

Description

Image



Caption

1. Close-up of the material. © Granta Design 2. The proportions and regularity of brick make it fast to assemble. Brick weathers well, and the texture and color make it visually attractive. © Granta Design

The material

Brick is as old as Babylon (4000 BC) and as durable. It is the most ancient of all man-made building materials. The regularity and proportions of bricks makes them easy to lay in a variety of patterns, and their durability makes them an ideal material for the construction of building. Clay - the raw material from which brick are made - is available almost everywhere; finding the energy to fire them can be more of a problem. Pure clay is gray-white in color; the red color of most bricks comes from impurities of iron oxide.

General properties

Density	99.9	-	131	lb/ft ³
Price	* 0.281	-	0.753	USD/lb
Date first used	-7500			

Mechanical properties

Young's modulus	2.18	-	4.35	10 ⁶ psi
Shear modulus	0.87	-	1.81	10 ⁶ psi
Bulk modulus	* 1.16	-	2.47	10 ⁶ psi
Poisson's ratio	0.2	-	0.25	
Yield strength (elastic limit)	0.725	-	2.03	ksi
Tensile strength	0.725	-	2.03	ksi
Compressive strength	1.45	-	10.2	ksi
Elongation	0			% strain
Hardness - Vickers	20	-	35	HV
Fatigue strength at 10 ⁷ cycles	* 0.87	-	1.31	ksi
Fracture toughness	0.91	-	1.82	ksi.in ^{0.5}
Mechanical loss coefficient (tan delta)	* 0.004	-	0.02	

Thermal properties

Melting point	1.7e3	-	2.24e3	°F
Maximum service temperature	1.7e3	-	2.24e3	°F
Minimum service temperature	-460			°F
Thermal conductor or insulator?	Poor insulator			
Thermal conductivity	0.266	-	0.422	BTU.ft/h.ft ² .F
Specific heat capacity	0.179	-	0.203	BTU/lb.°F
Thermal expansion coefficient	2.78	-	4.44	μstrain/°F

Electrical properties

Electrical conductor or insulator?	Good insulator		
Electrical resistivity	1e14	-	3e16 μohm.cm
Dielectric constant (relative permittivity)	7	-	10
Dissipation factor (dielectric loss tangent)	0.001	-	0.01
Dielectric strength (dielectric breakdown)	229	-	381 V/mil

Optical properties

Transparency	Opaque		
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Processability

Moldability	2	-	4
Machinability	1	-	2

Eco properties

Embodied energy, primary production	238	-	542 kcal/lb
CO2 footprint, primary production	0.206	-	0.227 lb/lb
Recycle	×		

Supporting information

Design guidelines

Bricks and the mortar used to bond them are strong in compression but weak in tension. This largely determines the way they are used: brick structures (like those of stone) are designed in such a way that the loads are compressive everywhere, ruling out cantilevered or very slender forms. The face of brick can be molded and glazed, allowing great freedom of decoration, and the pattern and natural color variation gives a visually attractive surface. Low-fired, unglazed brick is vulnerable to water-penetration and degradation, and should be screened from direct weathering. High-fired or glazed brick is extremely durable.

Technical notes

Brick is fired clay: hydrous aluminum silicate, with impurities of potash, soda, lime, and oxides of iron. On heating to 900-1200C, the aluminum silicate reacts with soda to form a viscous glass - it is this that bonds the brick together. Most brick is porous; if it is to resist water it is glazed. To do this the surface of the fired brick is painted with a mixture of glass-forming fluxes and the brick is re-fired, melting the glaze, and forming a glassy surface that can be colored.

Typical uses

Domestic and industrial building, walls, paths and roads.

Links

Reference

ProcessUniverse

Producers