

Description

Image



Caption

1. Decorative ceiling plaster work. © Richerd Needham at en.wikipedia - (CC BY-SA 3.0) 2. Hospital Corpsman applies cast material to the arm of Damage Controlman Fireman. © Class Jason R. Williams, U.S. Navy - Public domain

The material

Plaster of Paris is exactly that: a plaster that, originally, came from Paris, France. It is made by calcining the mineral gypsum, $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$, at about 180°C , driving off water to give the anhydrite $2\text{CaSO}_4 \cdot \text{H}_2\text{O}$. When mixed with water it rehydrates and sets to a hard, white solid. It is used to make molds and casts for ceramics and sculptures, to make pre-cast ornamental plasterwork on ceilings and cornices, and for orthopedic bandages or casts. In medieval and renaissance times gesso (plaster of Paris mixed with glue) was applied to wood panels or canvas as the ground for tempera paintings.

Composition (summary)

$2\text{CaSO}_4 \cdot \text{H}_2\text{O}$, Gypsum

General properties

Density	73.7	-	112	lb/ft ³
Price	* 0.658	-	0.939	USD/lb
Date first used	1730			

Mechanical properties

Young's modulus	0.653	-	1.16	10 ⁶ psi
Shear modulus	* 0.29	-	0.725	10 ⁶ psi
Bulk modulus	* 0.435	-	0.798	10 ⁶ psi
Poisson's ratio	0.25	-	0.3	
Yield strength (elastic limit)	* 0.145	-	0.653	ksi
Tensile strength	* 0.145	-	0.653	ksi
Compressive strength	2.03	-	2.9	ksi
Elongation	0			% strain
Hardness - Vickers	1	-	3	HV
Fatigue strength at 10 ⁷ cycles	0.247	-	0.29	ksi
Fracture toughness	0.0091	-	0.0127	ksi.in ^{0.5}
Mechanical loss coefficient (tan delta)	0.1	-	0.3	

Thermal properties

Melting point	* 572	-	932	°F
Maximum service temperature	230	-	356	°F
Minimum service temperature	-99.4	-	-9.4	°F
Thermal conductor or insulator?	Poor insulator			

Thermal conductivity	0.231	-	0.347	BTU.ft/h.ft^2.F
Specific heat capacity	0.143	-	0.239	BTU/lb.°F
Thermal expansion coefficient	4.44	-	5.56	µstrain/°F

Electrical properties

Electrical conductor or insulator?	Poor insulator			
Electrical resistivity	* 1e8	-	1e10	µohm.cm
Dielectric constant (relative permittivity)	* 5	-	9	
Dissipation factor (dielectric loss tangent)	0.001	-	0.01	
Dielectric strength (dielectric breakdown)	* 50.8	-	102	V/mil

Optical properties

Transparency	Opaque			
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Processability

Moldability	4	-	5	
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Eco properties

Embodied energy, primary production	226	-	250	kcal/lb
CO2 footprint, primary production	0.186	-	0.206	lb/lb
Recycle	×			

Supporting information

Technical notes

In use plaster of Paris is mixed with half its weight of water. It remains usable for 20 minutes, starts to set after 30 and is solid after one hour.

Typical uses

External and internal molded decoration on walls and ceilings; as a mold material for casting low-melting metals; and as medical casts and splints.

Links

Reference

ProcessUniverse

Producers