



MOMENTIVE

performance materials

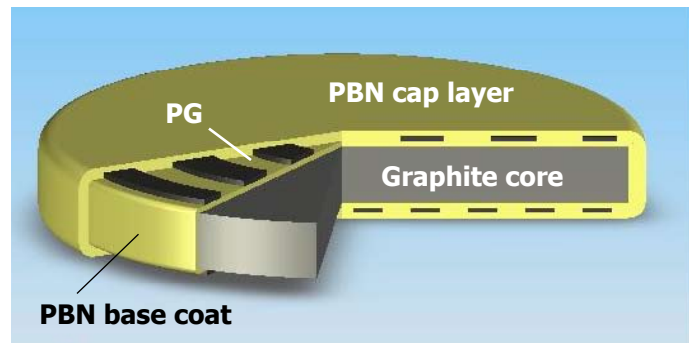
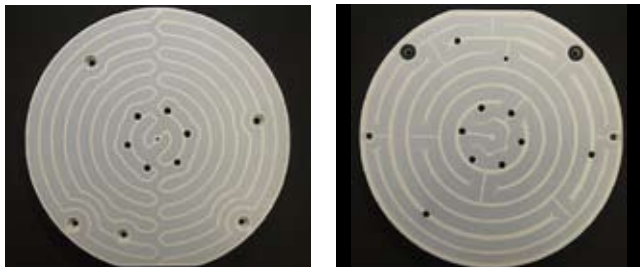
High-Performance Systems: Heaters and Electrostatic Chucks

Momentive's pyrolytic boron nitride (PBN) heaters and electrostatic chucks (e-chucks) combine the unique electrical, chemical, and thermal properties of PBN, a dielectric material, and pyrolytic graphite (PG), an electrical conductor, to produce a truly advanced system.

These non-brittle refractory materials owe their exceptional purity to the high-temperature chemical vapor deposition (CVD) production method. The high thermal conductivity and anisotropy of both materials result in excellent thermal uniformity.

Benefits

- High temperature capability: over 1500°C
- Fast cycle times: ramp rates up to 600°C/min
- Thermal uniformity (< 1%), tunable multiple zones
- Long life: shock resistant materials
- Heated JR and coulombic e-chucks



Product features

- Power densities over 50 watts/cm²
- Tailored thermal gradients and heat flux
- Chuck force up to 100 gm/cm²
- Low thermal resistance with Si
- Low heat capacity of 1.2 Joule/gm-°C to 700°C
- PBN dielectric strength of 200,000 V/mm¹
- PBN dielectric constant of 3.4¹
- Light weight

¹ c-direction

Design versatility

Momentive's heaters and e-chucks use PBN as the dielectric and PG as the conductor. For flatness, a graphite core is typically added. PBN and PG can be deposited in various shaped 3-D parts. Tailored power distributions and multiple zones can be designed into the conductor patterns. For chucks, dielectric layers can be doped for a JR effect.

Heaters and electrostatic chucks: thermally engineered solutions

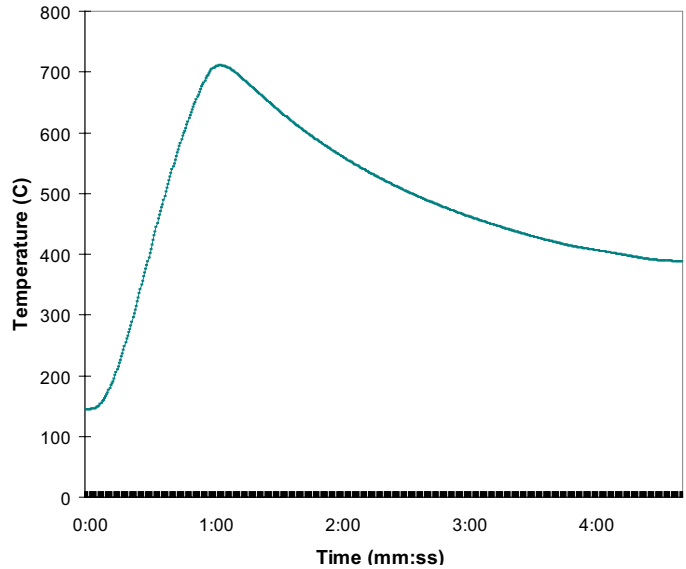
Thermal response

A key advantage of Momentive's technology is the use of low thermal mass, shock resistant materials, capable of high power densities.

Ramp rates for heating and cooling have been demonstrated as high as 600°C/minute for PBN plate based heaters, while conventional sintered ceramics are limited to ~15°C/minute.

PBN Plate Heater

Full power to 700°C, Cool to 400°C.

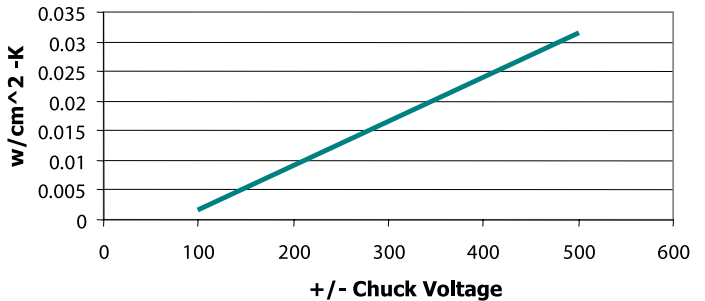


E-chuck performance

The dielectric materials used in Momentive's heaters and e-chucks have clear advantages

- > 0.03 watts/cm²-K heat transfer coefficient
- Back side gas not required
- Fast heating and cooling without thermal shock
- Broad operating temperature range
- No metal contamination
- Controlled doping for JR chucks
- Stable dielectric for high temperature chucking

E-Chuck Heat Transfer Coefficient



Applications

PVD Ion Implant MOCVD CVD ALD RTP PE-CVD

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