

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	* 11.2	-	17	USD/kg
-------	--------	---	----	--------

Physical properties

Density	2.2e3	-	2.26e3	kg/m ³
Porosity (closed)	0			%
Porosity (open)	0			%

Mechanical properties

Young's modulus	10	-	25	GPa
Yield strength (elastic limit)	* 10	-	110	MPa
Tensile strength	10	-	110	MPa
Elongation	* 0.04	-	1.1	% strain
Compressive strength	* 43	-	350	MPa
Flexural modulus	* 10	-	25	GPa
Flexural strength (modulus of rupture)	* 5.2	-	42	MPa
Shear modulus	* 3	-	9	GPa
Bulk modulus	30	-	36	GPa
Poisson's ratio	0.22	-	0.3	
Shape factor	14.2			
Hardness - Vickers	4	-	50	HV
Fatigue strength at 10 ⁷ cycles	* 26.9	-	31.3	MPa
Mechanical loss coefficient (tan delta)	* 8e-4	-	0.004	

Impact & fracture properties

Fracture toughness	0.9	-	1.1	MPa.m ^{0.5}
--------------------	-----	---	-----	----------------------

Thermal properties

Melting point	3.65e3	-	3.83e3	°C
Maximum service temperature	1.3e3	-	1.7e3	°C
Minimum service temperature	-273			°C
Thermal conductivity	80	-	240	W/m.°C
Specific heat capacity	700	-	720	J/kg.°C
Thermal expansion coefficient	0.6	-	4.3	µstrain/°C
Latent heat of fusion	* 1.61e3	-	1.81e3	kJ/kg

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	209	-	230	MJ/kg
-------------------------------------	-----	---	-----	-------

Sources

198 MJ/kg (Jungbluth, 2008); 240 MJ/kg (Jungbluth, 2008)

CO2 footprint, primary production	15.8	-	17.4	kg/kg
-----------------------------------	------	---	------	-------

Sources

14.8 kg/kg (Jungbluth, 2008); 18.3 kg/kg (Jungbluth,

Water usage	* 291	-	322	l/kg
-------------	-------	---	-----	------

Processing energy, CO2 footprint & water

Grinding energy (per unit wt removed)	* 10.9	-	12.1	MJ/kg
Grinding CO2 (per unit wt removed)	* 0.82	-	0.906	kg/kg

Recycling and end of life

Recycle	✗			
Recycle fraction in current supply	4.73	-	5.22	%
Downcycle	✓			
Combust for energy recovery	✓			
Heat of combustion (net)	* 32	-	33.6	MJ/kg
Combustion CO2	* 3.58	-	3.76	kg/kg
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