



SOLAR MATERIALS

Graphite and post processes

Overview

Graphite

The grades of graphite manufactured by POCO are segmented by grain size, including one, five, ten and fourteen micron products. These base materials are further segmented for specific performance requirements by application.

The defining characteristic of POCO graphites is the uniform microstructure inherent in the materials. These graphite grades have a proven cost of ownership due to the materials' isotropic microstructure, a result of a unique manufacturing process.

The high degree of isotropy found in POCO graphites makes them useful in many applications where an anisotropic material would fail. It also allows for a maximum utilization of material as machining orientation is of no importance. The net benefit is improved performance at a lower cost when compared to many other material choices.

POCO grades of graphite are available in bulk form or as custom machined parts for specific applications.

In addition to the unique properties engineered into the base graphite, POCO has a variety of post processing options to further modify the material to fit specific application requirements.

Typical Data Analysis

PURIFIED POCO GRAPHITE

Element	ppm Concentration
Na	<0.005*
Mg	<0.005*
Al	0.09
K	<0.005*
Ca	<0.005*
Ti	0.02
V	0.002
Mn	<0.001*
Fe	0.03
Ni	0.01
Cu	<0.001*
Zn	<0.005*

* Denotes value below detection limits

Post Processes

All POCO grades are available as bulk product, but post processing can be performed on five- and ten-micron grain size materials. All grades can be purified to less than 5 ppm.

Purity (-2)

Unpurified, POCO graphite has typical impurity levels over 1000 ppm, those impurities consisting primarily of metals. POCO's purification process reduces impurities to 5 ppm (99.9995%) or less, as determined by ash analysis.

Pyrolytic Carbon Treatment (PYC and FABMATE®)

Purified, finished graphite parts go through a unique, proprietary CVI process that provides a nonporous surface by depositing an amorphous carbon coating. The treatment seals the surface of the graphite and reduces particle generation in demanding environments. These materials are acid-resistant.

POCO produces a number of pyrolytic carbon treated materials marketed under different trade names for solar applications.

Silicon Carbide (SUPERSiC®)

POCO's unique conversion process produces the highest quality silicon carbide products available on the market today. This process starts with graphite material specially developed and manufactured for use as the precursor in the conversion process.

Near-net shaped parts are machined in graphite, purified, and subjected to a proprietary conversion process which substitutes pure silicon atoms for carbon atoms. During conversion POCO also has the ability to fuse parts so that they enter the furnace as an assembly of individual pieces and exit as a monolithic unit, with properties indistinguishable from those of a part originally made from a single structure. This "conversion bonding" process is accomplished without the use of adhesives or other bonding agents.

Services

In addition to premium materials, POCO provides technical material and applications engineering support. Experienced design engineers are ready to assist customers with modeling and prototypes, and they have electronic file exchange capability

to accept IGES, DXF and SolidWorks® files. Combining expertise in using CNC equipment with CMM and optical inspection equipment allows POCO to readily handle high volume production and quickturnaround items.

Typical Material Properties

	ZEE®	SFG	DFP	SCF	PLS	PVL
Particle size:	1 µm (40 µin)	1 µm (40 µin)	5 µm (200 µin)	5 µm (200 µin)	10 µm (400 µin)	14 µm (550 µin)
Pore size: ¹	0.3 µm (12 µin)	0.3 µm (12 µin)	0.8 µm (32 µin)	0.8 µm (32 µin)	1.5 µm (60 µin)	1.2 µm (47 µin)
Coefficient of thermal expansion: ²	8.4 µm/m°C (4.65 µin/in°F)	8.1 µm/m°C (4.5 µin/in°F)	8.1 µm/m°C (4.5 µin/in°F)	8.5 µm/m°C (4.7 µin/in°F)	8.2 µm/m°C (4.55 µin/in°F)	7.6 µm/m°C (4.22 µin/in°F)
Compressive strength:	193 MPa (28,000 psi)	166 MPa (24,100 psi)	140 MPa (20,000 psi)	163 MPa (23,600 psi)	100 MPa (14,500 psi)	104 MPa (15,100 psi)
Flexural strength: ³	103 MPa (15,000 psi)	96 MPa (13,900 psi)	86 MPa (12,500 psi)	93 MPa (13,500 psi)	60 MPa (8700 psi)	58 MPa (8400 psi)
Tensile strength: ⁴	72 MPa (10,400 psi)	67 MPa (9700 psi)	60 MPa (8700 psi)	65 Mpa (9400 psi)	42 MPa (6100 psi)	38 Mpa (5400 psi)
Shore hardness:	100	84	74	91	68	66
Electrical resistivity:	3050 µΩ-cm (1200 µΩ-in)	1950 µΩ-cm (770 µΩ-in)	1475 µΩ-cm (580 µΩ-in)	2450 µΩ-cm (965 µΩ-in)	1460 µΩ-cm (575 µΩ-in)	1300 µΩ-cm (512 µΩ-in)
Apparent density:	1.77 g/cm ³ (0.064 lb/in ³)	1.69 g/cm ³ (0.061 lb/in ³)				
Thermal conductivity: W/m.K (Btu/hr/ft°F)	44 (25)	75 (44)	95 (55)	50 (29)	105 (60)	70 (40)
Oxidation threshold: ⁵	470°C (880°F)	470°C (880°F)	470°C (880°F)	475°C (890°F)	460°C (860°F)	475°C (890°F)

¹ Measured using Hg porosimetry method

² Average for temperature range of RT-800°C

³ Measured using 4-point bend method

⁴ Estimated at 70% of flexural strength

⁵ Temperature that results in 1% weight loss in 24 hours; oxidation threshold increases by approximately 100°C if graphite is purified. Test sample size equals 0.5" × 0.5" × 1.0".

For More Information

Please call your Regional Customer Service Center today to learn what POCO can do for you. Visit www.poco.com and select the Contact Us link for the center nearest you.

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