National Institute of Standards & Technology

Certificate

Standard Reference Material 710a

Soda-Lime-Silica Glass

This Standard Reference Material (SRM) is primarily intended to check test methods and to calibrate equipment for the determination of the viscosity of glass in accordance with ASTM Procedure C965. The SRM is a soda-lime-silica glass 100 x 100 x 40 mm (4 x 4 x 1.5 inches).

The certified viscosity is based on results from ten cooperating laboratories. Fitted results from eight laboratories were used to calculate a consensus fit of the Fulcher equation given below and the certificate viscosity-temperature values.

The certified $\log_{10}$ viscosity values versus temperature are:

Log_{10} Viscosity (poise)	Temperature, T (°C)
2.00 ± .015	1464
2.10 ± .014	1432
2.25 ± .012	1387
2.50 ± .010	1319
2.75 ± .008	1259
3.00 ± .008	1205
3.25 ± .008	1157
3.50 ± .009	1113
4.00 ± .011	1037
4.50 ± .013	973
5.00 ± .016	918

The consensus fit to the Fulcher equation is:

$$\text{Log}_{10}\ \text{Viscosity (poise)} = -1.729 + \frac{4560.}{(T\,°C - 240.8)}$$

The certified Softening Point temperature as measured by ASTM Test Method C338 is:

$$\text{Softening Point} = 730.6 \pm 1.3\ °C\ (\log_{10}\ \text{viscosity poise} = 7.6)$$

$$\text{Note: } 10^{7.6}\ \text{poise} = 10^{6.6}\ \text{Pa}\bullet\text{s}$$

The uncertainties stated above are two standard deviations of the listed values.

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 Materials Program by R.L. Gladhill.

March 20, 1991
Gaithersburg, MD 20899

William P. Reed, Acting Chief
Standard Reference Materials Program

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SUPPLEMENTAL INFORMATION

The glass for this standard was donated by Schott Glass Technologies Inc., Duryea, Pennsylvania. The annealing and strain points as defined in ASTM Test Methods C336 and C338 were measured by several of the participating laboratories. These values are not certified, but provided for information only.

Annealing Point = 545 °C
Strain Point = 504 °C

Index of Refraction N_D = 1.5231
Dispersion V_D = 58.5

Glass Nominal Composition

Element	Wt. %
SiO_2	67.55
Al_2O_3	2.10
Na_2O	8.05
K_2O	9.30
CaO	8.50
ZnO	3.60
TiO_2	0.40
As_2O_3	0.05
Sb_2O_3	0.20

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:

Alfred University, Alfred, New York
Anchor Hocking Corp., Lancaster, Ohio
Brockway Glass Co., Brockway, Pennsylvania
Corning Inc., Corning, New York
Ferro Corp., Independence, Ohio
National Inst. of Standards & Technology, Gaithersburg, MD
Owens-Corning Fiberglas Corp., Granville, Ohio
Owens-Illinois Inc., Toledo, Ohio
PPG Industries Inc., Pittsburgh, Pennsylvania
Schott Glass Technologies Inc., Duryea, Pennsylvania

List of References

1) ASTM Designation C965, Measuring Viscosity of Glass Above the Softening Point.
2) ASTM Designation C338, Softening Point of Glass.
3) ASTM Designation C336, Annealing Point and Strain Point of Glass by Fiber Elongation.
4) ASTM Designation C162, Standard Definitions of Terms Relating to Glass and Glass Products.
5) ASTM Designation C598, Annealing Point and Strain Point of Glass by Beam Bending.