Description

Image

Caption

1. Close-up of the material. © John Fernandez 2. Georgia State Capitol. © John Fernandez

The material

Limestone is formed of petrified sea-creatures. In its pure form it is chalk (when porous) or marble (when fully dense). Most limestone is not pure but contains sand (silicate) and other minerals. The most interesting limestones contain visible shells and other fossils of the creatures from which they derived. It is easy to cut; where it is available it is widely used as a building stone.

Composition (summary)

Calcium carbonate (CaCO3) plus silicate impurities.

General properties

Density		159	-	162	lb/ft^3
Price	*	0.186	-	0.472	USD/lb
Date first used		-10000			

Mechanical properties

Young's modulus		5.08	-	7.98	10^6 psi
Shear modulus	*	2.03	-	3.19	10^6 psi
Bulk modulus	*	3.34	-	5.08	10^6 psi
Poisson's ratio		0.2	-	0.26	
Yield strength (elastic limit)		1.16	-	3.19	ksi
Tensile strength		1.16	-	3.19	ksi
Compressive strength		4.35	-	29	ksi
Elongation		0			% strain
Hardness - Vickers		3	-	18	HV
Fatigue strength at 10^7 cycles	*	0.58	-	2.32	ksi
Fracture toughness		0.546	-	0.91	ksi.in^0.5
Mechanical loss coefficient (tan delta)		0.0011	-	0.0054	

Thermal properties

Melting point		2.25e3	-	2.46e3	°F
Maximum service temperature	*	626	-	716	°F
Minimum service temperature		-459	-	-458	°F
Thermal conductor or insulator?		Poor insulator			
Thermal conductivity		0.532	-	1.24	BTU.ft/h.ft^2.F
Specific heat capacity		0.193	-	0.22	BTU/lb.°F
Thermal expansion coefficient					

		2.06	-	3.5	µstrain/°F

Electrical properties

Electrical conductor or insulator?		Poor insulator			
Electrical resistivity	*	1e8	-	1e12	µohm.cm
Dielectric constant (relative permittivity)		10	-	15	
Dissipation factor (dielectric loss tangent)	*	0.001	-	0.01	
Dielectric strength (dielectric breakdown)	*	127	-	305	V/mil

Optical properties

Transparency		Opaque			

Processability

Machinability		2	-	3	

Eco properties

Embodied energy, primary production		26	-	37.9	kcal/lb
CO2 footprint, primary production		0.0147	-	0.0163	lb/lb
Recycle		✗			

Supporting information

Design guidelines

Limestones vary widely in composition and porosity and their strength and weather resistance reflect this. The softer ones can be sawn and carved by hand, and so are widely used for sculpture and decorative moldings. They weather in a benign attractive way; the carbonic acid in rain dissolves a very thin surface film over time, making the surface self-cleaning.

Technical notes

Limestone consists mainly of calcite, CaCO3, with sand (SiO2) and, in some cases magnesium carbonate, MgCO3, (Dolomitic limestone). Limestones vary greatly in hardness and are generally easier to work than sandstones.

Typical uses

Limestone is widely used for building and sculpture. It is calcined in large quantities to make lime (CaO) for cement and as a flux in the smelting of iron.

Tradenames

Portland stone; Bath stone

Links

Reference

ProcessUniverse

Producers