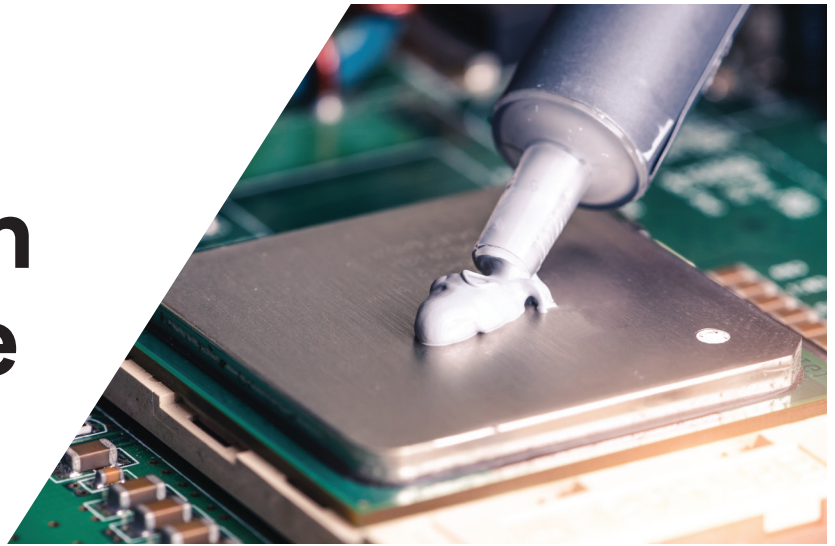


Boosting with Boron Nitride

Increasing thermal conductivity of polymer compounds



3M™ Boron Nitride Cooling Fillers (3M BN cooling fillers) are excellent for increasing the thermal conductivity of your compound formulas. 3M BN cooling fillers can be used for thermoplastic, elastomer and thermoset resins.

Resin compounds often contain additives to adjust key properties of finished plastic parts. However, thermal conductivity (TC) – a critical factor for materials in areas such as electronics, telecom and vehicle electrification – is typically very low for base polymers. Fillers like aluminosilicates can help improve the TC of finished parts. But they often require high volume loadings, making it hard to balance the necessary thermal conductivity with other performance attributes. An ideal solution: boosting with 3M Boron Nitride Cooling Fillers.

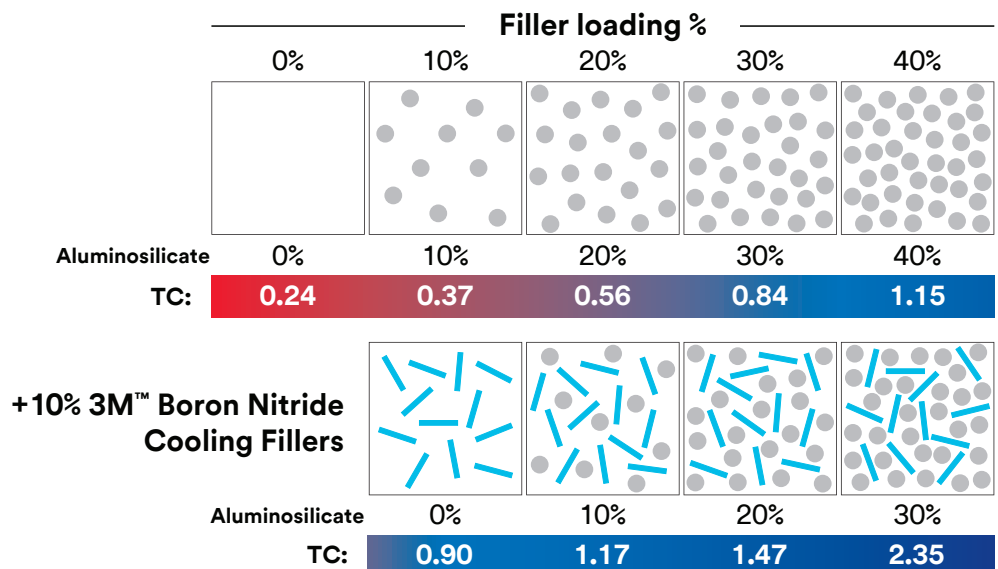
Common Additive	Property Achieved
Glass, mineral fiber	Mechanical stability
Aluminum hydroxide	Flame retardancy, lower cost
Talcum	Lower cost
3M Boron Nitride Cooling Fillers	Thermal conductivity

Boosting at a glance:

In this example using a polymer with an inherent TC of 0.24, the compounder introduced aluminosilicate up to 40% volume loading and achieved a total finished-part TC of 1.15. By reducing the aluminosilicate volume loading by 10% and replacing it with 3M BN cooling fillers, the compounder boosted the finished-part TC to 2.38 – more than 50% higher, without changing the total filler content.

Big boost. Same volume loading – or even less.

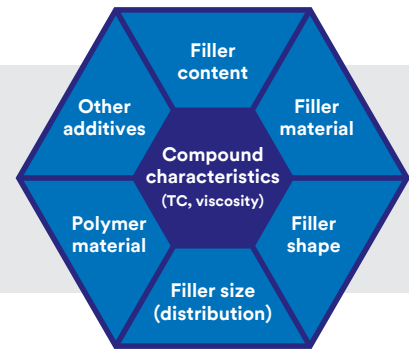
Introducing just 1–10 wt% 3M BN cooling fillers into a compound can typically improve the thermal conductivity of finished materials by 50–100%.



Your results may vary due to differences in test types and conditions.

Influencing factors

Multiple factors influence overall compound characteristics. Thermally conductive filler content, material, shape, and size all play important roles and need to be balanced to achieve desired final properties.

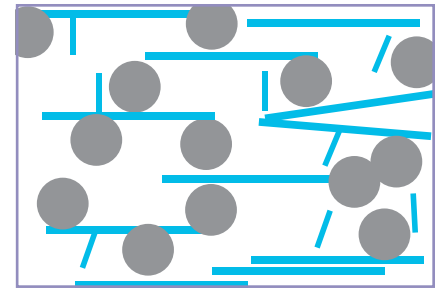
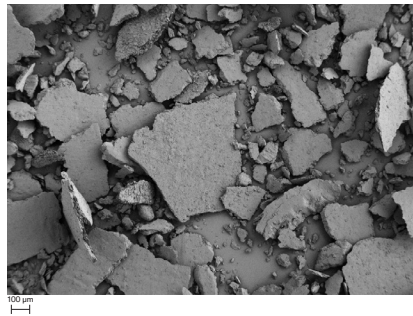


Controlling viscosity

Filler content, along with the shapes of filler particles, is very important for boosting TC in low-viscosity applications. Generally, the higher the volume loading, the higher the viscosity. Spherical particle shapes generally affect viscosity the least. 3M Boron Nitride Cooling Fillers are available in grades specifically recommended to preserve low viscosity – especially for epoxies and silicones – as they can help achieve desired TC without significantly affecting overall filler volume loading.

Role of filler size and shape

Boosting with a single filler can be simple as well as effective. But often, resin compounds include a number of secondary fillers which can make tailoring finished-part TCs more complex. It's important to know the intrinsic TC of secondary filler materials (3M BN cooling fillers have a very high intrinsic TC) and it is critical to understand the sizes and shapes of their particles. In general, the more various the filler particles, the higher the TC. Filler particles with differing geometries form complex networks within the polymer. The image of 3M Boron Nitride Cooling Filler Flakes 500-3 demonstrates the flat geometry of the flakes. When mixed with fillers of other shapes, for example spherical, the flakes enable multimodal heat distribution – better percolation, more heat paths and fewer interfaces between fillers and polymers. This increases thermal conductivity and can allow for higher filler loadings.



Grade of 3M Boron Nitride Cooling Fillers	Description
Flakes 200-3	Highest through-plane thermal conductivity. Boosts thermal conductivity of compounds as secondary filler.
Flakes 500-3	Highest through-plane thermal conductivity. Boosts thermal conductivity of compounds as secondary filler.
Agglomerates 50M	Mix of agglomerates, platelets and boron nitride clusters. Excellent for potting resins.
Platelets 007HS	Ideal for thin films <50 µm due to its controlled top size. Highest reflectivity and increased in-plane thermal conductivity in pads.

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