2
1
0
LOG VISCOSITY (POISE)
B - 13
OLIVINE THOLEIITE
(Makaopuhi Lava Lake, Kilauea)
SHAW (1969)
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})

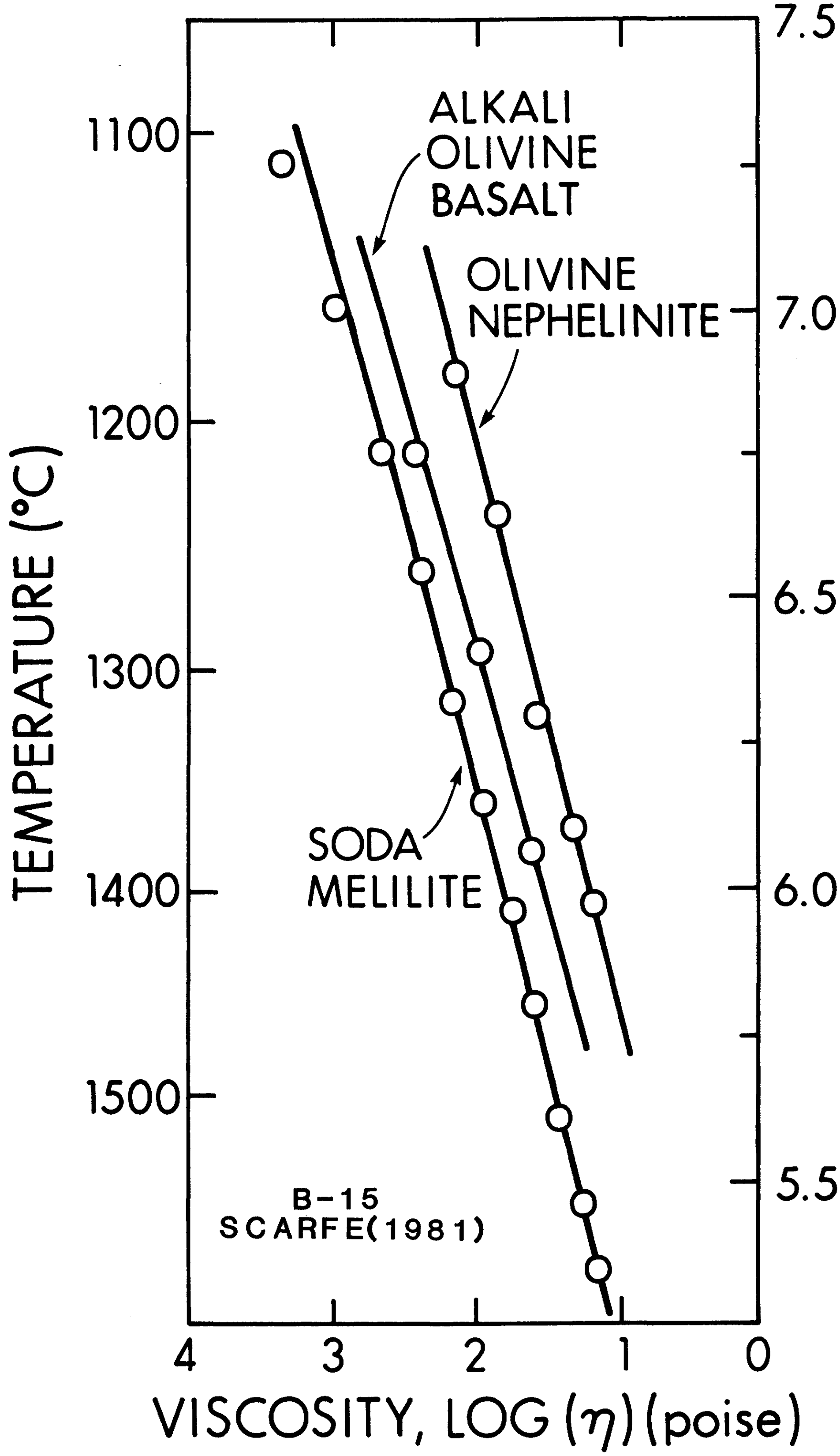

KUSHIRO etal.
1976a
Liquidus
η (poise)
ρ (g·cm⁻³)
50
35
30
20
10
2.85
2.90
3.00
3.10
KILAUEA 1921
OLIVINE THOLEIITE
PRESSURE (Kbar)
0
10
20
30
1000
1100
1200
1300
1400
1500
1600
TEMPERATURE (°C)

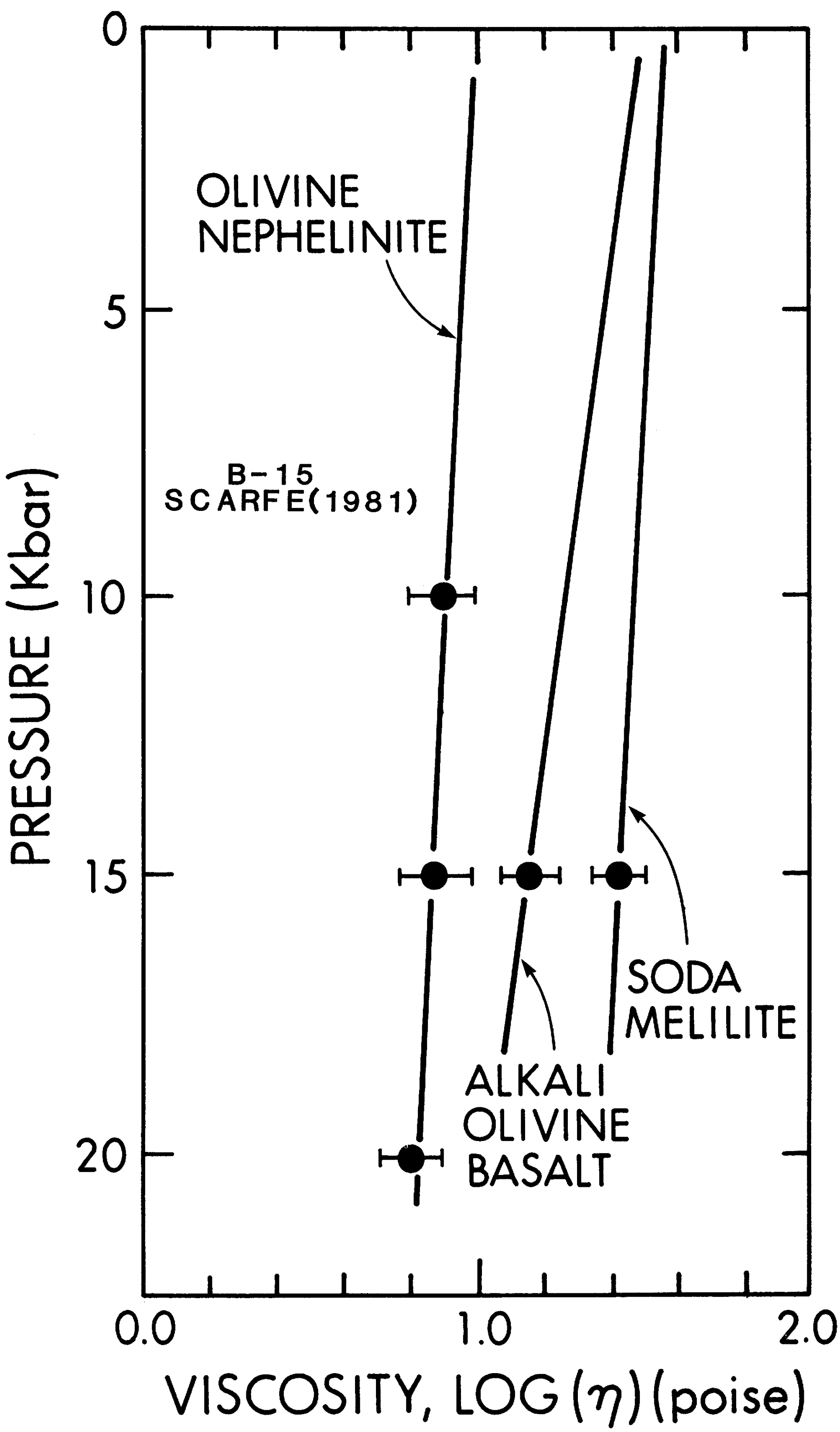


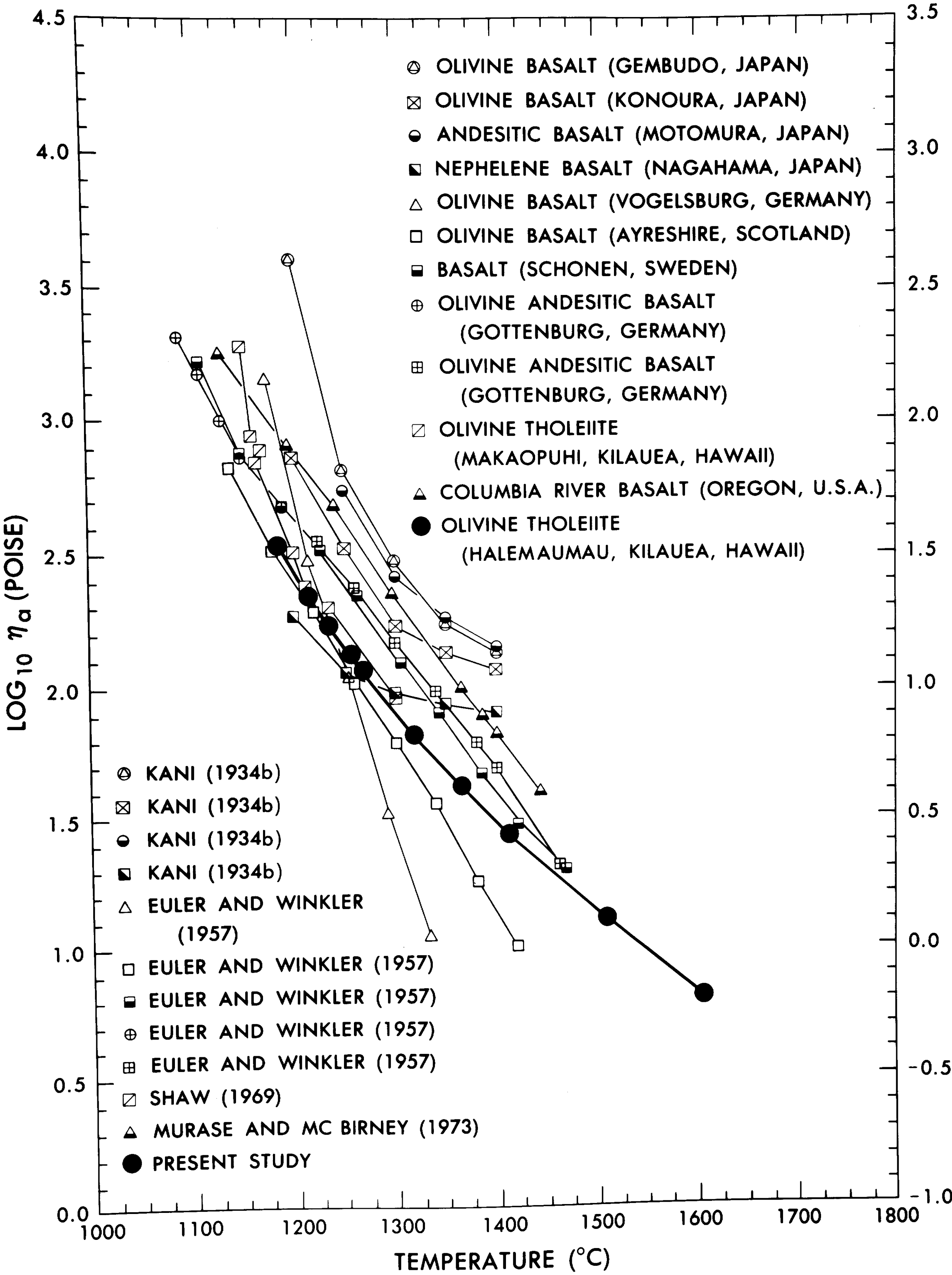
PRESSURE (Kbar)
0
5
10
15
20
25
30
63
33
82
29
η (poise)
31
21
FUJII and KUSHIRO
(1977a)
Liquidus
KILAUEA 1921
OLIVINE
THOLEIITE
1100
1200
1300
1400
1500
TEMPERATURE (°C)



0
5
10
15
PRESSURE (Kbar)
B-14
Liquidus
170
η (poise)
FUJII and KUSHIRO (1977b)
ABYSSAL OLIVINE THOLEIITE
240
79
1100
1200
1300
TEMPERATURE (°C)


ALKALI OLIVINE BASALT
OLIVINE NEPHELINITE
SODA MELILITE
B-15
SCARFE(1981)
TEMPERATURE (°C)
1100
1200
1300
1400
1500
10⁴/T(K)
7.5
7.0
6.5
6.0
5.5
4
3
2
1
0
VISCOSITY, LOG (η) (poise)


0
5
10
15
20
PRESSURE (Kbar)
OLIVINE
NEPHELINITE
B-15
SCARFE(1981)
SODA
MELILITE
ALKALI
OLIVINE
BASALT
0.0
1.0
2.0
VISCOSITY, LOG (η) (poise)



OLIVINE BASALT (GEMBUDO, JAPAN)
OLIVINE BASALT (KONOURA, JAPAN)
ANDESITIC BASALT (MOTOMURA, JAPAN)
NEPHELENE BASALT (NAGAHAMA, JAPAN)
OLIVINE BASALT (VOGELSBURG, GERMANY)
OLIVINE BASALT (AYRESHIRE, SCOTLAND)
BASALT (SCHONEN, SWEDEN)
OLIVINE ANDESITIC BASALT (GOTTENBURG, GERMANY)
OLIVINE ANDESITIC BASALT (GOTTENBURG, GERMANY)
OLIVINE THOLEIITE (MAKAOPUHI, KILAUEA, HAWAII)
COLUMBIA RIVER BASALT (OREGON, U.S.A.)
OLIVINE THOLEIITE (HALEMAUMAU, KILAUEA, HAWAII)
KANI (1934b)
KANI (1934b)
KANI (1934b)
KANI (1934b)
EULER AND WINKLER (1957)
EULER AND WINKLER (1957)
EULER AND WINKLER (1957)
EULER AND WINKLER (1957)
EULER AND WINKLER (1957)
SHAW (1969)
MURASE AND MC BIRNEY (1973)
PRESENT STUDY
LOG10 ηa (POISE)
LOG10 ηa (PASCAL•S)
TEMPERATURE (°C)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
1000
1100
1200
1300
1400
1500
1600
1700
1800

Andesites

SYSTEM
ANDESITE
(OLD RED SANDSTONE LAVA;
EDINBURGH, SCOTLAND)

AUTHOR
EULER AND WINKLER (1957)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 8

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

A-1

T	Z	LN(N)	LOG(N)	N
1260.	6.523	8.294	3.602	4000.
1300.	6.357	7.783	3.380	2400.
1340.	6.200	7.223	3.137	1370.
1380.	6.050	6.918	3.004	1010.
1415.	5.924	6.579	2.857	720.
1455.	5.787	6.153	2.672	470.
1498	5.646	5.704	2.477	300.

SYSTEM
HYPERSTHENE ANDESITE
(OLD RED SANDSTONE LAVA;
EDINBURGH, SCOTLAND)

AUTHOR
EULER AND WINKLER (1957)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

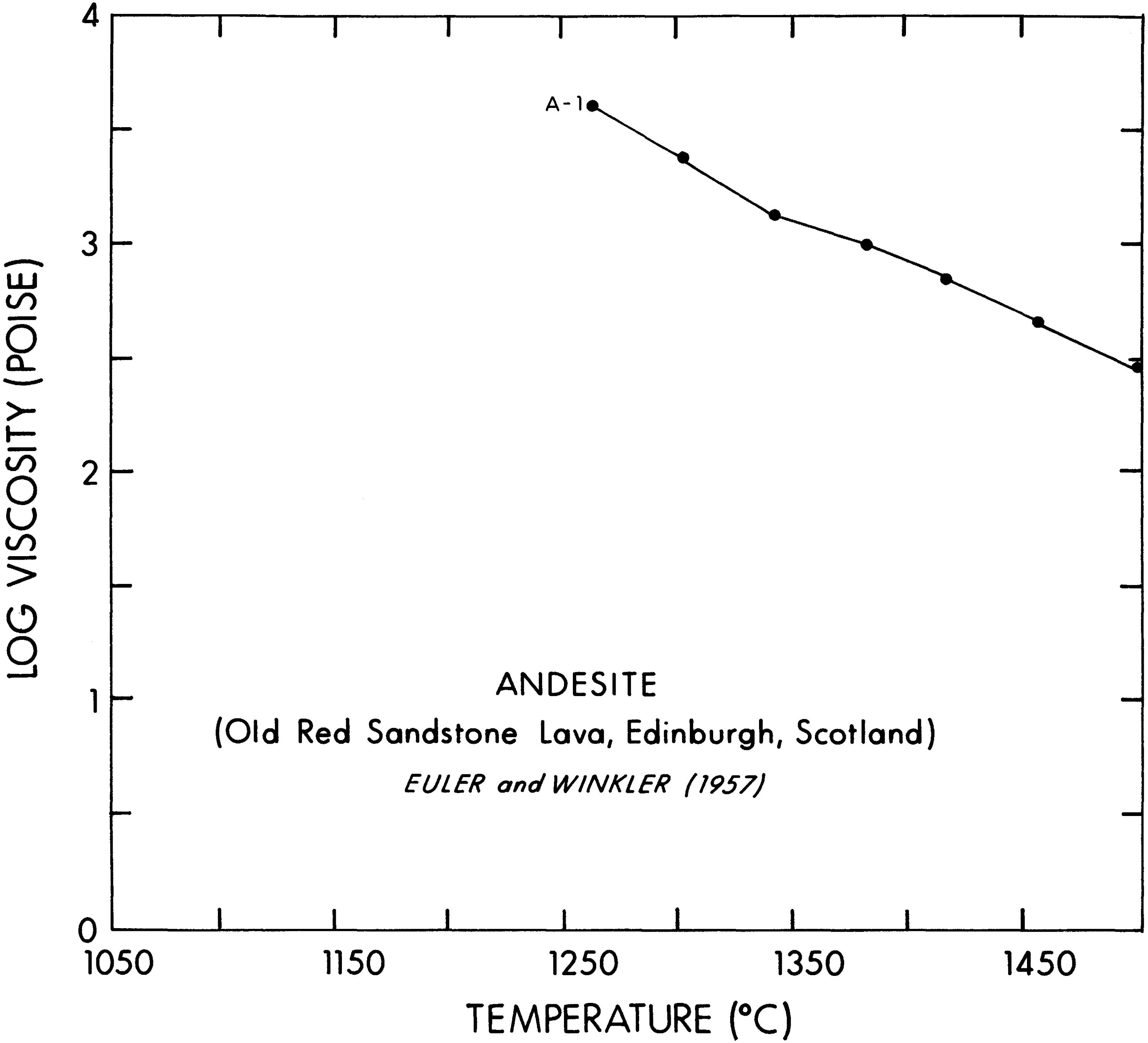
DERIVED FROM
TABLE 8

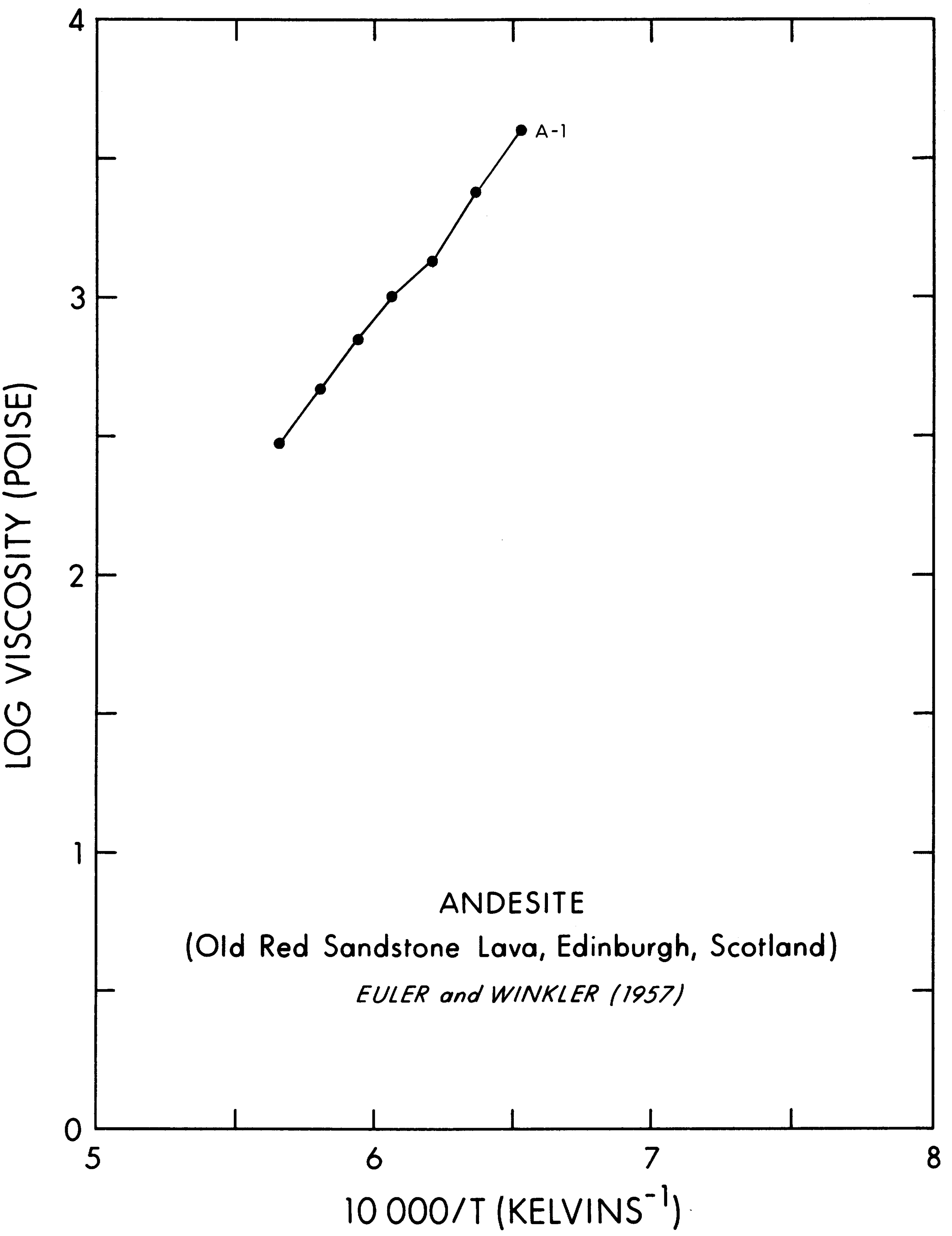
N (POISES)
T (DEGREES C)

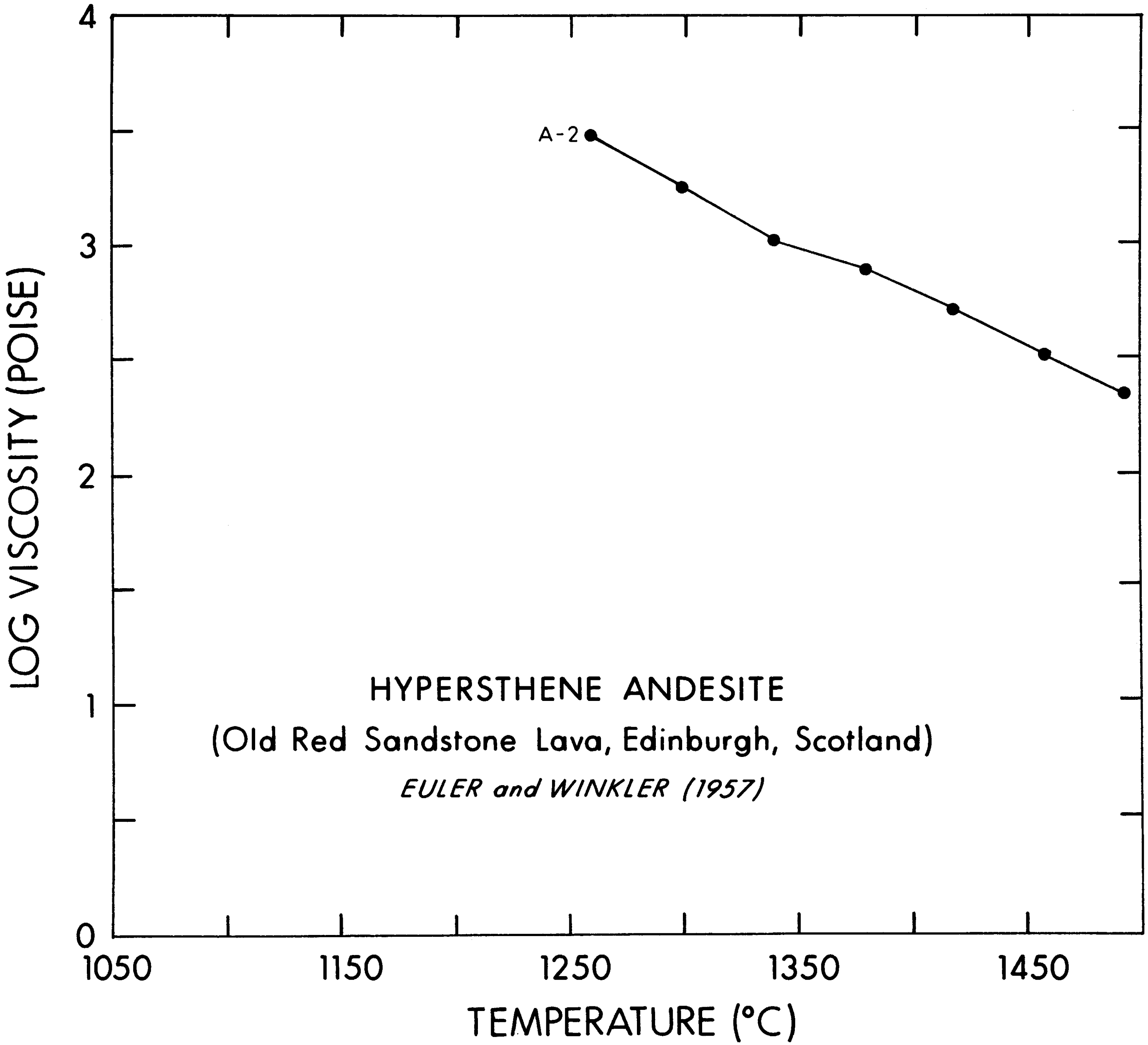
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

A-2

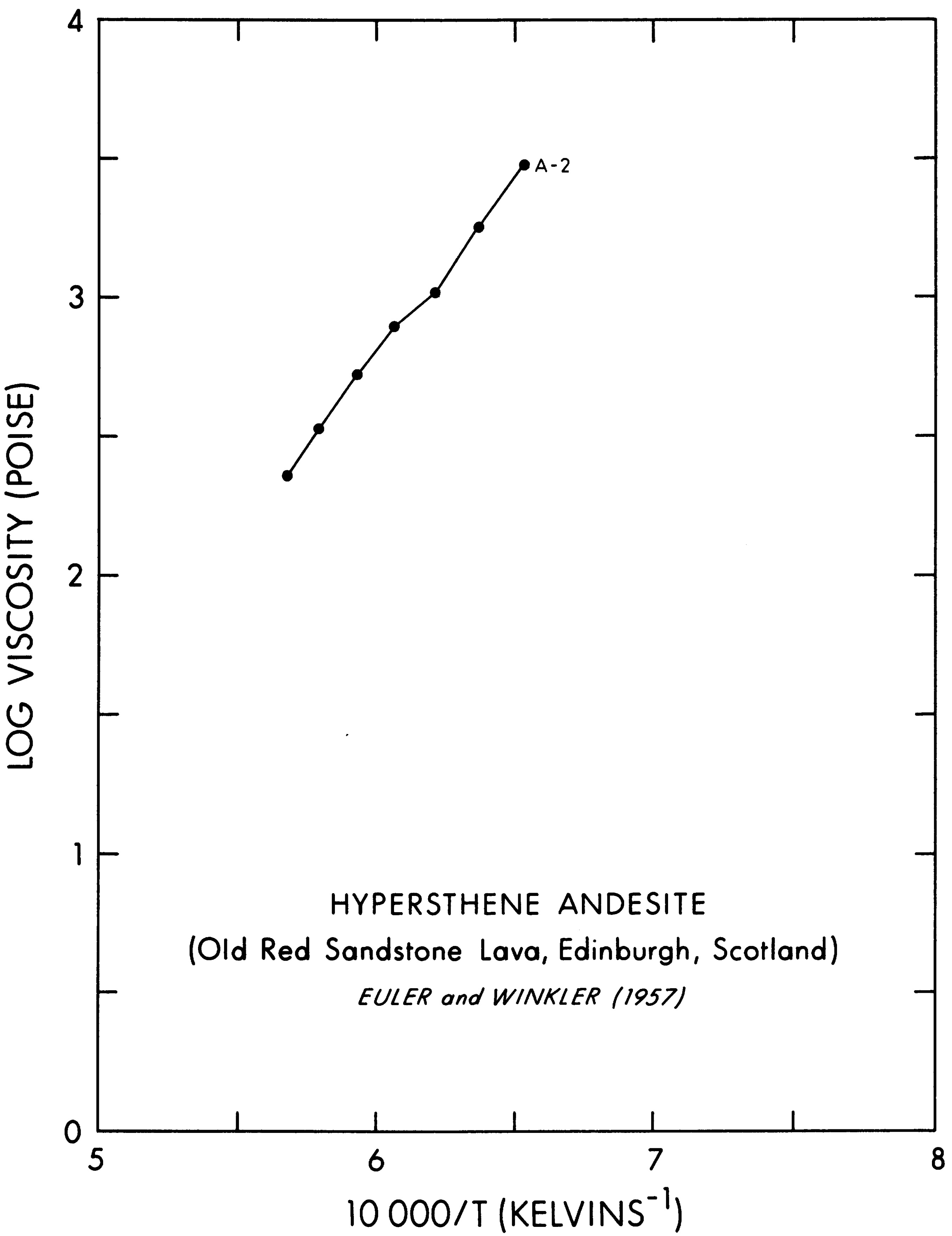
T	Z	LN(N)	LOG(N)	N
1260.	6.523	8.006	3.477	3000.
1300.	6.357	7.459	3.255	1800.
1340.	6.200	6.960	3.021	1050.
1380.	6.050	6.672	2.898	790.
1418.	5.914	6.273	2.724	530.
1458.	5.777	5.829	2.531	340.
1493.	5.663	5.438	2.362	230.


A-1
ANDESITE
(Old Red Sandstone Lava, Edinburgh, Scotland)
EULER and WINKLER (1957)
LOG VISCOSITY (POISE)
0
1
2
3
4
1050
1150
1250
1350
1450
TEMPERATURE (°C)


LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
5
6
7
8
A-1
ANDESITE
(Old Red Sandstone Lava, Edinburgh, Scotland)
EULER and WINKLER (1957)



HYPERSTHENE ANDESITE
(Old Red Sandstone Lava, Edinburgh, Scotland)
EULER and WINKLER (1957)
A-2
LOG VISCOSITY (POISE)
0
1
2
3
4
TEMPERATURE (°C)
1050
1150
1250
1350
1450



4
3
2
1
0
5
6
7
8
A-2
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
HYPERSTHENE ANDESITE
(Old Red Sandstone Lava, Edinburgh, Scotland)
EULER and WINKLER (1957)

SYSTEM
ANDESITE (CRATER LAKE, ORE.)
MEASUREMENT METHOD
FALLING SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
KUSHIRO ET AL. (1976b)
DERIVED FROM
TABLE / GRAPH
P = 7.5 KBAR
Z = 10000.0/T(K) (1/K)

A-3a

T	Z	LN(N)	LOG(N)	N
1250.	6.566	8.065	3.502	3180.
1350.	6.161	6.975	3.029	1070.

SYSTEM
ANDESITE (CRATER LAKE, ORE.)
MEASUREMENT METHOD
FALLING SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
KUSHIRO ET AL. (1976b)
DERIVED FROM
TABLE / GRAPH
P = 15.0 KBAR
Z = 10000.0/T(K) (1/K)

A-3b

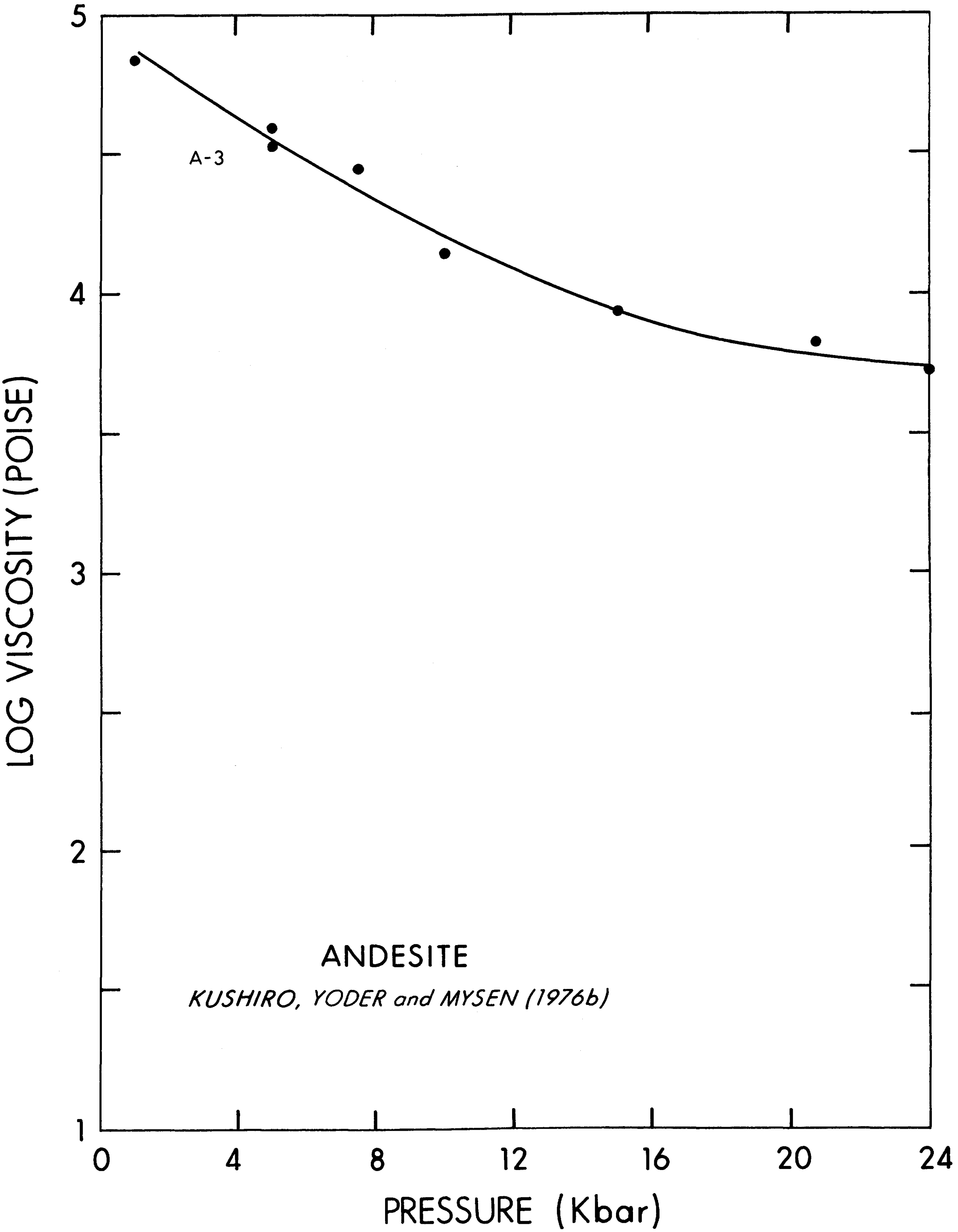
T	Z	LN(N)	LOG(N)	N
1350.	6.161	6.745	2.929	850.

SYSTEM
ANDESITE (CRATER LAKE, ORE.)
MEASUREMENT METHOD
FALLING SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
KUSHIRO ET AL. (1976b)
DERIVED FROM
TABLE / GRAPH
P = 20.0 KBAR
Z = 10000.0/T(K) (1/K)

A-3c

T	Z	LN(N)	LOG(N)	N
1350.	6.161	6.791	2.949	890.

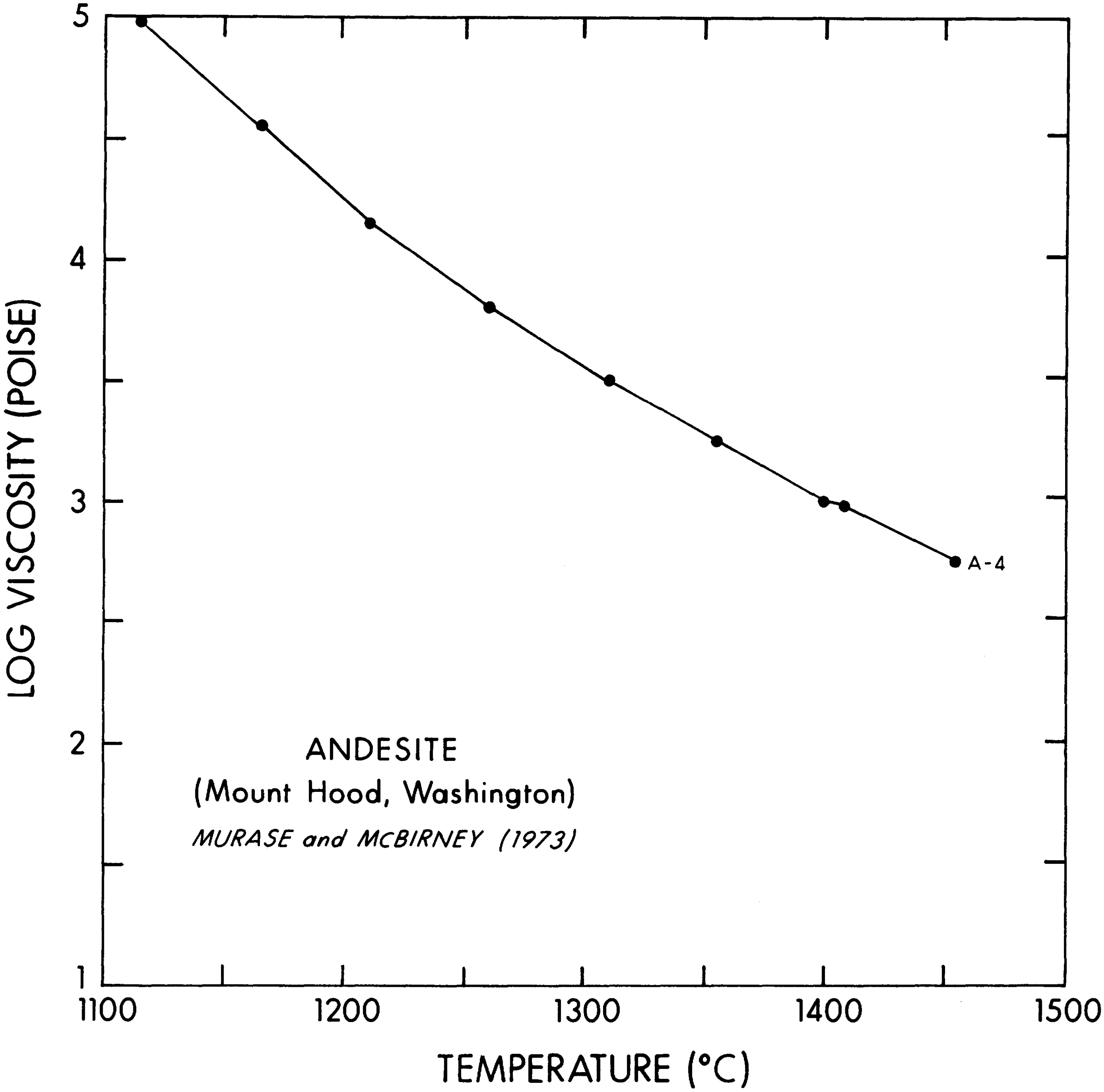

LOG VISCOSITY (POISE)
PRESSURE (Kbar)
A-3
ANDESITE
KUSHIRO, YODER and MYSEN (1976b)
5
4
3
2
1
0
4
8
12
16
20
24

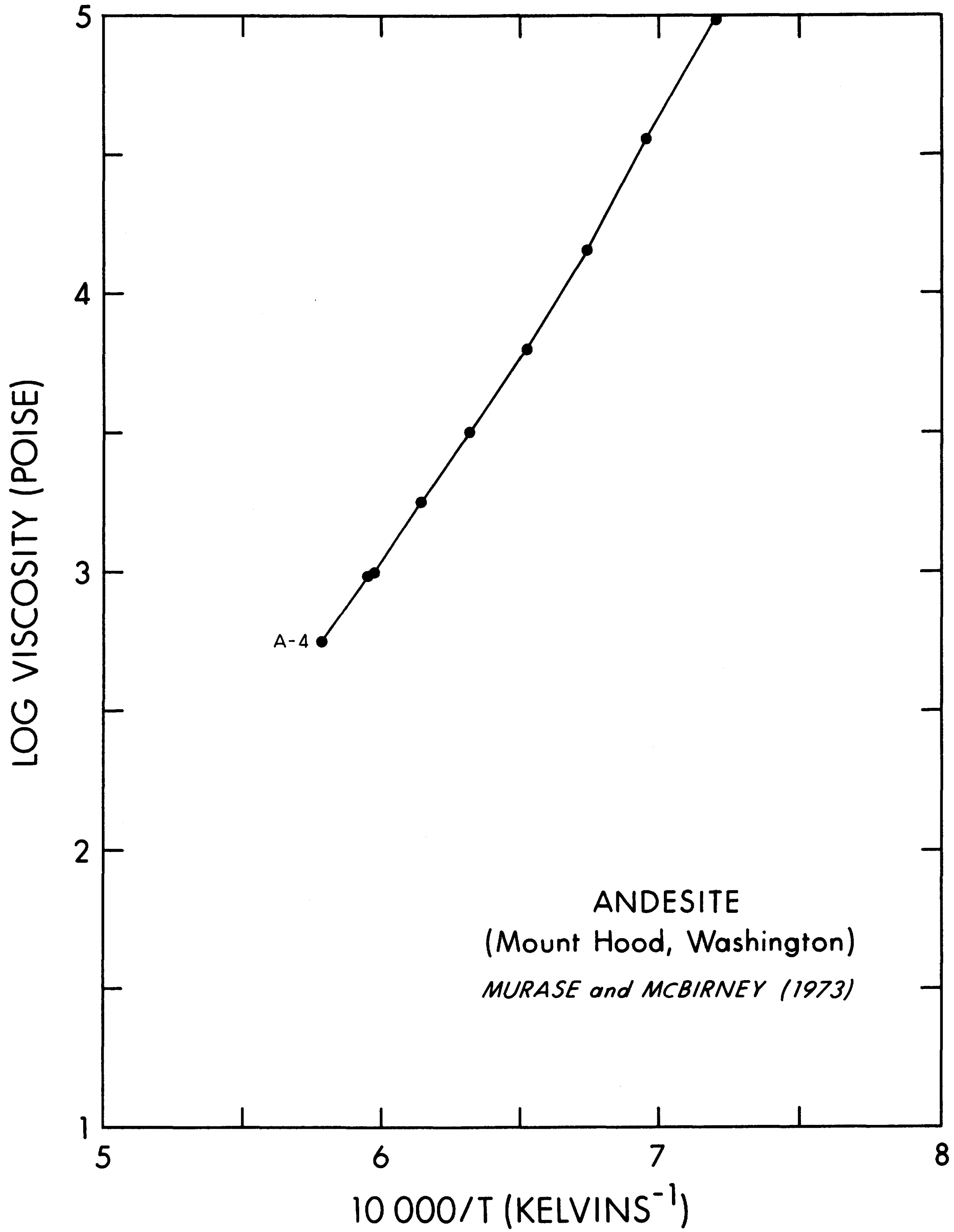
SYSTEM
MOUNT HOOD ANDESITE
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
MURASE AND MCBIRNEY (1973)
DERIVED FROM
GRAPH (D)
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

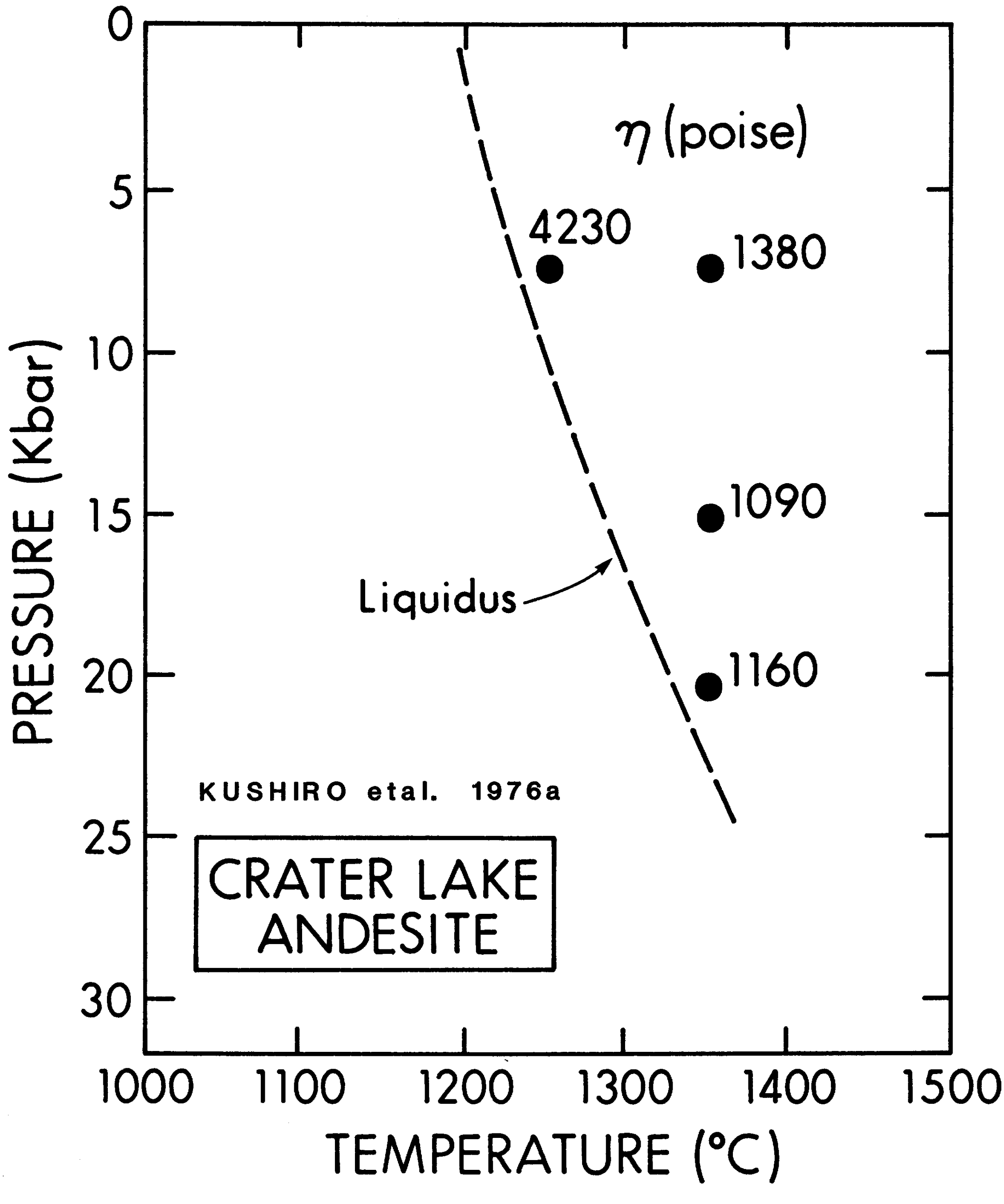
A-4

T	Z	LN(N)	LOG(N)	N
1115.00	7.205	11.47	4.98	9.55E4
1165.00	6.954	10.48	4.55	3.55E4
1210.00	6.743	9.556	4.15	1.41E4
1260.00	6.523	8.750	3.80	6.31E3
1310.00	6.317	8.060	3.50	3.16E3
1355.00	6.143	7.483	3.25	1.78E3
1400.00	5.977	6.908	3.00	1.00E3
1408.00	5.949	6.862	2.98	9.55E2
1455.00	5.787	6.332	2.75	5.62E2





LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
A-4
ANDESITE
(Mount Hood, Washington)
MURASE and MCBIRNEY (1973)
5
4
3
2
1
5
6
7
8


η (poise)
4230
1380
1090
1160
Liquidus
KUSHIRO etal. 1976a
CRATER LAKE ANDESITE
PRESSURE (Kbar)
0
5
10
15
20
25
30
1000
1100
1200
1300
1400
1500
TEMPERATURE (°C)

Rhyolites

SYSTEM
RHYOLITE GLASS
P (H2O) =0.0 BARS
MEASUREMENT METHOD
COMPO.-CURVE CALCULATION
N (POISES)
T (DEGREES C)

AUTHOR
FRIEDMAN, LONG AND SMITH (1963)
DERIVED FROM
TABLE 2
P = 15.2 BARS
Z = 10000.0/T(K) (1/K)

R – 1

T	Z	LN(N)	LOG(N)	N
735.00	9.921	29.934	13.0	1.0*10E13
785.00	9.452	28.782	12.5	3.16*10E12
835.00	9.025	24.407	10.6	3.98*10E10

SYSTEM
RHYOLITE GLASS
P (H2O) =1.72 BARS
MEASUREMENT METHOD
COMPO.-CURVE CALCULATION
N (POISES)
T (DEGREES C)

AUTHOR
FRIEDMAN, LONG AND SMITH (1963)
DERIVED FROM
TABLE 2
P = 15.2 BARS
Z = 10000.0/T(K) (1/K)

R – 2

T	Z	LN(N)	LOG(N)	N
735.00	9.921	26.019	11.3	2.0*10E11
785.00	9.452	26.019	11.3	2.0*10E11

SYSTEM
RHYOLITE GLASS
P (H2O) =3.45 BARS
MEASUREMENT METHOD
COMPO.-CURVE CALCULATION
N (POISES)
T (DEGREES C)

AUTHOR
FRIEDMAN, LONG AND SMITH (1963)
DERIVED FROM
TABLE 2
P = 15.2 BARS
Z = 10000.0/T(K) (1/K)

R – 3

T	Z	LN(N)	LOG(N)	N
635.00	11.013	32.236	14.0	1.0*10E14
735.00	9.921	25.559	11.1	1.26*10E11
785.00	9.452	25.559	11.1	1.26*10E11

SYSTEM
RHYOLITE GLASS
P (H2O) =10.3 BARS
MEASUREMENT METHOD
COMPO.-CURVE CALCULATION
N (POISES)
T (DEGREES C)

AUTHOR
FRIEDMAN, LONG AND SMITH (1963)
DERIVED FROM
TABLE 2
P = 15.2 BARS
Z = 10000.0/T(K) (1/K)

R – 4

T	Z	LN(N)	LOG(N)	N
635.00	11.013	28.322	12.3	2.00*10E12
735.00	9.921	23.717	10.3	2.00*10E10
785.00	9.452	23.717	10.3	2.00*10E10

SYSTEM
RHYOLITE GLASS
P (H2O) =20.7 BARS
MEASUREMENT METHOD
COMPO.-CURVE CALCULATION
N (POISES)
T (DEGREES C)

AUTHOR
FRIEDMAN, LONG AND SMITH (1963)
DERIVED FROM
TABLE 2
P = 15.2 BARS
Z = 10000.0/T(K) (1/K)

R – 5

T	Z	LN(N)	LOG(N)	N
635.00	11.013	26.019	11.3	2.0*10E11
735.00	9.921	23.256	10.1	1.26*10E10
785.00	9.452	22.796	9.9	7.94*10E09

SYSTEM
RHYOLITE GLASS
P(H2O)=0.0 BARS
MEASUREMENT METHOD
COMPO.-CURVE CALCULATION
N (POISES)
T (DEGREES C)

AUTHOR
FRIEDMAN, LONG AND SMITH (1963)

DERIVED FROM
TABLE 2
P = 36.4 BARS
Z = 10000.0/T(K) (1/K)

R- 6

T	Z	LN(N)	LOG(N)	N
735.00	9.921	28.782	12.5	3.16*10E12

SYSTEM
RHYOLITE GLASS
P(H2O)=1.72 BARS
MEASUREMENT METHOD
COMPO.-CURVE CALCULATION
N (POISES)
T (DEGREES C)

AUTHOR
FRIEDMAN, LONG AND SMITH (1963)

DERIVED FROM
TABLE 2
P = 36.4 BARS
Z = 10000.0/T(K) (1/K)

R-7

T	Z	LN(N)	LOG(N)	N
635.00	11.013	31.085	13.5	3.16*10E13
735.00	9.921	26.710	11.6	3.98*10E11

SYSTEM
RHYOLITE GLASS
P(H2O)=3.45 BARS
MEASUREMENT METHOD
COMPO.-CURVE CALCULATION
N (POISES)
T (DEGREES C)

AUTHOR
FRIEDMAN, LONG AND SMITH (1963)

DERIVED FROM
TABLE 2
P = 36.4 BARS
Z = 10000.0/T(K) (1/K)

R-8

T	Z	LN(N)	LOG(N)	N
635.00	11.013	29.243	12.7	5.01*10E12
735.00	9.921	25.559	11.1	1.26*10E11

SYSTEM
RHYOLITE GLASS
P(H2O)=10.3 BARS
MEASUREMENT METHOD
COMPO.-CURVE CALCULATION
N (POISES)
T (DEGREES C)

AUTHOR
FRIEDMAN, LONG AND SMITH (1963)

DERIVED FROM
TABLE 2
P = 36.4 BARS
Z = 10000.0/T(K) (1/K)

R-9

T	Z	LN(N)	LOG(N)	N
535.00	12.376	31.085	13.5	3.16*10E13
635.00	11.013	27.401	11.9	7.94*10E11
735.00	9.921	24.407	10.6	3.98*10E10

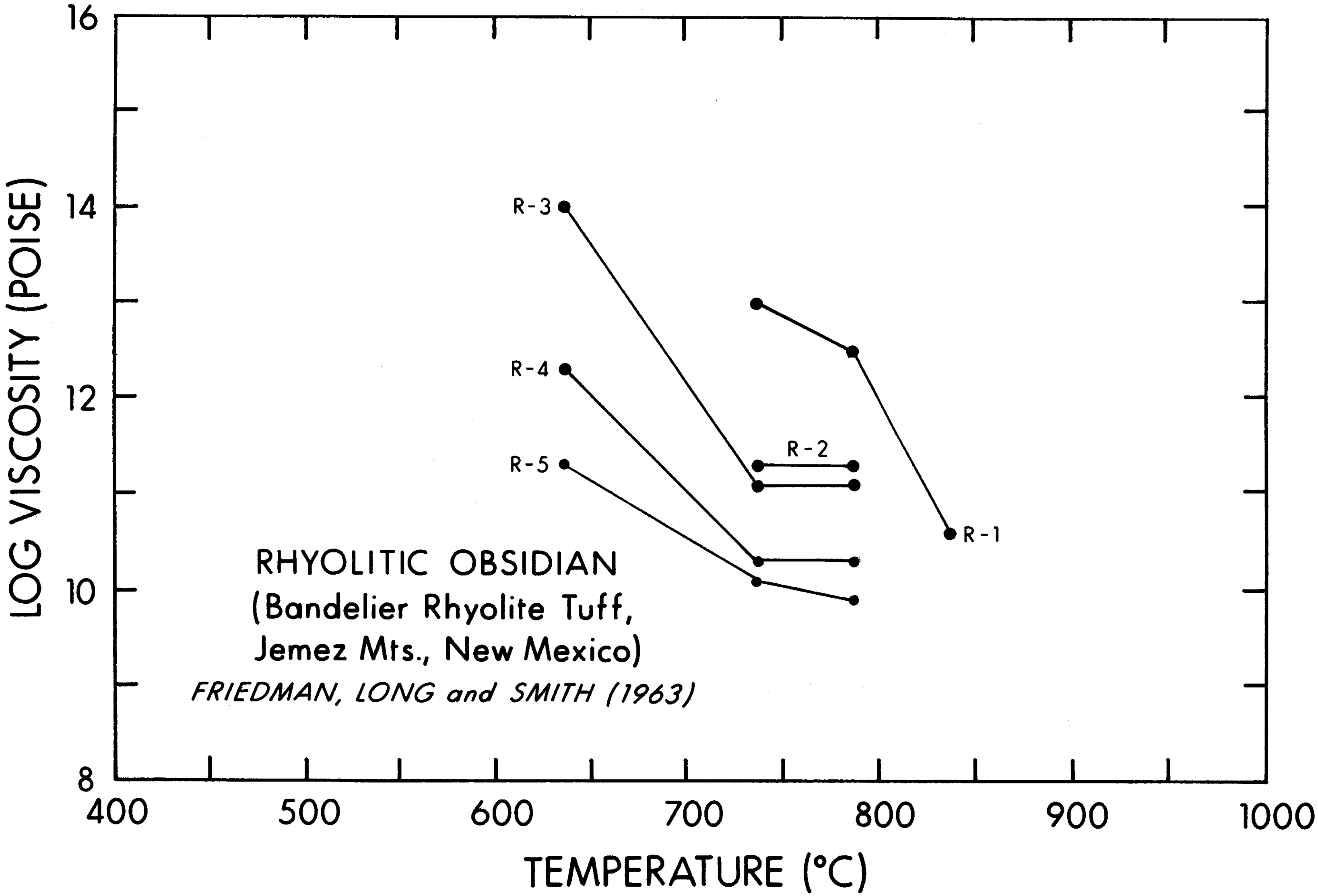
SYSTEM
RHYOLITE GLASS
P(H2O)=20.7 BARS
MEASUREMENT METHOD
COMPO.-CURVE CALCULATION
N (POISES)
T (DEGREES C)

AUTHOR
FRIEDMAN, LONG AND SMITH (1963)

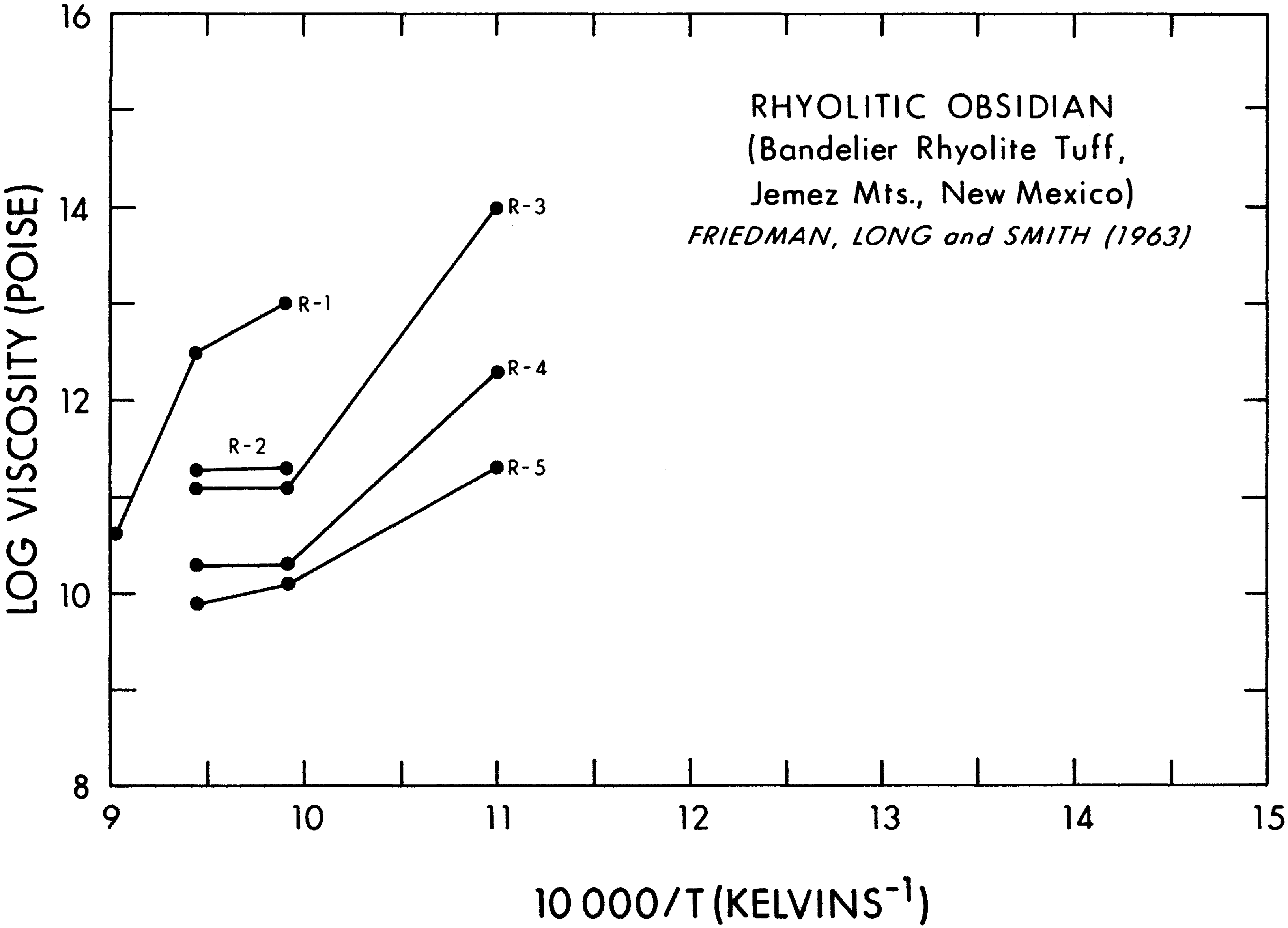
DERIVED FROM
TABLE 2
P = 36.4 BARS
Z = 10000.0/T(K) (1/K)

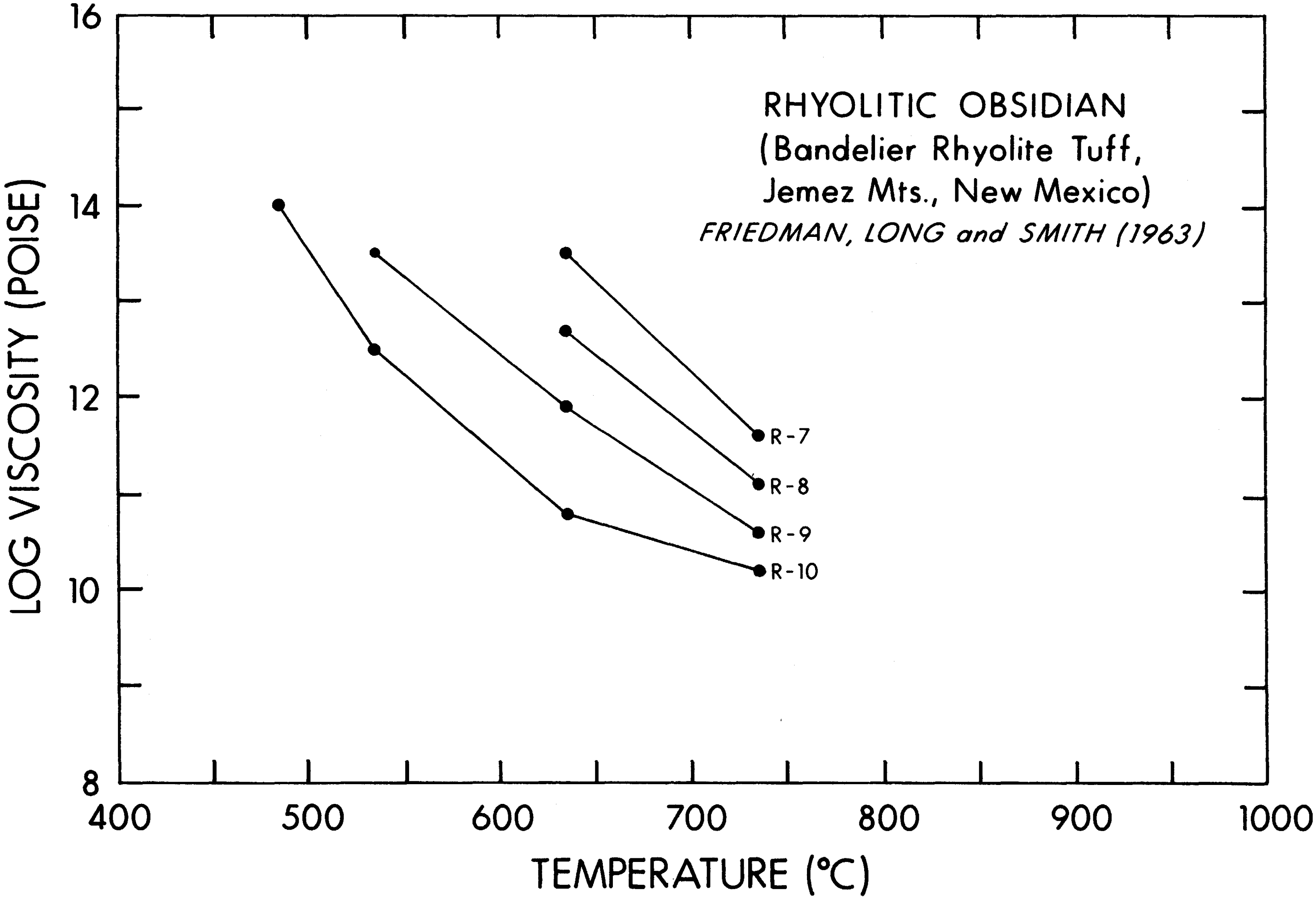
R-10

T	Z	LN(N)	LOG(N)	N
485.00	13.193	32.236	14.0	1.0*10E14
535.00	12.376	28.782	12.5	3.16*10E12
635.00	11.013	24.868	10.8	6.31*10E10
735.00	9.921	23.486	10.2	1.58*10E10

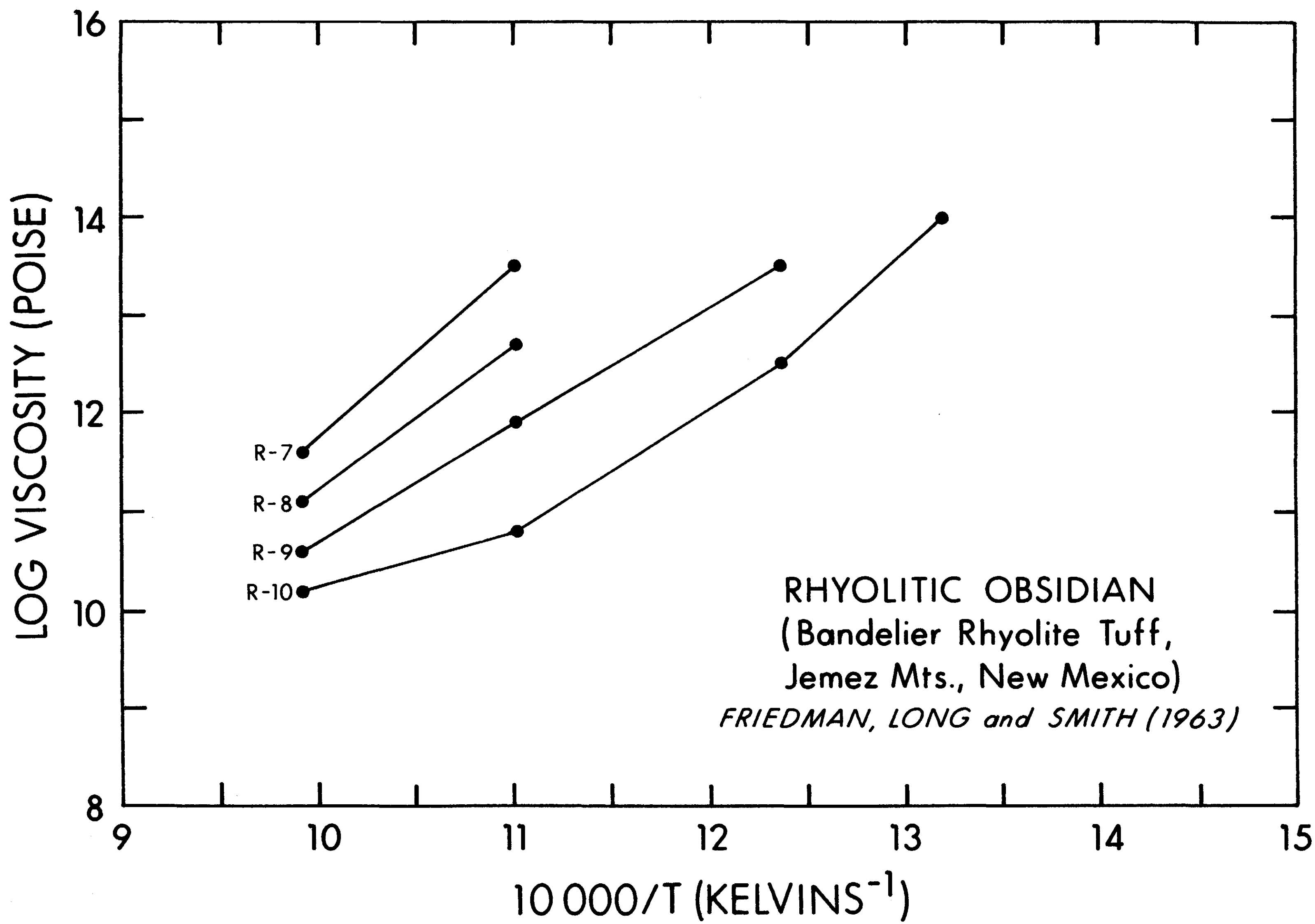


16
14
12
10
8
400
500
600
700
800
900
1000
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
R-3
R-4
R-5
R-2
R-1
RHYOLITIC OBSIDIAN
(Bandelier Rhyolite Tuff,
Jemez Mts., New Mexico)
FRIEDMAN, LONG and SMITH (1963)


RHYOLITIC OBSIDIAN
(Bandelier Rhyolite Tuff,
Jemez Mts., New Mexico)
FRIEDMAN, LONG and SMITH (1963)
R-1
R-2
R-3
R-4
R-5
LOG VISCOSITY (POISE)
16
14
12
10
8
9
10
11
12
13
14
15
10 000/T (KELVINS⁻¹)



RHYOLITIC OBSIDIAN
(Bandelier Rhyolite Tuff,
Jemez Mts., New Mexico)
FRIEDMAN, LONG and SMITH (1963)
R-7
R-8
R-9
R-10
LOG VISCOSITY (POISE)
16
14
12
10
8
400
500
600
700
800
900
1000
TEMPERATURE (°C)


LOG VISCOSITY (POISE)
16
14
12
10
8
9
10
11
12
13
14
15
10 000/T (KELVINS^{-1})
R-7
R-8
R-9
R-10
RHYOLITIC OBSIDIAN
(Bandelier Rhyolite Tuff,
Jemez Mts., New Mexico)
FRIEDMAN, LONG and SMITH (1963)

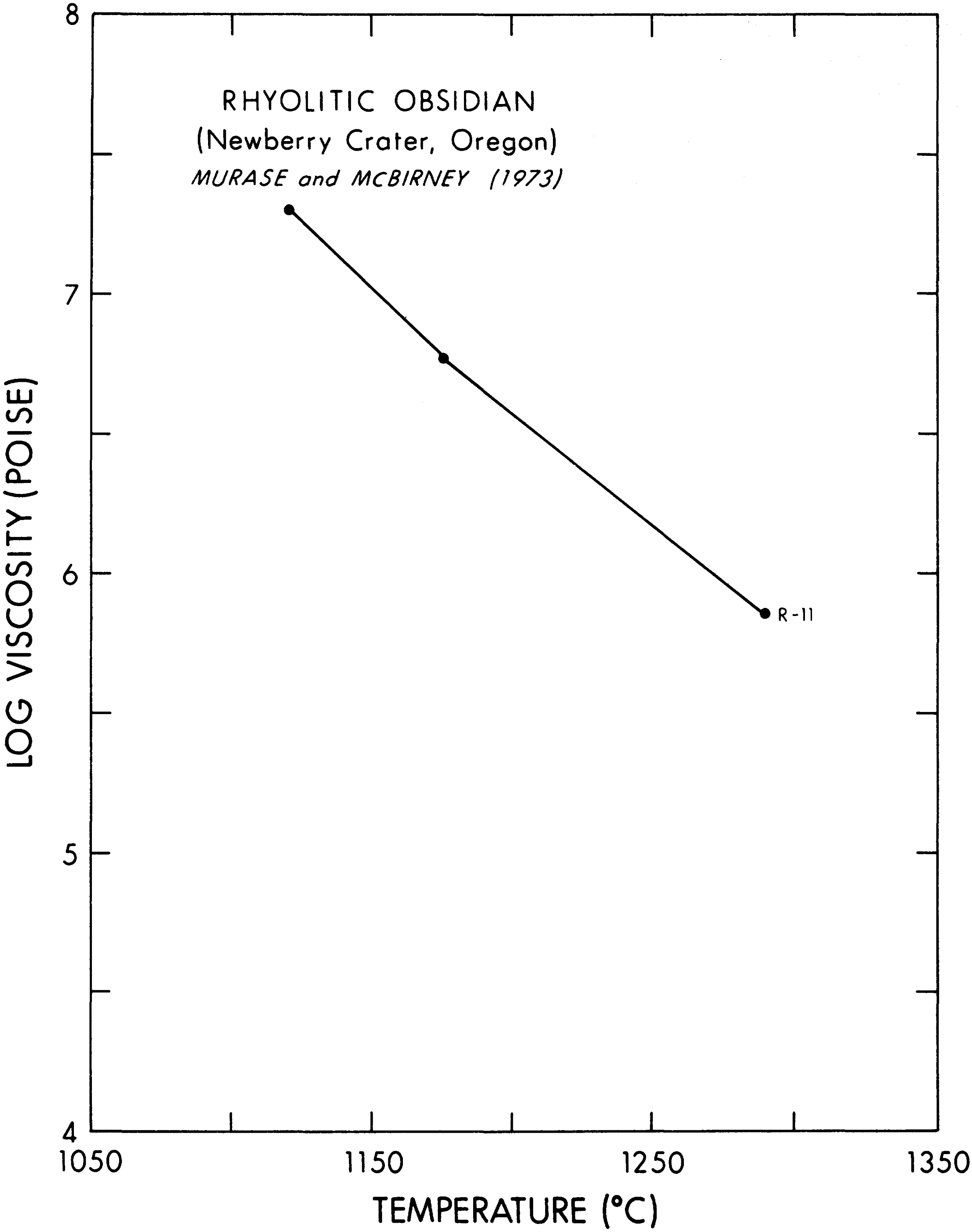
SYSTEM
NEWBERRY RHYOLITE OBSIDIAN
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

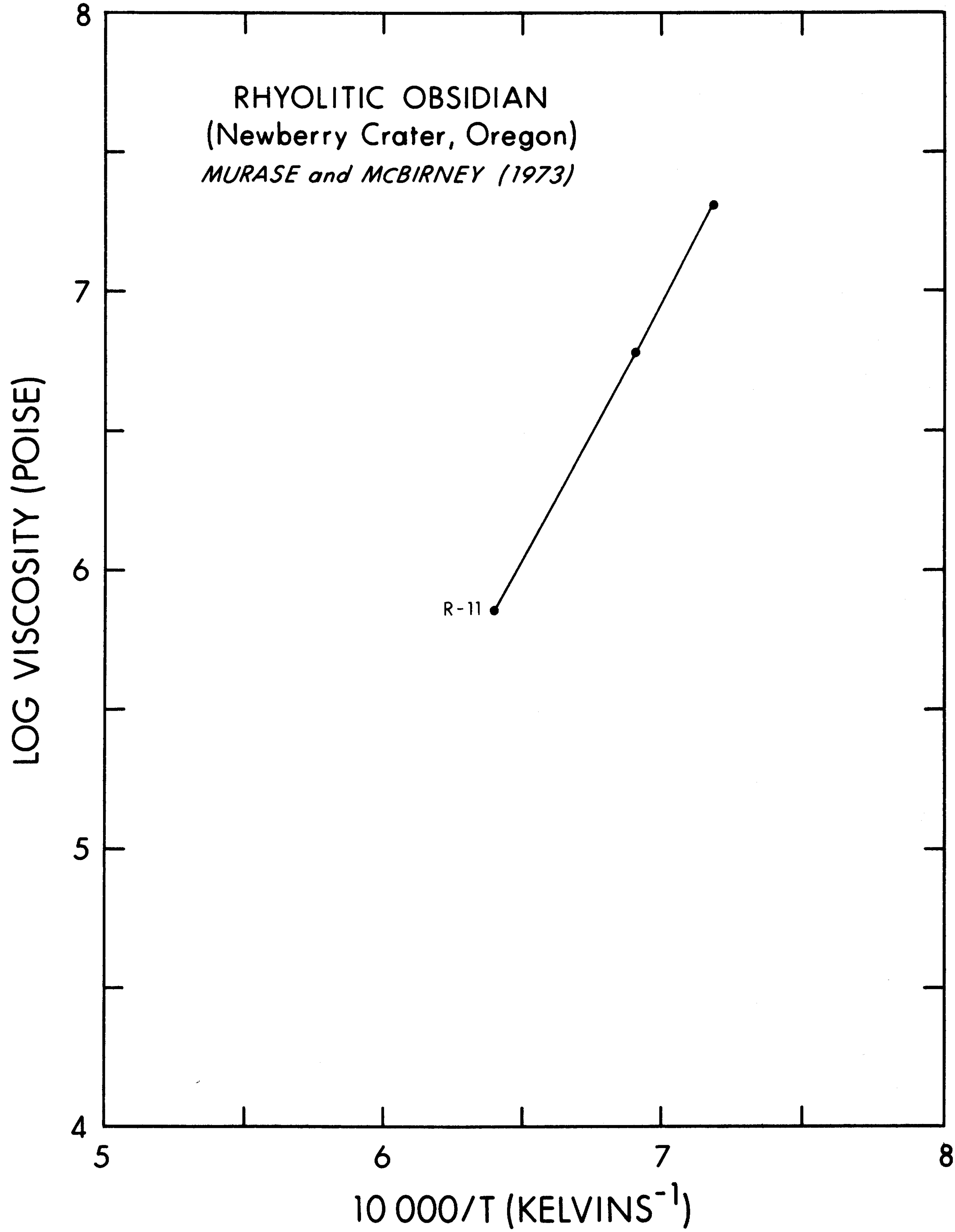
AUTHOR
MURASE AND MCBIRNEY (1973)
DERIVED FROM
GRAPH (D)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

R-11

T	Z	LN(N)	LOG(N)	N
1120.00	7.719	16.81	7.3	1.99E7
1175.00	6.906	15.59	6.77	5.88E6
1290.00	6.398	13.42	5.85	6.76E5


RHYOLITIC OBSIDIAN
(Newberry Crater, Oregon)
MURASE and MCBIRNEY (1973)
R-11
8
7
6
5
4
1050
1150
1250
1350
LOG VISCOSITY (POISE)
TEMPERATURE (°C)


RHYOLITIC OBSIDIAN
(Newberry Crater, Oregon)
MURASE and MCBIRNEY (1973)
R-11
LOG VISCOSITY (POISE)
10 000/T (KELVINS⁻¹)
8
7
6
5
4
5
6
7
8

SYSTEM
RHYOLITIC OBSIDIAN
(JEMEZ MNTS., NEW MEXICO)
MEASUREMENT METHOD
FALLING SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
SHAW (1963)

DERIVED FROM
TABLE 2
P = 2000 BARS
Z = 10000.0/T(K) (1/K)
X(H2O) = 0.043

R-12

T	Z	LN(N)	LOG(N)	N
800.	9.320	14.852	6.45	2.82*10E6
850.	8.905	14.207	6.17	1.48*10E6

SYSTEM
RHYOLITIC OBSIDIAN
(JEMEZ MTNS., NEW MEXICO)
MEASUREMENT METHOD
FALLING SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
SHAW (1963)

DERIVED FROM
TABLE 2
P = 2000.0 BARS
Z = 10000.0/T(K) (1/K)
X(H20) = 0.062

R-13

T	Z	LN(N)	LOG(N)	N
700.@	10.277	15.012	6.52	3.31*10E6
750.@	9.775	13.929	6.05	1.12*10E6
800.@	9.320	12.824	5.57	3.71*10E5
800.*	9.320	12.965	5.63	4.27*10E5
850.@	8.905	12.090	5.25	1.78*10E5

@ MEASUREMENT MADE WITH PLATINUM SPHERE
* MEASUREMENT MADE WITH SILVER SPHERE

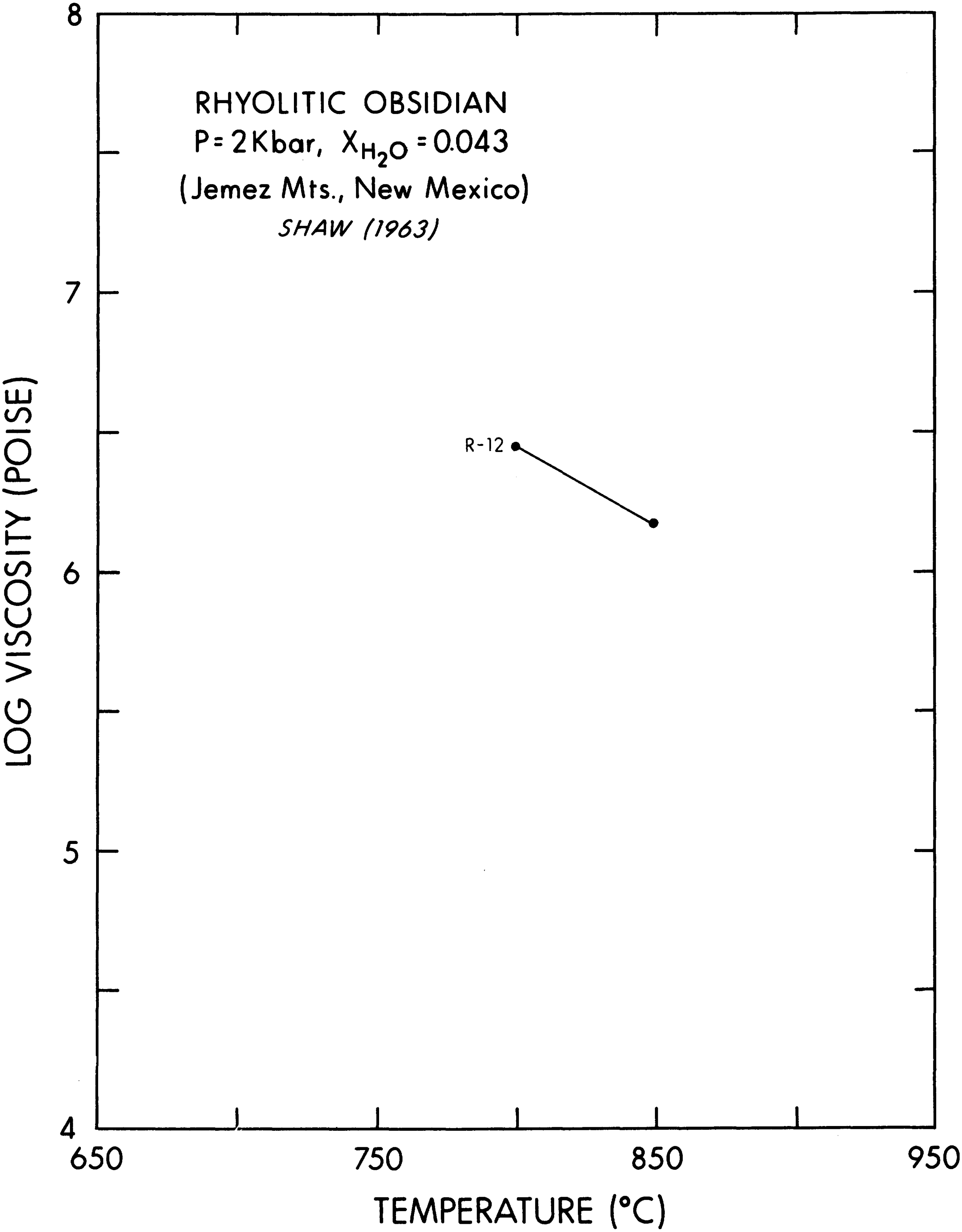
SYSTEM
RHYOLITIC OBSIDIAN
(JEMEZ MTNS., NEW MEXICO)
MEASUREMENT METHOD
FALLING SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
SHAW (1963)

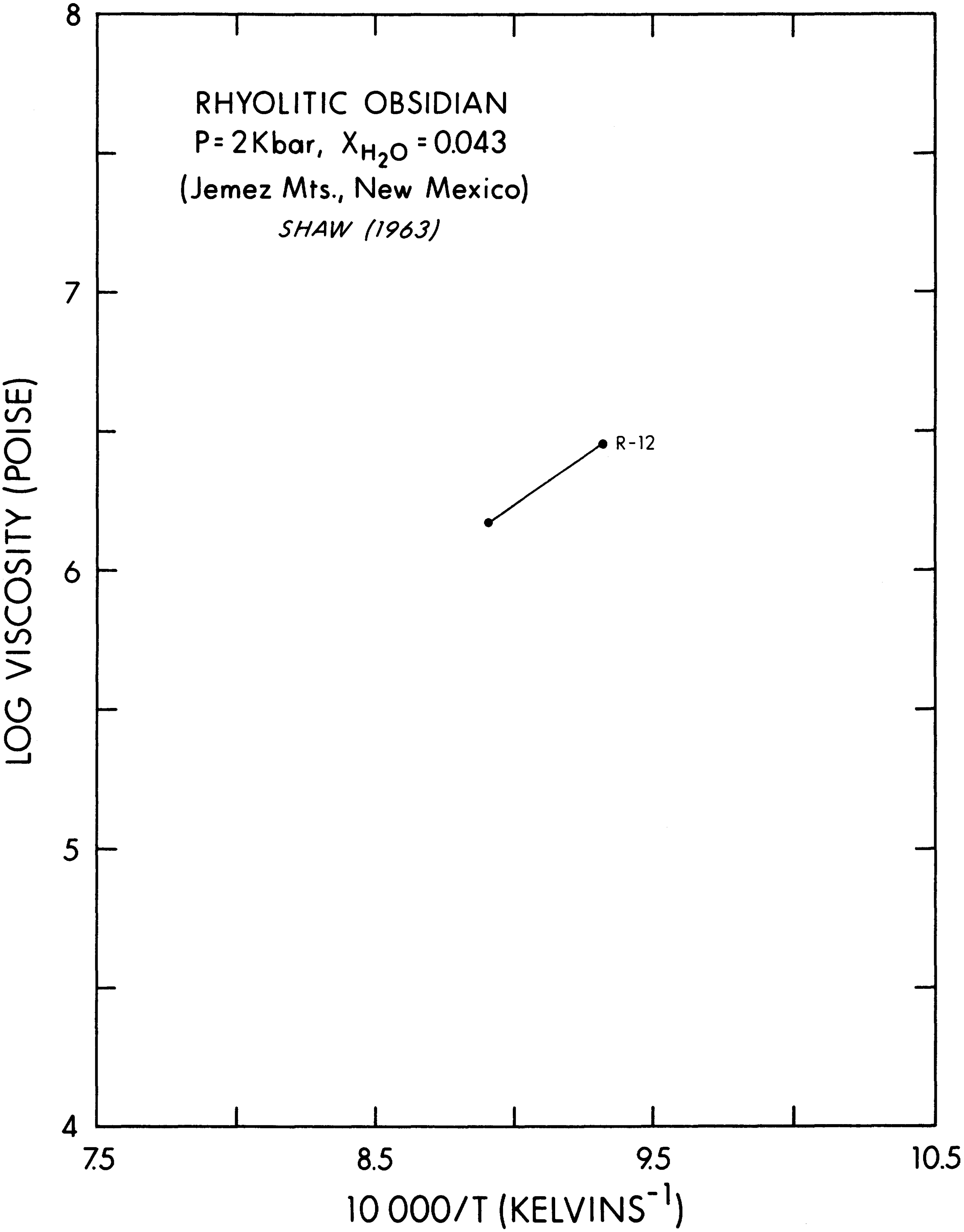
DERIVED FROM
TABLE 2
P = 1000.0 BARS
Z = 10000.0/T(K) (1/K)
X(H20) = 0.043

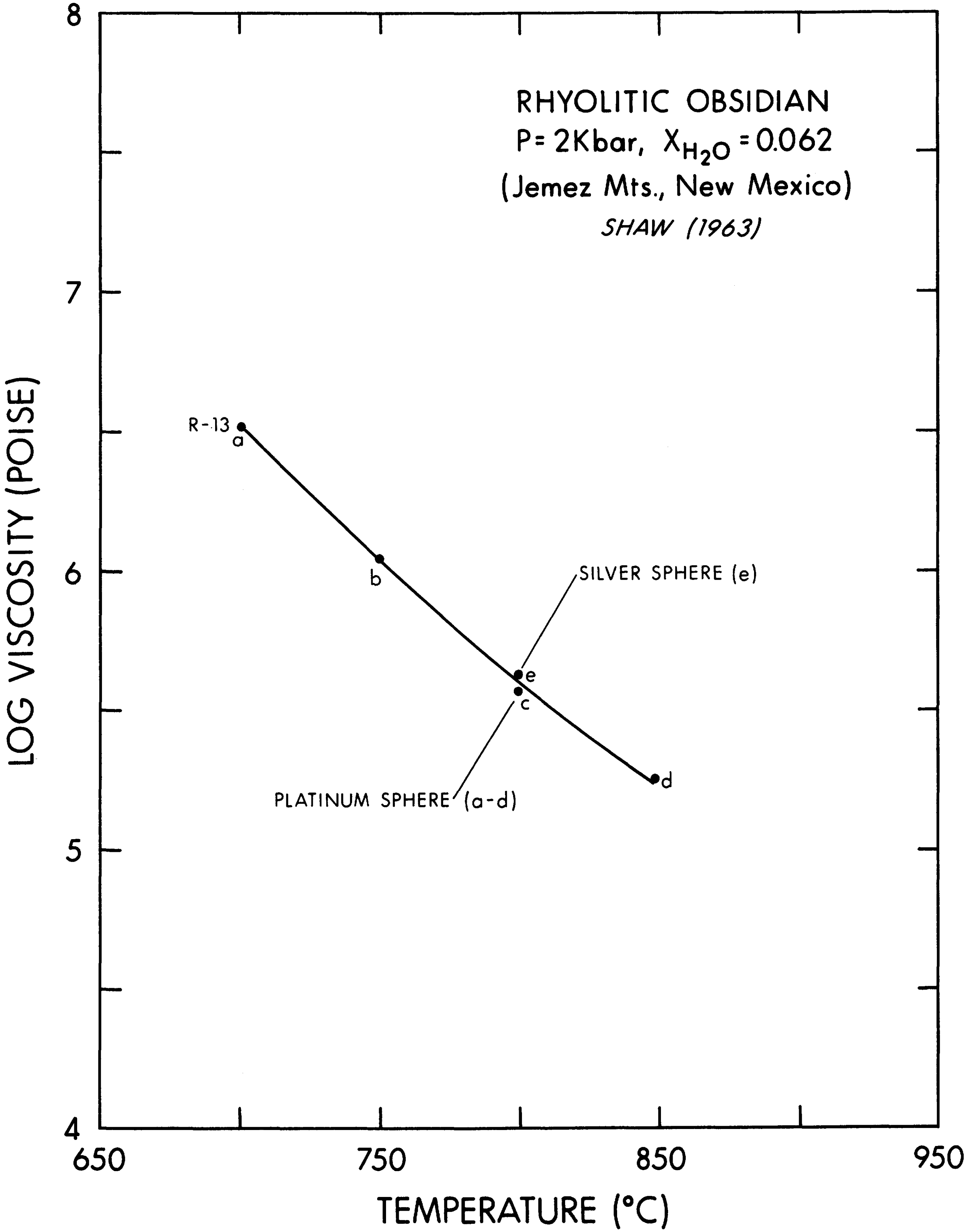
R-14

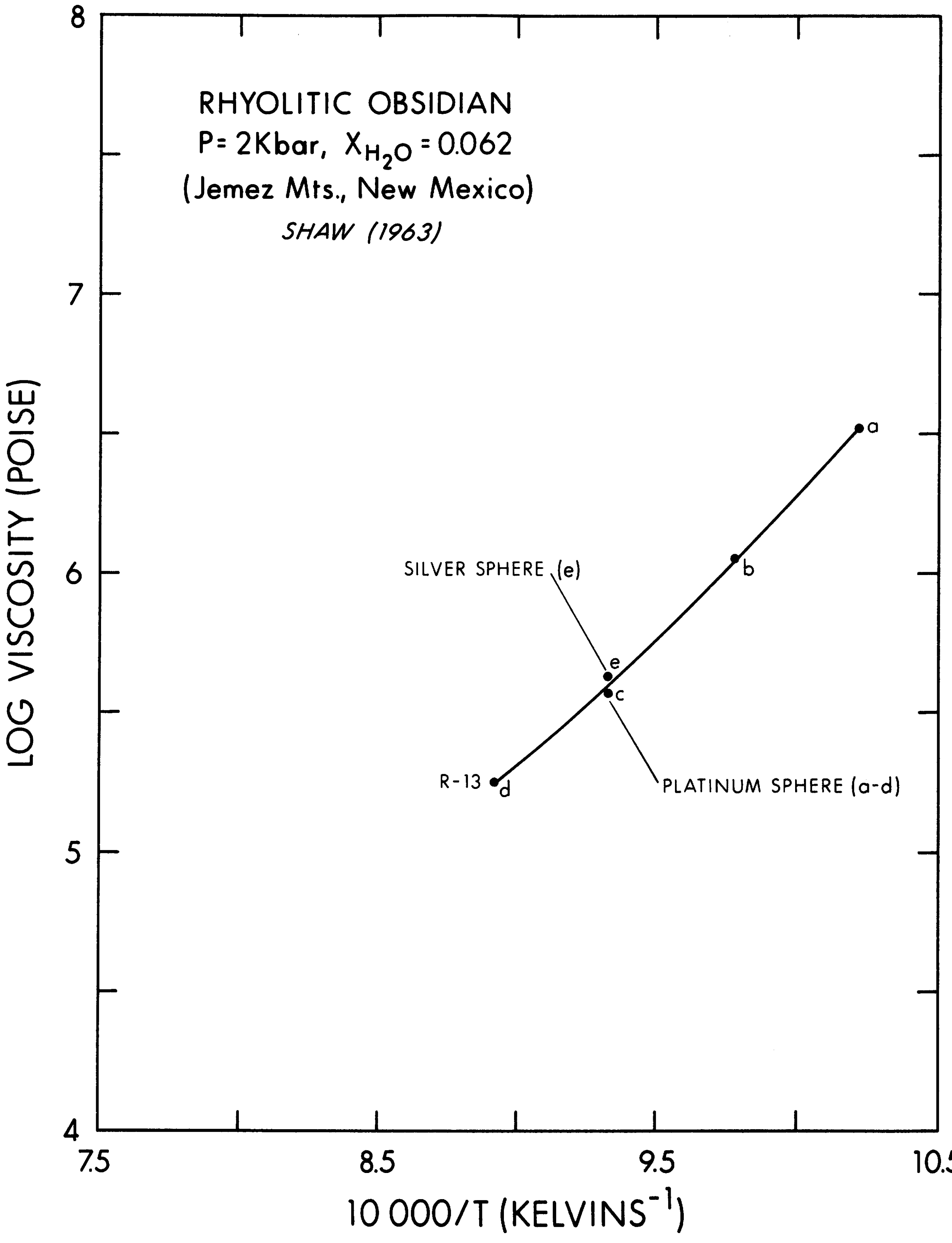
T	Z	LN(N)	LOG(N)	N
800.	9.320	14.966	6.51	3.16*10E6
850.	8.905	14.414	6.26	1.82*10E6
900.	8.525	13.540	5.88	7.59*10E5

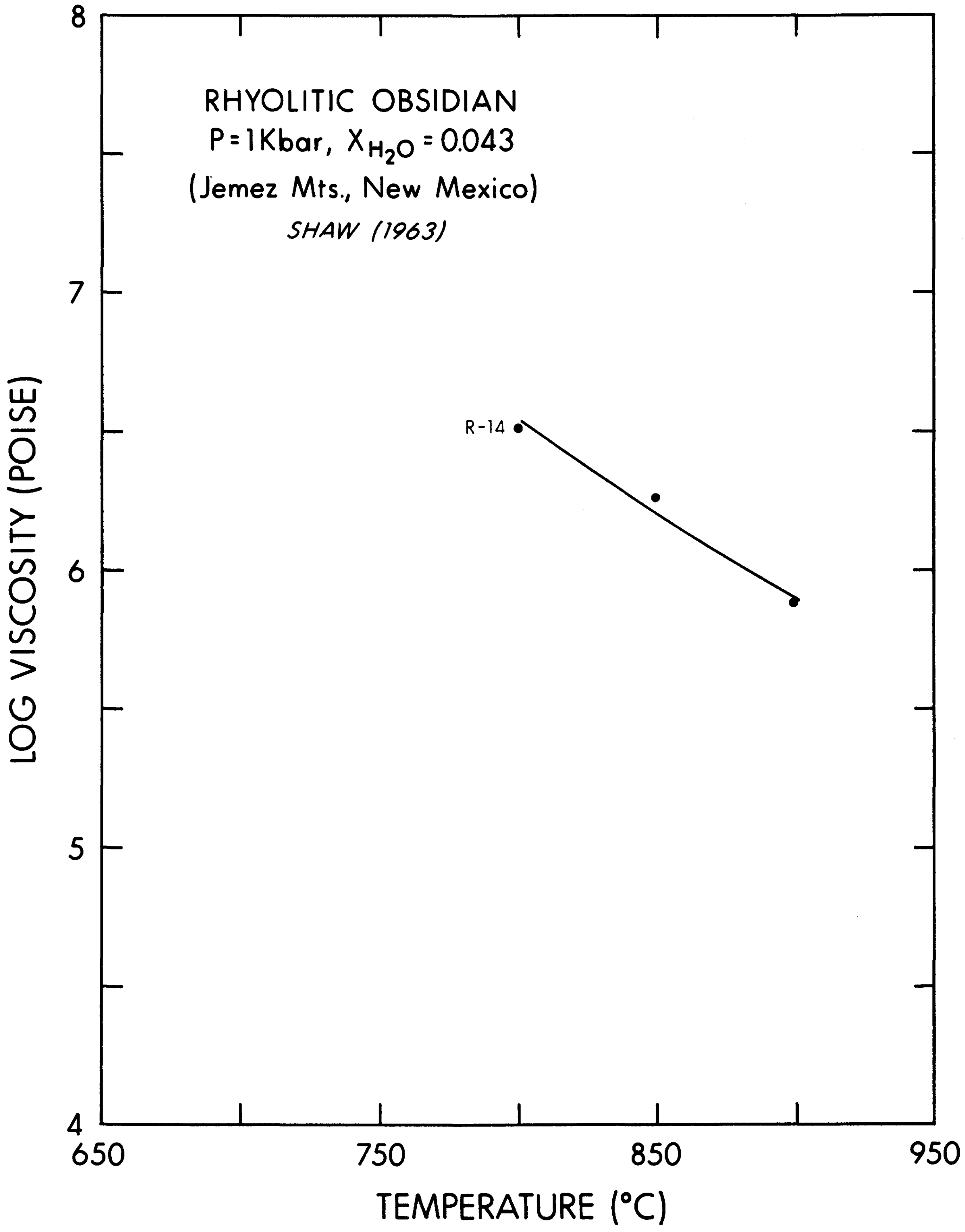


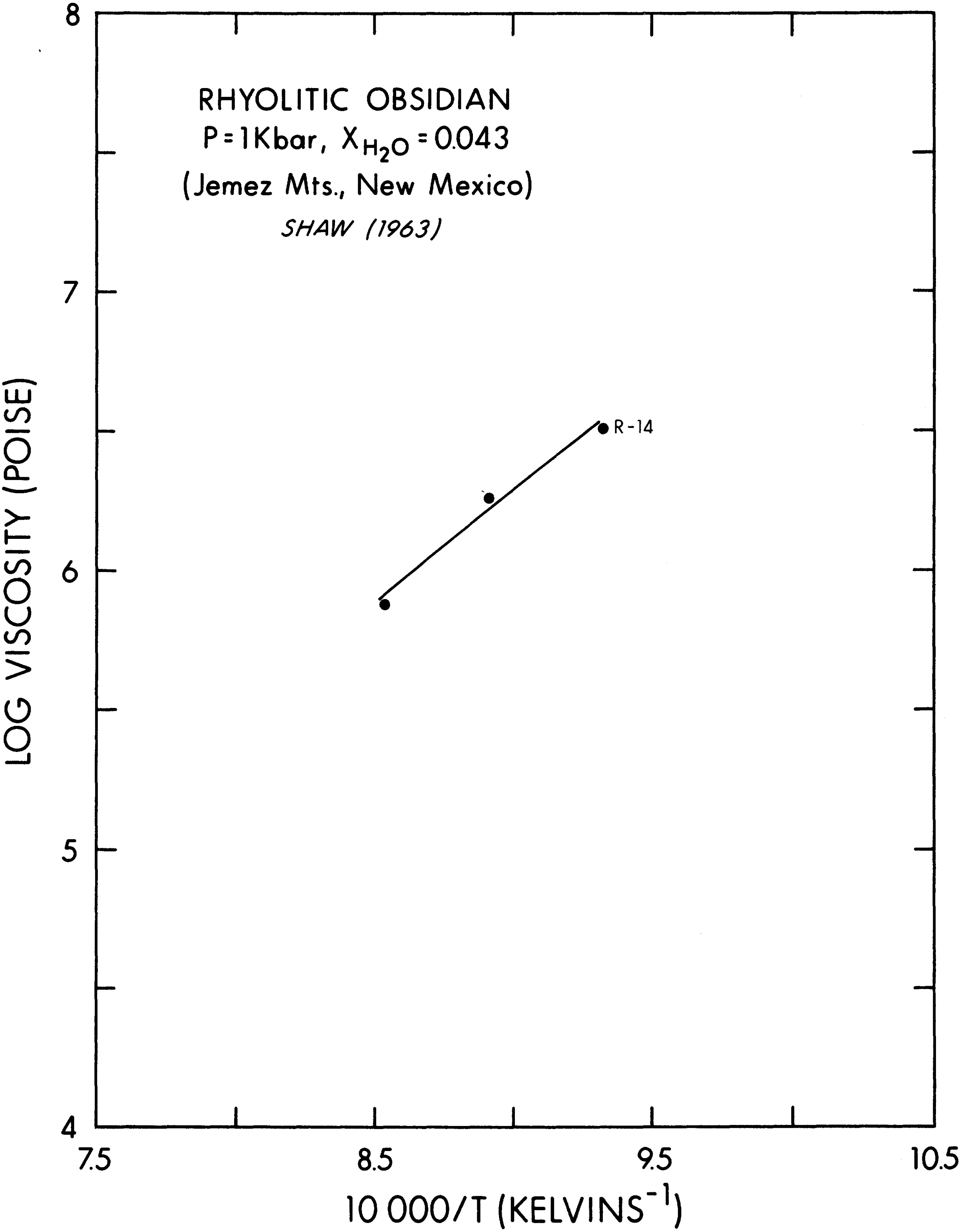
RHYOLITIC OBSIDIAN
P=2Kbar, X_{H_2O} = 0.043
(Jemez Mts., New Mexico)
SHAW (1963)
R-12
8
7
6
5
4
LOG VISCOSITY (POISE)
650
750
850
950
TEMPERATURE (°C)


RHYOLITIC OBSIDIAN
P = 2 Kbar, X_{H_2O} = 0.043
(Jemez Mts., New Mexico)
SHAW (1963)
R-12
LOG VISCOSITY (POISE)
8
7
6
5
4
7.5
8.5
9.5
10.5
10 000/T (KELVINS^{-1})


RHYOLITIC OBSIDIAN
P= 2Kbar, X_{H_2O} = 0.062
(Jemez Mts., New Mexico)
SHAW (1963)
R-13
a
b
c
d
e
SILVER SPHERE (e)
PLATINUM SPHERE (a-d)
LOG VISCOSITY (POISE)
8
7
6
5
4
650
750
850
950
TEMPERATURE (°C)


RHYOLITIC OBSIDIAN
P= 2Kbar, X_{H_2O} = 0.062
(Jemez Mts., New Mexico)
SHAW (1963)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
8
7
6
5
4
7.5
8.5
9.5
10.5
a
b
c
d
e
SILVER SPHERE (e)
PLATINUM SPHERE (a-d)
R-13


RHYOLITIC OBSIDIAN
P = 1Kbar, X_{H_2O} = 0.043
(Jemez Mts., New Mexico)
SHAW (1963)
R-14
LOG VISCOSITY (POISE)
8
7
6
5
4
650
750
850
950
TEMPERATURE (°C)


RHYOLITIC OBSIDIAN
P = 1Kbar, X_{H_2O} = 0.043
(Jemez Mts., New Mexico)
SHAW (1963)
R-14
LOG VISCOSITY (POISE)
8
7
6
5
4
7.5
8.5
9.5
10.5
10 000/T (KELVINS^{-1})

Additional Igneous Melts

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SYSTEM
NEPHELINE-LEUCITE TEPHRITE
(BRUCH, MICHELS, EIFEL, GERMANY)

AUTHOR
EULER AND WINKLER (1957)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 2

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

IM-1

T	Z	LN(N)	LOG(N)	N
1101.	7.278	7.650	3.322	2100.
1144.	7.057	7.170	3.114	1300.
1188.	6.845	6.551	2.845	700.
1224.	6.680	6.215	2.699	500.
1261.	6.519	5.913	2.568	370.
1300.	6.357	5.501	2.394	245.
1340.	6.200	5.043	2.190	155.
1378.	6.057	4.635	2.013	103.
1416.	5.921	4.190	1.829	66.
1462.	5.764	3.538	1.556	36.

--

SYSTEM
KERSANTIT
(SCHWARTZWALD, GERMANY)

AUTHOR
EULER AND WINKLER (1957)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

DERIVED FROM
TABLE 8

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

IM-2

T	Z	LN(N)	LOG(N)	N
1186.	6.854	8.071	3.505	3200.
1225.	6.675	7.601	3.301	2000.
1264.	6.506	7.244	3.146	1400.
1302.	6.349	6.802	2.954	900.
1341.	6.196	6.273	2.724	530.
1378.	6.057	6.087	2.643	440.
1420.	5.907	5.704	2.447	300.
1462.	5.764	5.136	2.230	170.

--

SYSTEM
OLIVINE DOLERITE

AUTHOR
EULER AND WINKLER (1957)

MEASUREMENT METHOD
ROTATIONAL VISCOMETER

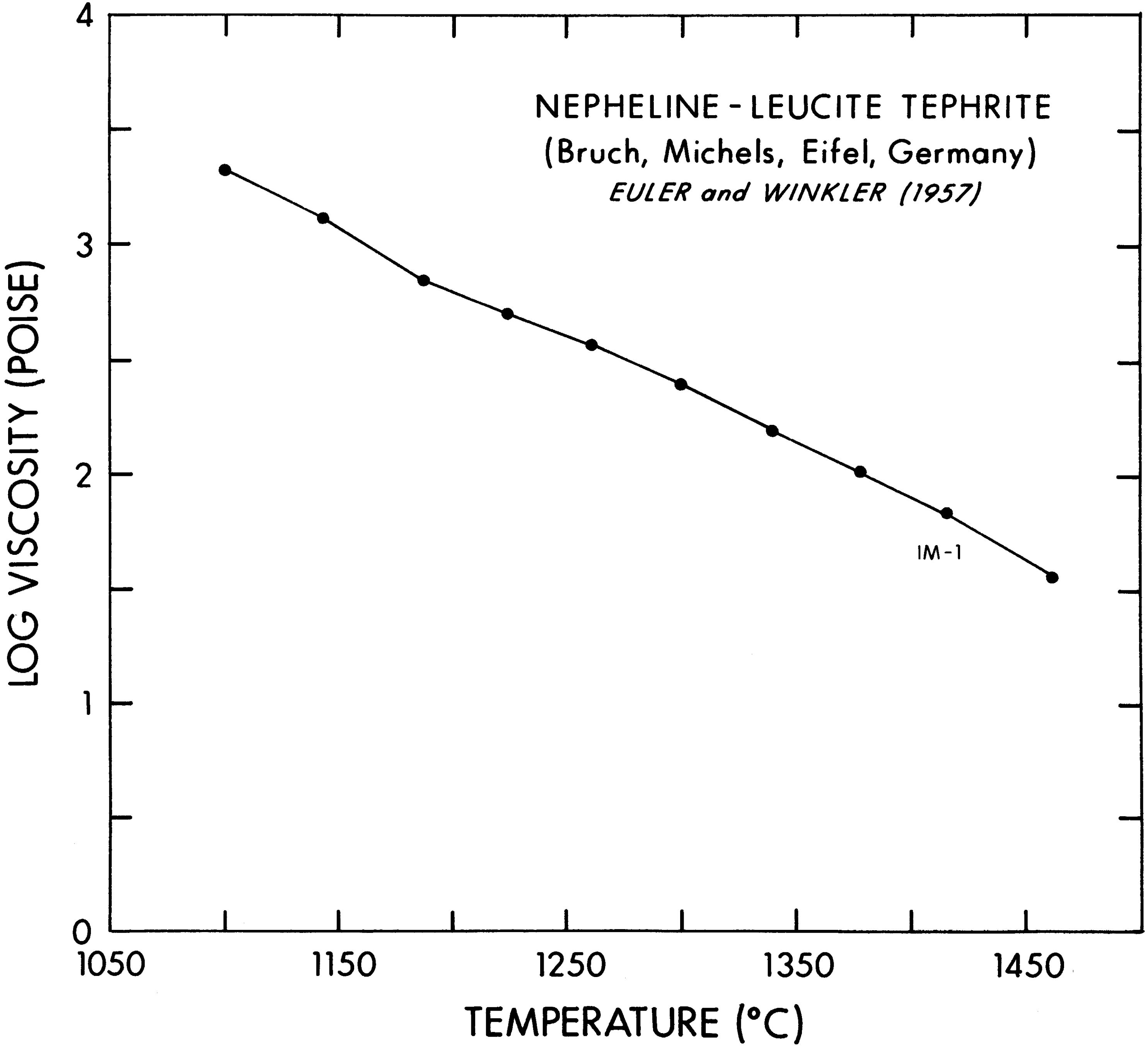
DERIVED FROM
TABLE 2

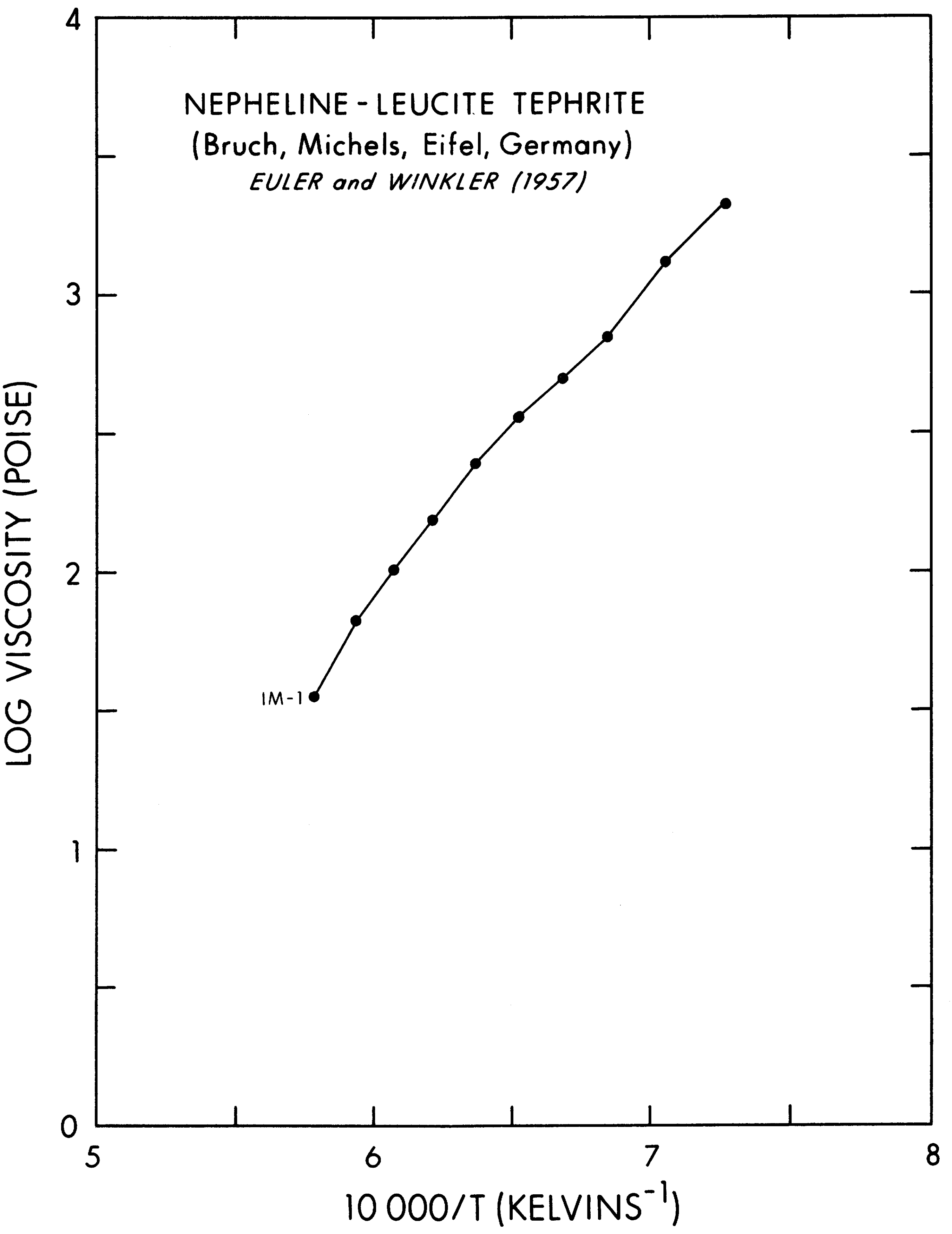
N (POISES)
T (DEGREES C)

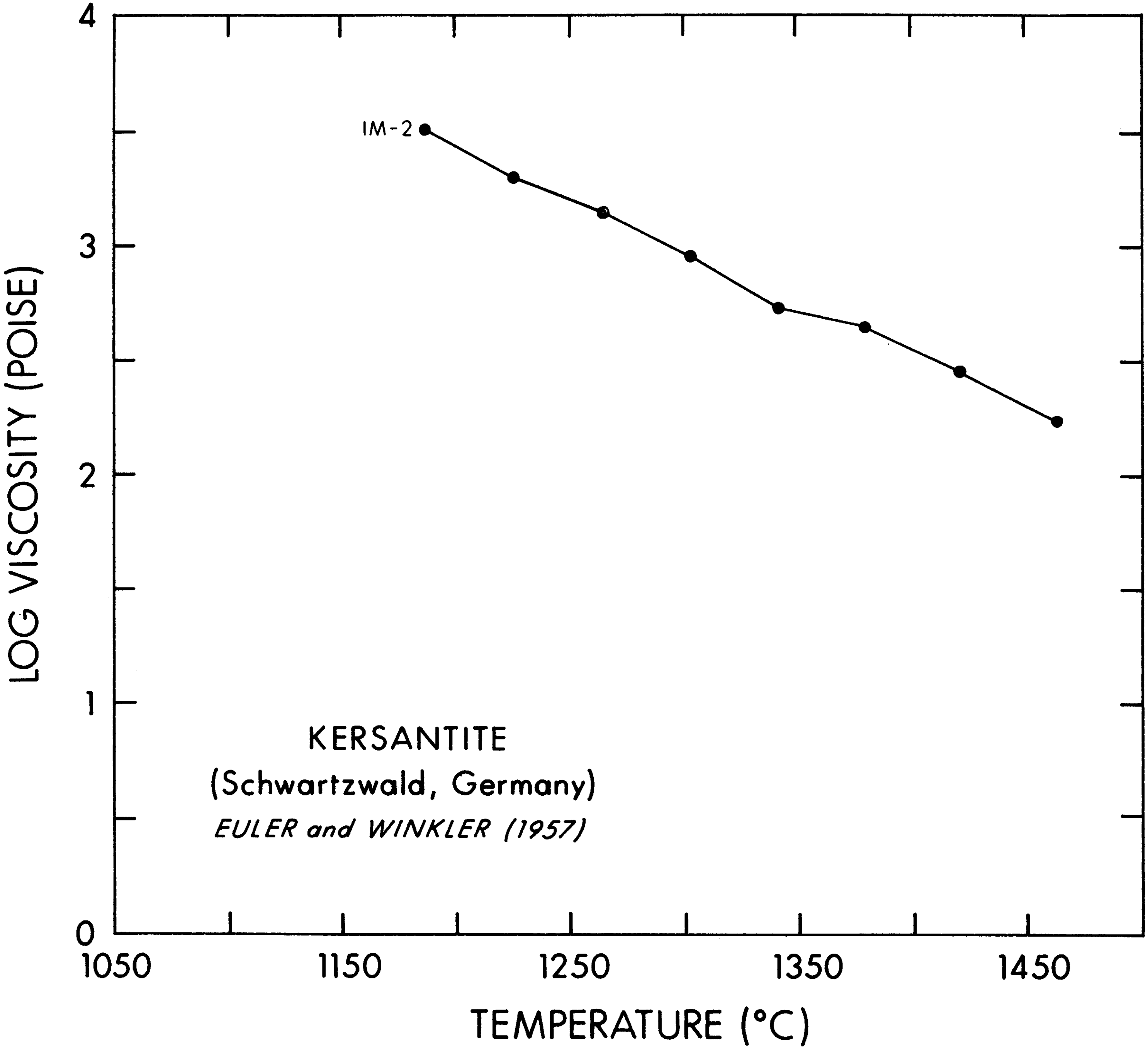
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

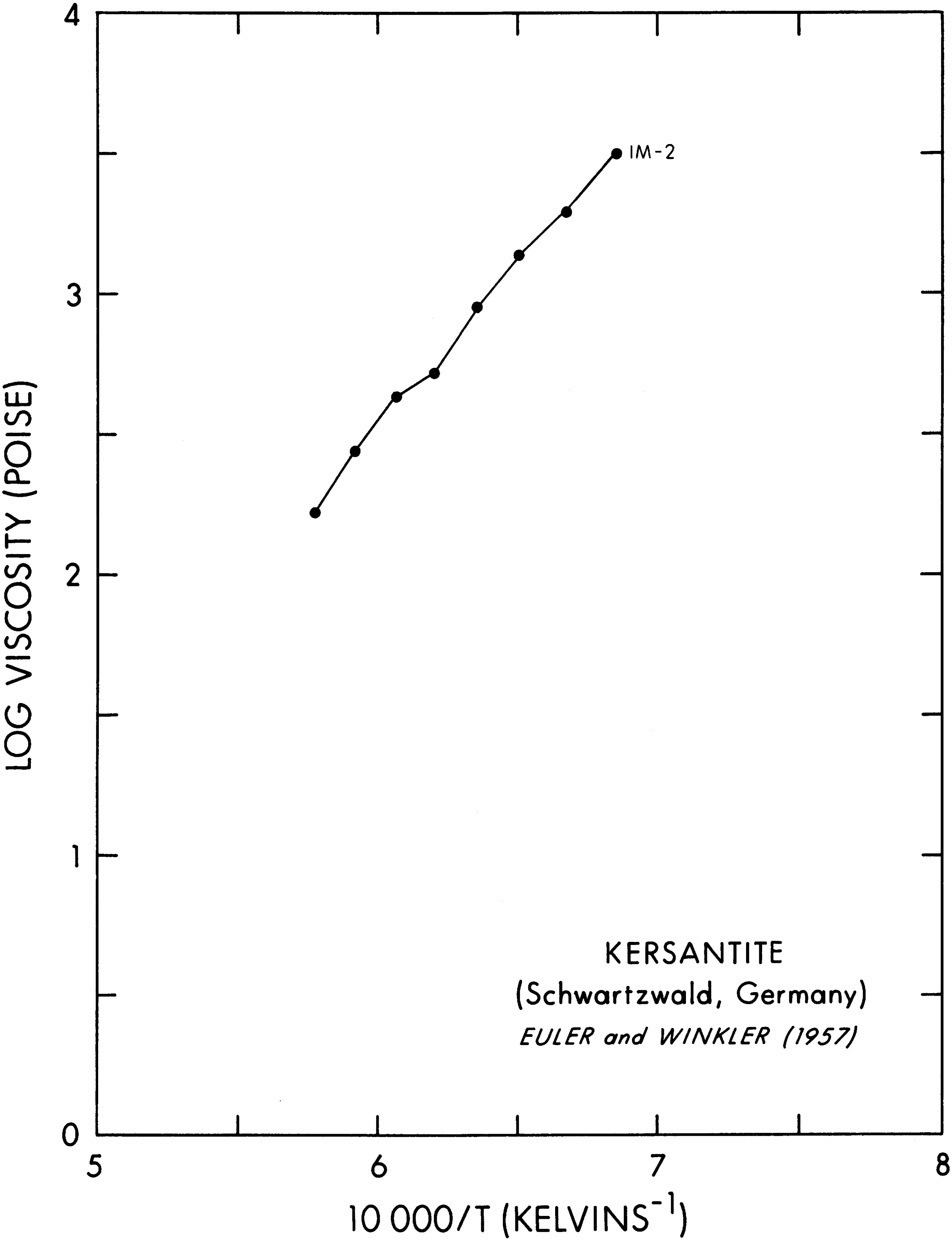
IM-3

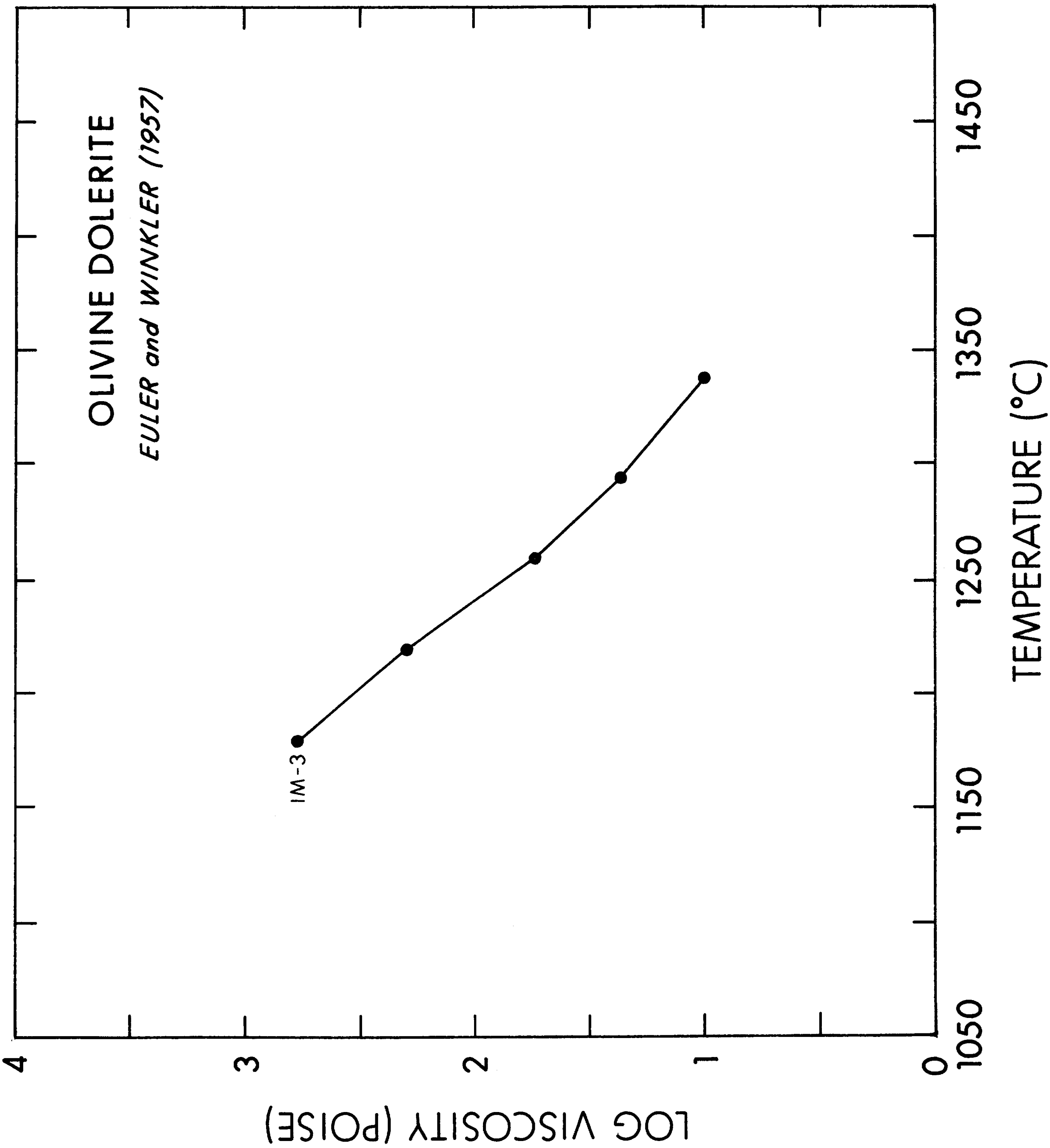
T	Z	LN(N)	LOG(N)	N
1180.	6.882	6.380	2.771	590.
1220.	6.698	5.298	2.301	200.
1260.	6.523	4.007	1.740	55.
1295.	6.378	3.135	1.362	23.
1338.	6.207	2.303	1.000	10.

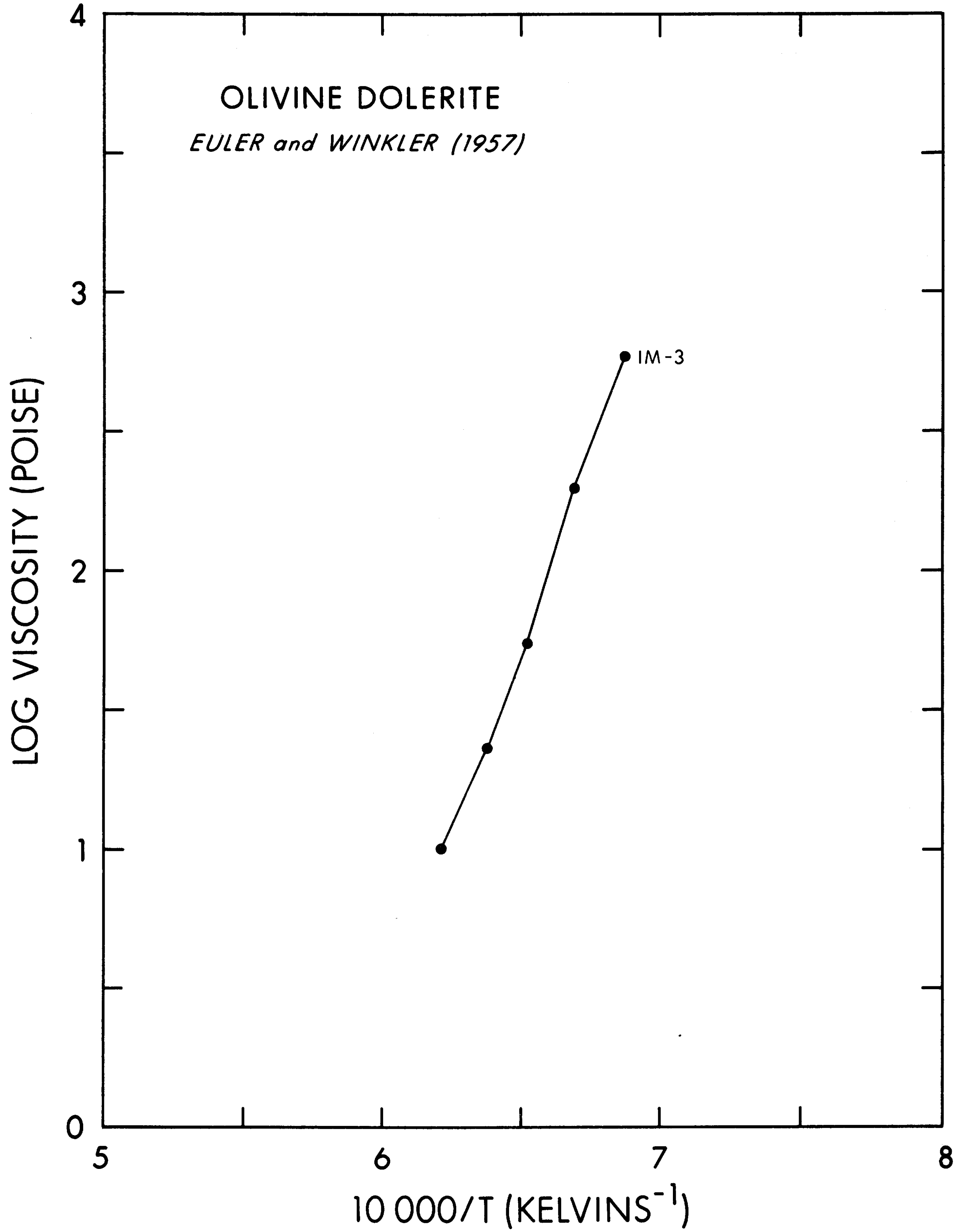

NEPHELINE - LEUCITE TEPHRITE
(Bruch, Michels, Eifel, Germany)
EULER and WINKLER (1957)
IM-1
LOG VISCOSITY (POISE)
0
1
2
3
4
1050
1150
1250
1350
1450
TEMPERATURE (°C)


NEPHELINE - LEUCITE TEPHRITE
(Bruch, Michels, Eifel, Germany)
EULER and WINKLER (1957)
IM-1
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
5
6
7
8


LOG VISCOSITY (POISE)
TEMPERATURE (°C)
4
3
2
1
0
1050
1150
1250
1350
1450
IM-2
KERSANTITE
(Schwartzwald, Germany)
EULER and WINKLER (1957)


IM-2
KERSANTITE
(Schwartzwald, Germany)
EULER and WINKLER (1957)
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
5
6
7
8


OLIVINE DOLERITE
EULER and WINKLER (1957)
IM-3
LOG VISCOSITY (POISE)
0
1
2
3
4
TEMPERATURE (°C)
1050
1150
1250
1350
1450

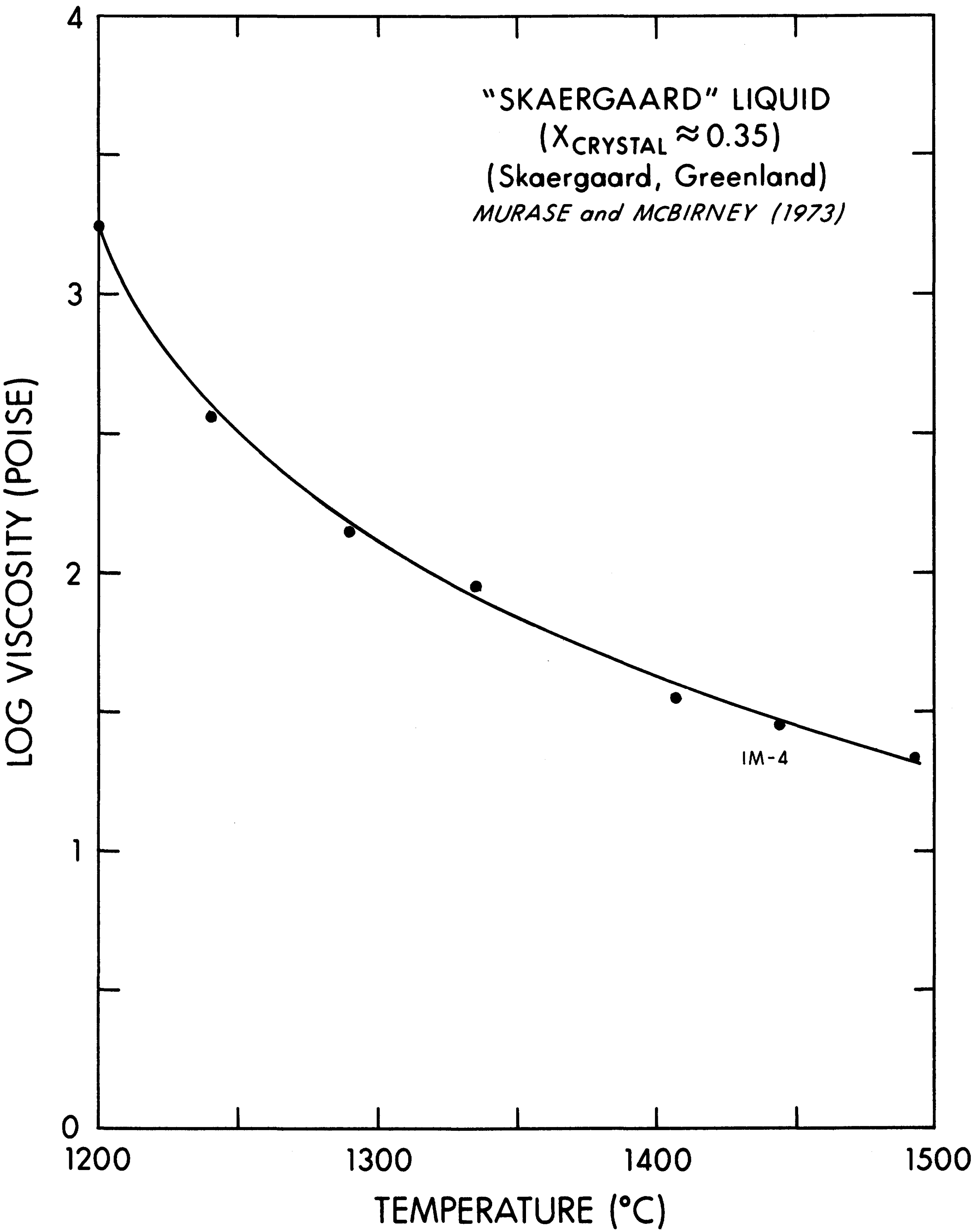

OLIVINE DOLERITE
EULER and WINKLER (1957)
IM-3
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
1
2
3
4
5
6
7
8

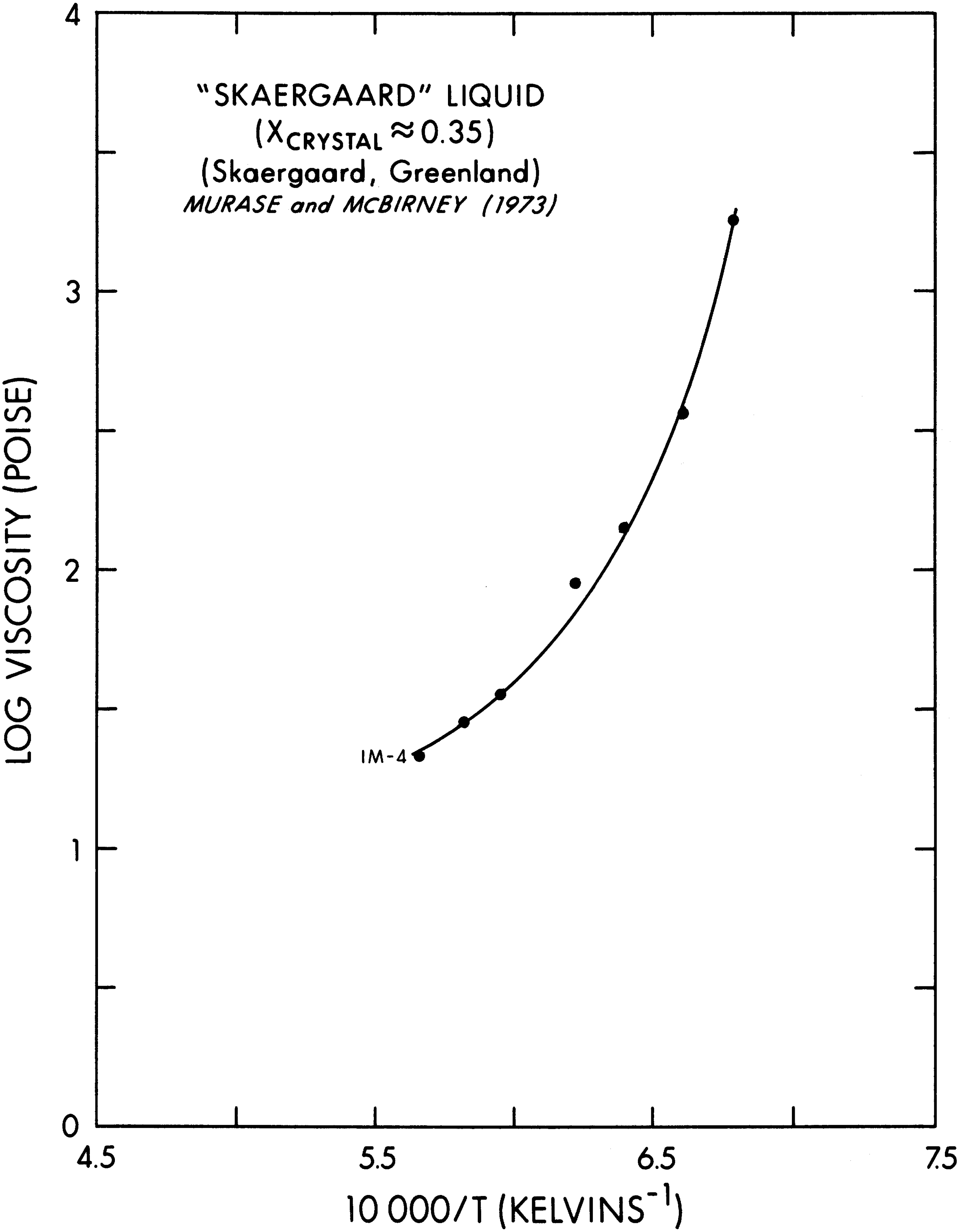
SYSTEM
SKAERGAARD INTRUSION
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
MURASE AND MCBIRNEY (1973)
DERIVED FROM
GRAPH (D)
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

IM-4

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	7.483	3.25	1778.
1240.00	6.609	5.895	2.56	363.1
1290.00	6.398	4.951	2.15	141.3
1335.00	6.219	6.793	2.95	89.13
1408.00	5.949	3.569	1.55	35.48
1445.00	5.821	3.339	1.45	28.18
1494.00	5.659	3.062	1.33	21.38


"SKAERGAARD" LIQUID
($X_{CRYSTAL} \approx 0.35$)
(Skaergaard, Greenland)
MURASE and MCBIRNEY (1973)
IM-4
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
1
2
3
4
1200
1300
1400
1500


"SKAERGAARD" LIQUID
($X_{CRYSTAL} \approx 0.35$)
(Skaergaard, Greenland)
MURASE and MCBIRNEY (1973)
IM-4
LOG VISCOSITY (POISE)
0
1
2
3
4
4.5
5.5
6.5
7.5
10 000/T (KELVINS^{-1})

SYSTEM
SYNTHETIC LUNAR SAMPLE
IN AIR (SLS,A)
MEASUREMENT METHOD
COUNTER-BALANCED SPHERE
N (POISES)
T (DEGREES C)

AUTHOR
MURASE AND MCBIRNEY (1970)

DERIVED FROM
FIG. 1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

IM-5

T	Z	LN(N)	LOG(N)	N (APPROX.)
1390.00	6.013	2.303	1.000	10.00
1400.00	5.977	2.303	1.000	10.00
1440.00	5.838	1.727	0.75	5.62
1455.00	5.787	1.612	0.70	5.01
1490.00	5.672	1.497	0.65	4.47

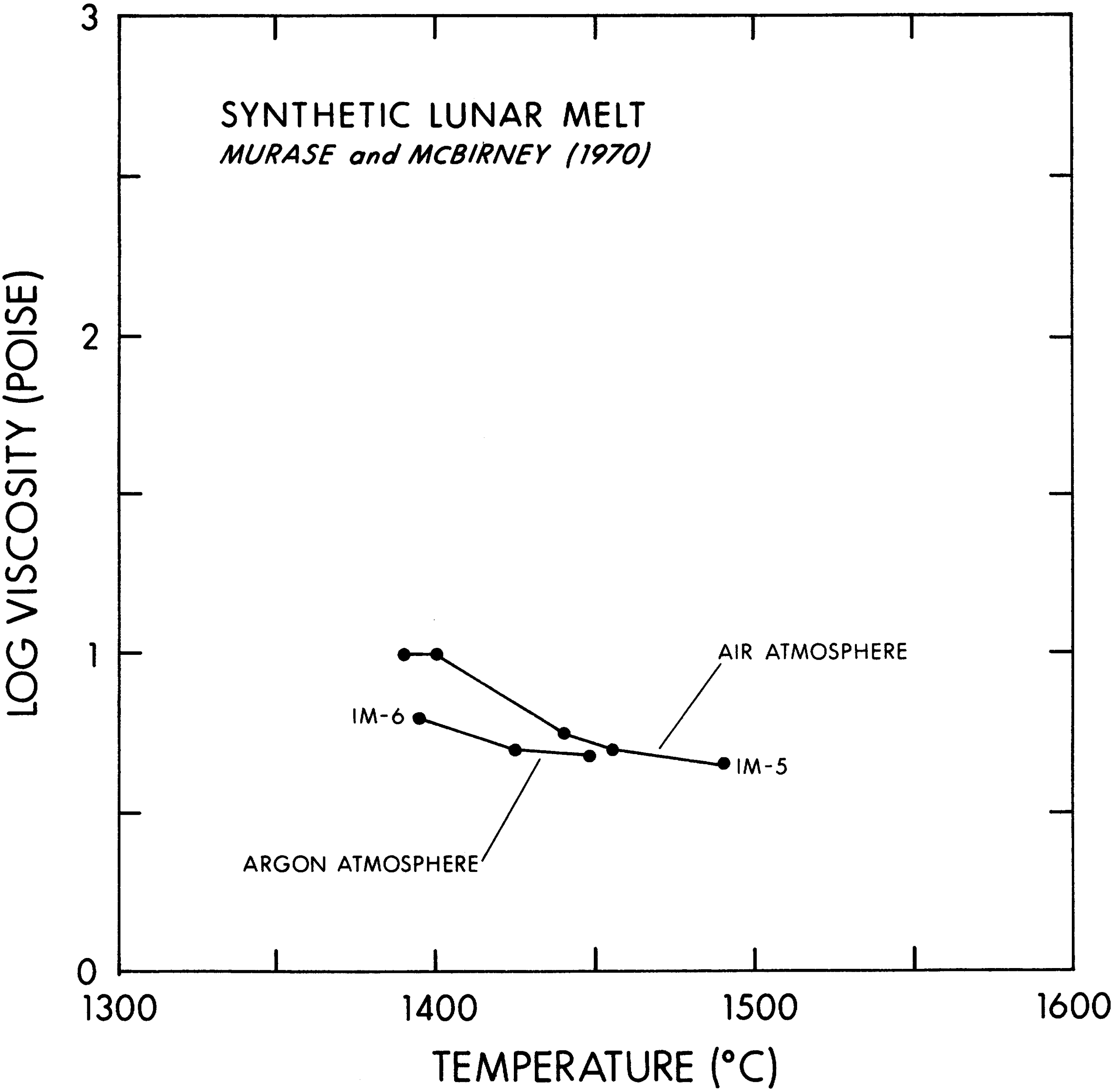
SYSTEM
SYNTHETIC LUNAR SAMPLE
IN ARGON (SLS,B)
MEASUREMENT METHOD
COUNTER-BALANCED SPHERE
N (POISES)
T (DEGREES C)

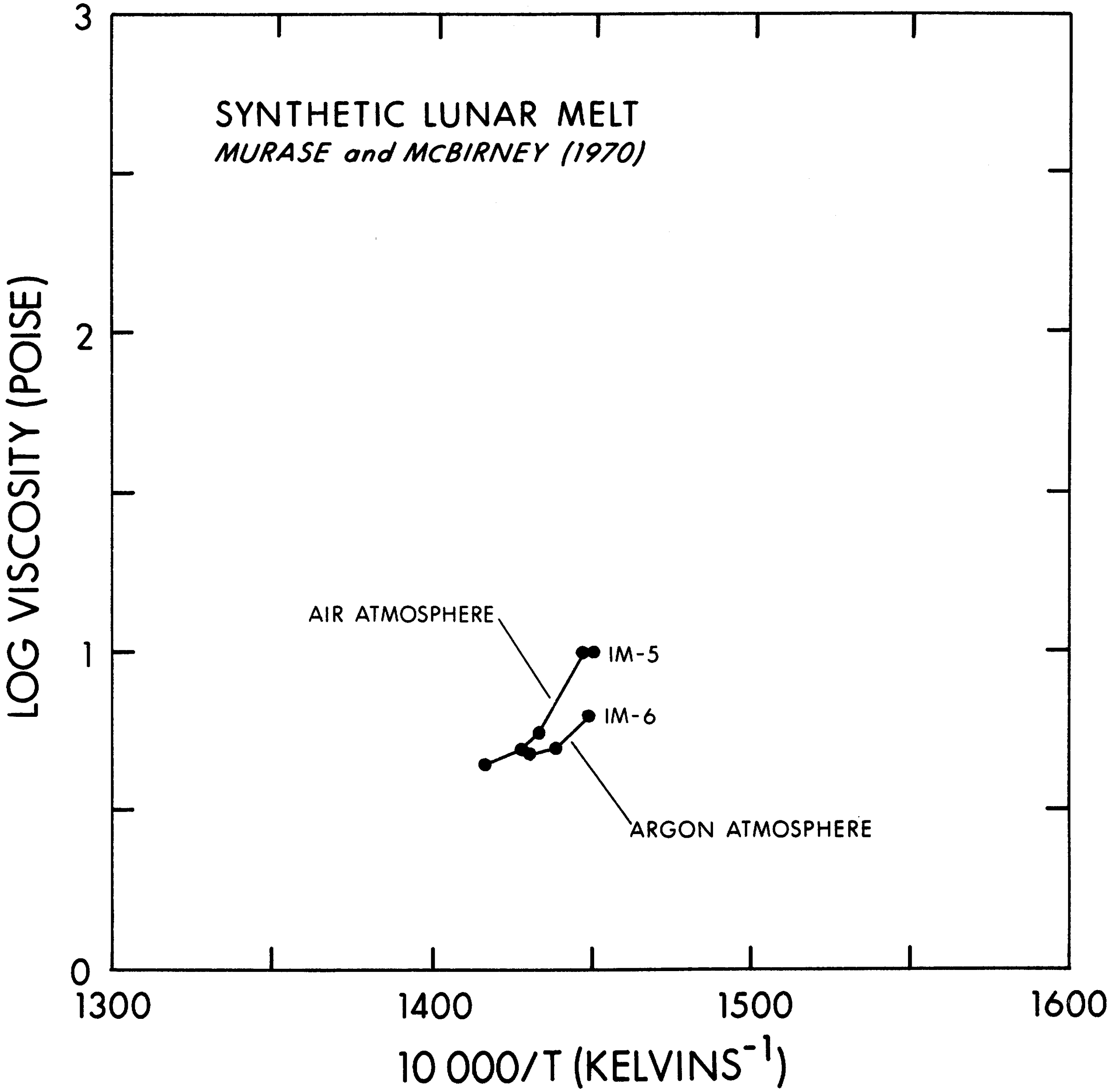
AUTHOR
MURASE AND MCBIRNEY (1970)

DERIVED FROM
FIG. 1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

IM-6

T	Z	LN(N)	LOG(N)	N (APPROX.)
1395.00	5.995	1.842	0.80	6.31
1425.00	5.889	1.612	0.70	5.01
1448.00	5.811	1.566	0.68	4.79


SYNTHETIC LUNAR MELT
MURASE and MCBIRNEY (1970)
LOG VISCOSITY (POISE)
3
2
1
0
AIR ATMOSPHERE
IM-6
IM-5
ARGON ATMOSPHERE
1300
1400
1500
1600
TEMPERATURE (°C)



SYNTHETIC LUNAR MELT
MURASE and MCBIRNEY (1970)
LOG VISCOSITY (POISE)
3
2
1
0
AIR ATMOSPHERE
IM-5
IM-6
ARGON ATMOSPHERE
1300
1400
1500
1600
10 000/T (KELVINS⁻¹)

SYSTEM
SPRUCE PINE PEGMATITE
WITH 8.8 WT. % H2O
(SPRUCE PINE, N. CAROLINA)

AUTHOR
BURNHAM (1963)

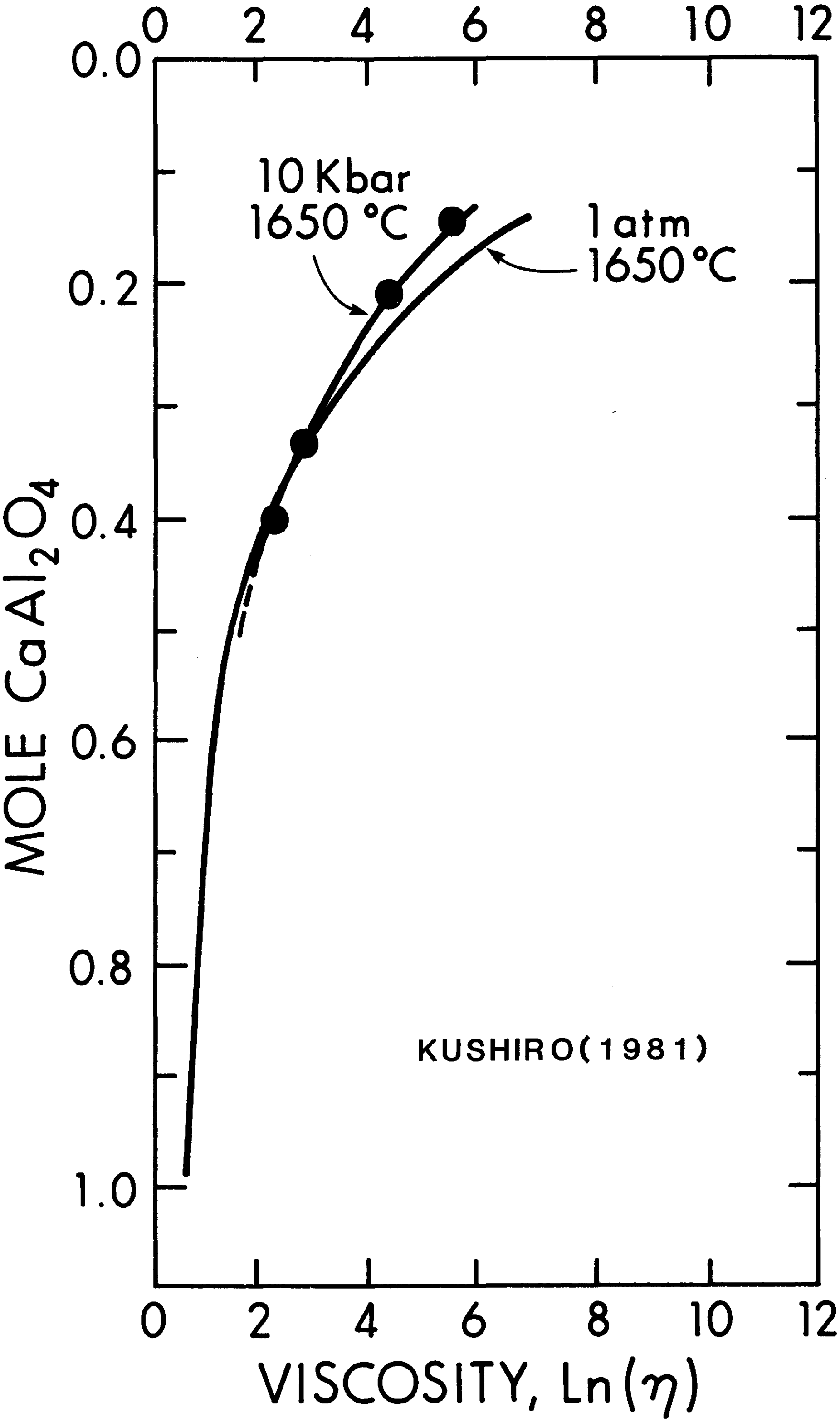
MEASUREMENT METHOD
RESTRAINED SPHERE
N (POISES)
T (DEGREES C)

DERIVED FROM
TABLE (ABS.)
P = 4800 TO 7400 BARS **
Z = 10000.0/T(K) (1/K)

IM-7

T	Z	LN(N)	LOG(N)	N
700.	10.277	14.077	6.113	1.3*10E6
800.	9.319	11.775	5.113	1.3*10E5
900.	8.525	10.239	4.447	2.8*10E4

** THE APPARENT VISCOSITY WAS PRESSURE-INDEPENDENT OVER THIS RANGE.



0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10
12
10 Kbar
1650 °C
1 atm
1650 °C
KUSHIRO(1981)
MOLE CaAl2O4
VISCOSITY, Ln(η)

Standard Glasses

SYSTEM
SS 710 (SAMPLE 1)
(SODA-LIME SILICA GLASS)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO AND HAWKINS (1964)
DERIVED FROM
TABLE 3
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

710-1

T	Z	LN(N)	LOG(N)	N
855.1	8.864	12.805	5.561	3.64*10E 5
881.4	8.663	12.100	5.255	1.80*10E 5
901.4	8.515	11.587	5.032	1.08*10E 5
907.4	8.472	11.506	4.997	9.93*10E 4
946.8	8.198	10.587	4.598	3.96*10E 4
1000.4	7.853	9.523	4.136	1.37*10E 4
1102.9	7.268	7.905	3.433	2710.00
1112.4	7.218	7.767	3.373	2360.00
1202.5	6.777	6.675	2.899	793.00
1306.1	6.333	5.607	2.435	272.00
1306.7	6.330	5.630	2.445	279.00
1412.3	5.934	4.743	2.060	115.00

SYSTEM
SS 710 (SAMPLE 2)
(SODA-LIME SILICA GLASS)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO AND HAWKINS (1964)
DERIVED FROM
TABLE 3
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

710-2

T	Z	LN(N)	LOG(N)	N
905.1	8.488	11.511	4.999	9.98*10E 4
1025.3	7.702	9.095	3.950	8910.00
1124.6	7.155	7.587	3.295	1970.00
1198.5	6.796	6.730	2.923	838.00
1248.0	6.575	6.194	2.690	490.00
1315.6	6.295	5.563	2.416	261.00
1411.1	5.938	4.794	2.082	121.00

SYSTEM
SS 710 (SAMPLE 3)
(SODA-LIME SILICA GLASS)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO AND HAWKINS (1964)
DERIVED FROM
TABLE 3
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

710-3

T	Z	LN(N)	LOG(N)	N
900.3	8.523	11.617	5.045	1.11*10E 5
945.7	8.205	10.594	4.601	3.99*10E 4
1019.1	7.739	9.245	4.015	1.04*10E 4
1054.6	7.543	8.637	3.751	5640.00
1103.5	7.265	7.893	3.428	2680.00
1200.6	6.786	6.705	2.912	817.00
1212.0	6.734	6.569	2.853	713.00
1298.4	6.364	5.699	2.475	299.00
1402.4	5.969	4.861	2.111	129.00

SYSTEM
SS 710 (SAMPLE 4)
(SODA-LIME SILICA GLASS)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO AND HAWKINS (1964)

DERIVED FROM
TABLE 3
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

710-4

T	Z	LN(N)	LOG(N)	N
904.7	8.491	11.582	5.030	1.07*10E 5
963.4	8.088	10.226	4.441	2.76*10E 4
996.5	7.877	9.586	4.163	1.46*10E 4
1103.1	7.267	7.914	3.437	2740.00
1123.0	7.163	7.635	3.316	2070.00
1214.8	6.721	6.569	2.853	713.00
1315.7	6.294	5.611	2.437	274.00
1414.5	5.926	4.776	2.074	119.00

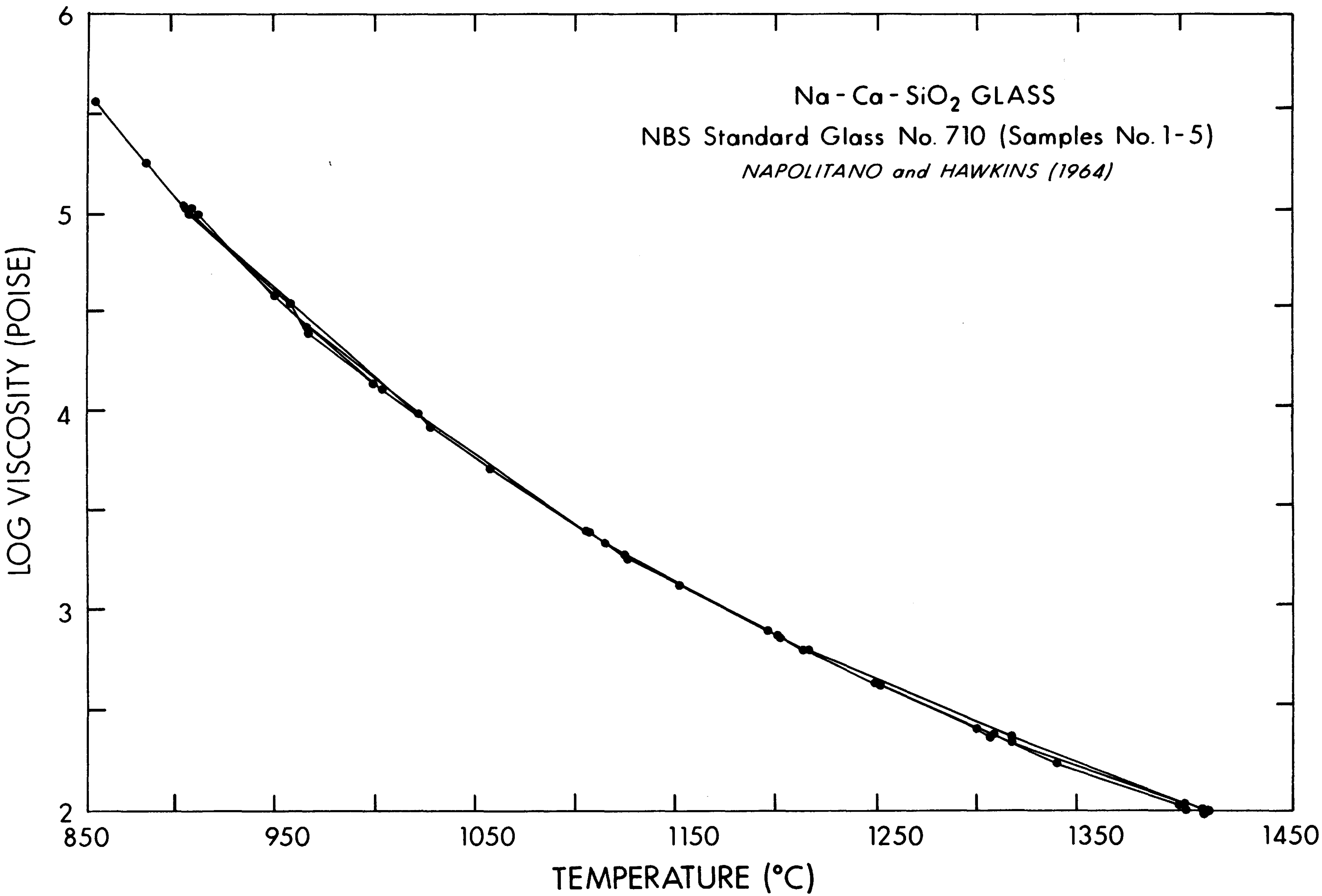
SYSTEM
SS 710 (SAMPLE 5)
(SODA-LIME SILICA GLASS)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

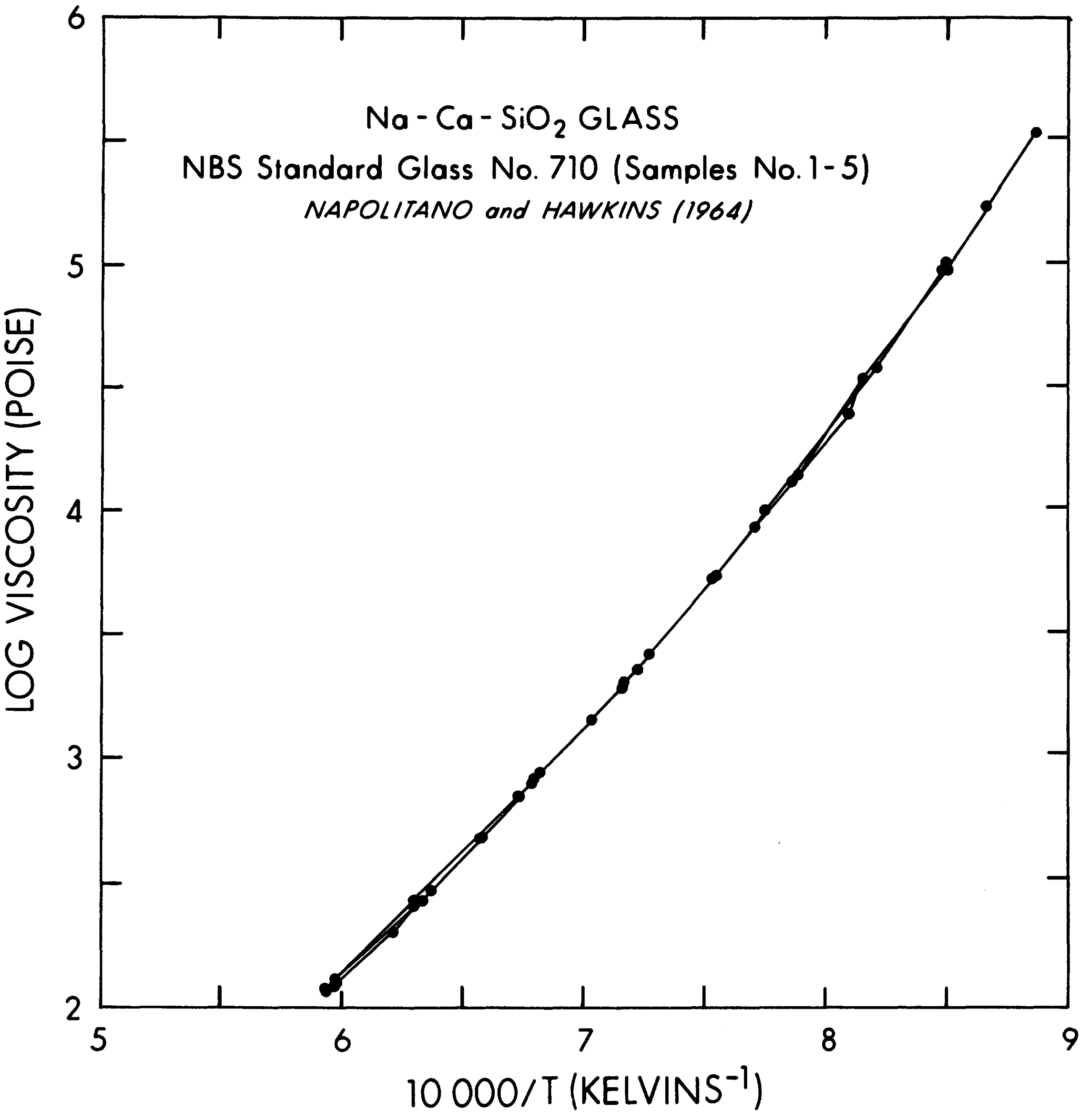
AUTHOR
NAPOLITANO AND HAWKINS (1964)

DERIVED FROM
TABLE 3
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

710-5

T	Z	LN(N)	LOG(N)	N
903.0	8.503	11.511	4.999	9.98*10E 4
954.4	8.147	10.493	4.557	3.61*10E 4
963.5	8.087	10.157	4.411	2.58*10E 4
1054.8	7.531	8.609	3.739	5480.00
1104.5	7.260	7.898	3.430	2690.00
1149.9	7.028	7.285	3.164	1460.00
1194.3	6.815	6.786	2.947	885.00
1250.4	6.564	6.173	2.681	480.00
1250.8	6.563	6.180	2.684	483.00
1338.5	6.205	5.321	2.311	205.00
1399.8	5.978	4.847	2.105	127.00
1402.7	5.968	4.794	2.082	121.00


Na - Ca - SiO_2 GLASS
NBS Standard Glass No. 710 (Samples No. 1-5)
NAPOLITANO and HAWKINS (1964)
LOG VISCOSITY (POISE)
6
5
4
3
2
850
950
1050
1150
1250
1350
1450
TEMPERATURE (°C)


Na - Ca - SiO2 GLASS
NBS Standard Glass No. 710 (Samples No. 1-5)
NAPOLITANO and HAWKINS (1964)
LOG VISCOSITY (POISE)
10 000/T (KELVINS-1)
6
5
4
3
2
5
6
7
8
9

SYSTEM
SRM 710
(SODA-LIME SILICA GLASS)
MEASUREMENT METHOD
FIBER ELONGATION
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO, SIMMONS,
BLACKBURN AND CHIDESTER (1974)
DERIVED FROM
TABLE 1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

710-6

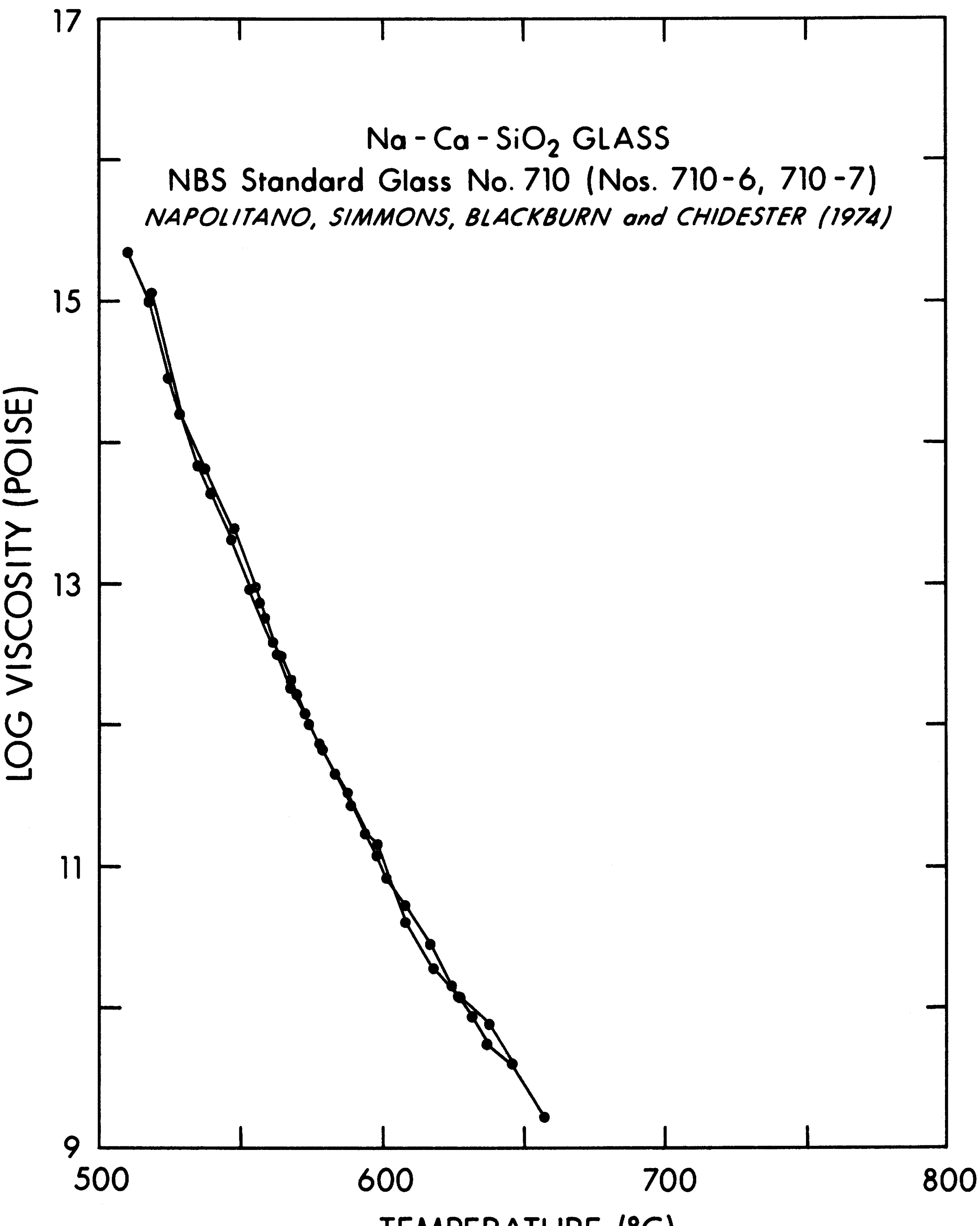
T	Z	LN(N)	LOG(N)	N
519.2	12.623	34.649	15.048	1.12*10E15
529.4	12.463	32.674	14.190	1.55*10E14
538.4	12.324	31.785	13.804	6.37*10E13
548.9	12.167	30.820	13.385	2.43*10E13
556.6	12.054	29.860	12.968	9.29*10E12
558.3	12.029	29.597	12.854	7.14*10E12
560.2	12.002	29.360	12.751	5.64*10E12
564.7	11.937	28.750	12.486	3.06*10E12
565.7	11.923	28.736	12.480	3.02*10E12
569.4	11.871	28.347	12.311	2.05*10E12
571.6	11.840	28.098	12.203	1.60*10E12
574.6	11.798	27.778	12.064	1.16*10E12
575.8	11.781	27.631	12.000	1.00*10E11
580.4	11.718	27.180	11.804	6.37*10E11
585.2	11.652	26.814	11.645	4.42*10E11
590.6	11.587	26.307	11.425	2.66*10E11
600.1	11.453	25.480	11.066	1.16*10E11
603.2	11.413	25.107	10.904	8.02*10E10
609.8	11.328	24.665	10.712	5.15*10E10
618.7	11.215	24.030	10.436	2.73*10E10
626.5	11.117	23.357	10.144	1.39*10E10
628.4	11.094	23.180	10.067	1.17*10E10
633.9	11.027	22.837	9.918	8.28*10E9
639.6	10.958	22.413	9.734	5.42*10E9
648.0	10.858	22.073	9.586	3.85*10E9

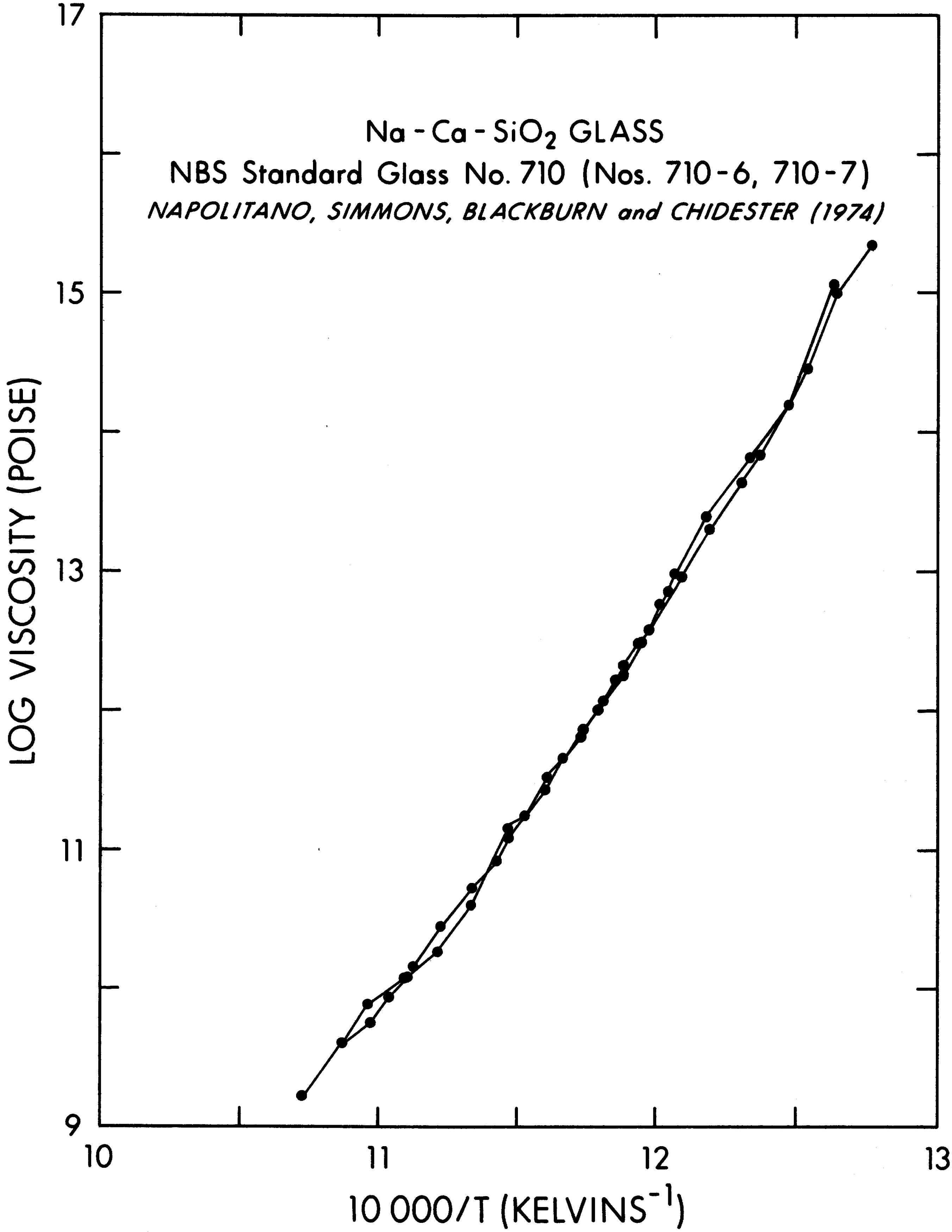
SYSTEM
SRM 710
(SODA-LIME SILICA GLASS)
MEASUREMENT METHOD
BEAM BENDING
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO, SIMMONS,
BLACKBURN, AND CHIDESTER (1974)
DERIVED FROM
TABLE 2
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

710-7

T	Z	LN(N)	LOG(N)	N
510.8	12.758	35.324	15.341	2.19*10E15
518.5	12.634	34.513	14.989	9.75*10E14
525.3	12.527	33.279	14.453	2.84*10E14
536.1	12.359	31.845	13.830	6.76*10E13
540.4	12.294	31.391	13.633	4.30*10E13
548.0	12.180	30.620	13.298	1.99*10E13
554.9	12.079	29.828	12.954	8.99*10E12
562.8	11.965	28.957	12.576	3.77*10E12
563.0	11.962	28.950	12.573	3.74*10E12
569.5	11.869	28.211	12.252	1.79*10E12
579.8	11.726	27.286	11.850	7.08*10E11
589.5	11.594	26.505	11.511	3.24*10E11
595.6	11.513	25.847	11.225	1.68*10E11
600.0	11.455	25.648	11.139	1.38*10E11
610.0	11.325	24.387	10.591	3.90*10E10
619.9	11.199	23.627	10.261	1.82*10E10
629.4	11.082	23.157	10.057	1.14*10E10
640.0	10.953	22.729	9.871	7.43*10E 9
660.0	10.718	21.209	9.211	1.63*10E 9


Na - Ca - SiO_2 GLASS
NBS Standard Glass No. 710 (Nos. 710-6, 710-7)
NAPOLITANO, SIMMONS, BLACKBURN and CHIDESTER (1974)
LOG VISCOSITY (POISE)
17
15
13
11
9
500
600
700
800
TEMPERATURE (°C)



Na - Ca - SiO_2 GLASS
NBS Standard Glass No. 710 (Nos. 710-6, 710-7)
NAPOLITANO, SIMMONS, BLACKBURN and CHIDESTER (1974)
17
15
13
11
9
LOG VISCOSITY (POISE)
10
11
12
13
10 000/T (KELVINS^{-1})

--

SYSTEM
SRM 711 (BAR NO. 50)
(LEAD SILICA GLASS)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO AND HAWKINS (1966)
DERIVED FROM
TABLE 1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

711-1

T	Z	LN(N)	LOG(N)	N
788.8	9.418	11.658	5.063	1.16*10E 5
805.8	9.270	11.278	4.898	7.91*10E 4
865.3	8.785	10.023	4.353	2.25*10E 4
908.2	8.466	9.233	4.010	1.02*10E 4
924.0	8.354	8.980	3.900	7943.28
979.8	7.982	8.124	3.528	3372.87
1046.9	7.576	7.251	3.149	1409.29
1119.4	7.182	6.424	2.790	616.60
1158.2	6.987	6.035	2.621	417.83
1217.5	6.709	5.469	2.375	237.14
1266.7	6.495	5.080	2.206	160.69
1297.9	6.366	4.826	2.096	124.74
1320.1	6.277	4.665	2.026	106.17

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SYSTEM
SRM 711 (BAR NO. 130)
(LEAD SILICA GLASS)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO AND HAWKINS (1966)
DERIVED FROM
TABLE 1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

711-2

T	Z	LN(N)	LOG(N)	N
912.0	8.439	9.169	3.982	9594.01
970.7	8.041	8.248	3.582	3819.44
1032.2	7.662	7.426	3.225	1678.80
1089.9	7.337	6.724	2.920	831.76
1126.7	7.144	6.353	2.759	574.12
1203.6	6.772	5.616	2.439	274.79
1240.2	6.609	5.296	2.300	199.53
1298.3	6.364	4.835	2.100	125.89
1349.0	6.165	4.458	1.936	86.30

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SYSTEM
SRM 711 (BAR NO. 205)
(LEAD SILICA GLASS)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO AND HAWKINS (1966)
DERIVED FROM
TABLE 1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

711-3

T	Z	LN(N)	LOG(N)	N
899.0	8.532	9.392	4.079	1.2*10E 4
952.3	8.161	8.540	3.709	5116.82
1009.0	7.800	7.737	3.360	2290.87
1019.6	7.736	7.608	3.304	2013.72
1099.4	7.287	6.643	2.885	767.36
1103.0	7.267	6.602	2.867	736.21
1197.9	6.799	5.667	2.461	289.07
1240.0	6.609	5.296	2.300	199.53
1300.3	6.356	4.822	2.094	124.17
1352.3	6.153	4.432	1.925	84.14

SYSTEM
SRM 711 (BAR NO. 280)
(LEAD SILICA GLASS)

AUTHOR
NAPOLITANO AND HAWKINS (1966)

MEASUREMENT METHOD
ROTATING CYLINDER

DERIVED FROM
TABLE 1

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

711-4

T	Z	LN(N)	LOG(N)	N
876.2	8.702	9.809	4.260	1.82*10E 4
907.8	8.469	9.233	4.010	1.02*10E 4
997.2	7.873	7.893	3.428	2679.17
1012.0	7.782	7.668	3.330	2137.96
1067.7	7.459	6.986	3.034	1081.43
1108.0	7.241	6.528	2.835	683.91
1166.4	6.947	5.961	2.589	388.15
1197.8	6.799	5.648	2.453	283.79
1273.6	6.466	5.038	2.188	154.17
1321.0	6.274	4.651	2.020	104.71
1343.3	6.187	4.483	1.947	88.51

SYSTEM
SRM 711 (BAR NO. 353)

AUTHOR
NAPOLITANO AND HAWKINS (1966)

(LEAD SILICA GLASS)
MEASUREMENT METHOD
ROTATING CYLINDER

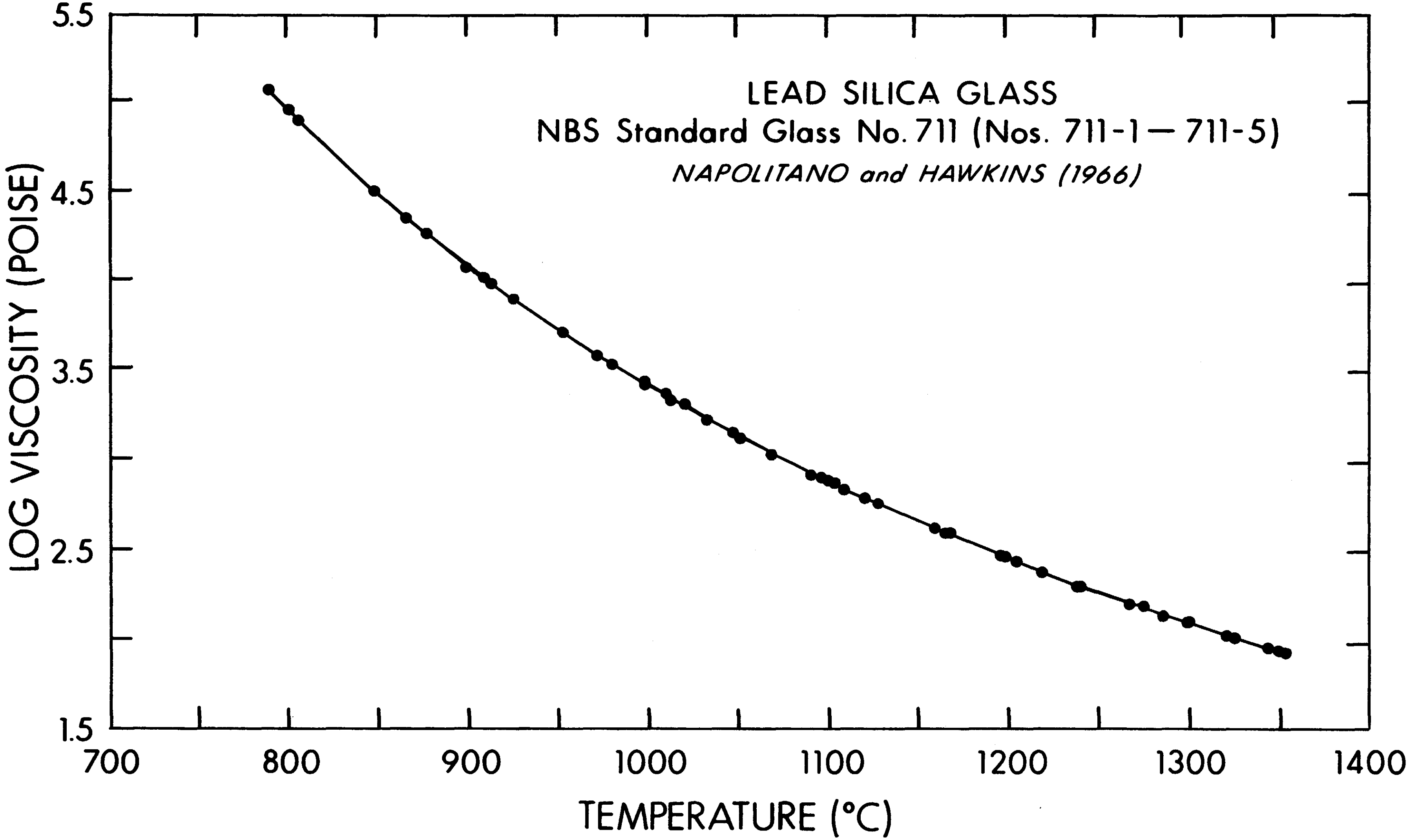
DERIVED FROM
TABLE 1

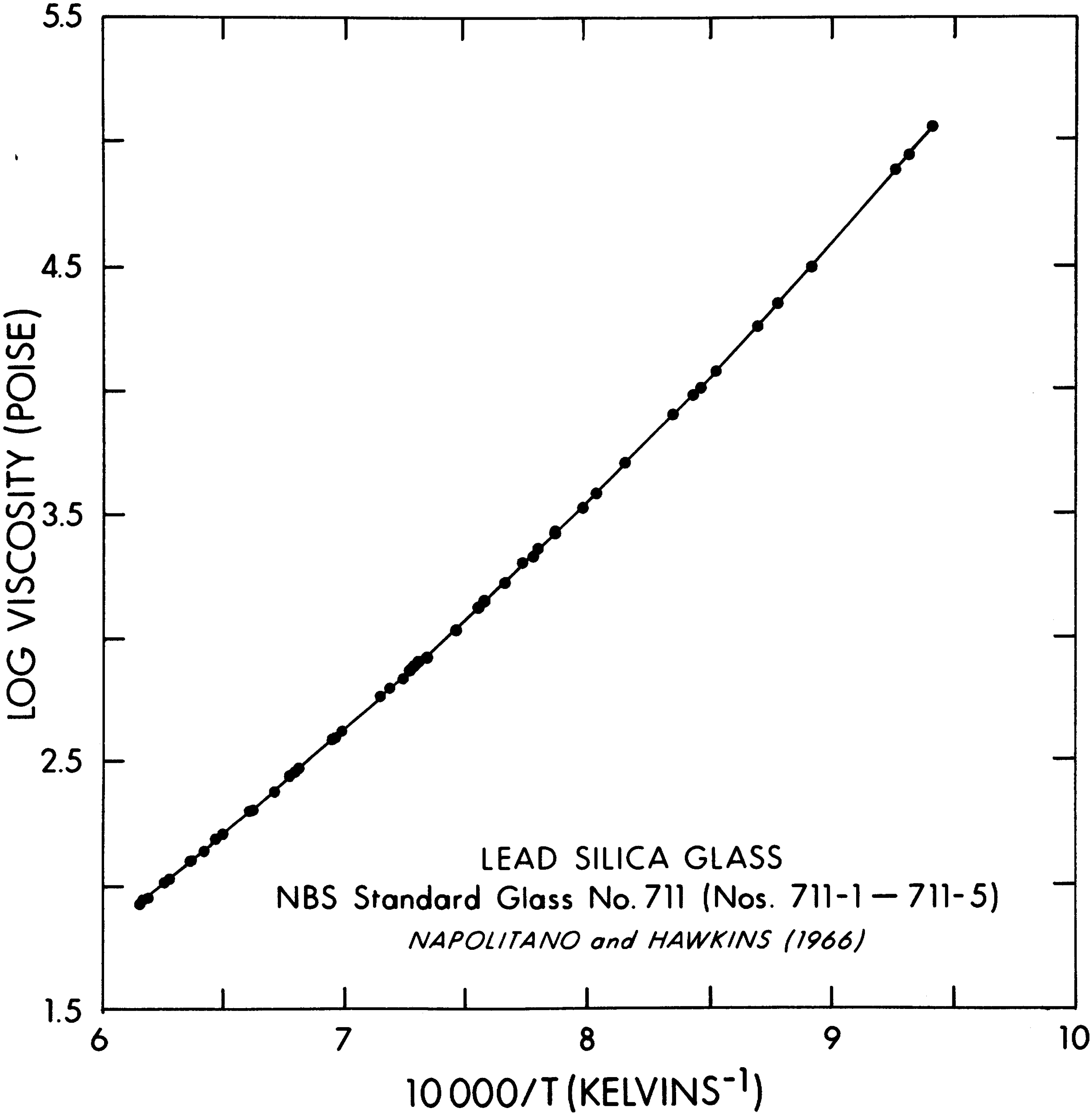
N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

711-5

T	Z	LN(N)	LOG(N)	N
799.7	9.322	11.409	4.955	9.02*10E 4
847.7	8.923	10.362	4.500	3.16*10E 4
925.0	8.347	8.964	3.893	7816.28
997.7	7.870	7.866	3.416	2606.15
1051.0	7.553	7.191	3.123	1327.39
1095.3	7.308	6.684	2.903	799.83
1164.0	6.959	5.975	2.595	393.55
1195.0	6.812	5.680	2.467	293.09
1237.0	6.623	5.301	2.302	200.45
1285.3	6.417	4.916	2.135	136.46
1325.0	6.258	4.630	2.011	102.57
1352.5	6.152	4.428	1.923	83.75


LEAD SILICA GLASS
NBS Standard Glass No. 711 (Nos. 711-1 — 711-5)
NAPOLITANO and HAWKINS (1966)
LOG VISCOSITY (POISE)
5.5
4.5
3.5
2.5
1.5
700
800
900
1000
1100
1200
1300
1400
TEMPERATURE (°C)


5.5
4.5
3.5
2.5
1.5
LOG VISCOSITY (POISE)
6
7
8
9
10
10 000/T (KELVINS⁻¹)
LEAD SILICA GLASS
NBS Standard Glass No. 711 (Nos. 711-1 — 711-5)
NAPOLITANO and HAWKINS (1966)

SYSTEM
SRM 711
(LEAD SILICA GLASS)
MEASUREMENT METHOD
FIBER ELONGATION
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO, SIMMONS
BLACKBURN AND CHIDESTER (1974)
DERIVED FROM
TABLE 3
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

711-6

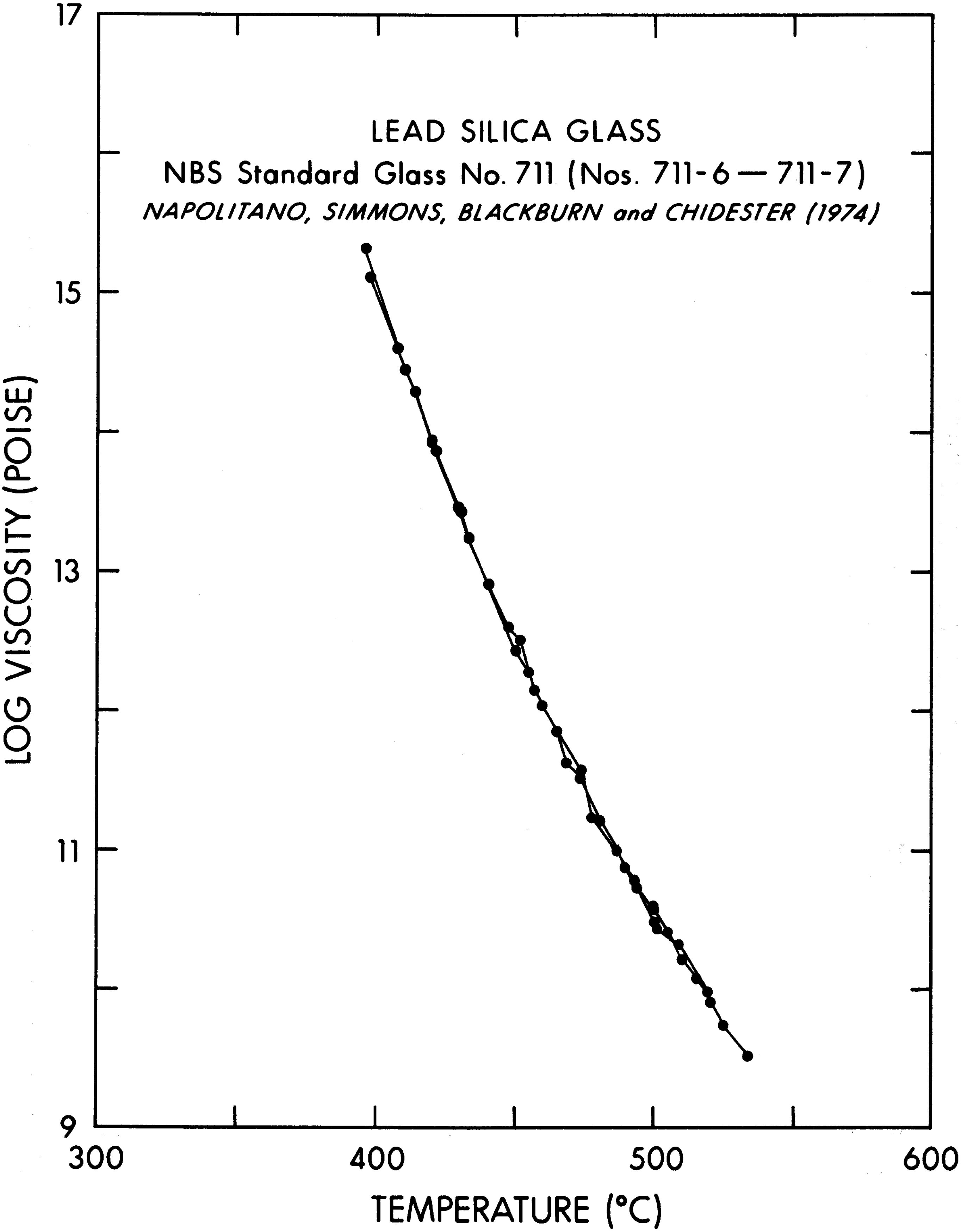
T	Z	LN(N)	LOG(N)	N
396.3	14.941	35.278	15.321	2.09*10E15
411.1	14.618	33.275	14.451	2.82*10E14
414.5	14.545	32.925	14.299	1.99*10E14
420.7	14.415	32.068	13.927	8.45*10E13
422.3	14.382	31.935	13.869	7.40*10E13
431.5	14.194	30.921	13.429	2.69*10E13
441.3	14.000	29.708	12.902	7.98*10E12
441.9	13.988	29.729	12.911	8.15*10E12
451.4	13.805	28.646	12.441	2.76*10E12
456.0	13.717	28.276	12.280	1.91*10E12
460.7	13.630	27.728	12.042	1.10*10E12
466.2	13.528	27.299	11.856	7.18*10E11
470.1	13.457	26.781	11.631	4.28*10E11
475.3	13.364	26.500	11.509	3.23*10E11
482.2	13.242	25.794	11.202	1.59*10E11
488.2	13.137	25.299	10.987	9.71*10E10
491.3	13.084	25.015	10.864	7.31*10E10
495.4	13.014	24.684	10.720	5.25*10E10
501.5	12.912	24.327	10.565	3.67*10E10
506.5	12.829	23.945	10.399	2.51*10E10
511.9	12.740	23.496	10.204	1.60*10E10
516.9	12.660	23.176	10.065	1.16*10E10
521.9	12.580	22.789	9.897	7.89*10E 9
526.7	12.505	22.397	9.727	5.33*10E 9
535.7	12.366	21.888	9.506	3.21*10E 9

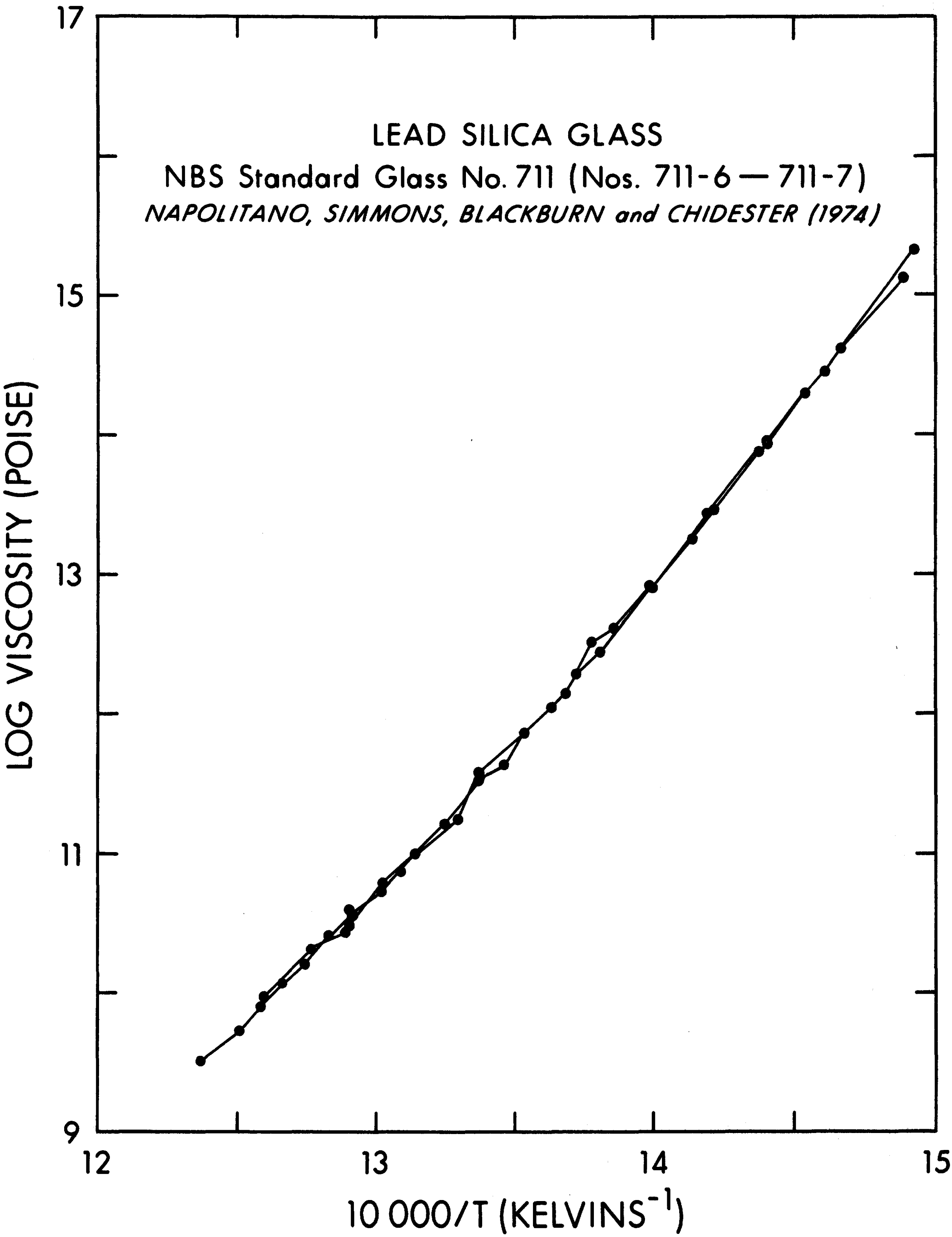
SYSTEM
SRM 711
LEAD SILICA GLASS
MEASUREMENT METHOD
BEAM BENDING
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO, SIMMONS,
BLACKBURN AND CHIDESTER (1974)
DERIVED FROM
TABLE 4
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

711-7

T	Z	LN(N)	LOG(N)	N
398.0	14.903	34.810	15.118	1.31*10E15
408.3	14.678	33.645	14.612	4.09*10E14
420.8	14.413	32.123	13.951	8.93*10E13
430.2	14.221	30.997	13.462	2.90*10E13
434.3	14.138	30.495	13.244	1.75*10E13
441.6	13.994	29.731	12.912	8.17*10E12
448.8	13.854	29.029	12.607	4.05*10E12
452.9	13.776	28.805	12.510	3.24*10E12
458.1	13.678	27.963	12.144	1.39*10E12
475.3	13.364	26.641	11.570	3.72*10E11
479.6	13.287	25.870	11.235	1.72*10E11
494.9	13.023	24.824	10.781	6.04*10E10
502.0	12.903	24.133	10.481	3.03*10E10
502.0	12.903	24.380	10.588	3.87*10E10
503.0	12.887	24.004	10.425	2.66*10E10
510.4	12.765	23.737	10.309	2.04*10E10
520.9	12.596	22.957	9.970	9.33*10E 9


LEAD SILICA GLASS
NBS Standard Glass No. 711 (Nos. 711-6 — 711-7)
NAPOLITANO, SIMMONS, BLACKBURN and CHIDESTER (1974)
17
15
13
11
9
LOG VISCOSITY (POISE)
300
400
500
600
TEMPERATURE (°C)


LEAD SILICA GLASS
NBS Standard Glass No. 711 (Nos. 711-6 — 711-7)
NAPOLITANO, SIMMONS, BLACKBURN and CHIDESTER (1974)
LOG VISCOSITY (POISE)
17
15
13
11
9
12
13
14
15
10 000/T (KELVINS⁻¹)

SYSTEM
SRM 717 (STRIP NO. 70)
(BOROSILICATE GLASS)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO AND HAWKINS (1970)

DERIVED FROM
TABLE 1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

717-1

T	Z	LN(N)	LOG(N)	N
636.6	10.994	21.598	9.380	2.40*10E 9
643.2	10.915	21.168	9.193	1.56*10E 9
681.0	10.482	19.187	8.333	2.15*10E 8
749.8	9.777	16.328	7.091	1.23*10E 7
835.8	9.019	13.670	5.937	8.65*10E 5
893.4	8.573	12.243	5.317	2.07*10E 5
914.4	8.422	11.831	5.138	1.37*10E 5
1078.9	7.397	8.856	3.846	7014.55
1177.5	6.894	7.631	3.314	2060.63
1283.5	6.425	6.562	2.850	707.95
1359.6	6.125	5.915	2.569	370.68

SYSTEM
SRM 717 (STRIP NO. 100)
(BOROSILICATE GLASS)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO AND HAWKINS (1970)

DERIVED FROM
TABLE 1
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

717-2

T	Z	LN(N)	LOG(N)	N
599.3	11.464	23.979	10.414	2.59*10E10
600.8	11.444	23.627	10.261	1.82*10E10
652.0	10.811	20.758	9.015	1.04*10E 9
704.3	10.232	18.248	7.925	8.41*10E 7
725.9	10.011	17.348	7.534	3.42*10E 7
763.7	9.646	15.962	6.932	8.55*10E 6
804.5	9.281	14.631	6.354	2.26*10E 6
858.8	8.835	13.102	5.690	4.90*10E 5
909.8	8.455	11.870	5.155	1.43*10E 5
935.0	8.278	11.395	4.949	8.89*10E 4
983.2	7.961	10.440	4.534	3.42*10E 4
1051.0	7.553	9.284	4.032	1.08*10E 4
1144.2	7.056	8.089	3.513	3258.37
1250.4	6.564	6.850	2.975	944.06
1300.3	6.356	6.477	2.813	650.13
1333.7	6.224	6.194	2.690	489.78
1401.2	5.973	5.653	2.455	285.10

SYSTEM
SRM 717 (STRIP NO. 125)
(BOROSILICATE GLASS)
MEASUREMENT METHOD
FIBER ELONGATION
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO AND HAWKINS (1970)

DERIVED FROM
TABLE 1

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

717- 3

T	Z	LN(N)	LOG(N)	N
607.0	11.364	23.367	10.148	1.41*10E10
619.5	11.204	22.561	9.798	6.28*10E 9
709.3	10.180	18.006	7.820	6.61*10E 7
781.7	9.481	15.347	6.665	4.62*10E 6
810.9	9.226	14.442	6.272	1.87*10E 6
908.2	8.466	11.934	5.183	1.52*10E 5
929.9	8.313	11.492	4.991	9.79*10E 4
996.2	7.879	10.237	4.446	2.79*10E 4
1027.0	7.692	9.703	4.214	1.64*10E 4
1095.0	7.310	8.688	3.773	5929.25
1129.6	7.130	8.266	3.590	3890.45
1195.3	6.811	7.467	3.243	1749.85
1227.7	6.664	7.143	3.102	1264.74
1294.7	6.379	6.489	2.818	657.66
1320.7	6.275	6.279	2.727	533.33
1377.0	6.061	5.823	2.529	338.06
1408.9	5.946	5.591	2.428	267.92

SYSTEM
SRM 717 (STRIP NO. 85)
(BOROSILICATE GLASS)
MEASUREMENT METHOD
ROTATING CYLINDER
N (POISES)
T (DEGREES C)

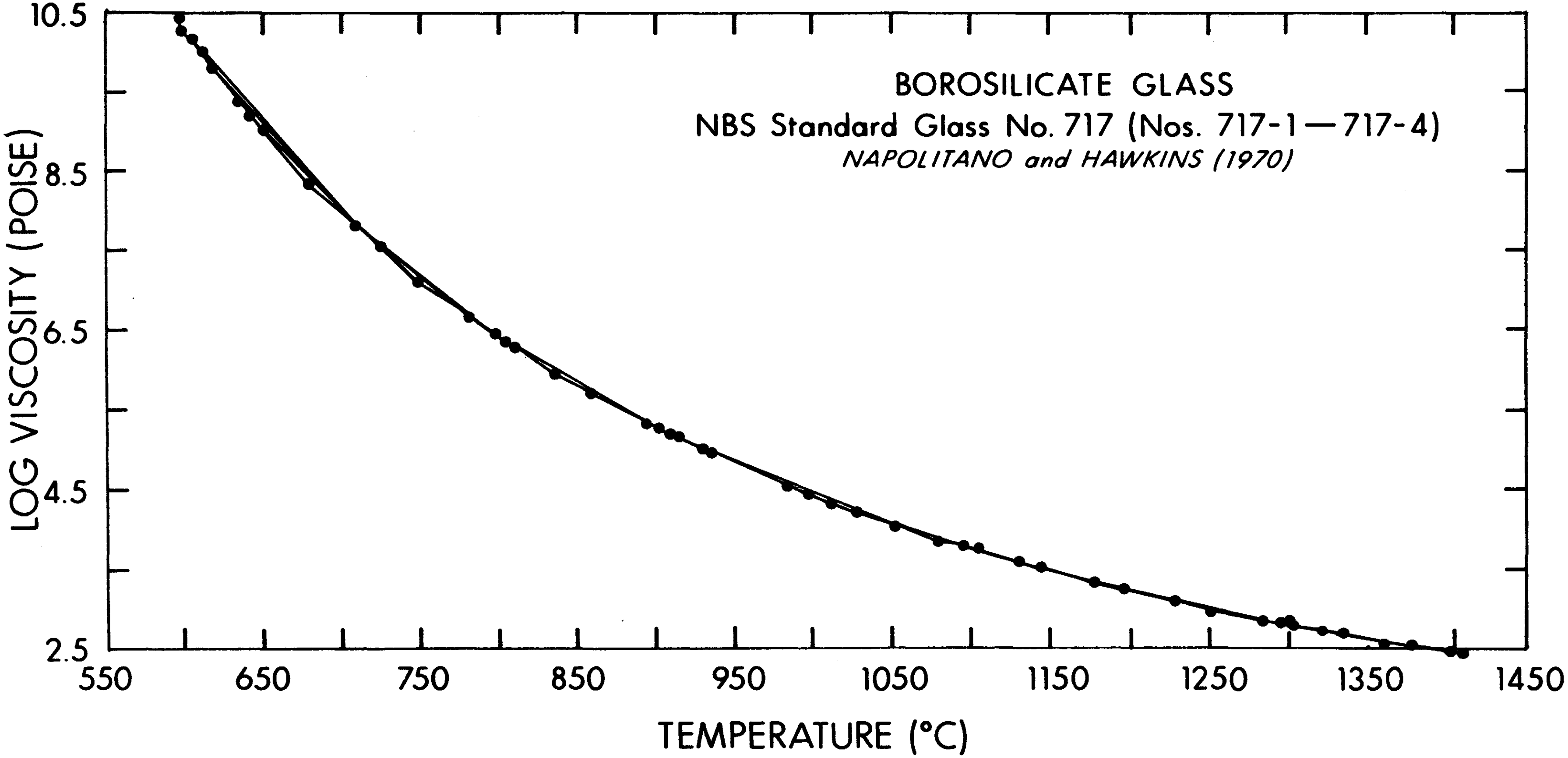
AUTHOR
NAPOLITANO AND HAWKINS (1970)

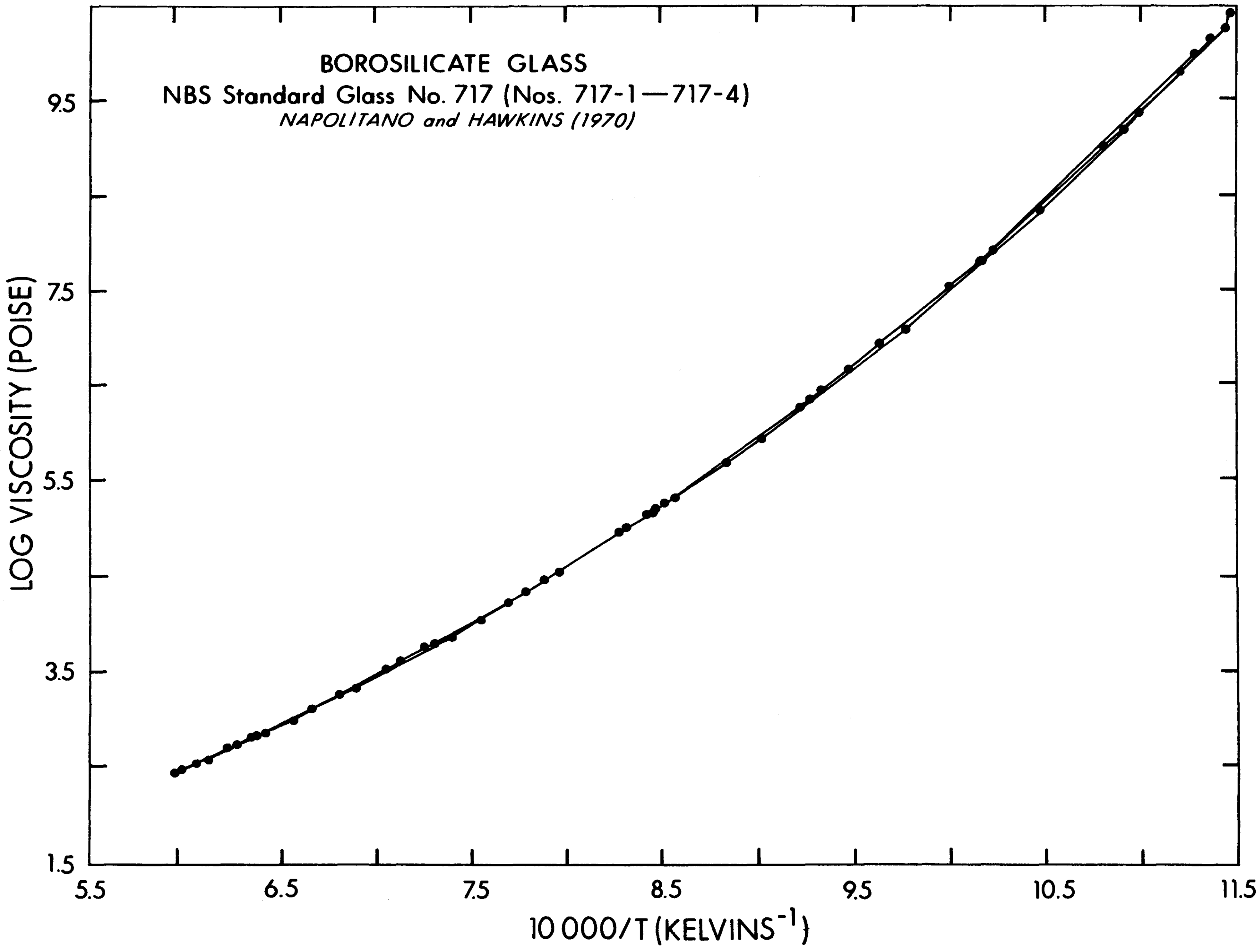
DERIVED FROM
TABLE 1

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

717-4

T	Z	LN(N)	LOG(N)	N
613.4	11.282	23.014	9.995	9.89*10E 9
710.9	10.164	17.988	7.812	6.49*10E 7
798.6	9.332	14.833	6.442	2.77*10E 6
901.8	8.512	12.098	5.254	1.79*10E 5
1010.7	7.790	9.975	4.332	2.15*10E 4
1104.3	7.261	8.602	3.736	5445.03
1196.0	6.807	7.483	3.250	1778.28
1302.6	6.347	6.436	2.795	623.73
1400.1	5.977	5.664	2.460	288.40


BOROSILICATE GLASS
NBS Standard Glass No. 717 (Nos. 717-1 — 717-4)
NAPOLITANO and HAWKINS (1970)
LOG VISCOSITY (POISE)
10.5
8.5
6.5
4.5
2.5
550
650
750
850
950
1050
1150
1250
1350
1450
TEMPERATURE (°C)


BOROSILICATE GLASS
NBS Standard Glass No. 717 (Nos. 717-1—717-4)
NAPOLITANO and HAWKINS (1970)
LOG VISCOSITY (POISE)
9.5
7.5
5.5
3.5
1.5
5.5
6.5
7.5
8.5
9.5
10.5
11.5
10 000/T (KELVINS^{-1})

SYSTEM
SRM 717
BOROSILICATE GLASS
MEASUREMENT METHOD
FIBER ELONGATION
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO, SIMMONS,
BLACKBURN, AND CHIDESTER (1974)
DERIVED FROM
TABLE 5
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

717-5

T	Z	LN(N)	LOG(N)	N
470.9	13.443	35.082	15.236	1.72*10E15
485.5	13.184	33.625	14.603	4.01*10E14
501.1	12.918	32.045	13.917	8.26*10E13
515.0	12.690	30.797	13.375	2.37*10E13
528.7	12.473	29.445	12.788	6.14*10E12
539.5	12.308	28.460	12.360	2.29*10E12
549.0	12.165	27.689	12.025	1.06*10E12
555.2	12.074	27.069	11.756	5.70*10E11
556.0	12.063	27.161	11.796	6.25*10E11
560.0	12.005	26.793	11.636	4.33*10E11
564.0	11.947	26.533	11.523	3.33*10E11
564.4	11.942	26.519	11.517	3.29*10E11
568.6	11.882	26.259	11.404	2.54*10E11
574.4	11.801	25.715	11.168	1.47*10E11
577.6	11.756	25.501	11.075	1.19*10E11
580.8	11.712	25.287	10.982	9.59*10E10
580.9	11.711	25.259	10.970	9.33*10E10
585.5	11.648	24.856	10.795	6.24*10E10
590.4	11.582	24.546	10.660	4.57*10E10
596.0	11.507	24.039	10.440	2.75*10E10
600.2	11.452	23.737	10.309	2.04*10E10
600.4	11.450	23.758	10.318	2.08*10E10
605.0	11.390	23.507	10.209	1.62*10E10
610.8	11.315	23.090	10.028	1.07*10E10
614.9	11.263	22.869	9.932	8.55*10E 9
620.7	11.189	22.547	9.792	6.19*10E 9

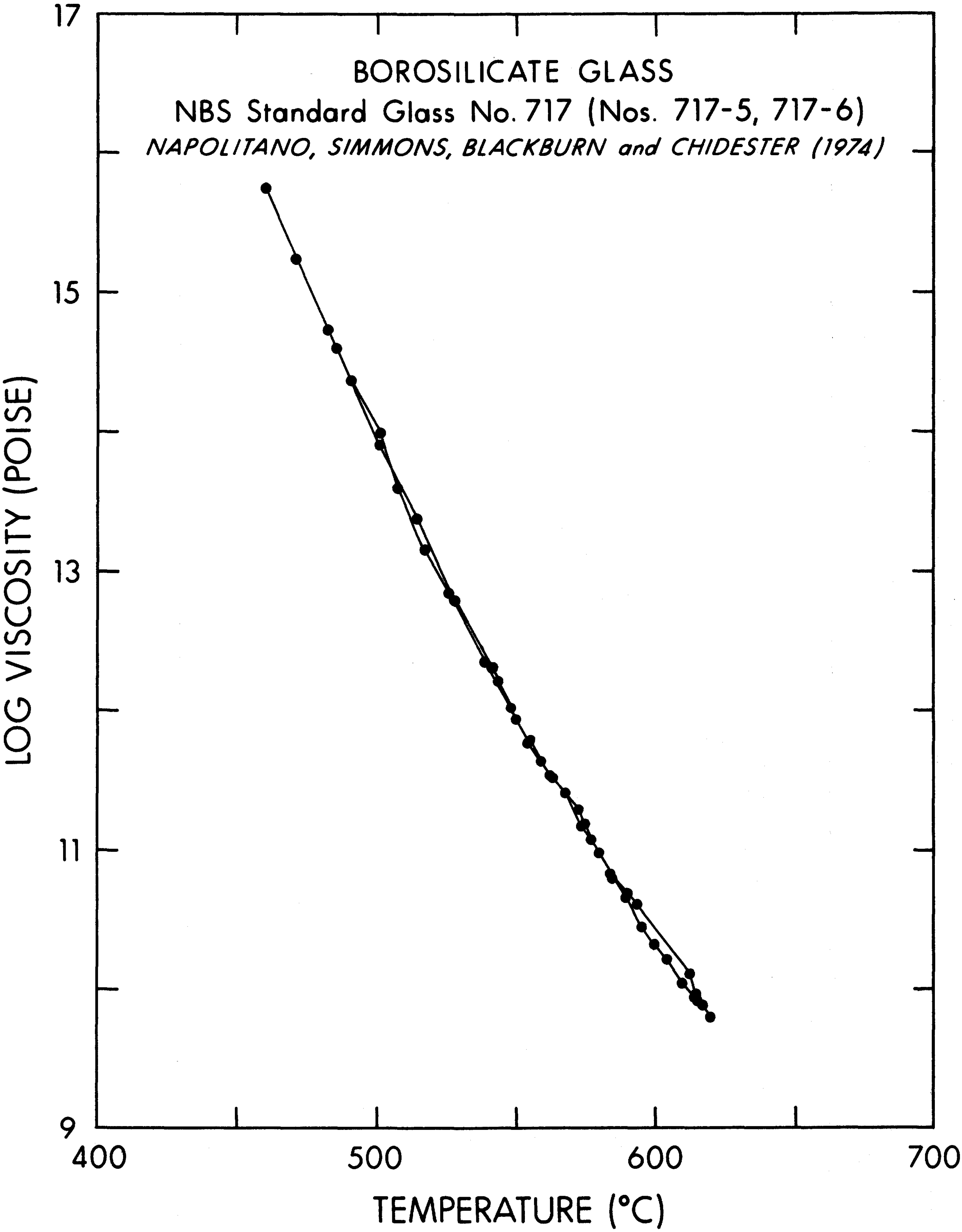
SYSTEM
SRM 717
BOROSILICATE GLASS
MEASUREMENT METHOD
BEAM-BENDING
N (POISES)
T (DEGREES C)

AUTHOR
NAPOLITANO, SIMMONS,
BLACKBURN, AND CHIDESTER (1974)
DERIVED FROM
TABLE 6

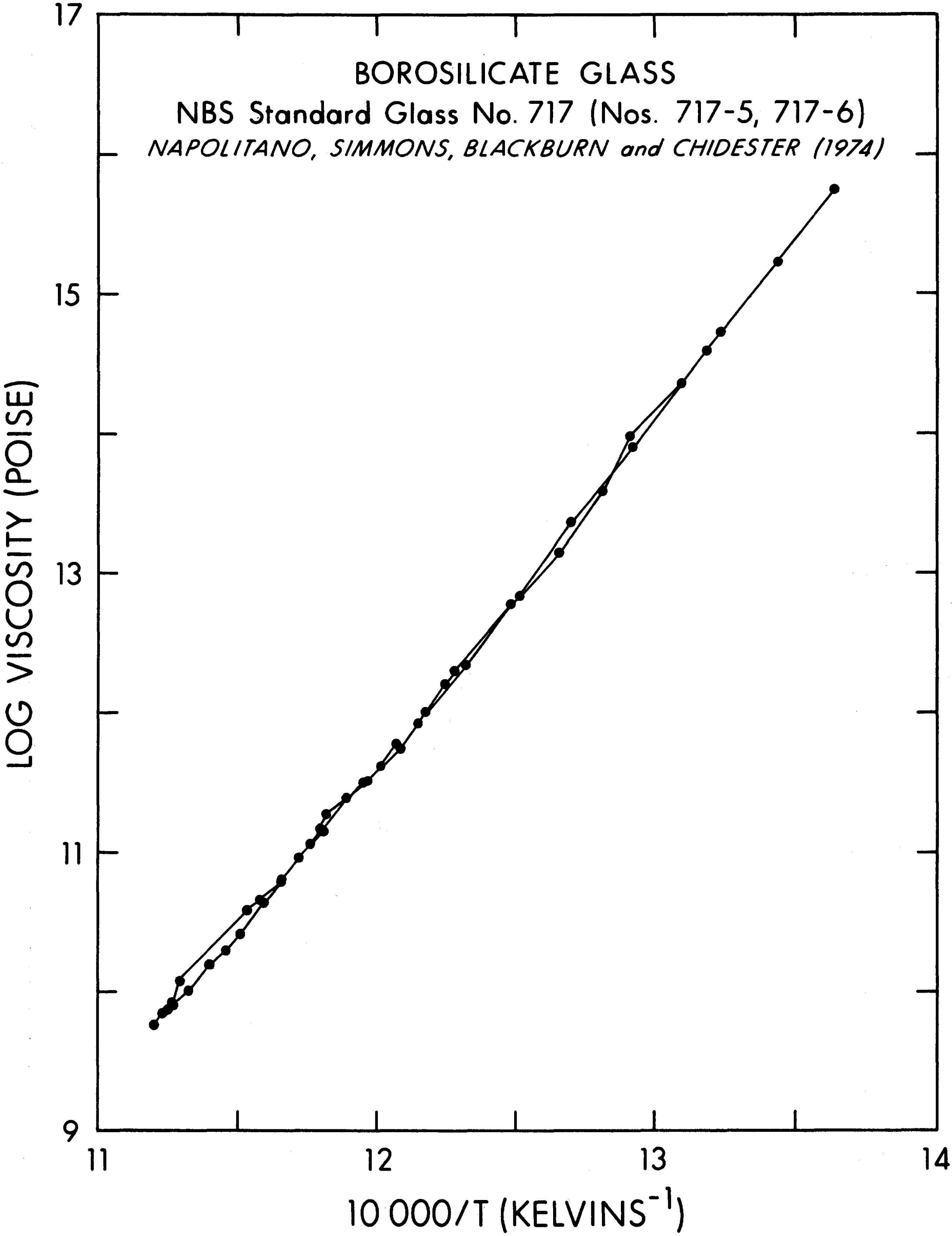
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

717-6

T	Z	LN(N)	LOG(N)	N
460.0	13.643	36.270	15.752	5.65*10E15
482.6	13.235	33.924	14.733	5.41*10E14
490.8	13.092	33.084	14.368	2.33*10E14
501.7	12.908	32.220	13.993	9.84*10E13
508.0	12.804	31.329	13.606	4.04*10E13
517.7	12.647	30.307	13.162	1.45*10E13
526.6	12.506	29.586	12.849	7.06*10E12
542.0	12.270	28.340	12.308	2.03*10E12
544.3	12.235	28.140	12.221	1.66*10E12
550.7	12.140	27.495	11.941	8.73*10E11
555..2	12.074	27.099	11.769	5.87*10E11
563.1	11.960	26.544	11.528	3.37*10E11
573.4	11.815	25.992	11.288	1.94*10E11
575.0	11.792	25.741	11.179	1.51*10E11
585.1	11.654	24.919	10.822	6.64*10E10
591.0	11.574	24.596	10.682	4.81*10E10
594.3	11.530	24.419	10.605	4.03*10E10
613.3	11.283	23.268	10.105	1.27*10E10
615.3	11.257	22.895	9.943	8.77*10E 9
616.5	11.242	22.786	9.896	7.87*10E 9
618.1	11.222	22.722	9.868	7.38*10E 9



BOROSILICATE GLASS
NBS Standard Glass No. 717 (Nos. 717-5, 717-6)
NAPOLITANO, SIMMONS, BLACKBURN and CHIDESTER (1974)
LOG VISCOSITY (POISE)
17
15
13
11
9
400
500
600
700
TEMPERATURE (°C)


BOROSILICATE GLASS
NBS Standard Glass No. 717 (Nos. 717-5, 717-6)
NAPOLITANO, SIMMONS, BLACKBURN and CHIDESTER (1974)
LOG VISCOSITY (POISE)
17
15
13
11
9
11
12
13
14
10 000/T (KELVINS⁻¹)

Commercial Glasses

SYSTEM
GLASS NO. 1
R2O(14.22),RO(10.68),R2O3(0.66),
SIO2(74.59) (%)

AUTHOR
LILLIE (1929)

MEASUREMENT METHOD
CONCENTRIC CYLINDER

DERIVED FROM
FIG. 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-1

T	Z	LN(N)	LOG(N)	N
1000.00	7.855	9.662	4.196	15703.63
1100.00	7.283	8.015	3.481	3026.91
1300.00	6.357	5.724	2.486	306.20

SYSTEM
GLASS NO. 2
R2O(13.54),RO(9.83),R2O3(0.5),
SIO2(74.13) (%)

AUTHOR
LILLIE (1929)

MEASUREMENT METHOD
CONCENTRIC CYLINDER

DERIVED FROM
FIG. 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-2

T	Z	LN(N)	LOG(N)	N
1000.00	7.855	9.800	4.256	18030.18
1100.00	7.283	8.170	3.548	3531.83
1300.00	6.357	5.902	2.563	365.59

SYSTEM
GLASS NO. 3
R2O(13.54),RO(9.83),R2O3(1.5),
SIO2(74.13) (%)

AUTHOR
LILLIE (1929)

MEASUREMENT METHOD
CONCENTRIC CYLINDER

DERIVED FROM
FIG. 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG- 3

T	Z	LN(N)	LOG(N)	N
1000.00	7.855	9.961	4.326	21183.61
1100.00	7.283	8.404	3.650	4466.84
1300.00	6.357	6.132	2.663	460.26

SYSTEM
GLASS NO. 10
R2O(14.22),RO(10.68),R2O3(0.66),
SIO2(74.59) (%)

AUTHOR
LILLIE (1929)

MEASUREMENT METHOD
CONCENTRIC CYLINDER

DERIVED FROM
FIG. 4

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-4

T	Z	LN(N)	LOG(N)	N
1000.00	7.855	9.510	4.130	13489.63
1100.00	7.283	8.006	3.477	2999.16
1300.00	6.357	5.941	2.580	380.19

SYSTEM
GLASS NO. 460
R2O(13.54), RO(9.83), R2O3(2.76),
SIO2(74.13) (%)

AUTHOR
LILLIE (1929)

MEASUREMENT METHOD
CONCENTRIC CYLINDER

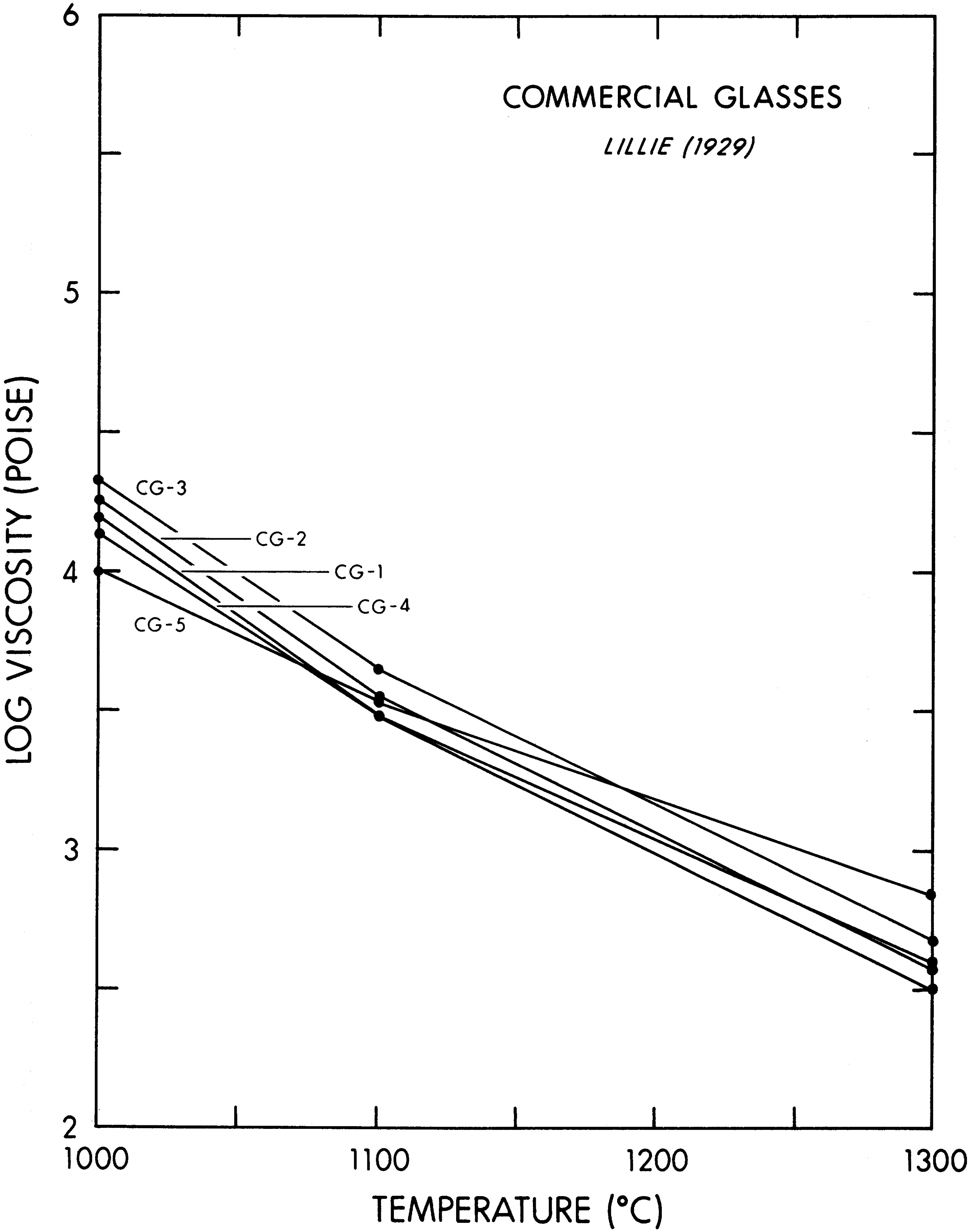
DERIVED FROM
FIG. 4

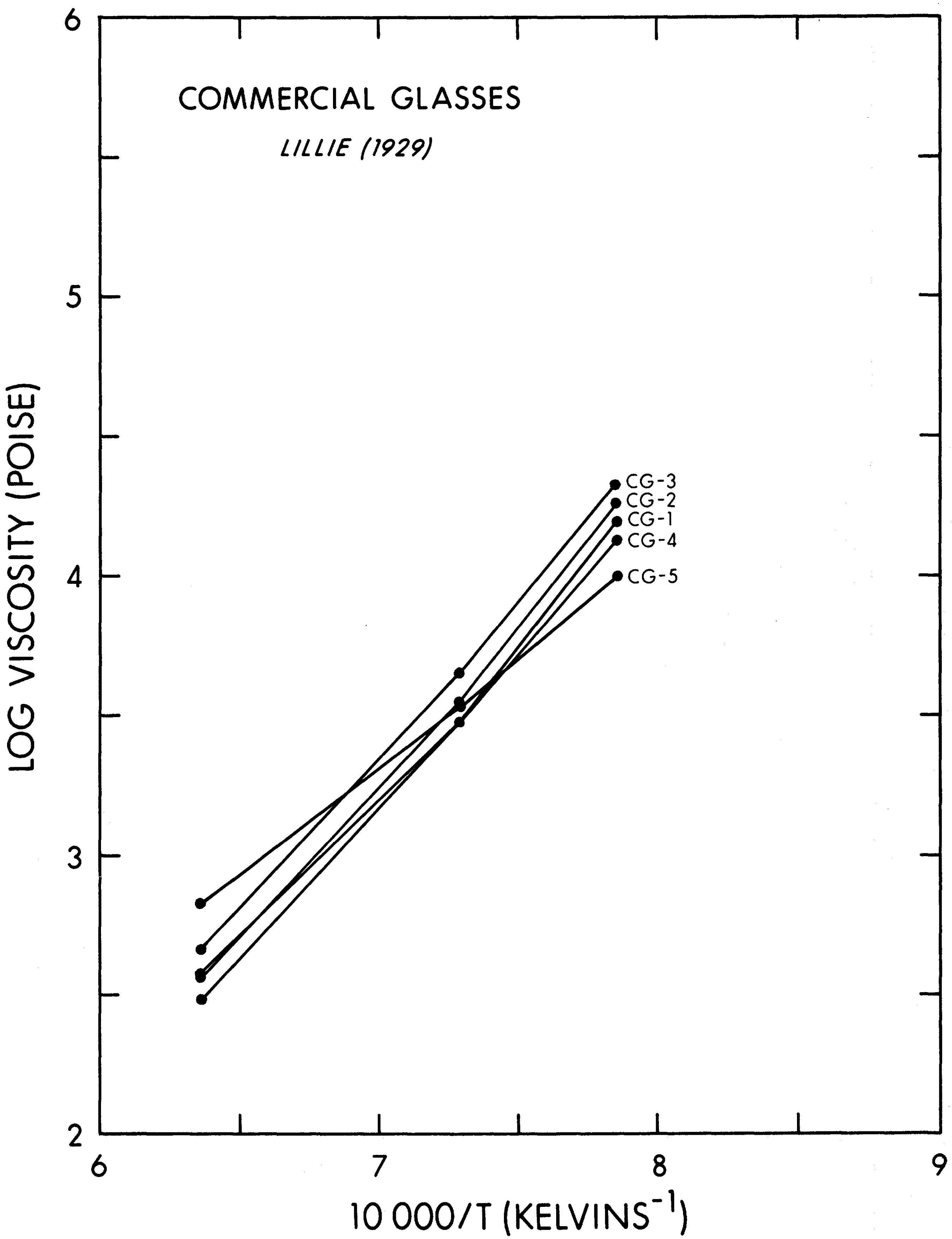
N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-5

T	Z	LN(N)	LOG(N)	N
1000.00	7.855	9.210	4.000	10000.0
1100.00	7.283	8.130	3.531	3396.25
1300.00	6.357	6.537	2.839	690.24


COMMERCIAL GLASSES
LILLIE (1929)
LOG VISCOSITY (POISE)
6
5
4
3
2
CG-3
CG-2
CG-1
CG-4
CG-5
1000
1100
1200
1300
TEMPERATURE (°C)


COMMERCIAL GLASSES
LILLIE (1929)
CG-3
CG-2
CG-1
CG-4
CG-5
6
5
4
3
2
LOG VISCOSITY (POISE)
6
7
8
9
10 000/T (KELVINS⁻¹)

SYSTEM
GLASS I
MEASUREMENT METHOD
FIBER ELONGATION
(ANNEALING POINT)

AUTHOR
LILLIE (1931)
DERIVED FROM
FIG. 3

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-6a

T	Z	LN(N)	LOG(N)	N
509.00	12.788	30.855	13.4	2.51*10E13
519.00	12.626	29.934	13.0	1.0*10E13
545.00	12.225	27.631	12.0	1.0*10E12
570.00	11.862	25.328	11.0	1.0*10E11
596.00	11.507	23.026	10.0	1.0*10E10
624.00	11.148	20.723	9.0	1.0*10E 9
658.00	10.741	18.421	8.0	1.0*10E 8

SYSTEM
GLASS II
MEASUREMENT METHOD
FIBER ELONGATION
(ANNEALING POINT)

AUTHOR
LILLIE (1931)
DERIVED FROM
FIG. 3

N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-7 a

T	Z	LN(N)	LOG(N)	N
515.00	12.690	30.855	13.4	2.51*10E13
525.00	12.531	29.934	13.0	1.0*10E13
551.00	12.136	27.631	12.0	1.0*10E12
577.00	11.765	25.328	11.0	1.0*10E11
604.00	11.403	23.026	10.0	1.0*10E10
633.00	11.038	20.723	9.0	1.0*10E 9
668.00	10.627	18.421	8.0	1.0*10E 8

SYSTEM
GLASS III
MEASUREMENT METHOD
FIBER ELONGATION
(ANNEALING POINT)

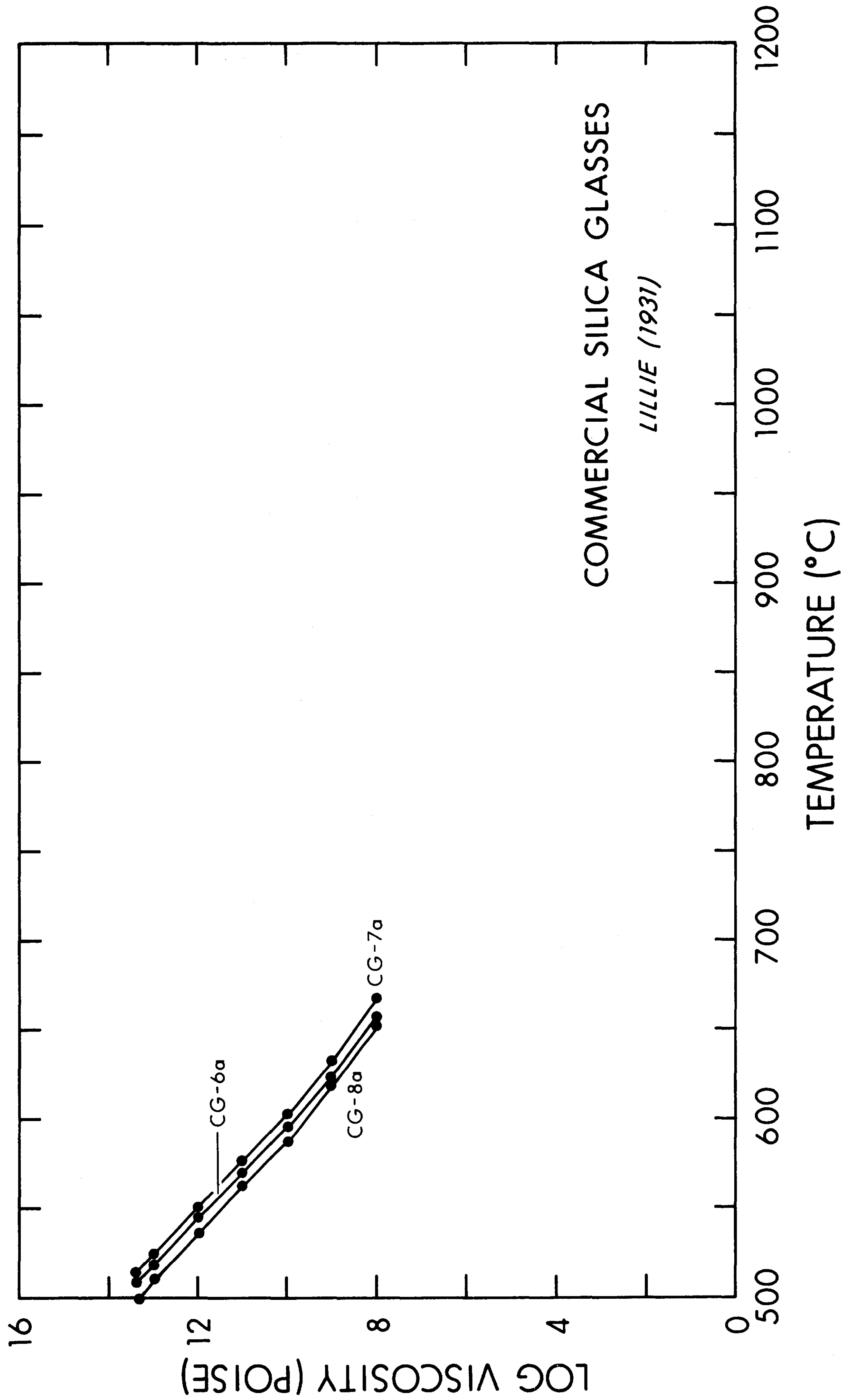
AUTHOR
LILLIE (1931)
DERIVED FROM
FIG. 3

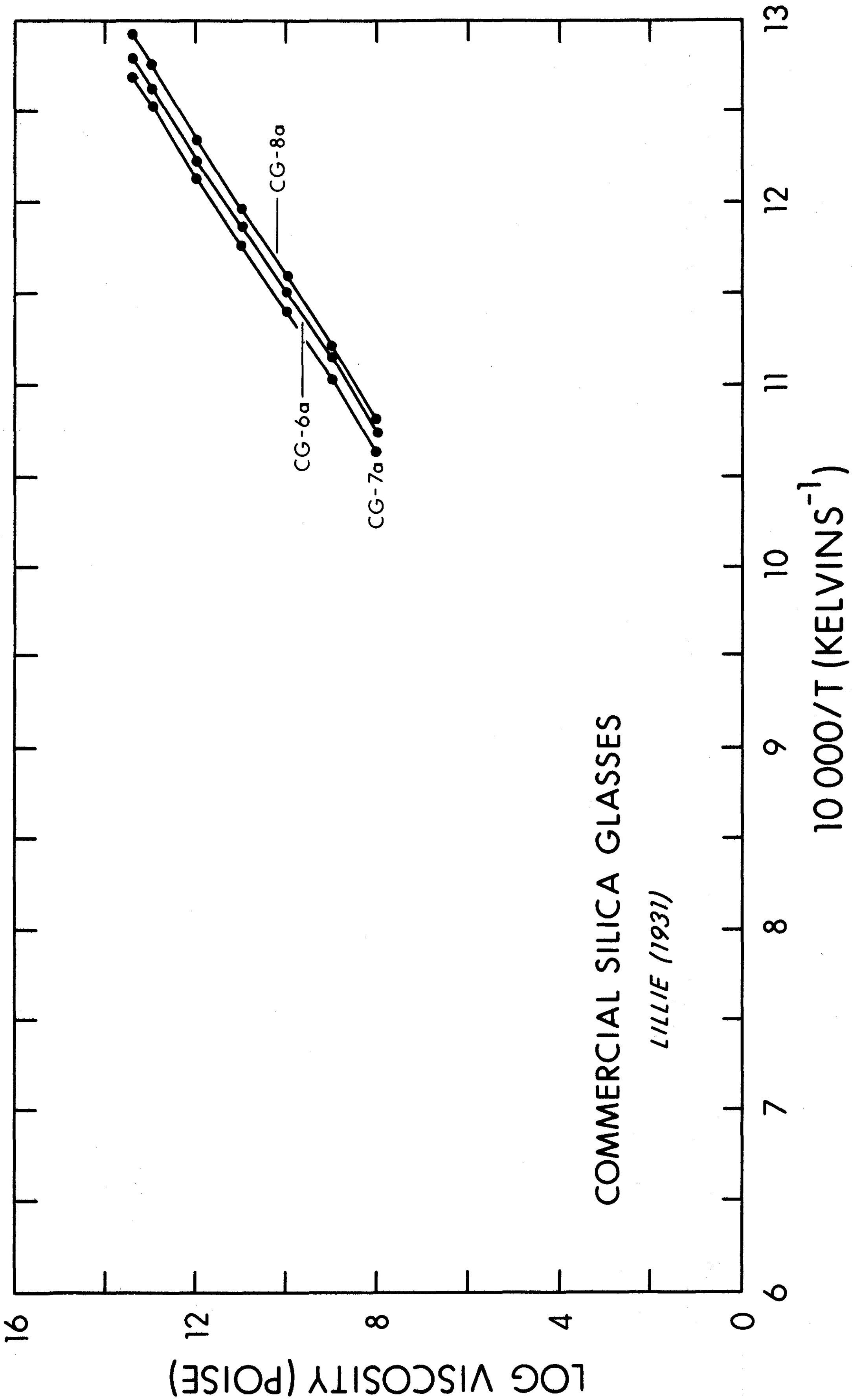
N (POISES)
T (DEGREES C)

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-8a

T	Z	LN(N)	LOG(N)	N
501.00	12.920	30.855	13.4	2.51*10E13
511.00	12.755	29.934	13.0	1.0*10E13
537.00	12.346	27.631	12.0	1.0*10E12
563.00	11.962	25.328	11.0	1.0*10E11
589.00	11.601	23.026	10.0	1.0*10E10
619.00	11.211	20.723	9.0	1.0*10E 9
652.00	10.811	18.421	8.0	1.0*10E 8


COMMERCIAL SILICA GLASSES
LILLIE (1931)
CG-6a
CG-7a
CG-8a
TEMPERATURE (°C)
LOG VISCOSITY (POISE)
500
600
700
800
900
1000
1100
1200
0
4
8
12
16


COMMERCIAL SILICA GLASSES
LILLIE (1931)
CG-8a
CG-6a
CG-7a
LOG VISCOSITY (POISE)
10 000/T (KELVINS^{-1})
0
4
8
12
16
6
7
8
9
10
11
12
13

SYSTEM
GLASS I
MEASUREMENT METHOD
FIBER ELONGATION
(SOFTENING POINT)
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1931)
DERIVED FROM
FIG. 3

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-6b

T	Z	LN(N)	LOG(N)	N
670.00	10.604	17.615	7.65	4.47*10E 7
702.00	10.256	16.118	7.00	1.00*10E 7
759.00	9.690	13.816	6.00	1.00*10E 6
793.00	9.381	12.664	5.50	3.16*10E 5
833.00	9.042	11.513	5.00	1.00*10E 5
888.00	8.613	10.362	4.50	3.16*10E 4
936.00	8.271	9.210	4.00	1.00*10E 4
1004.00	7.831	8.059	3.50	3162.28
1087.00	7.353	6.908	3.00	1000.00
1194.00	6.817	5.756	2.50	316.23
1325.00	6.258	4.605	2.00	100.00

SYSTEM
GLASS II
MEASUREMENT METHOD
FIBER ELONGATION
(SOFTENING POINT)
N (POISES)
T (DEGREES C)

AUTHOR
LILLIE (1931)
DERIVED FROM
FIG. 3

P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-7b

T	Z	LN(N)	LOG(N)	N
679.00	10.504	17.615	7.65	4.47*10E 7
709.00	10.183	16.118	7.00	1.00*10E 7
768.00	9.606	13.816	6.00	1.00*10E 6
803.00	9.294	12.664	5.50	3.16*10E 5
845.00	8.945	11.513	5.00	1.00*10E 5
903.00	8.503	10.362	4.50	3.16*10E 4
953.00	8.157	9.210	4.00	1.00*10E 4
1024.00	7.710	8.059	3.50	3162.28
1109.00	7.236	6.908	3.00	1000.00
1206.00	6.761	5.756	2.50	361.23
1352.00	6.154	4.605	2.00	100.00

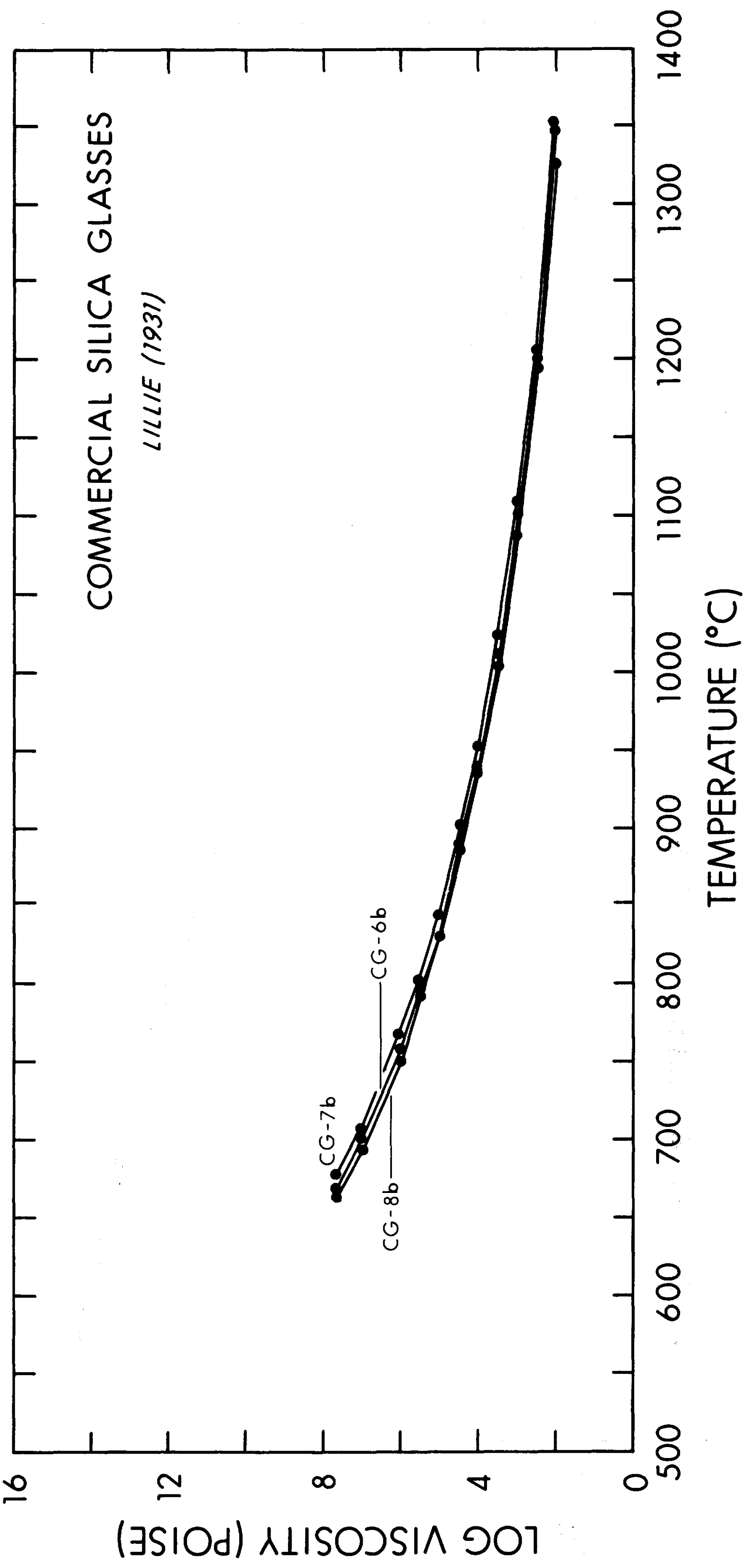
SYSTEM
GLASS III
MEASUREMENT METHOD
FIBER ELONGATION
(SOFTENING POINT)
N (POISES)
T (DEGREES C)

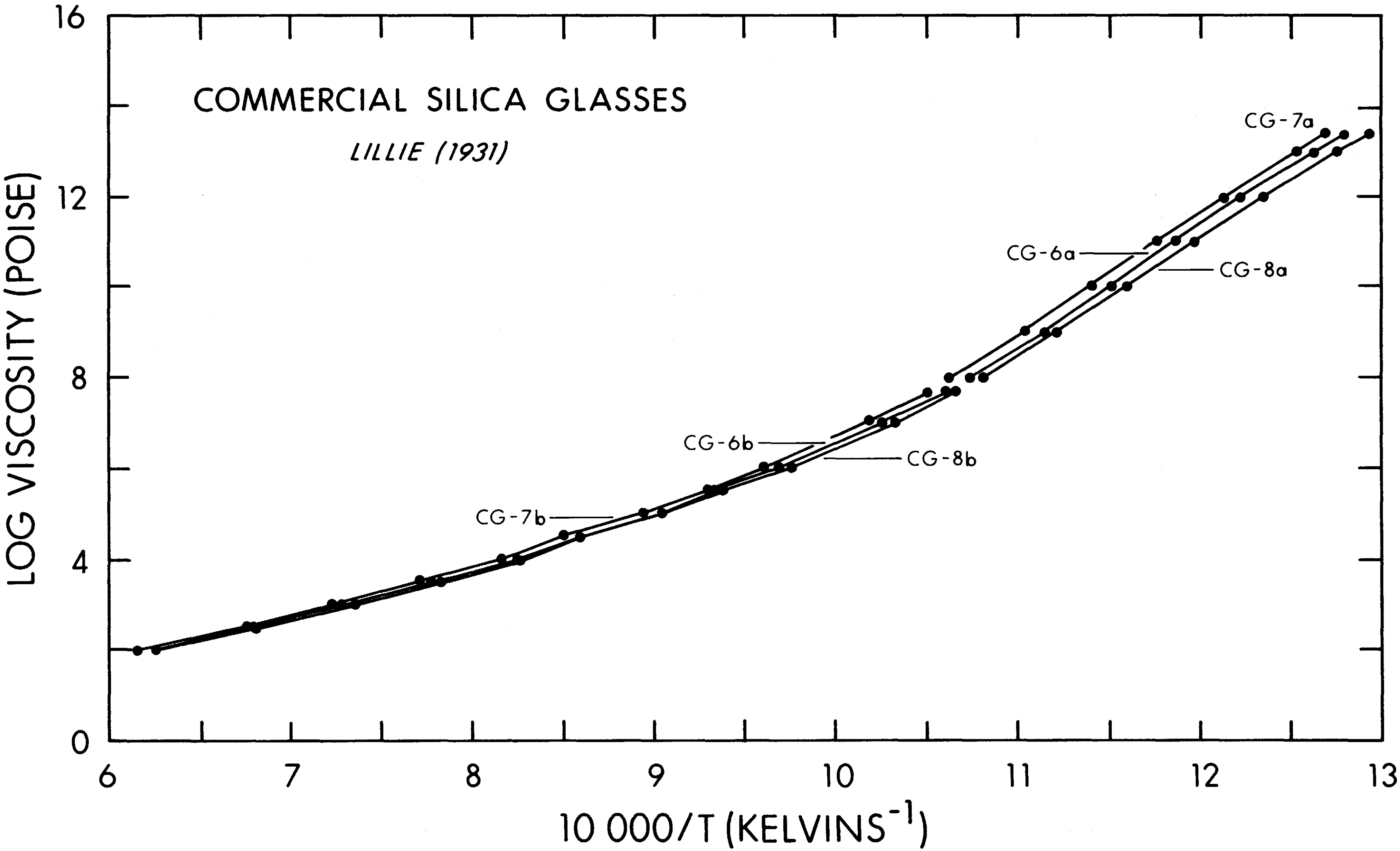
AUTHOR
LILLIE (1931)
DERIVED FROM
FIG. 3

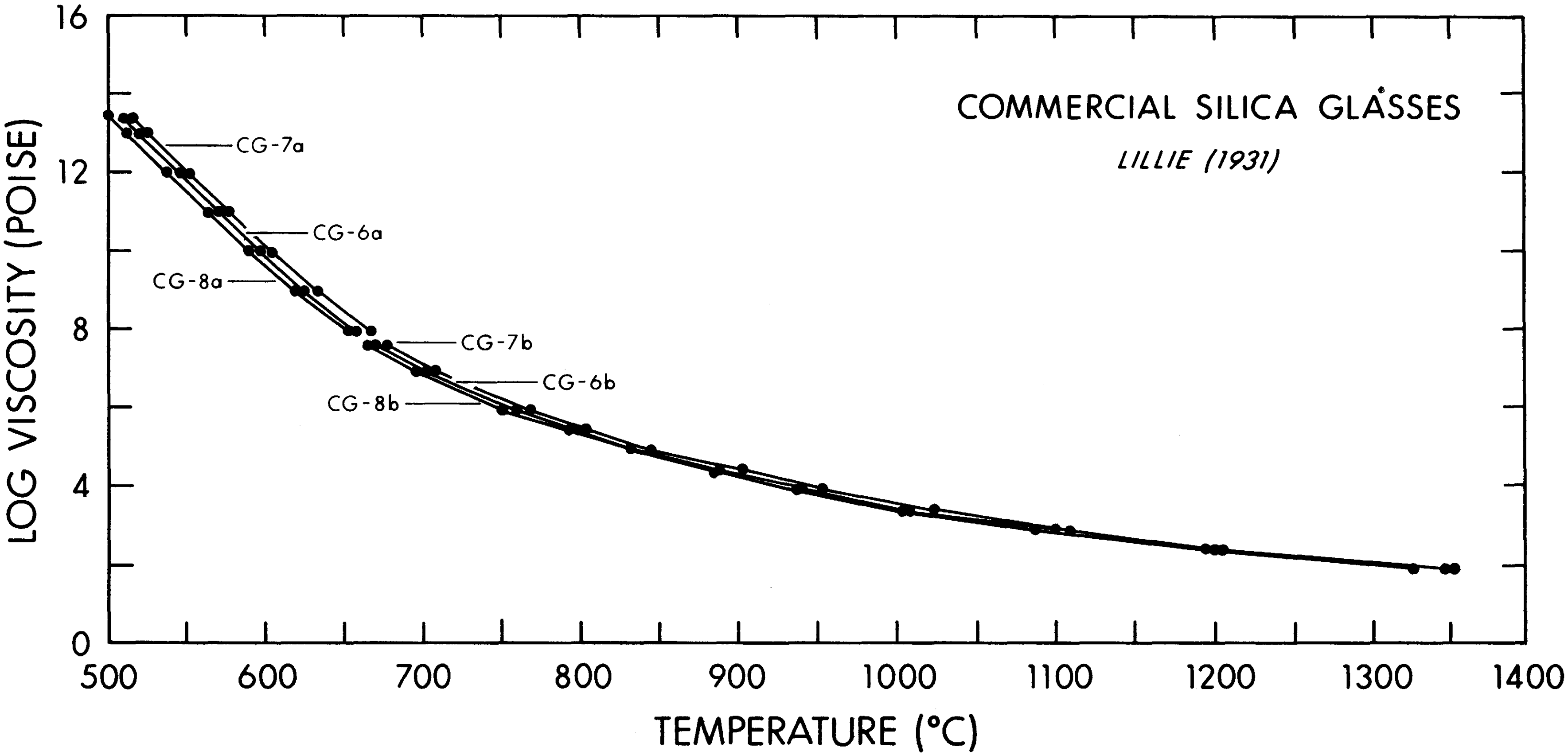
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-8b

T	Z	LN(N)	LOG(N)	N
665.00	10.661	17.615	7.65	4.47*10E7
696.00	10.320	16.118	7.00	1.00*10E7
752.00	9.756	13.816	6.00	1.00*10E6
798.00	9.337	12.664	5.50	3.16*10E5
832.00	9.050	11.513	5.00	1.00*10E5
891.00	8.591	10.362	4.50	3.16*10E4
940.00	8.244	9.210	4.00	1.00*10E4
1012.00	7.782	8.059	3.50	3162.28
1102.00	7.273	6.908	3.00	1000.0
1200.00	6.789	5.756	2.50	316.23
1346.00	6.177	4.605	2.00	100.00


COMMERCIAL SILICA GLASSES
LILLIE (1931)
CG-7b
CG-6b
CG-8b
TEMPERATURE (°C)
500
600
700
800
900
1000
1100
1200
1300
1400
LOG VISCOSITY (POISE)
0
4
8
12
16


COMMERCIAL SILICA GLASSES
LILLIE (1931)
CG-7a
CG-6a
CG-8a
CG-6b
CG-8b
CG-7b
LOG VISCOSITY (POISE)
0
4
8
12
16
6
7
8
9
10
11
12
13
10 000/T (KELVINS⁻¹)


COMMERCIAL SILICA GLASSES
LILLIE (1931)
CG-7a
CG-6a
CG-8a
CG-7b
CG-6b
CG-8b
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
4
8
12
16
500
600
700
800
900
1000
1100
1200
1300
1400

SYSTEM
RENNANLAGE LARYMNA
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
JOHANNSEN AND BRUNION (1959)
DERIVED FROM
TABLE 2
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-9

T	Z	LN(N)	LOG(N)	N
1200.00	6.789	~9.903	~4.301	~20000.
1250.00	6.566	8.795	3.820	6600.
1300.00	6.357	7.832	3.401	2520.
1350.00	6.161	7.048	3.061	1150.
1400.00	5.977	6.446	2.799	630.

SYSTEM
RENNANLAGE AVILES
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
JOHANNSEN AND BRUNION (1959)
DERIVED FROM
TABLE 2
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-10

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	~9.741	~4.230	~17000.
1200.00	6.789	9.197	3.994	9870.
1250.00	6.566	8.343	3.623	4200.
1300.00	6.357	7.550	3.279	1900.
1350.00	6.161	6.908	3.000	1000.
1400.00	5.977	6.354	2.760	575.

SYSTEM
RENNANAGE WATENSTEDT
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
JOHANNSEN AND BRUNION (1959)
DERIVED FROM
TABLE 2
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-11

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	9.259	4.021	10500.
1200.00	6.789	8.357	3.629	4260.
1250.00	6.566	7.467	3.243	1750.
1300.00	6.357	6.709	2.914	820.
1350.00	6.161	6.087	2.643	440.
1400.00	5.977	5.521	2.398	250.

SYSTEM
RENN-WAELZANLAGE STUERZELBERG
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
JOHANNSEN AND BRUNION (1959)
DERIVED FROM
TABLE 2
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-12

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	9.413	4.088	12300.
1200.00	6.789	8.487	3.686	4850.
1250.00	6.566	7.682	3.336	2170.
1300.00	6.357	6.947	3.017	1040.
1350.00	6.161	6.328	2.748	560.
1400.00	5.977	5.799	2.519	330.

SYSTEM
RENN-WAELZANLAGE NORDENHAM
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
JOHANNSEN AND BRUNION (1959)
DERIVED FROM
TABLE 2
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-13

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	8.802	3.823	6650.
1200.00	6.789	7.941	3.449	2810.
1250.00	6.566	7.139	3.100	1260.
1300.00	6.357	6.461	2.806	640.
1350.00	6.161	5.814	2.525	335.
1400.00	5.977	5.193	2.255	180.

SYSTEM
RENN-WAELZANLAGE BERZELIUS
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
JOHANNSEN AND BRUNION (1959)
DERIVED FROM
TABLE 2
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-14

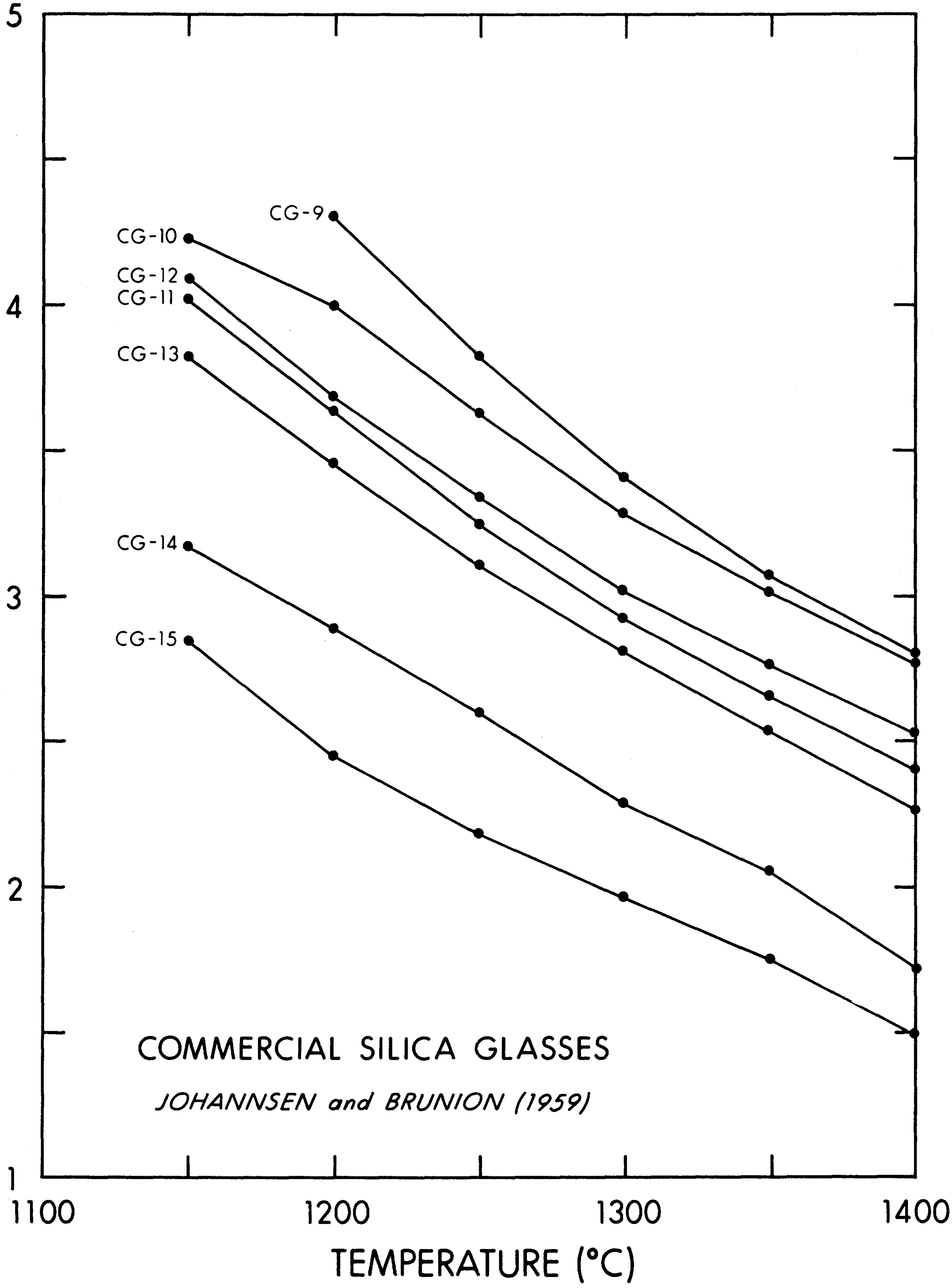
T	Z	LN(N)	LOG(N)	N
1150.00	7.027	7.307	3.173	1490.
1200.00	6.789	6.646	2.886	770.
1250.00	6.566	5.966	2.591	390.
1300.00	6.357	5.247	2.279	190.
1350.00	6.161	4.700	2.041	110.
1400.00	5.977	3.912	1.699	50.

SYSTEM
SCHACHTOFEN MANSFELD
MEASUREMENT METHOD
ROTATIONAL VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
JOHANNSEN AND BRUNION (1959)
DERIVED FROM
TABLE 2
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-15

T	Z	LN(N)	LOG(N)	N
1150.00	7.027	6.551	2.845	700.
1200.00	6.789	5.635	2.447	280.
1250.00	6.566	5.011	2.176	150.
1300.00	6.357	4.500	1.954	90.
1350.00	6.161	4.007	1.740	55.
1400.00	5.977	3.401	1.477	30.


5
4
3
2
1
1100
1200
1300
1400
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
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CG-10
CG-12
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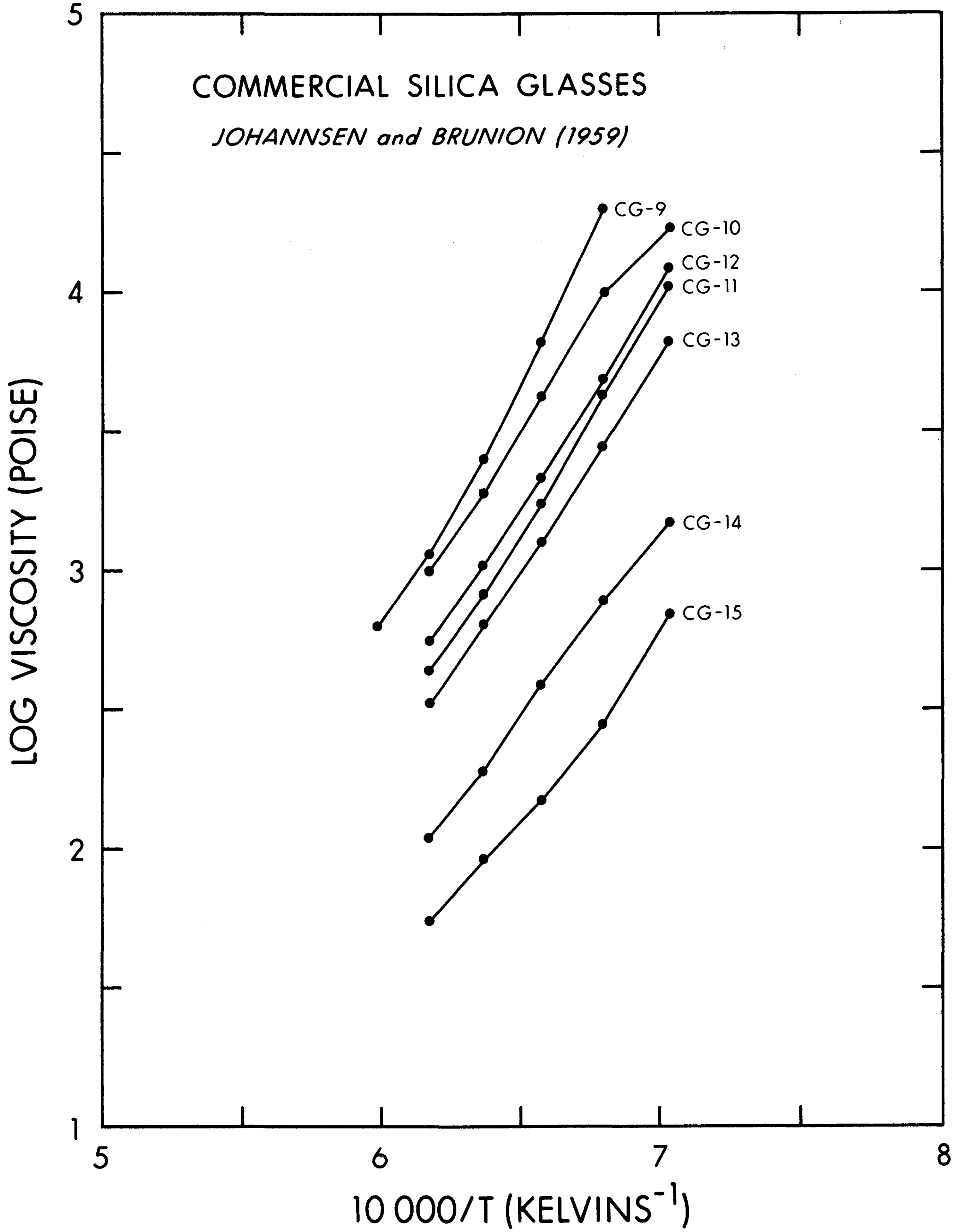
CG-15
COMMERCIAL SILICA GLASSES
JOHANNSEN and BRUNION (1959)


COMMERCIAL SILICA GLASSES
JOHANNSEN and BRUNION (1959)
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CG-12
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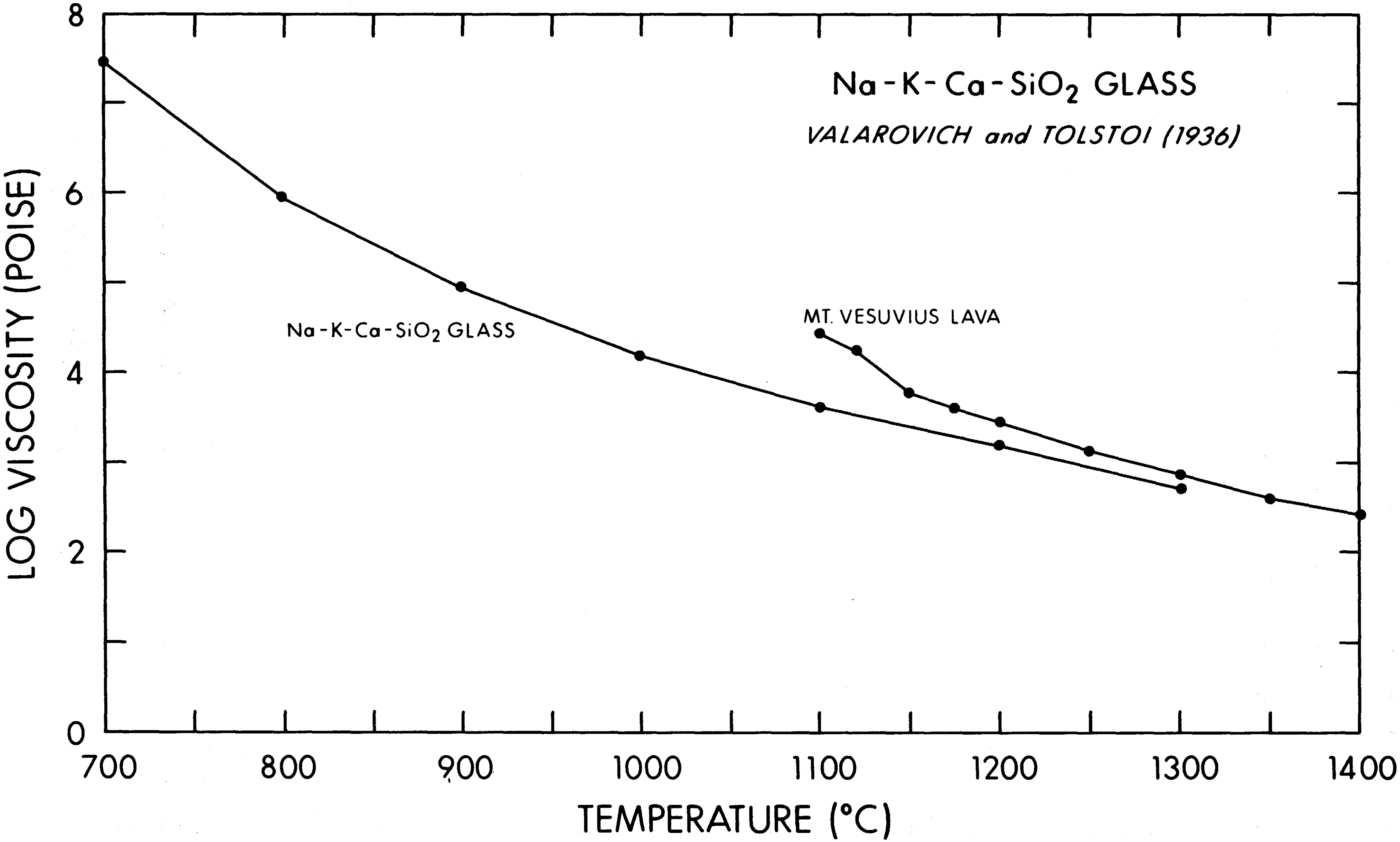
CG-13
CG-14
CG-15
LOG VISCOSITY (POISE)
5
4
3
2
1
5
6
7
8
10 000/T (KELVINS^{-1})

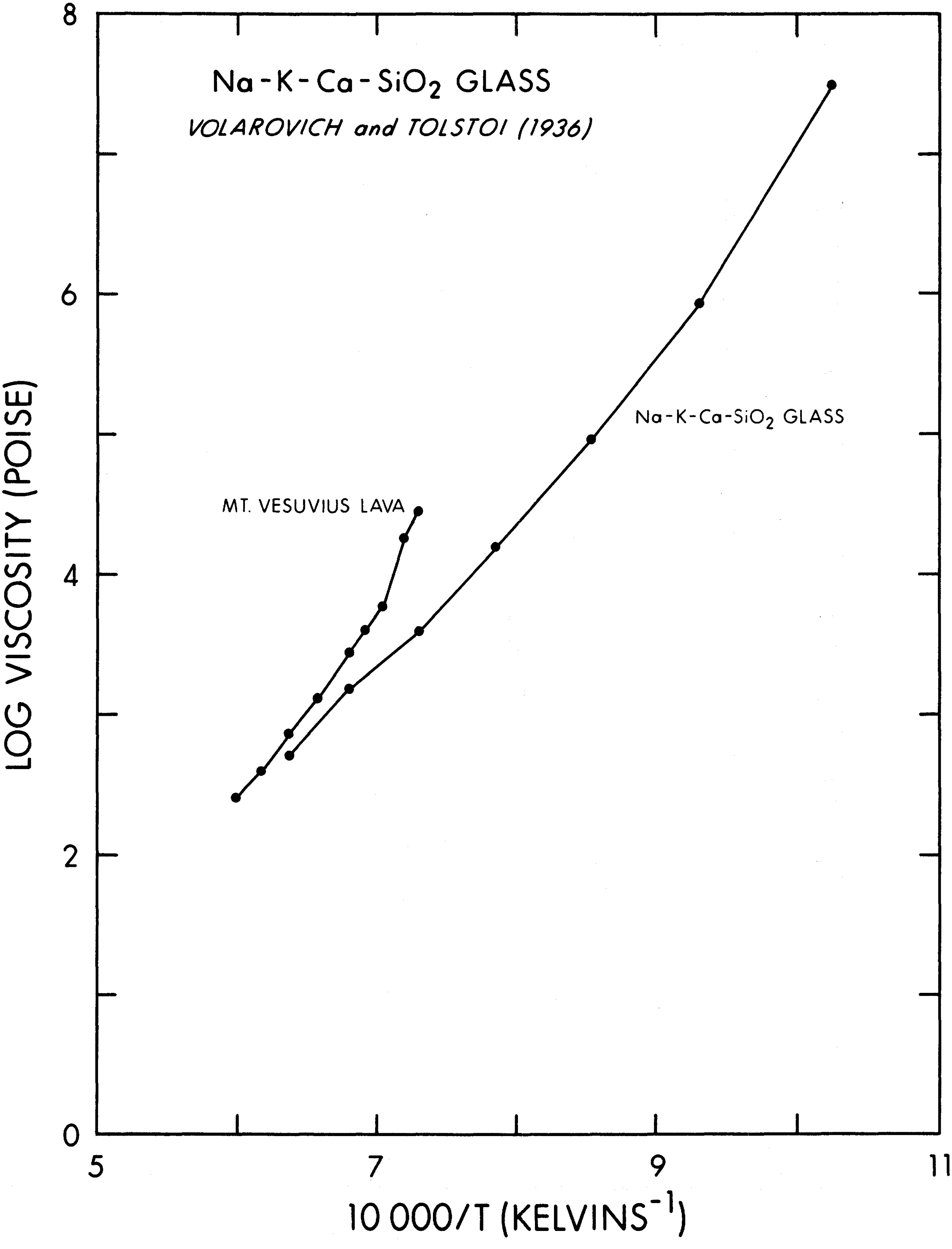
SYSTEM
SODA-POTASH-LIME-SILICA GLASS
MEASUREMENT METHOD
ROTATING-CYC. VISCOMETER
N (POISES)
T (DEGREES C)

AUTHOR
VOLAROVICH AND TOLSTOI (1936)
DERIVED FROM
TABLE II
P = 1.0 ATM.
Z = 10000.0/T(K) (1/K)

CG-16

T	Z	LN(N)	LOG(N)	N
700.00	10.277	17.217	7.477	3.0*10E7
800.00	9.320	13.661	5.933	8.57*10E5
900.00	8.525	11.402	4.952	89500.
1000.00	7.855	9.642	4.188	15400.
1100.00	7.283	8.304	3.606	4040.
1200.00	6.789	7.352	3.193	1560.
1300.00	6.357	6.234	2.708	510.


Na-K-Ca-SiO_2 GLASS
VALAROVICH and TOLSTOI (1936)
MT. VESUVIUS LAVA
Na-K-Ca-SiO_2 GLASS
LOG VISCOSITY (POISE)
TEMPERATURE (°C)
0
2
4
6
8
700
800
900
1000
1100
1200
1300
1400


Na-K-Ca-SiO2 GLASS
VOLAROVICH and TOLSTOI (1936)
Na-K-Ca-SiO2 GLASS
MT. VESUVIUS LAVA
LOG VISCOSITY (POISE)
10 000/T (KELVINS-1)
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6
4
2
0
5
7
9
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Lithologic

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