EnableX™

pre-preg molding system

Continuous Fiber Reinforced Pre-preg Adds Strength

The addition of continuous fiber reinforced pre-preg has a significant effect on the load bearing capacity of a composite part.

The part below (Image 1) was originally manufactured entirely from epoxy molding compound. As Image 1 indicates it was redesigned with a combination of molding compound and continuous fiber pre-preg. Both material options yield a part of equal weight, but varying thickness in the bridge section, notable is the bridge with pre-preg reduced the thickness by 0.040".

image 1

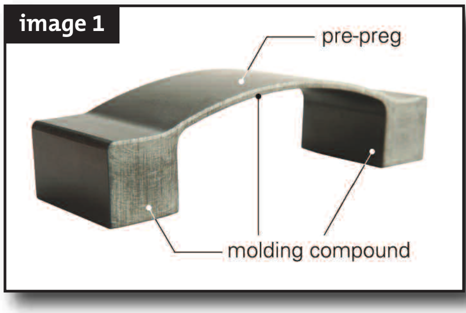
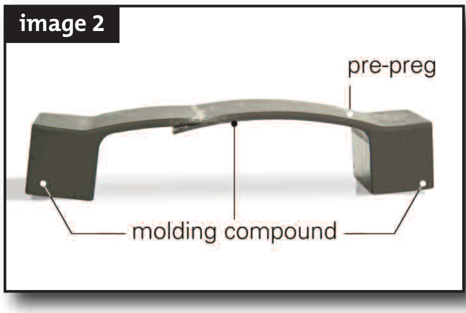


image 2

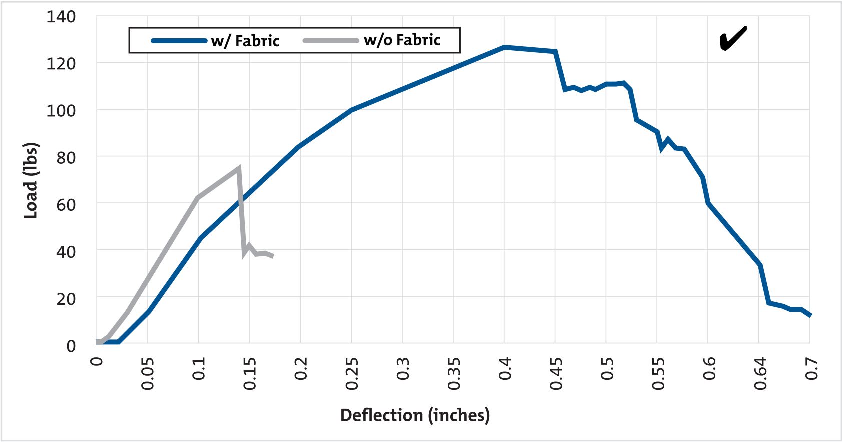


Note: The continuous fiber pre-preg did not break. The molding compound delaminated from the pre-preg.

The decreased thickness at the bridge section opens space in sub-assemblies for additional design flexibility.

Despite this difference in the thickness of the bridge section, the redesigned part utilizing pre-preg showed a significant increase in the flexural performance, max load at failure and deflection at failure (Chart 1). In the redesigned pre-preg part, total failure (complete fiber break) was not observed but a delamination of the molding compound from pre-preg did occur (Image 2).

chart 1



	Bridge Thickness	Max Load @ Failure	Flexural Strength
Molding Compound	0.175"	75 lb	13,476 psi
Molding Compound with Pre-preg	0.135"	125 lb	37,722 psi

Adding Continuous Fiber Reinforced Pre-preg Increases the Load Bearing Capacity of the Bridge Section by 300%

"Norplex-Micarta's pre-preg material had excellent workability. The tack free nature of the material was particularly helpful, and the material responded well to our molding process. This certainly opens new opportunities for our customers to expand their design options."
– Greg Rinard, Supplier Development Engineer, HyComp LLC

Parts molded and tested by

HyComp

Advanced Composite Solutions

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pre-preg molding system

Designing for Strength & Stiffness: Multi-Material Combinations & Geometry

Features common in plastic design excel in minimizing deflection in composite parts.

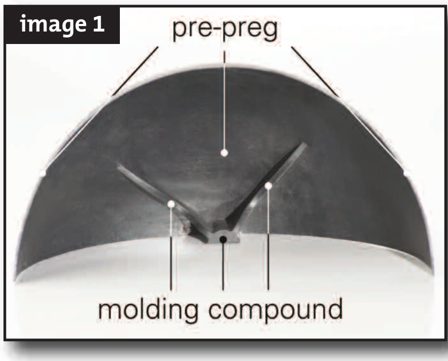


image 1

The combination of pre-preg and molding compound opens options for designing geometrically complex parts. The addition of ribs in the domed part produces a part with nonuniform deflection behavior (Image 1). A load placed directly on top of a rib produces less deflection than if the load is placed between the ribs (Image 2 and 3). While this behavior is expected, the degree by which it was manifest in this case demonstrates the significance of using geometry to alter the deflection of a part.

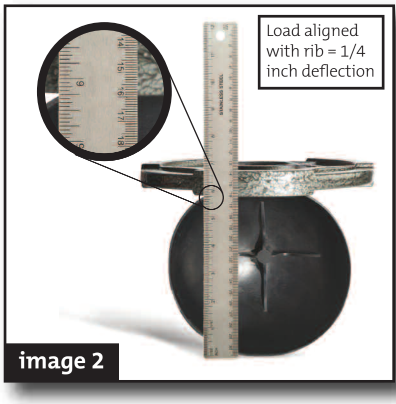


image 2

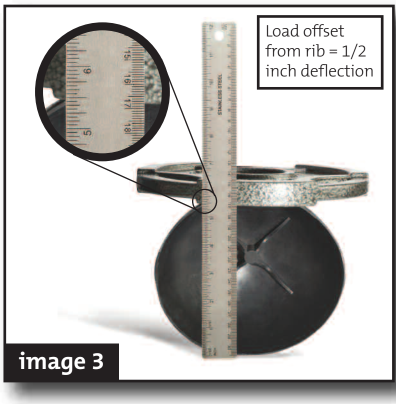


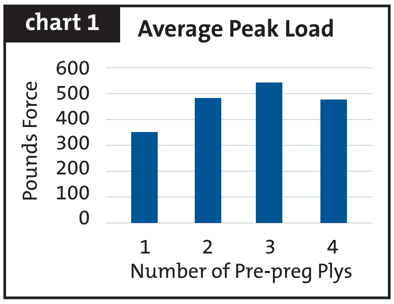
image 3

The use of molding compound allows for the creation of detailed features (such as ribs) that open the designer's window for changing the moment of inertia – using very little material, and therefore adding minimal mass, to dramatically affect deflection.

Strength of a composite part is improved with continuous fiber reinforced materials.

While the deflection performance can be best affected through geometry, strength is best improved through continuous fiber reinforcements. As a part contains more continuous fibers, it gets stronger.

chart 1



The part weighs approximately 0.20 pounds resulting in a load to weight ratio of more than 2,500.

The same part, now loaded from the top (Image 4), was tested with various ply count configurations. Without pre-preg, the part was not strong enough to eject from the tooling. At 0.032˝ nominal wall thickness, at least one ply of pre-preg was required to make a part. At four ply, the average strength begins to fall.

This is a function of the pressed ply thickness of the pre-preg and the part wall thickness. At three ply, the optimal consolidation of the material could occur, resulting in the greatest strength. In this case, peak load coincided with a delamination between the continuous fiber pre-preg and the molding compound ribs, which is the expected failure mode.


image 4

"Norplex-Micarta has invested in a mold base to quickly and economically evaluate material combinations, affects of geometry, and effects of various molding parameters. We look forward to working with you on your next project."
– Jeff Okeke, Applications Engineer, Norplex-Micarta

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