National Institute of Standards & Technology

Certificate

Standard Reference Material 1414

Lead-Silica Glass
High-Temperature Resistivity

This Standard Reference Material (SRM) is primarily intended to check test methods and to calibrate equipment for the determination of the resistivity of glass in the molten range. The SRM is a lead-silica glass bar 4 x 4 x 12 cm.

The certified resistivity is based on results from four cooperating laboratories, who collectively made 15 series of measurements. Fitted results from fourteen of the fifteen submitted data sets were used to calculate a consensus fit of the Fulcher equation and the certificate resistivity-temperature values given below.

The certified resistivity values versus temperature are:

Resistivity, (Ohm-cm)	Temperature, T(°C)
132 ± 7	950
84.4 ± 2.6	1000
56.8 ± 1.5	1050
40.0 ± 1.1	1100
29.2 ± 0.7	1150
22.0 ± 0.5	1200
17.1 ± 0.4	1250
13.5 ± 0.4	1300

The uncertainties stated above are two standard deviations of the listed values. For the certified temperature range (950-1300 °C), the consensus fit to the Fulcher equation is:

$$\text{Log}_{10}\ \text{Resistivity (Ohm-cm)} = -0.956 + \frac{2270.5}{(T°C - 212.4)}$$

NIST measurements and technical coordination for this SRM were performed by M.J. Cellarosi, NIST Ceramics Division. Statistical analysis was performed by R.C. Paule, NIST Statistical Engineering Division. The support aspects involved in the certification, and issuance of this SRM were coordinated through the Standard Reference Material Program by J.S. Kane.

Gaithersburg, MD 20899
July 17, 1991

William P. Reed, Chief
Standard Reference Materials Program

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Supplemental Information

Measurement techniques (a.c.) used by the cooperating laboratories included the four-probe electrode system, the method listed in reference (1), and using for the conductivity cell the spindle and crucible system provided in ASTM Designation C 965.

Calibrations of the conductivity cell were performed using 0.1 N KCl solution in the room temperature range with standard resistivity or conductivity data published in Handbooks of Physics and Chemistry. Frequency of the a.c. bridge used in the determination of the cell constants with the fixed volume of KCl solution and electrodes in place was at 20×10^3 Hz or above to minimize polarization effects in the solution.

The nominal composition of the glass, its index of refraction and dispersion for the sodium D line are stated for information only, and are not certified.

Constituent	Weight, %
SiO_2	46.0
PbO	45.3
K_2O	5.6
Na_2O	2.5
R_2O_3	0.6

Index of Refraction $N_D = 1.61822$
Dispersion $V_D = 36.6$

The interlaboratory comparison measurements leading to certification were performed under the auspices of ASTM Subcommittee C14.04 on Physical and Mechanical Properties of Glass, H.E. Hagy, Chairman. The laboratories that cooperated in the measurements are:

Anchor Hocking Corp., Lancaster, Ohio
Corning Inc., Corning, New York
National Institute of Standards & Technology, Gaithersburg, MD
Schott Glass Technologies Inc., Duryea, Pennsylvania

REFERENCES:

1) Tickle, R.E., The Electrical Conductance of Molten Alkali Silicates, J. Phys. and Chem. Glass, 8-3 (1967), 101-112.
2) Baucke, F.G. and Frank, W., Conductivity Cell for Molten Glasses and Salts, Glastechn. Ber. 49 (1976), 157-161.
3) ASTM Designation C 965, Measuring the Viscosity of Glass above the Softening Point.