Minteq Pyrogenics Group

Pyroid® Pyrolytic Graphite for Ion Implantation

Pyroid pyrolytic graphite beam line components offer high temperature stability, plasma, and chemical erosion resistance for ion milling machines and semiconductor etching cathodes.

Benefits of Pyrolytic Graphite

Pyrolytic graphite ion grids offer major benefits for ion implantation applications relative to alternative materials such as molybdenum and other graphite-based infiltrated material.

Pyroid pyrolytic graphite offers:

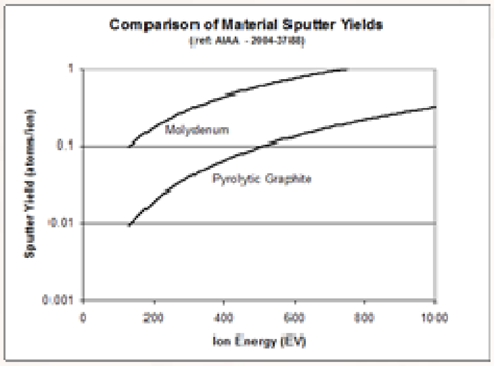
- **Lowest erosion rate of any material**

Lowest Erosion (Sputter Rate Material)

Material	Sputter Rate (Å/min.)
Molybdenum	870
Aluminum	630
Silicon	310
Pure Pyrolytic Graphite	40

Customer Benefit: Ion impact erosion of the ion optics (i.e., the grids) is the primary mechanism limiting the life of the ion grids. The erosion of the grid eventually weakens it to the point that the grid fails and breaks causing unnecessary and costly production down time

Ion grids of pyrolytic graphite offer low erosion potential, which provides longer life and more precise beam focus. Our grids can lower maintenance and decreases production down time, thereby saving costs.



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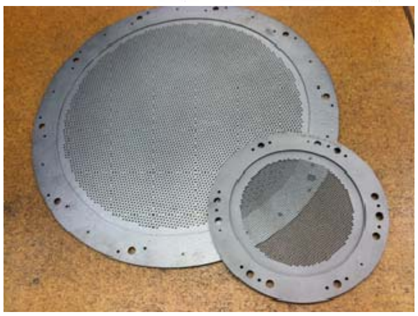

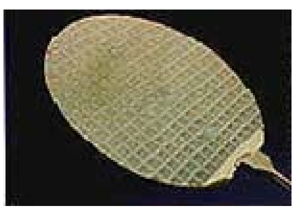

Pyroid pyrolytic graphite offers superior physical properties.

- **Zero porosity**

Customer Benefit:

Zero porosity translates into little or no outgassing of contaminants and no structure capable of trapping contaminants that can alter the dopant effect on the implantation.

Near zero coefficient of thermal expansion

Pyroid pyrolytic graphite has a coefficient of thermal expansion of essentially zero. Temperature gradient effects on the ion grids are negligible.

Customer Benefit:

Near zero thermal expansion means the grids maintain their relative spacing across a range of temperature and energy settings. This translates into more precise control for depositing dopant atoms into the substrate.

- **Single crystal structure** (versus material with grains)

Customer Benefit:

The theoretical density of monocrystalline graphite is 2.26 g/cm3. The density of highly pure pyrolytic graphite is 2.23 g/cm3 which is greater than any known graphite due to its single crystal structure. This means that there is no porosity due to ash contamination in the material that degrades the structure. This porosity is found in even purified isostatically pressed fine-grained graphite material

In addition pyrolytic graphite offers:

- High purity > 99.999%
- Stability at high temperature and vacuums
- Extreme resistance to thermal shock

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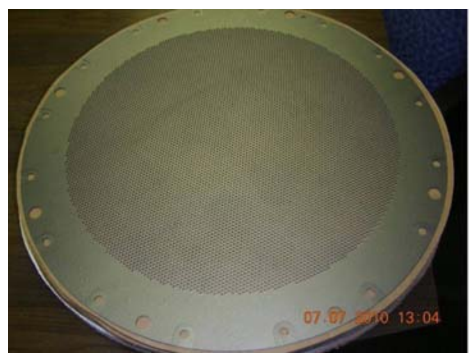
Typical Pyroid® Pyrolytic Graphite Anallysis > 99.999% (75 element analysis)	
Element	Concentration (ppm wt)
F	<0.05
Na	0.01
B	<0.01
Al	<0.01
Mg	<0.05
K	<0.05
Ca	<0.05
Cr	< 0.1
Si	0.37
Ti	0.04
V	<0.005
Mn	<0.005
Fe	<0.01
Ni	<0.01
Cu	<0.05
Zn	<0.05
P	<0.01
all others	<0.001 or better

Ion Implant Applications

- Ion Implantation Grids
- Wafer Trays
- Electrodes for Plasma Etch
- Boats
- Crucibles
- Susceptors
- Brazing and glass-to-metal sealing jigs



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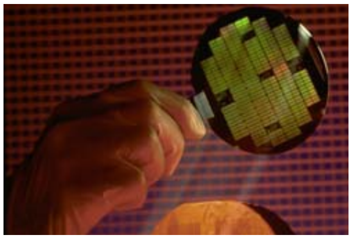


Case Study – Pyrolytic Graphite Provides Optimum Erosion in MOCVD

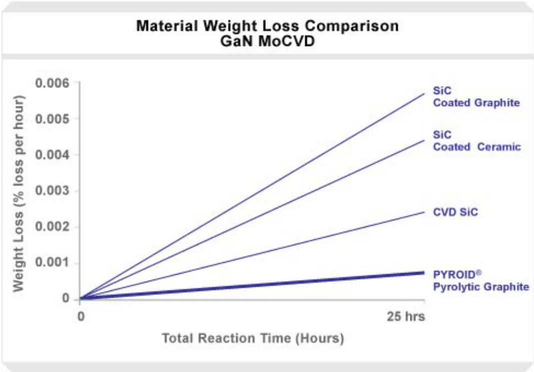
A leading electronics manufacturer of Metal Organic Chemical Vapor Deposition (MOCVD) in looking to increase productivity has used SiC coated graphite and solid SiC susceptors.

In MOCVD, a laminar carrier gas with precursor molecules of metal-organic compounds flow over a wafer placed on hot graphite based susceptor inside a reactor vessel. The atoms are deposited by decomposing the metal-organic molecules while passing over the hot substrate. The undesired remnants are removed or deposited on the walls of the reactor.

The Challenge: Test materials to determine the best selection for new resistance to ammonium offering material stability and consistent long life.

The manufacturer undertook a detailed duration test under temperature (800 °C) for 40 hours with GaN cleaning media under a N2 and 0.3-0.5% levels of CL2 and HCl at flow rates of 0.33 to 1.095 SLM.

The results indicated that Pyroid pyrolytic graphite provided the most erosion resistance of all the materials (2.5X times that of CVD SiC and 8X greater than SiC coated graphite).



For Details or Samples Call, FAX or Email

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