Implant Materials and Components

Creating the optimized beamline

Regardless of the ion implant equipment or process chemistry, Entegris has a material solution for the components used along the beamline. Entegris' family of materials provide the optimum performance/cost benefits for each area of the beam line.

Entegris' graphite components are used across all generations and types of implant equipment. Typical applications are electrodes, high wear beam defining parts, structural shielding parts, structural extraction hardware, source area parts, and analyzer magnet components.

IMPLANT MATERIALS

Tight quality controls ensure that these graphite grades have uniform microstructures and physical properties that result in predictable performance from part to part. These grades are manufactured isotropically with tightly packed grain structures, high strengths, and uniform microstructure. Metallic impurity levels are below 5 ppm. These grades have a proven track record in the fab for improving yields, machine up time, and part lifetime.

Optimized Beamline

To maximize the performance throughout the beamline, Entegris has developed a family of Implant graphites. These graphites fit the performance requirements of all equipment, from new to legacy; and all areas of the beamline, from the source area to the end station. The goal is to create an "optimized" beamline which matches the requirements of the specific areas of the beamline to the attributes of the specific grades of graphite. This results in a beamline that has the highest performance with the lowest Cost of Ownership (COO). Entegris has developed software tools to help match process, equipment set, and material.

ZEE®

ZEE is a hard, wear-resistant material that offers improved performance in current and next generation implant equipment. A unique manufacturing process yields a one micron grain size graphite with elevated hardness and strengths that exhibits reduced wear and particle generation even in the highest energy environment. ZEE components enhance beam stability for extended up time and higher yields. ZEE is targeted at high wear areas or problem systems.

SCF

SCF has a five micron grain size microstructure with high strengths that generates fewer particles and resists wear better than competitive materials. SCF is an ideal material for structural components or components in older generation equipment.

DFP

DFP has a five micron grain size and sets the market standard for semiconductor grades of graphite. DFP is an ideal material for structural components or components in older equipment.

Pyrograph

Pyrograph is a pyrolytic carbon infiltrated graphite. This process seals the graphite surface to reduce particle generation in the chamber and intercalation of the implanted species, preventing cross-contamination. Minimum depth of infiltration is 0.1 inch through the entire surface of the component. Pyrograph is typically used in systems where cross-contamination is a problem.

CZR

CZR is a lower density five micron graphite manufactured using the Entegris proprietary process, which yields an economical graphite with the uniform microstructure. This material is targeted at legacy beamline components.

POST PROCESSES

Most Entegris grades are available as bulk product, but post processing is normally done on five micron grain size materials. All grades can be purified to less than 5 ppm.

Densification (-3)

Graphite has 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, which is then regraphitized. The resulting material has improved properties.

Purity (-2)

Unpurified Entegris graphite has typical impurity levels over 1000 ppm. These impurities include vanadium, iron, aluminum, calcium, nickel, titanium, and silicon. Entegris purification reduces impurities to 5 ppm (99.9995%) or less as determined by ash analysis.

COMPONENTS

All implant components are machined to customer prints or specifications. Design engineers are available to translate drawings into manufactured parts.

TYPICAL MATERIAL PROPERTIES

Property	ZEE-2	DFP-3-2	SCF-2	CZR-2	Pyrograph
Particle size	1 µm (40 µin)	5 µm (200 µin)	5 µm (200 µin)	5 µm (200 µin)	5 µm (200 µin)
Apparent density	1.77 g/cm^3 (0.064 lb/in^3)	1.82 g/cm^3 (0.066 lb/in^3)	1.77 g/cm^3 (0.064 lb/in^3)	1.65 g/cm^3 (0.0596 lb/in^3)	1.53 g/cm^3 (0.055 lb/in^3)
Flexural strength[1]	103 MPa (15,000 psi)	83 MPa (12,000 psi)	93 MPa (13,500 psi)	61 MPa (8800 psi)	34 MPa (5000 psi)
Compressive strength	193 MPa (28,000 psi)	140 MPa (20,000 psi)	172 MPa (25,000 psi)	93 MPa (13,500 psi)	83 MPa (12,000 psi)
Electrical resistivity	3048 µΩ-cm (1200 µΩ-in)	1524 µΩ-cm (600 µΩ-in)	2438 µΩ-cm (960 µΩ-in)	1840 µΩ-cm (725 µΩ-in)	2145 µΩ-cm (845 µΩ-in)
Shore hardness	100	74	91	70	68
Coefficients of thermal Expansion	8.4 µm/m°C (4.6 µin/in°F)	8.1 µm/m°C (4.5 µin/in°F)	7.6 µm/m°C (4.2 µin/in°F)	7.8 µm/m°C (4.3 µin/in°F)	7.8 µm/m°C (4.3 µin/in°F)
Purity	<5 ppm	<5 ppm	<5 ppm	<5 ppm	<5 ppm
Pyrolytic carbon[2]					12% pick-up

[1] *Measured using 4-point bend method*
[2] *Test area = 1.25" diameter/sample thickness – .25"*

FOR MORE INFORMATION

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Entegris

Corporate Headquarters
129 Concord Road
Billerica, MA 01821
USA

Customer Service
Tel +1 952 556 4181
Fax +1 952 556 8022
Toll Free 800 394 4083