

Chemical and Physical Characteristics for Corning® 51-C Clear Borosilicate Glass Tubing with Cerium for Gamma Sterilization

Table 1: Glass Composition (approximate oxide weight [%])

| Oxide Component | Symbol | Corning® 51-C Tubing |
|---------------------------|--------------------------------------|----------------------|
| Silicon Dioxide | SiO ₂ | 72.0 |
| Boron Trioxide | B ₂ O ₃ | 11.0 |
| Aluminium Trioxide | Al ₂ O ₃ | 6.0 |
| Sodium Oxide | Na ₂ O | 7.0 |
| Potassium Oxide | K ₂ O | 2.0 |
| Cerium Oxide | CeO ₂ | 0.7–1.0 |
| Calcium & Magnesium Oxide | CaO + MgO | 1.0 |
| Chloride | Cl | 0.1 |
| Ferrous & Ferric Oxides | FeO + Fe ₂ O ₃ | < 1000 ppm |

Table 2: Chemical Resistance Classifications

| | | |
|-------------------------------------|-------------------------------|----------|
| Hydrolytic Resistance (Glass Grain) | Ph. Eur. (3.2.1B) / USP <660> | Type 1 |
| Hydrolytic Resistance (Glass Grain) | ISO 720 | HGA1 |
| Soluble Alkali Test | JP 7.01 | Complies |
| Acid Resistance Class | DIN 12116 | Class S1 |
| Alkali Resistance Class | ISO 695 | Class A2 |

Table 3: Physical Properties

| Name | Unit | Corning® 51-C Tubing |
|---------------------------|----------------------------------|----------------------|
| Average Linear T.E.C. | 10 ⁻⁷ K ⁻¹ | 55 |
| Density | g/cc | 2.39 |
| Relative Refractive Index | (number) * | 1.49 |

* λ at 587.6nm

Table 4: Viscosity Curve — Characteristic Temperatures

| Name | Viscosity [Poise] | Corning® 51-C Tubing |
|-----------------|--------------------|----------------------|
| Working Point | 10 ^{4.0} | 1140 °C |
| Softening Point | 10 ^{7.6} | 785 °C |
| Annealing Point | 10 ^{13.0} | 570 °C |
| Strain Point | 10 ^{14.5} | 530 °C |

Table 5: Heavy Metals / Arsenic / Antimony

Heavy Metals

Contents of Pb, Cd, Hg, Cr^{VI} is below the 100 ppm limit value stated by the US Toxics in Packaging Clearing House (TPCH) and European Parliament and Council Directive Article 11 of 94/62/ EC of 10. Dec. 1994 on packaging and packaging waste with updates 2001/171/EC and 2006/340/EC.

Arsenic and Antimony

Corning Pharmaceutical Glass does not introduce any arsenic nor antimony in the batch composition of its glasses. Tests performed as per U.S. and European Pharmacopoeia prescriptions on containers made from Corning clear glass tubes give the following results: As = Not detectable; Sb = Not detectable