

# CVD SiC and PBN Products for semiconductor applications



# MACOR Machining China Inc.

MACOR Machining China Inc. is a global materials engineering company which designs and manufactures a wide range of high specification products with extraordinary properties, across multiple sectors and geographies.

We produce components, assemblies and systems that deliver significantly enhanced performance for our customer's products and processes from an extensive range of advanced materials. Our engineered solutions are produced to very tight tolerances and many are designed for use in extreme environments.

The Company thrives on breakthrough innovation. Our material scientists and application engineers work directly with customers to create outstanding highly differentiated products that enhance reliability and improve efficiency.

Morgan Advanced Materials has a global presence with over 9,000 employees across 50 countries serving specialist markets in the energy, transport, healthcare, electronics, security and defense, petrochemical and industrial sectors. We are listed on the London Stock Exchange in the engineering sector, ticker symbol MGAM.

The Technical Ceramics business of Morgan Advanced Materials designs and manufactures advanced ceramic components from a portfolio of cutting edge materials. We routinely engineer complex parts that enhance the reliability or the performance of our customer's products in technically challenging applications.

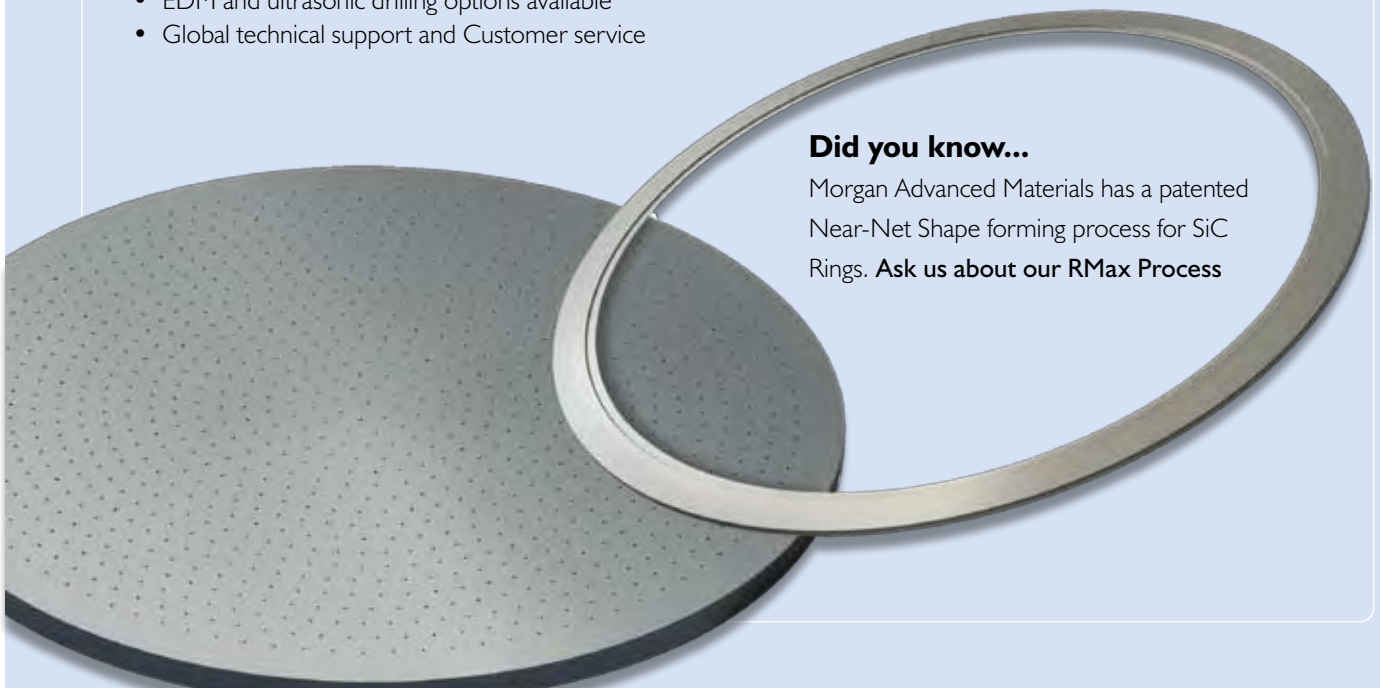
## Our CVD SiC and PBN Capabilities

We specialize in high performance ceramic materials manufactured by chemical vapor deposition (CVD), a process that produces ultra-pure and uniform material. Our silicon carbide (SiC) and pyrolytic boron nitride (PBN) are used in LED, semiconductor, compound semiconductor, crystal growth applications and more.

- High volume growth capability
- Large diameter and thick products available
- CNC grinding and lapping to very tight tolerances
- EDM and ultrasonic drilling options available
- Global technical support and Customer service

### Did you know...

Morgan Advanced Materials has a patented Near-Net Shape forming process for SiC Rings. Ask us about our RMax Process



# Silicon Carbide

Morgan CVD SiC ceramic material has a unique combination of excellent thermal, electrical and chemical properties that makes it well-suited to applications across semi-conductor industries where a high performance material is required.

Two grades of SiC are available. High Resistivity (HR Grade) and Engineered Low Resistivity (ELR Grade).



## Features

- Ultra-pure 99.999% (by GDMS)
- Outstanding corrosion resistance in plasma applications
- Proven durability in high temperature ammonia environments
- Excellent thermal shock resistant
- High thermal conductivity
- Excellent stiffness to weight ratio
- Fine grained microstructure
- Non-porous
- Two resistivity grades  
HR Grade:  $>10 \Omega\text{-cm}$   
ELR Grade:  $<0.1 \Omega\text{-cm}$

# Pyrolytic Boron Nitride

Morgan CVD PBN is a high purity, non-porous, and inert ceramic material. The material has anisotropic properties due to its planar crystal structure. PBN exhibits high thermal conductivity along its crystal planes and good thermal insulation through its crystal planes.



## Features

- Ultra-pure 99.995%
- Anisotropic thermal properties
- Very high dielectric strength
- High temperature stability (up to  $1800^{\circ}\text{C}$  in vacuum,  $2500^{\circ}\text{C}$  in  $\text{N}_2$ )
- Non-toxic and non-wetting
- Inert to most acids, alkalis, organic solvents, molten metals and graphite
- Excellent thermal shock resistance
- Oxidation resistant
- Low out-gassing at elevated temperature

## SiC Applications

### MOCVD

- Very high erosion resistance, providing a 20 fold increase in lifetime compared to conventional coated graphite
- Ultra-high purity, reduces process drift
- Excellent stability at high temperature in ammonia environment
- Very high thermal conductivity
- Uniform and efficient heating
- Satellite and cover plate options available



### Plasma Etch

- Highly resistant to chlorine/fluorine erosion
- Ultrasonic drilling for tight tolerance gas distribution plates
- Patented RMax process for high volume production of focus rings
- Extended lifetime in plasma etch chamber
- Proprietary surface treatment process minimizes initial particle release



### Rapid Thermal Processing (RTP)

- Excellent resistance to thermal shock
- High thermal conductivity ( $250\text{W/m} \cdot ^\circ\text{C}$ ), providing uniform wafer heating
- High volume production capability



# PBN Applications

## Crucibles

- Ultra-high purity and chemical inertness
- Non-toxic and non-wetting
- Uniform heating within crucibles, reduce growth rate variation
- Anisotropic thermal profile
- Thermal shock resistant
- High volume capability
- Extensive experience with MBE/OLED applications



## Plates

- Extends heater life and increases system uptime
- Reliable performance in MOCVD and MBE environment
- High oxidation resistance
- Negligible out-gassing at high temperature
- Quick turn prototyping

