Premium Carbon Materials

For the aerospace industry

OVERVIEW

Entegris' POCO Materials are ideal for the extreme environments required by the aerospace industry. The defining characteristic of our graphite is the uniform microstructure inherent in the graphite materials. These graphites have a proven cost of ownership advantage in many applications, due to the properties that result from the material's uniform, isotropic microstructure. All of which are a result of a unique manufacturing process.

Our grades of graphite are segmented by grain size. These include one, five, 10, and 14 micron, and then are further segmented by application. They are sold in bulk form, or as custom machined components for specific applications. The properties of our graphite make them ideal for use as a replacement for structural, tribological, thermal, even electrical components. In many applications, our graphite has a lower cost of ownership and improved performance compared to other material choices.

In addition to engineering specific properties into the graphite, we offer a variety of post-processing options to further modify the material to fit the needs of specific aerospace applications.

HIGH-PERFORMANCE SOLUTIONS

Performing in extreme environments and adhering to stringent aerospace and aviation safety regulations demand components and materials that are both reliable and resilient. Our solutions benefit from our more than 50 years of experience with materials and design innovation. We rely on the knowledge we've gained through that experience to optimize the performance of applications, even under the most extreme conditions. Our solutions have served the civil, commercial, and military aerospace sectors for many years. Our tightly controlled manufacturing and quality processes, along with superior customer service remain our hallmarks.

Leading Manufacturer of Aerospace Products

We are a worldwide supplier of high-performance materials and products. Our proven materials help to improve a number of aerospace systems. Our solutions are supplied to several leading aircraft manufacturers, jet engine OEM's, rotable manufactures, MRO suppliers, and subcontractors in the aerospace sector.

Energy Performance

By reducing weight, increasing reliability and durability, our material solutions contribute to improving the efficiency of our customers' systems and applications.

Engineering, Technology Development – Teaming

Our dedicated engineering and technology development experts will partner with our customers to develop innovative solutions that improve the performance of their applications.

Quality and the Environment

Our production site, located in the Dallas/Fort Worth metroplex area, is an ISO-certified facility. This means customers will receive products built to meet their strictest quality criteria, and in accordance with applicable environmental standards for the aerospace sector.

POST PROCESSES

Purification (-1)

Unpurified graphites have typical impurity levels over 1000 ppm, of which, the major constituents are metals. Our purification process reduces impurities to 5 ppm (99.9995%) or less as determined by ash analysis. By removing metallic impurities, the oxidation threshold for our materials is increased by up to 50°C.

Densification (BG)

The process of manufacturing bulk synthetic graphite yields tiny voids (pores), which may link to the surface (open porosity) or be isolated (closed porosity). Densification partially fills the open pores with pure carbon, reducing the average pore size and open porosity. The open porosity is reduced by 80% through the BG process, resulting in graphite with reduced permeability.

Oxidation Inhibition (E2 and AP)

Graphite is subject to oxidation at high temperatures, typically above 450°C. Service temperature can be raised to 600°C by impregnating the pore structure of the graphite. The oxidation threshold increases an additional 50°C if the graphite is purified.

Silicon Carbide Conversion (SUPERSiC®)

Our unique conversion process produces the highest quality silicon carbide products available on the market today. This process starts with graphite material specially designed 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 that substitutes pure silicon atoms for carbon atoms. The conversion to SUPERSiC silicon carbide results in significantly increased strength, electrical resistivity, and an oxidation threshold above 800°C.

TYPICAL MATERIAL PROPERTIES

Material name	AXF-5Q	AXF-5QC*	ACF-10Q	ACF-10QE2	ACF-10QE2.1*	ACF-10Q1AP*	SUPERSiC
Particle size	5 µm (200 µin)	5 µm (200 µin)	5 µm (200 µin)	5 µm (200 µin)	5 µm (200 µin)	5 µm (200 µin)	N/A
Pore size	0.8 µm (32 µin)	0.8 µm (32 µin)	0.8 µm (32 µin)	0.8 µm (32 µin)	0.8 µm (32 µin)	0.8 µm (32 µin)	N/A
Total porosity: % volume	20%	17%	21%	18%	18%	19%	20%
Open porosity: % of total porosity	80%	60%	75%	60%	50%	63%	19%
Apparent density	1.78 g/cm³	3.00 g/cm³	1.77 g/cm³	1.85 g/cm³	1.85 g/cm³	1.85 g/cm³	2.53 g/cm³
Compressive strength	138 MPa (20,000 psi)	170 MPa (24,650 psi)	186 MPa (27,000 psi)	201 MPa (29,200 psi)	205 MPa (29,700 psi)	187 MPa (27,200 psi)	N/A
Flexural strength[1]	86 MPa (12,500 psi)	107 MPa (15,500 psi)	97 MPa (14,000 psi)	103 MPa (15,000 psi)	110 MPa (16,000 psi)	105 MPa (15,200 psi)	155 MPa (22,400 psi)

TYPICAL MATERIAL PROPERTIES (CONTINUED)

Material name	AXF-5Q	AXF-5QC*	ACF-10Q	ACF-10QE2	ACF-10QE2.1*	ACF-10Q1AP*	SUPERSiC
Tensile strength[2]	62 MPa (9,000 psi)	72 MPa (25,500 psi)	69 MPa (10,000 psi)	72 MPa (10,500 psi)	77 MPa (11,200 psi)	73 MPa (10,650 psi)	129 MPa (18,700 psi)
Modulus of elasticity	11,000 N/mm² (1.69 10^6 psi)	20,000 N/mm² (2.9 10^6 psi)	11,000 N/mm² (1.6 10^6 psi)	14,320 N/mm² (1.7 10^6 psi)	13,470 N/mm² (1.9 10^6 psi)	13,040 N/mm² (1.8 10^6 psi)	217 GPa (31 10^6 psi)
Tensile strain to failure	0.95%	0.95%	0.62%	0.62%	0.62%	0.62%	N/A
Shore hardness	74	75	95	95	97	96	N/A
Electrical resistivity	1470 µΩ-cm (580 µΩ-in)	175 µΩ-cm (69 µΩ-in)	2460 µΩ-cm (970 µΩ-in)	2460 µΩ-cm (970 µΩ-in)	2460 µΩ-cm (970 µΩ-in)	2460 µΩ-cm (970 µΩ-in)	N/A
Coefficient of thermal expansion	7.9 µm/m°C 4.4 µin/in°F	8.7 µm/m°C 4.8 µin/in°F	7.6 µm/m°C 4.2 µin/in°F	7.6 µm/m°C 4.2 µin/in°F	7.6 µm/m°C 4.2 µin/in°F	7.6 µm/m°C 4.2 µin/in°F	4.2 µm/m°C 2.4 µin/in°F
Thermal conductivity[3] W/m-K (BTU-ft/hr/ft²°F)	95 (55)	175 (101)	60 (35)	46.1 (27)	44.6 (26)	65.5 (38)	151 (86)
Oxidation threshold[4]	450°C (840°F)	495°C (923°F)	470°C (880°F)	N/A	N/A	N/A	N/A
Oxidation resistance[5]	N/A	N/A	N/A	0.94%	1.21%	1.71%	N/A
Total impurity level	–	–	–	–	–	–	<10 ppm
Specific stiffness	–	–	–	–	–	–	85 kN.m/g
Poisson's ratio	–	–	–	–	–	–	0.17
Dynamic shear modulus	–	–	–	–	–	–	97 GPa (14 10^6 psi)
Fracture toughness	–	–	–	–	–	–	2.44 MPa.$m^{0.5}$
Hardness knoop	–	–	–	–	–	–	1992 kg/mm²
Thermal diffusivity	–	–	–	–	–	–	92 x 10^{-6} m²/s
Instantaneous CTE at RT	–	–	–	–	–	–	2.4 10^{-6}/K (1.3 10^{-6}/°F)

**Impregnated Graphite.*

[1] Measured using four-point bend method.

[2] Estimated at 70% of flexural strength.

[3] Estimated value.

[4] Temperature that results in 1% weight loss in 24 hours in air. Oxidation threshold increases by approximately 100° if graphite is purified. Test sample size equals (surface area to volume = 10).

[5] Percent weight loss of a sample with 10:1 surface area: volume ratio for 24 hours @ 1125°F (607°C) in air.

FOR MORE INFORMATION

Please call our Customer Service Center today to learn what our premium graphite and silicon carbide solutions can do for you. Visit poco.entegris.com/contact-us for the location nearest you.

TERMS AND CONDITIONS OF SALE

All purchases are subject to Poco Graphite's Terms and Conditions of Sale. To view and print this information, visit poco.entegris.com/terms-and-conditions.

Entegris
POCO Materials

300 Old Greenwood Road
Decatur, Texas 76234
USA

Customer Service
Tel +1 940 627 2121
Fax +1 940 393 8366