

**Case
Application**

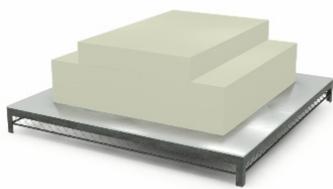
Epoxy-urethane foam: an economical
alternative for soft-tooling molds

**LAST-A-FOAM® FR-4700
High-Temperature
Tooling Board
Series**



GENERALPLASTICS
MANUFACTURING COMPANY

Where Great ideas Take Shape



Bonding



Machining & Sealing



Layup & Autoclave



Demold

Background

High-density polyurethane foam tooling boards have proven their value in constructing molds or shapes for making composite or thermoform parts. Polyurethane soft tools are a very fast and low-cost alternative to traditional metal tools, typically one-third to one-half the cost. The polyurethane foam is rapidly machined, and LAST-A-FOAM® tooling boards are able to hold very sharp edges and tolerances. With very low residual stress on the materials, they don't warp or move around.

Challenge

The advent of higher-temperature resins and carbon-fiber composites such as Hexcel's HexTOOL®, created the need for polyurethane foam that can withstand much higher process temperatures. It needed to stand up to high-heat prepreg and autoclave curing while delivering substantial cost- and time-savings compared to hard tooling. Our customers sought a material for one-off, prototype and short-run tooling that could handle the high-temperature curing cycles required to produce advanced composite parts.

Response

General Plastics introduced its LAST-A-FOAM® FR-4700 High-Temperature Tooling Board Series. This rigid, high-temperature, hybrid-polyurethane tooling board is designed for prototype machining, prepreg composite layup tooling, vacuum form tooling, tool proofing, pattern making, and master model making. These HT boards are low-cost, rapidly machined into complex shapes and easy to work with. When specifications change, or modifications need to be made to a master tool, this soft tooling substrate is easily adjusted and reused at a fraction of the cost of metal tooling, especially when creating very large, monolithic tools or molds.

Considerations

To achieve the best soft-tooling results, select the right material and plan properly for the specific curing processes and conditions. In particular, the foam material requires larger thermal compensations. Key considerations include the material's:

- Dimensional stability
- Process temperatures
- Prepreg resin cure cycles
- Autoclave pressures
- Thermal expansion changes
- Compatibility of material properties

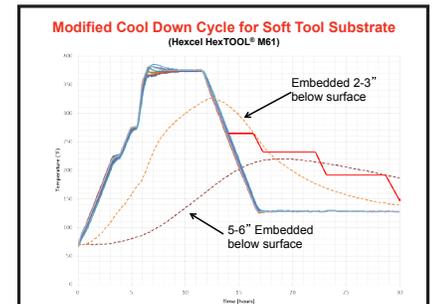
Because the foams are heavily influenced by the type of filler and by polymer crosslinking, it's essential to match these boards to the temperature range under which the foam will be used:

- A low-temperature prepreg will typically cure at 60°F-120°F
- BMI-resins require 350°F-375°F for the prime cure

Additional recommendations

When using vacuum-bag or autoclave-cure processes, test the tooling material under process conditions (including the predicted ramp-up and cool-down cycles) prior to production to ensure it is suitable and stable.

FR-4700 tooling board withstands autoclave conditions up to 400°F (200°C) at 90 psi. General Plastics provides recommended cool-down cycles to ensure that the tool properly equilibrates before cooling to room temperature.



Case Example: Hexcel Corporation

Hexcel Corporation chose LAST-A-FOAM® FR-4718 High-Temperature Tooling Board for soft tooling a master mold. This product served as an excellent substrate because of its high Tg and compressive modulus, and predictable CTE. In addition, the foam would not distort under required cure conditions. They used HexTOOL® M61 Tooling Compound, which was readily machined to the final dimensions. Ultimately, they created a HexTOOL® carbon-fiber layup tool in significantly less time and at dramatically lower costs than when using metal materials.



FR- 4700 High-Temperature Tooling Board

Advantages for Soft Tooling:

- Can be used from ambient to high temperatures and under pressure conditions
- Blocks can be bonded to make large, complex-shaped tooling
- Material is machinable and offers fast surface preparation
- Can be used several times with a controlled cool-down rate

*HexTOOL® is a registered trademark of Hexcel Corporation.