

## Chemical and Physical Characteristics for Corning® 51-A Amber Borosilicate Glass Tubing

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

Oxide Component	Symbol	Corning® 51-A Tubing
Silicon Dioxide	SiO <sub>2</sub>	70.2
Boron Oxide	B <sub>2</sub> O <sub>3</sub>	10.5
Aluminium Oxide	Al <sub>2</sub> O <sub>3</sub>	5.8
Calcium & Magnesium Oxide	CaO + MgO	1.0
Sodium Oxide	Na <sub>2</sub> O	5.8
Potassium Oxide	K <sub>2</sub> O	1.3
Iron Oxide	Fe <sub>2</sub> O <sub>3</sub>	1.0
Barium Oxide	BaO	1.4
Titanium Dioxide	TiO <sub>2</sub>	3.0

Table 2: Chemical Resistance Classifications

Hydrolytic Resistance (Glass Grain)	EP (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
ASTM Laboratory Glass Class	ASTM E 438	—

Table 3: Physical Properties

Name	Unit	Corning® 51-A Tubing
Average Linear T.E.C.	10 <sup>-7</sup> K <sup>-1</sup>	52
Density	g cm <sup>-3</sup>	2.36
Relative Refractive Index	(number) *	1.50

\* λ at 587.6nm

Table 4: Viscosity Curve Characteristic Temperatures

Name	Viscosity [Poise]	Corning® 51-A Tubing
Working Point	10 <sup>-4.0</sup>	1140 °C
Softening Point	10 <sup>-7.6</sup>	760 °C
Annealing Point	10 <sup>-13.0</sup>	535 °C
Strain Point	10 <sup>-14.5</sup>	505 °C

Table 5: Heavy Metals / Arsenic / Antimony

## Heavy Metals

Contents of Pb, Cd, Hg, Cr<sup>VI</sup> 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