HexTOOL™ M61

Quasi-isotropic High Temperature Prepreg Tooling Compound (Patent Pending)

Product Data

Description

HexTOOL™ Tooling Compound is randomly layered strips of uni-directional prepreg which is consolidated into rolled goods. It can be utilized as multi-ply quasi-isotropic hand lay-up, and subsequently CNC milled to close tolerance. HexTOOL™ has proved to be dimensionally stable with the ability to hold vacuum integrity before and after machining, and after more than 500 part cure cycles. Fabricated from Hexcel's BMI resin HexPly® M61, HexTOOL™ tools are ideally suited for 356°F (180°C) cure carbon fiber tools. This makes them lighter weight, more energy efficient than tools made of steel or Invar®, and more cost-effective with tighter mold tolerance than standard composites.

Benefits

- Ability to machine tool surface without distortion permitting the manufacture of tools with complex shapes and tight tolerances
- Lighter weight compared to metal tooling allowing easier handling and reduced infrastructure investment
- Faster heat-up and cool-down rates relative to metal tools facilitating reduced production costs
- Reparability and potential for modification of tool dimensions following engineering changes
- Formulated to withstand several hundred autoclave cycles at 356°F (180°C)
- Coefficient of thermal expansion to match carbon/epoxy
- Vacuum integrity following machining
- Rapid material deposition as HexTOOL™ is much thicker than standard composite tooling prepregs

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Uncured Material Properties

Property	Value	Comment
Nominal Resin Content	38%	by weight
Nominal Bundle Size (Prepreg Strip Size)	0.315 in. x 1.97 in. (8.0 mm x 50 mm)	
Nominal HexTOOL™ Ply Areal Weight	0.41 lbs/ft^2 (2000 g/m^2) 0.81 lbs/ft^2 (4000 g/m^2)	
Specific Gravity	1.55	
Autoclave Work Life at 70ºF (21ºC)	20 days	
Storage Life	12 months	0ºF (-18ºC or below)

Cured Material Properties*

Property	Value	Comment
Cured Ply Thickness: HexTOOL™ M61 (2000) HexTOOL™ M61 (4000)	 0.05 in.(1.27 mm) 0.10 in.(2.54 mm)	Based on nominal prepreg properties
Tg Postcured	527ºF (275ºC)	Dry
Maximum Use Temperature	425ºF (218ºC)	
Coefficient of Linear Thermal Expansion	(4.0 x 10^{-6}/ºC)	(In Plane ASTM E 289-95)
Minimum Initial Cure Temperature	375ºF (190ºC)	

*Cured Material Properties are for reference only and not to be considered certification values.

Mechanical Properties*

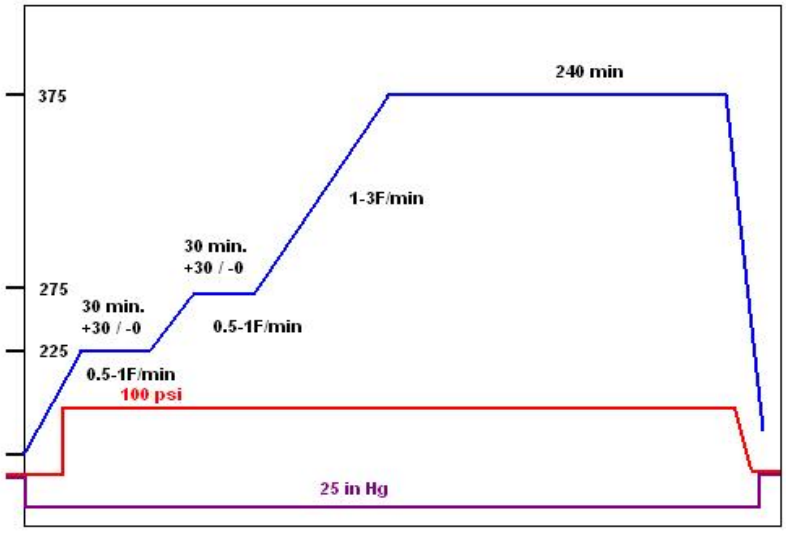
Property	Units	Condition	Temp. ˚F (˚C)	Method	Value
Tensile Strength	ksi (MPa)	Dry	73 (23)	EN2561	37.7 (260)
			356 (180)		30.5 (210)
Tensile Modulus	msi (GPa)	Dry	73 (23)	EN2561	5.95 (41)
			356 (180)		5.80 (40)
Compression Strength	ksi (MPa)	Dry	73 (23)	EN2850B	43.5 (300)
			356 (180)		39.1 (270)
Compression Modulus	msi (GPa)	Dry	73 (23)	EN2850B	4.64 (32)
			356 (180)		4.35 (30)
Flexural Strength	ksi (MPa)	Dry	73 (23)	EN2562	55.1 (380)
Flexural Modulus	msi (GPa)	Dry	73 (23)	EN2562	5.51 (38)
Short Beam Shear Strength	ksi (MPa)	Dry	73 (23)	EN2563	7.3 (50)
			356 (180)		6.2 (43)

* Mechanical Properties are for reference only and not to be considered certification values.

Typical Autoclave Cure Cycle

Specific cure cycles [temperature, pressure (amount and application of)] depend on autoclave type and dimensions, the extent and type of tooling used and the size and complexity of the lay-up. Please contact your local Hexcel Technical Support for consultation prior to cycle definition. The following cycles are typical for HexTOOL™ M61.

Cure Cycle



- Part must be fully thermocoupled prior to the start of the cure cycle (ref. HexTOOL User Guide); deviations from recommended thermocoupling procedure or from recommended cure cycle may result in unacceptable part quality.
- Establish 25 in. Hg vacuum on part for minimum of 60 minutes.
- Heat part at 0.5-1.0ºF/min to 225ºF (0.25-0.5ºC/min to 107 ºC).
- When leading TC reaches 120ºF +/-5ºF introduce 100 psi pressure at a maximum of 10 psi/min (49ºC +/- 2.5ºC introduce 7 barr pressure at max of 0.65 barr/minute).
- When lagging TC reaches 225ºF +/-5ºF begin 30 min. +30/-0 minute soak (107ºC +/- 2.5ºC begin 30 minute soak).
- Heat part at 0.5-1.0ºF/min to 275ºF (0.25-0.5ºC /min to 135ºC).
- When lagging TC reaches 275ºF +/-5ºF begin 30 min. +30/-0 minute soak (135ºC +/-2.5ºC begin 30 minute +30/-0 min soak).
- Heat part at 1-3ºF/min to 375ºF (0.5-1.5ºC/min to 190ºC).
- When lagging TC reaches 375ºF +/-5ºF begin 240 min. +15/-0 minute soak (190ºC +/-2.5ºC begin 240 minute soak).
- Cool part at maximum rate of 5ºF/min. to 150ºF (2.5ºC/min to 66ºC) before releasing pressure.

Free Standing Post Cure Cycle

- Heat up to 300°F (150°C) at 1°-4°F/min (0.5°-2°C/min)
- Heat up to 425°F (220°C) at 0.5°-2°F/min (0.25°-1°C/min)
- Hold at 425°F (220°C) for 16 hours
- Cool down at 1°F/min (0.5°C/min) to 300°F (150°C)
- Cool down at 2°F/min (1°C/min) to 140°F (60°C)

Storage and Handling

Store the product in its original (or equivalent) sealed packaging at 0°F (-18°C). Prevent condensation on the product by warming to room temperature before opening vapor barrier bag (reseal for subsequent storage). The usual precautions when handling uncured synthetic resins and fine fibrous materials should be observed, see Material Safety Data Sheet. The use of clean disposable impervious gloves provides protection for the operator and avoids contamination of material and components.

Important

For more Information

Hexcel is a leading worldwide supplier of composite materials to aerospace and other demanding industries. Our comprehensive product range includes:

- Carbon Fiber
- RTM Materials
- Honeycomb Cores
- Carbon, Glass, Aramid and Hybrid Prepregs
- Structural Film Adhesives
- Honeycomb Sandwich Panels
- Engineered Core
- Reinforcement Fabrics

For other worldwide sales office telephone numbers and a full address list please click here: **http://www.hexcel.com/contact/salesoffices**.