MOMENTIVE
performance materials

PolarTherm* thermally conductive Boron Nitride fillers for polymeric materials

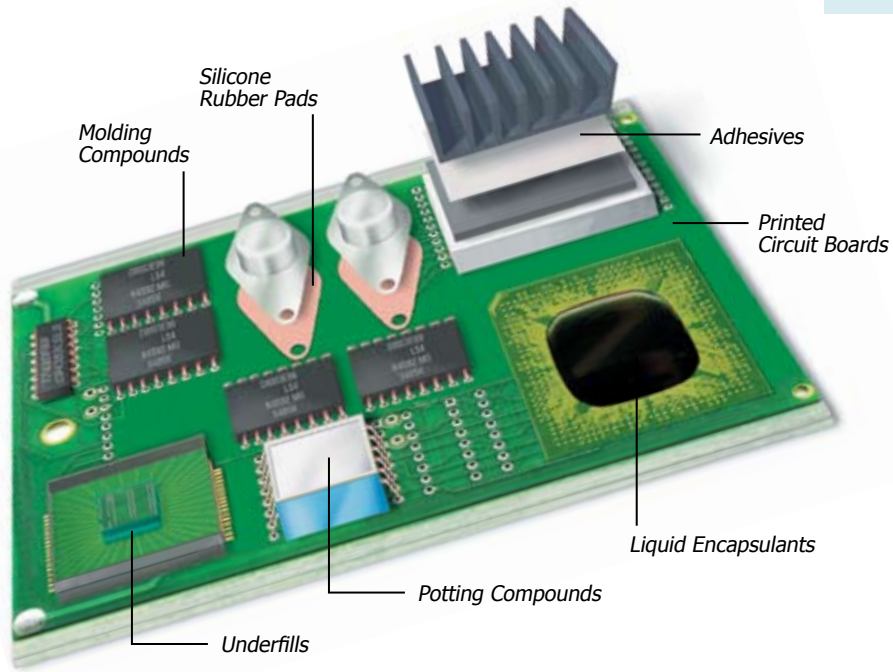
Heat – it's one of the major enemies of today's electronic components and assemblies. It shortens service life and threatens reliability. Every day designers are asked to produce smaller, faster assemblies making the need for heat dissipation even greater. PolarTherm*Boron Nitride (BN) fillers solve tough heat problems by conducting and dissipating heat far better than other materials, as shown in Table 1.

PolarTherm®Advantages:

- High thermal conductivity
- Low dielectric constant
- Low CTE
- Non abrasive
- High volume resistivity
- Chemically inert

Table 1:Comparison of Filler Properties

	BN	AlN	Al_2O_3	Fused SiO_2
Thermal Conductivity W/mK @ 25° C	300+	260	30	1.4
Dielectric Constant	3.9	8.8	9.7	3.8
Volume Resistivity ohm-cm	10^{15}	10^{14}	10^{14}	10^{14}
Loss Tangent @ 1 Mhz	<.0002	.0004	.0001	.0002
Knoop Hardness kg/mm^2	11	1200	1500	500
Coefficient of Expansion Linear, x 10^{-6}/ ° C	<1	4.4	6.7	0.5
Specific Heat J/kgK @ 25° C	794	734	798	689
Theoretical Density g/cc	2.25	3.26	3.98	2.20



Engineered to your specifications

Momentive Performance Materials offers over 75 grades to suit your application and can tailor grades for specific needs. You can specify PolarTherm* powders to give you the precise combination of thermal conductivity, flow properties and other characteristics you're looking for. Powder surfaces can be modified for greater flowability at high loading levels.

Application Notes

Factors that determine the conductivity of a BN-loaded polymer include:

BN Related Factors

- Crystal size & inherent T_c
- Particle size and shape
- Particle hardness
- Surface area
- Oxygen content
- Tap density

PolarTherm*Fillers – Sampling of Grades

	Typical Properties			
	Surface Area (m2/g)	Average Particle Size (microns)	Oxygen %	Tap Density g/cc
100 Series (Fine Hexagonal BN Powders - Single Crystal)				
PT 100	5.5	13	0.3	0.3
PT 110	0.6	45	0.3	0.65
PT 120	2.0	12-13	0.3	0.55
PT 131	14.0	10	1.1	0.4
PT 140	7.0	9-12	0.4	0.5
PT 160	13.0	7-10	0.4	0.4
PT 180	17.0	6-9	0.5	0.35
300 Series (Medium-Density Agglomerates)				
PT 350	3.3	125-150	0.3	0.7
PT 360	6.5	250	0.3	0.5
PT 371	4.0	275	0.2	0.4
600 Series (High-Density Agglomerates)				
PT 620	4.4	16	0.55	0.6
PT 670	1.5	300	0.3	1.0
PTX Series (Spherical Agglomerates)				
PTX 25	7	25	0.2	0.3
PTX 60	5.5	60	0.4	0.4

Typical Purity Levels

Ca, Si	<500 ppm (per element)
Cu, Al, Mg, Fe, K	<100 ppm (per element)
Cl, S	<50 ppm (per element)
Na	<20 ppm
Other Metals	<10 ppm each

Low alpha particle emissions . . . .0.018 counts/cm^2- hr

Additional product specification sheets are available from Momentive Performance Materials. Call Momentive for other grades and custom materials.

Polymer Related Factors

- Base resin viscosity
- Compounding technique

Application Factors

- Acceptable viscosity of polymer with BN

How Much PolarTherm*Should I Use?

Typically, the volume loading of BN required to experience an increase above the polymer's baseline thermal conductivity is about 40%. The loading where conductivity begins to increase dramatically is known as the percolation threshold. Depending on the T_c required and acceptable viscosity, the loading level typically ends up in the 40-70% range by volume.

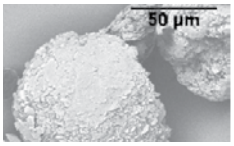
What Thermal Conductivity Can I Expect?

The inherent conductivity of a single BN crystal is 300 to 400 W/m-K. A polymer composite with BN crystals typically yields 10 W/m-K, while conductivities up to 25 W/m-K can be achieved via special compounding techniques and optimal selection of the crystal and polymer.

Note on Agglomerates:

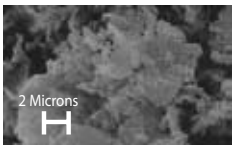
Resins do not coat BN crystal surfaces or penetrate crevices; therefore, BN agglomerates are an excellent method to maximize BN loading while maintaining contact between particles and keeping a workable viscosity. Momentive's medium-density agglomerates provide an increase in effective loading of BN while not substantially increasing the weight of BN in a composite. These agglomerates are more fragile than high-density grades, so care must be taken to not break them apart during compounding.

PT 100



PTX60 SEM

PT 120



PT 131

PT 140

PT 350

PT 670

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