Description

Image



Caption

1. Wine bottles. © iStockphoto 2. Building windows. © John Fernandez 3. Building windows. © John

The material

Soda lime glass is the glass of windows, bottles and light bulbs, used in vast quantities, the commonest of them all. The name suggests its composition: 13-17% NaO (the "soda"), 5-10% CaO (the "lime") and 70-75% SiO2 (the "glass"). It has a low melting point, is easy to blow and mold, and it is cheap. It is optically clear unless impure, when it is typically green or brown. Windows today have to be flat and that was not - until 1950 - easy to do; now the float-glass process, solidifying glass on a bed of liquid tin, makes 'plate' glass cheaply and quickly.

Compositional summary

73% SiO2/1% Al2O3/17% Na2O/4% MgO/5% CaO

General properties

Density	152	-	155	lb/ft^3
Price	* 0.64	-	0.753	USD/lb
Date first used	-3500			

Mechanical properties

Young's modulus	9.86	-	10.4	10^6 psi
Shear modulus	4.06	-	4.28	10^6 psi
Bulk modulus	5.77	-	6.08	10^6 psi
Poisson's ratio	0.21	-	0.22	
Yield strength (elastic limit)	* 4.35	-	5.08	ksi
Tensile strength	4.5	-	5.08	ksi
Compressive strength	* 52.2	-	60.9	ksi
Elongation	0			% strain
Hardness - Vickers	439	-	484	HV
Fatigue strength at 10^7 cycles	* 4.26	-	4.71	ksi
Fracture toughness	* 0.501	-	0.637	ksi.in^0.5

Mechanical loss coefficient (tan delta)		7.5e-4	-	8.8e-4	

Thermal properties

Glass temperature		827	-	1.1e3	°F
Maximum service temperature		338	-	752	°F
Minimum service temperature		-460			°F
Thermal conductor or insulator?		Poor insulator			
Thermal conductivity	*	0.404	-	0.751	BTU.ft/h.ft^2.F
Specific heat capacity	*	0.203	-	0.227	BTU/lb.°F
Thermal expansion coefficient		5.06	-	5.28	µstrain/°F

Electrical properties

Electrical conductor or insulator?		Good insulator			
Electrical resistivity		7.94e17	-	7.94e18	µohm.cm
Dielectric constant (relative permittivity)		7	-	7.6	
Dissipation factor (dielectric loss tangent)		0.007	-	0.01	
Dielectric strength (dielectric breakdown)	*	305	-	356	V/mil

Optical properties

Transparency		Optical Quality			
Refractive index		1.5	-	1.52	

Processability

Castability		3	-	4	
Moldability		5			
Weldability		3	-	4	

Eco properties

Embodied energy, primary production	*	1.09e3	-	1.2e3	kcal/lb
CO2 footprint, primary production	*	0.72	-	0.796	lb/lb
Recycle		✓			

Supporting information

Design guidelines

Soda lime glass is an exceptionally versatile material. It is easily cast, rolled, blow-molded, pressure molded or drawn to a great variety of shapes. It can be cut, polished, and toughened. It is an exceptionally durable material, surviving weathering and normal handling with no trace of degradation, sometimes for hundreds of years.

Typical uses

Windows, bottles, containers, tubing, lamp bulbs, lenses and mirrors, bells, glazes on pottery and tiles.

Links

Reference

ProcessUniverse

Producers