MCM Composites Draws Attention to Guide Detailing Thermoset Versus Thermoplastic Properties

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MCM Composites, LLC, a thermoset plastic molding company, has highlighted its educational guide comparing thermoset plastics and thermoplastics, a resource created to help engineers and product designers select the correct material for demanding applications. The guide addresses a common source of confusion, as the two material categories are frequently treated as interchangeable despite behaving very differently when exposed to heat.

Although both material families begin as polymer powders, they react in fundamentally different ways during processing. Thermoset plastics are cured by heat and can be formed only once, developing permanent chemical bonds through a crosslinking reaction. Engineered thermoplastics, by contrast, soften when heated and solidify when cooled, allowing them to be ground and reformed without altering their chemical composition. The guide explains that this difference in molecular structure drives nearly every performance distinction between the two categories.

At the molecular level, thermoplastics consist of linear or branched polymer chains held together by weak secondary bonds that break and reform with heat, which permits repeated melting and solidification cycles.

Thermosets form three-dimensional crosslinked networks connected by strong covalent bonds, creating permanent links between chains. Because these crosslinks prevent the material from flowing when heated, thermosets decompose rather than melt at extreme temperatures, a property that gives them exceptional dimensional stability and resistance to creep under load.

The guide details how these structural differences translate into practical performance. Thermoset plastics offer higher impact resistance and durability than many alternatives, along with heat resistance, creep resistance, and suitability for tight tolerances. They are often comparable to metal in strength and rigidity while providing greater corrosion resistance at lower weight. Thermoplastics, meanwhile, deliver excellent flexibility and impact absorption and can be recycled, though they are generally limited to service temperatures below 300 degrees Fahrenheit, while thermosets can perform in applications requiring strength at temperatures up to 500 degrees Fahrenheit.

Processing methods differ as well. Thermoplastics are commonly shaped through injection molding, extrusion, blow molding, and thermoforming, benefiting from fast cycle times as the material cools quickly. Thermoset processing relies on methods that facilitate crosslinking during manufacturing, including compression molding, reaction injection molding, resin transfer molding, and bulk molding compound techniques. These processes typically require longer cycle times but often produce parts with tighter tolerances and less need for secondary finishing.

Michael Fredrich, Chief Executive Officer of MCM Composites, said the guide reflects the questions the company hears regularly from customers weighing material options. "Engineers come to us assuming the two materials are close substitutes, and then they are surprised by how different the results can be once a part is in service," Fredrich said. "We built this guide so designers can walk through temperature, chemical exposure, dimensional stability, and cost considerations before they commit to tooling, rather than discovering a mismatch after production has started."

The resource also addresses chemical and environmental resistance, an area where thermosets generally outperform thermoplastics because their crosslinked structure resists chemical penetration and ultraviolet degradation. That characteristic makes thermosets well suited to outdoor exposure, marine environments, and contact with industrial oils, fuels, and solvents. Thermoplastics offer good durability under normal conditions, and many engineering grades incorporate stabilizers and additives that improve their resistance to chemicals and weathering.

Recyclability represents one of the clearer trade-offs discussed in the guide. Thermoplastics can be remelted and reformed multiple times, supporting mechanical recycling and circular economy goals, while traditional thermosets have historically been more difficult to recycle because their crosslinked structure cannot simply be remelted. The guide notes that emerging chemical recycling methods and dynamic thermosets known as

vitrimers are beginning to narrow that gap.

Fredrich added that material selection rarely comes down to a single factor. "The right answer depends on how the part will actually be used, from operating temperature to load, chemical contact, and expected life," he said. "Our team works with both customers and suppliers to match the application to the material, and this guide gives people a clear starting point for that conversation."

MCM Composites, LLC produces more than 1,000 different parts for customers throughout the United States, Canada, China, Mexico, and the Caribbean in an ISO 9001:2015 certified mold shop. The company specializes in thermoset injection molding and compression molding and offers secondary services that include tapping, drilling, coating, and multi-piece assembly. The guide comparing thermoset and thermoplastic materials, along with additional capabilities information, is available at www.mcmusa.net.

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MCM Composites

MCM Composites is a trusted leader in custom molding, providing high-quality solutions to a diverse clientele across the globe

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