SEMICONDUCTOR

Vacuum Chamber Solutions

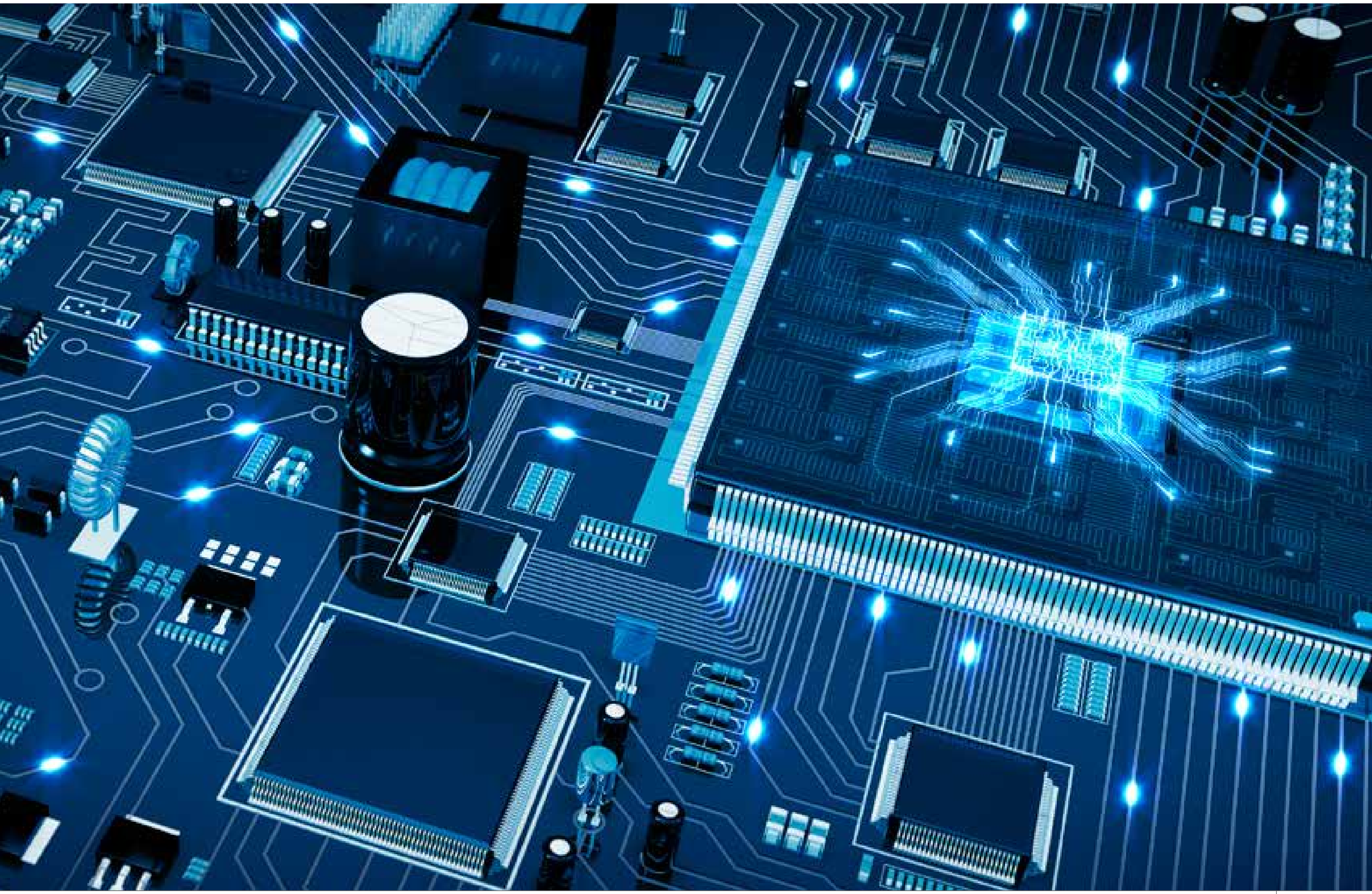
World’s broadest portfolio of polymer solutions for use in vacuum chamber applications

MITSUBISHI
CHEMICAL
GROUP

Typical process tools: Etch, CVD, PVD & ion implant

Material Solutions & key properties

- **Ketron® 1000 PEEK**
  For use in lower power, lower heat (300°F) or indirect plasma chamber applications such as wafer mobility.
- **Duratron® T4203 PAI**
  For use in medium power, medium heat (500°F) applications or indirect chamber applications in presence of Oxygen plasma.
- **Duratron® CU60 PBI**
  For use in high power, high heat (750°F) applications or indirect chamber applications when in the presence of Oxygen plasma.
- **Semitron® MPR1000**
  For use in high power, medium heat (520°F) applications. Best in class when in presence of Oxygen plasma.



General Trends

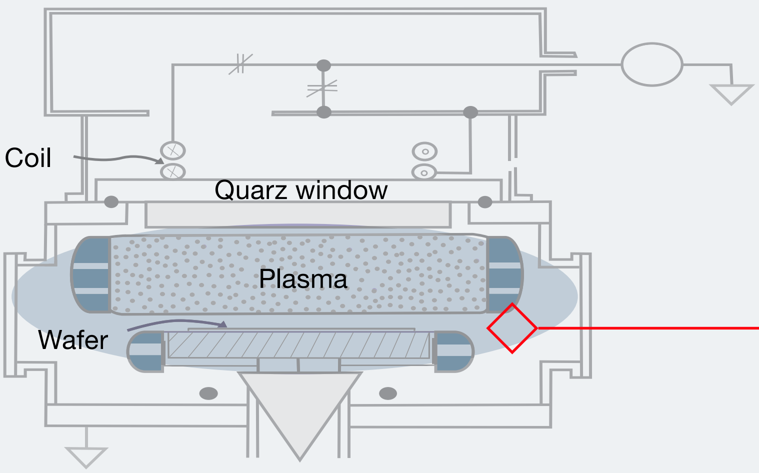
Key Considerations

- Increasing energy in plasma chambers
- More aggressive plasma chemistries, introduction of Oxygen into the chambers
- Pinpoint material selection on a per application basis to maximize “cost vs. performance”
- Replacement of polyimide for reduced cost & increased performance
- Careful use of ceramics & quartz due to cost & breakage
- Increased requirements for ionic purity due to reduced node size

Typical Applications

- Screws & pins
- Clamp & trench rings
- Valve housings
- Shower heads
- Various etch & CVD parts

Vacuum chamber

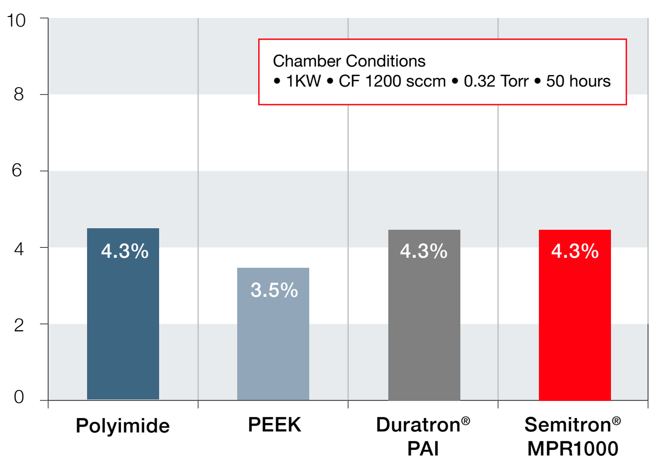


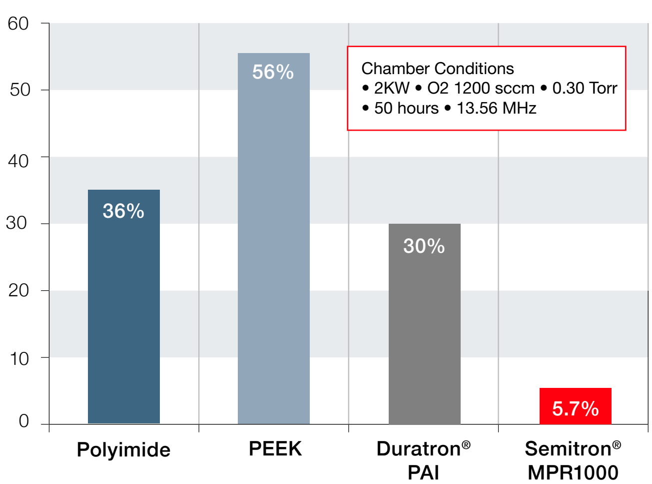
Competitive Quartz vs. Semitron® MPR1000

Competitive quartz (left) is much more brittle than Semitron® MPR1000 (right) often chipping in vacuum chambers

Introducing: Semitron® MPR1000

Semitron® MPR1000 was developed to provide engineers with a viable polymer-based option when confronted with the increasing demands in vacuum plasma based chamber design due to use of Oxygen to clean the chamber and the rapidly increasing electrode power.





Product features

- Excellent plasma resistance in Oxygen plasma, approaches quartz
- 12-25X* better than polyimide in Oxygen plasma
- Excellent chip resistance, durability & machinability compared to quartz
- Lowest overall cost of any polymer solution
- Excellent ionic purity

Percent weight loss in Cf4 plasma - low energy

- Most advanced engineering plastics perform similar in freon plasma gases
- The mode of degradation is mechanical erosion, a function of surface hardness & type of solid, crystalline vs amorphous

Percent Weight Loss In O2 Plasma - 2kw

- Advanced engineering plastics mode of degradation in Oxygen plasma is catastrophic oxidation
- Semitron® MPR1000 was developed to withstand the typical erosion experienced in Oxygen plasma chambers
- Semitron® MPR1000 displays 10X better results than PEEK and 6X better results than polyimide in a 2KW Oxygen plasma chamber and up to 25X better results than polyimide at 2.5KW Oxygen plasma

Ionic purity data

	Aluminum (Al)	Barium (Ba)	Calcium (C)	Cromium (Cr)	Copper (Cu)	Iron (Fe)	Lead (Pb)	Lithium (Li)	Magnesium (Mg)	Manganese (Mn)	Nickel (Ni)	Potassium (K)	Sodium (Na)	Strontium (Sr)	Titanium (Ti)	Zinc (Zn)
Semitron® MPR1000	0.14	0.07	2.8	2.6	0.14	2.3	0	0	0.3	0.11	0.36	0.77	4.4	0.04	0.12	0
Ketron® PEEK	0.38	0.02	8	0.49	0.2	6	0.005	0.005	0.8	0.2	0.42	1.6	480	0.06	0.18	0.15
Standard Polyimide	0.47	0.05	0.01	0.01	0.05	0.36	0.05	0.05	0.28	0.02	0.02	0.13	0.44	0.05	0.05	0.02
Semitron® MPR1000	0.14	0.07	2.8	2.6	0.14	2.3	0	0	0.3	0.11	0.36	0.77	4.4	0.04	0.12	0
Standard Polyimide	17.68	1.88	0.38	0.38	1.88	13.55	1.88	1.88	10.54	0.75	0.75	4.89	16.56	1.88	1.88	0.75

by total digestion   Adjusted for mass loss during erosion 2.5 KW • 2000 sccm • O2

Material comparison guide

		Standard Polyimide	Duratron® CU60 PBI	Ketron® 1000 PEEK	Semitron® MPR1000	Duratron® T4203 PAI
MECHANICAL PROPERTIES						
Tensile strength (psi)	D638	12,500	16,000	16,000	17,000	20,000
Tensile modulus (psi)	D638	-	850,000	630,000	1,200,000	600,000
Flexural strength (psi)	D790	16,000	32,000	25,000	24,000	24,000
Flexural modulus (psi)	D790	450,000	950,000	600,000	1,050,000	600,000
Hardness rockwell	D785	M82	M125	M100	M106	M120
Moisture absorption 24hrs @73°F (%)	D570[2]	0.24	0.40	0.10	0.28	0.40
Moisture absorption @ saturation (%)	D570[2]	1.5	5.0	0.5	3.4	1.7
TRIBOLOGICAL PROPERTIES						
CLTE (in./in./°F)	E-831 (TMA)	3.0×10^{-5}	1.3×10^{-5}	2.6×10^{-5}	1.5×10^{-5}	1.7×10^{-5}
Heat deflection temperature @66psi (°F)	D648	632	800	320	534	532
ELECTRICAL PROPERTIES						
Dielectric constant @ 1 Hz	D150	4.20	3.20	3.30	3.68	4.20
Dissipation factor @ 1 Hz	D150	0.0034	0.0030	0.0030	0.0080	0.0260
Dielectric strength	D149	560	550	480	570	580
Ionic purity	-	excellent	good	fair	excellent	good

1) Data represents our estimated maximum long-term service temperature based on practical field experience.
(2) Specimens: 1/8” thick x 2” diameter or square.
(3) Estimated rating based on available data. The UL-94 Test is a laboratory test and does not relate to actual fire hazard.

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Poland I South Africa I Switzerland I The Netherlands I United Kingdom I United States Of America

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