Graphite (pure)

General information

Designation

C: pure, graphite

Typical uses

Brushes; electrodes; jigs; casting molds; thermal insulation; bearings; rocket nozzles; composites; refractory bricks; nuclear seals;

Composition overview

Compositional summary

100% C

Material family	Ceramic (technical)
Base material	C (Carbon)

Composition detail (metals, ceramics and glasses)

C (carbon)	100			%

Price

Price	*	5.08	-	7.71	USD/lb

Physical properties

Density	0.0795	-	0.0816	lb/in^3
Porosity (closed)	0			%
Porosity (open)	0			%

Mechanical properties

Young's modulus		1.45	-	3.63	10^6 psi
Yield strength (elastic limit)	*	1.45	-	16	ksi
Tensile strength		1.45	-	16	ksi
Elongation	*	0.04	-	1.1	% strain
Compressive strength	*	6.24	-	50.8	ksi
Flexural modulus	*	1.45	-	3.63	10^6 psi
Flexural strength (modulus of rupture)	*	0.754	-	6.09	ksi
Shear modulus	*	0.435	-	1.31	10^6 psi
Bulk modulus		4.35	-	5.22	10^6 psi
Poisson's ratio		0.22	-	0.3	
Shape factor		14.2			
Hardness - Vickers		4	-	50	HV
Fatigue strength at 10^7 cycles	*	3.9	-	4.55	ksi
Mechanical loss coefficient (tan delta)	*	8e-4	-	0.004	

Impact & fracture properties

Fracture toughness	0.819	-	1	ksi.in^0.5

Thermal properties

Melting point	6.61e3	-	6.92e3	°F
Maximum service temperature	2.37e3	-	3.09e3	°F
Minimum service temperature	-459			°F
Thermal conductivity	46.2	-	139	BTU.ft/hr.ft^2.°F
Specific heat capacity	0.167	-	0.172	BTU/lb.°F
Thermal expansion coefficient	0.333	-	2.39	µstrain/°F
Latent heat of fusion	* 692	-	778	BTU/lb

Electrical properties

Electrical resistivity	34.7	-	6.03e3	µohm.cm
Galvanic potential	0.2	-	0.28	V

Magnetic properties

Magnetic type	Non-magnetic

Optical properties

Color	Black
Transparency	Opaque

Durability

Water (fresh)	Excellent
Water (salt)	Excellent
Weak acids	Excellent
Strong acids	Acceptable
Weak alkalis	Excellent
Strong alkalis	Unacceptable
Organic solvents	Excellent
Oxidation at 500C	Limited use
UV radiation (sunlight)	Excellent
Halogens	Acceptable
Metals	Acceptable
Flammability	Non-flammable

Primary production energy, CO2 and water

Embodied energy, primary production	8.99e4	-	9.89e4	BTU/lb
Sources 198 MJ/kg (Jungbluth, 2008); 240 MJ/kg (Jungbluth, 2008)				
CO2 footprint, primary production	15.8	-	17.4	lb/lb
Sources 14.8 kg/kg (Jungbluth, 2008); 18.3 kg/kg (Jungbluth,				

Water usage	* 8.05e3	-	8.91e3	in^3/lb

Processing energy, CO2 footprint & water

Grinding energy (per unit wt removed)	* 4.7e3	-	5.19e3	BTU/lb
Grinding CO2 (per unit wt removed)	* 0.82	-	0.906	lb/lb

Recycling and end of life

Recycle	✗			
Recycle fraction in current supply	4.73	-	5.22	%
Downcycle	✓			
Combust for energy recovery	✓			
Heat of combustion (net)	* 1.37e4	-	1.44e4	BTU/lb
Combustion CO2	* 3.58	-	3.76	lb/lb
Landfill	✓			
Biodegrade	✗			

Notes

Other notes

Price depends very strongly on form - lump, chip and flake graphite is 4-5x the price of amorphous graphite. Graphite has excellent thermal shock resistance and good abrasion resistance.

Links

ProcessUniverse

Producers

Reference

Shape