Science.
Applied to Life.™

3M Technical Ceramics
for Semiconductor Manufacturing

Higher yields. Lower costs.

Advanced technical ceramics for electronics manufacturing

Hard-working, hard-wearing materials.

Engineered to help you achieve higher yields while controlling costs.

As fab costs continue to rise year over year, finding ways to reduce maintenance, extend equipment life and improve yields has become more critical than ever before.

Device components made from 3M Technical Ceramics can help you achieve these goals – providing dependable performance in the harshest thermal, chemical and structural environments.

Since 1996, technical ceramics from Ceradyne Inc., a 3M company, have been used to produce consistent, high-quality semiconductor processing components that translate to higher yields and lower cost of ownership. Our solutions range from complex ceramic parts as large as 700 mm in diameter to the smallest, most intricate injection molded devices.

We offer fully integrated manufacturing with substantial resources for the design and development of innovative product concepts and applications. Our manufacturing facilities provide advanced ceramic fabrication flexibility and custom engineering services.

Consider 3M Technical Ceramics, when your application calls for:

- High Purity
- High Thermal Conductivity
- Reduced Particulate Generation
- Corrosion/Erosion Resistance
- Controlled Electrical Properties

Combining materials science with creativity – to solve your toughest challenges.

3M is your trusted source for advanced non-oxide and select oxide ceramics. 3M Semiconductor Grade Ceramics are specially formulated to meet the stringent demands of these extreme processing environments.

Applications include:

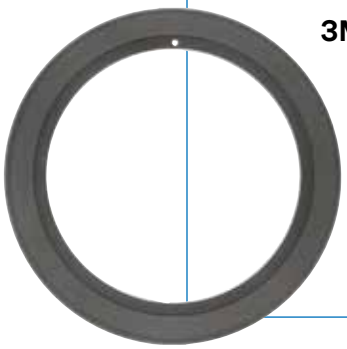
- Chamber Liners
- Chucks
- E-chucks
- Edge Rings
- Electrical Dissipation Plugs
- Electrodes
- Electrode Covers
- Focus Rings
- Gas Distribution Plates
- Heaters
- Microwave Windows
- RF Windows
- Vacuum Chucks

Custom ceramic formulations

3M™ Aluminum Nitride (AlN) 1370 Series

Key features

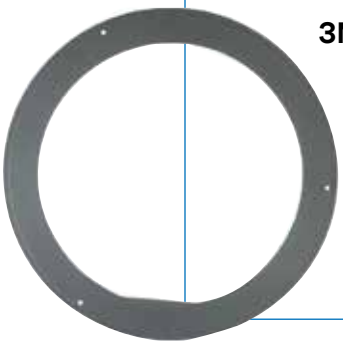
- Electrical insulator
- High thermal conductivity
- Critical thermal management material



3M™ Silicon Nitride (Si_3N_4) 147-A

Key features

- Electrical insulator
- Excellent mechanical properties
- Good wear resistance



3M™ Silicon Carbide (SiC) 146-IS

Key features

- Electrical properties tailored for semi-conductor: Resistivity >10^6 Ω•cm
- Outstanding high temperature, corrosion and wear properties
- High specific stiffness

3M™ Boron Carbide (B_4C) 546-4E

Key features

- Electrical conductor
- Very high hardness
- High specific stiffness
- Excellent wear resistance in plasma

Typical Properties of 3M Semiconductor Grade Materials

Not for specification purposes

Material	3M™ Silicon Nitride	3M™ Silicon Carbide	3M™ Aluminum Nitride			3M™ Boron Carbide
	Si_3N_4	SiC	AlN			B_4C
Grade	147A	146-IS	1370CS	1370-IE	1370DP	546-4E
Production process	Hot pressing	Hot pressing	Hot pressing	Hot pressing	Sintering	Hot pressing
Properties						
Chemical purity- metal based (%)	>98.9%	99.3%	95%	99.7%	97%	>99%
Color	Gray-Tan	Black	Black	Black	Gray-Tan	Black
Density (g/cm^3)	3.18	>3.12	3.3	3.26	3.3	2.50
Mean grain intercept size, typical (µm)	–	–	5–10 (typical)	6	6	6
Flexural strength (MPa)	700	350	350	330	300	400
Elastic modulus (GPa)	310	400	320	320	310	430
Poisson's ratio	0.23	0.16	0.24	0.24	0.24	0.17
Hardness -HV1 (Kg/mm^2)	1650 (HV5)	2300	920	1040	940	3100
Fracture toughness ($MPa \bullet m^{1/2}$)	4.5	3.0	2.5	1.7	3.0	3
Thermal expansion coefficient RT-1000°C ($10^{-6}/K$)	3.2	4.5	4.4	4.46	5.2	5.3
Thermal conductivity @ 25°C ($W/m \bullet K$)	42	>150	>140	76	>170	33
Electrical resistivity ($\Omega \bullet cm$)	$>10^{14}$	$>10^{6}$	$>10^{12}$	$1 \cdot 10^{13}$	$>10^{12}$	$<10^{6}$
Dielectric constant, ε	9	–	8.9	9	8.4	–
Key features	High Purity, Excellent Mechanical Properties	High Purity, Corrosion Resistance, Wear Resistance	High Thermal Conductivity	High Purity	High Thermal Conductivity	High Purity, Lightweight, Hardness and Wear Resistance, Neutron Absorption
Applications	Semiconductor and Wear Components	Semiconductor Components, Sputtering Targets	Semiconductor Components, Heaters, Chucks	Semiconductor Components, RF Windows, Heaters, Chucks, Clamp Rings, Gas Distribution Plates	Semiconductor and Microwave Components, EM Windows, Heaters, Chucks, Collector Rods, Helix Support Rods	Sputtering Targets, Semiconductor and Wear Components, Nuclear Shielding

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