

## Description

### Image



### Caption

1. Close-up of the material. © John Fernandez 2. Granite Butts Mehre Heritage Hall, University of Georgia. © John Fernandez

### The material

Granite is one of the most durable of materials. The pyramid of Giza (2980 BC) was built of limestone cased in granite. It is a coarse grained igneous rock, very hard and compact. It takes a fine polish, showing the beauty of its crystals. It is the most important stone in building - whole cities are built of it (Edinburgh, in Scotland UK, is an example). It is used for work-surfaces because of its durability, resistance to acids and alkalis, and its decorative appearance. Granites, because of the lack of porosity, do not weather or crack as more porous stones do.

### Compositional summary

Granite is made up of quartz ( $\text{SiO}_2$ ) and feldspars and micas (both complex aluminosilicates).

## General properties

Density	164	-	200	lb/ft <sup>3</sup>
Price	* 0.472	-	2.82	USD/lb
Date first used	-10000			

## Mechanical properties

Young's modulus	7.25	-	10.2	10 <sup>6</sup> psi
Shear modulus	3.05	-	4.21	10 <sup>6</sup> psi
Bulk modulus	* 4.35	-	6.53	10 <sup>6</sup> psi
Poisson's ratio	0.15	-	0.26	
Yield strength (elastic limit)	1.16	-	3.34	ksi
Tensile strength	1.16	-	3.34	ksi
Compressive strength	16	-	37	ksi
Elongation	0			% strain
Hardness - Vickers	27	-	45	HV
Fatigue strength at 10 <sup>7</sup> cycles	* 0.58	-	2.32	ksi

Fracture toughness	0.819	-	2	ksi.in <sup>0.5</sup>
Mechanical loss coefficient (tan delta)	* 0.01	-	0.03	

### Thermal properties

Melting point	* 2.19e3	-	2.91e3	°F
Maximum service temperature	* 1.11e3	-	1.29e3	°F
Minimum service temperature	-459	-	-458	°F
Thermal conductor or insulator?	Poor insulator			
Thermal conductivity	1.44	-	1.62	BTU.ft/h.ft <sup>2</sup> .F
Specific heat capacity	0.185	-	0.201	BTU/lb.°F
Thermal expansion coefficient	5.56	-	6.67	µstrain/°F

### Electrical properties

Electrical conductor or insulator?	Good insulator			
Electrical resistivity	* 1e13	-	1e14	µohm.cm
Dielectric constant (relative permittivity)	14	-	18	
Dissipation factor (dielectric loss tangent)	* 0.001	-	0.01	
Dielectric strength (dielectric breakdown)	* 127	-	305	V/mil

### Optical properties

Transparency	Opaque			
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### Processability

Machinability	2	-	3	
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### Eco properties

Embodied energy, primary production	596	-	693	kcal/lb
CO2 footprint, primary production	0.303	-	0.335	lb/lb
Recycle	✗			

### Supporting information

#### Design guidelines

Granite is exceptionally hard, making it expensive to quarry and work, but it is exceptionally durable and wear resistant, and can be polished to a mirror-like finish. Its great chemical stability gives resistance to aqueous and organic fluids, acids and alkalis. Granite is used in optical tables; streets paved with granite cobbles looked today as they did when they were laid. Stone weathers in a benign attractive way, unlike concrete; and its association with the great structures of the past makes it attractive for imposing buildings of today.

#### Technical notes

Granites are made up of crystals of feldspar, dull white to deep red in color, with small grains of gray quartz and crystals of mica that give the stone its sparkle.

#### Typical uses

Granites are used for building and facing, floors and work surfaces, stable supports for machine tools, optical tables and supports for other precision instruments. Much is now used in ornamental ways.

## Links

Reference

ProcessUniverse

Producers