

TEPIC: A high temperature, high strength, lightweight material

Fact Sheet

TEPIC was initially formulated as a high temperature, high strength structural support foam for Defense Program applications. It has also been demonstrated to be an excellent material for machined or molded-to-shape prototype tooling for composites manufacturing.

Most tooling for composites is made from metals, which can be expensive, difficult to repair and heavy and unwieldy in larger tools. TEPIC, in contrast, is about 5 to 10 times more affordable than bulk aluminum (6061-T6) and its density is approximately 4 times lower. Compared to dense Invar 36, TEPIC is also approximately 10 times less expensive.

Other lightweight polymer-based materials have limited utility in this type of application due to their maximum-use temperature of less than 250 °F. Many of these materials are also only available as thin-slab stock, so larger applications require bonding multiple boards together.

TEPIC's high temperature stability (greater than 400 °F) is among its many advantages. It can be cast as an oversize billet and machined to final shape or, if a mold is available, formed to final shape. Fine features have successfully been machined and replicated on the molded surface. A gloss finish is possible using commercial gel coats.



20-kg pour of TEPIC and machined structural part



Machined TEPIC with gel coat and composite part



Fly cut and milled surface of TEPIC tool



Fine features machined into TEPIC tool

TEPIC

Features:

- Machined or molded to final shape
- Easy processing
- Uses commercially available ingredients
- Greater section thickness than other board stock
- Machineable to rough dimensions prior to cure
- Good for autoclave processing of composite over 400 °F
- Accepts gel coat for high-gloss surface
- No epoxide inhibition
- Repairable

Envisioned applications include:

Tooling for composite manufacturing

- Machine to shape
- Mold to shape

Prototype-injection-molding tooling

Hot-embossing tooling

High temperature adhesives

Structural

Properties:

Compression strength, 77 °F	>7,000 psi
Compression strength, 392 °F	>4,000 psi
Modulus	300,000 psi
Coefficient of thermal expansion	
77 – 257 °F	8.6 x 10 ⁻⁵ °F ⁻¹
with low CTE filler	5.0 x 10 ⁻⁵ °F ⁻¹
Density range	0.3 – 0.8 g/cm ³
Approximate materials costs	\$100/ft ³
Billet size	greater than 24" x 24" x 8"
Cure	400 °F
Maximum use temperature	>400 °F

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