

Description

Image



Caption

1. Close-up of the material. © Granta Design 2. The Basilica of Pisa. © Granta Design

The material

Marble is the purest form of limestone. It is almost pure calcium carbonate that has been compacted and heated such that it has recrystallized. It is used for ornamental building, statuary, ornamental furniture and for electric power panels. The purest marble (Italian Carrara marble is an example) is very white, delicate in texture and hard. Other marbles are dark green, red, black or gray, allowing their use for decorative patterning like that of the Basilica shown in the picture.

Composition (summary)

Calcium carbonate (CaCO_3).

General properties

Density	170	-	178	lb/ft ³
Price	* 0.186	-	0.472	USD/lb
Date first used	-10000			

Mechanical properties

Young's modulus	7.25	-	10.2	10 ⁶ psi
Shear modulus	* 3.19	-	4.06	10 ⁶ psi
Bulk modulus	* 3.77	-	5.22	10 ⁶ psi
Poisson's ratio	0.14	-	0.22	
Yield strength (elastic limit)	0.87	-	1.45	ksi
Tensile strength	0.87	-	1.45	ksi
Compressive strength	7.98	-	15.2	ksi
Elongation	0			% strain
Hardness - Vickers	16	-	20	HV
Fatigue strength at 10 ⁷ cycles	* 0.725	-	1.16	ksi
Fracture toughness	0.546	-	1.09	ksi.in ^{0.5}
Mechanical loss coefficient (tan delta)	* 5e-4	-	0.001	

Thermal properties

Melting point	2.25e3	-	2.44e3	°F
Maximum service temperature	1.17e3	-	1.26e3	°F
Minimum service temperature	-459	-	-458	°F
Thermal conductor or insulator?	Poor insulator			
Thermal conductivity	2.89	-	3.47	BTU.ft/h.ft ² .F
Specific heat capacity	0.203	-	0.213	BTU/lb.°F
Thermal expansion coefficient				

1.67 - 2.78 $\mu\text{strain}/^{\circ}\text{F}$

Electrical properties

Electrical conductor or insulator?

Semiconductor

Electrical resistivity

* 1e8 - 1e12 $\mu\text{ohm.cm}$

Dielectric constant (relative permittivity)

* 6 - 8

Dissipation factor (dielectric loss tangent)

* 5e-4 - 0.001

Dielectric strength (dielectric breakdown)

* 127 - 305 V/mil

Optical properties

Transparency

Translucent

Processability

Machinability

3 - 4

Eco properties

Embodied energy, primary production

195 - 238 kcal/lb

CO2 footprint, primary production

0.118 - 0.13 lb/lb

Recycle

✗

Supporting information

Design guidelines

Marble, nearly pure calcium carbonate, is easily cut and carved. Its fine grain size makes it ideal for detailed carving. Marble is hard and dense, and takes a near-perfect polish. It has a wonderful translucency, making it the choice of many sculptors. Like limestone, it weathers well in a clean environment but is attacked by acid, and thus by industrial emissions.

Technical notes

Good marble is expensive. Marbleite is an artificial substitute used for casting statues and small objects. Crushed marble is used as an aggregate in flooring.

Typical uses

Buildings, facings, floors, stairs, statuary and ornamental furniture, electric-power panels.

Tradenames

Carerra marble

Links

Reference

ProcessUniverse

Producers