ER450
EPOXY MATRIX

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GENERAL FEATURES

ER450 is a toughened epoxy resin developed for a wide range of structural applications in race, automotive, aerospace, industrial and sporting goods.
It features a flexible processing cycle with a range of cure temperatures from 80°C to 180°C and can be cured by autoclave, hot press molding or vacuum bag processes.

MAIN CHARACTERISTICS

- Flexible cure: 80÷180°C
- Maximum Tg of 210°C.
- Maximum service temperature
- of 180°C.
- Autoclave, press or vacuum bag processing.
- Toughened epoxy matrix.
- Solvent free.
- Available on a wide range of reinforcements (carbon, glass, aramid and hybrids, UD, fabrics and multi-axial).
- Mechanical properties suitable for structural requirements.
- Up to 45 days shop life at room temperature
- Controlled flow system.

QUICK REFERENCE TIPS

The standard cure cycle of 135°C for 2 hours achieves high conversion and optimal mechanical performance; however, good conversion can be obtained in as little as 1 hour @ 120°C. A post-cure at 200°C may be used in order to obtain the maximum glass transition temperature.

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OPERATIONAL INSTRUCTIONS

CURE PROCESS RECOMMENDATIONS

This epoxy matrix system can be processed under a very wide range of temperature as described below:

Temperature (°C)	Time (h)	Tg (°C) DSC	Tg (°C) E' DMA
80	16	96	-
120	1	135	-
135	**2**	**161**	**171**
160	1.5	171	173
180	2	176	180

Custom cure cycles can be developed in conjunction with the CIT Technical Department.

AUTOCLAVE

The standard cure cycle is shown below:

Step	Temperature (°C)	Time (min)	Heating rate to isothermal (°C/min)	Pressure (bar)
1	25	–	–	Vacuum -0.8
2	135	–	1÷3	3÷7*
3	135	120	–	3÷7
4	65**	–	3÷5	3÷7
5	25	–	–	–

** Vent the vacuum when the pressure reaches 1 bar.*

*** The part can be removed when the part temperature is less than 65°C*

POST-CURE (OPTIONAL)

After the initial cure, a post-cure may be used in order to obtain the maximum glass transition temperature:

Cure Cycle	Post-Cure Temperature (°C)	Post-Cure Time	Tg (°C) E' DMA	Ramp rate	Tg (°C) DSC
90'@130°C	180	2h	180	0.3°C/min	181
8h@90°C	200	2h	-	2°C/min	210

RESIN MATRIX

GENERAL PROPERTIES

Property	Unit	Value	Standard
Storage life @ -18°C	months	12	
Out life @ 23°C	days	45	
Prepreg volatiles	%wt	< 1	ASTM D3530-97R03
Cured resin density	g/cm³	1.23	ASTM D792-00
Tg (DSC)	°C	181	ASTM D3418-03
Tg E' (DMA)*	°C	171	ASTM E1640-09
Tg Peak Tan δ (DMA)*	°C	187	ASTM E1640-09
Tack		medium	
Max Dry Tg (DMA)**	°C	180	ASTM E1640-09
Max Wet*** Tg E' (DMA)	°C	120	ASTM E1640-09

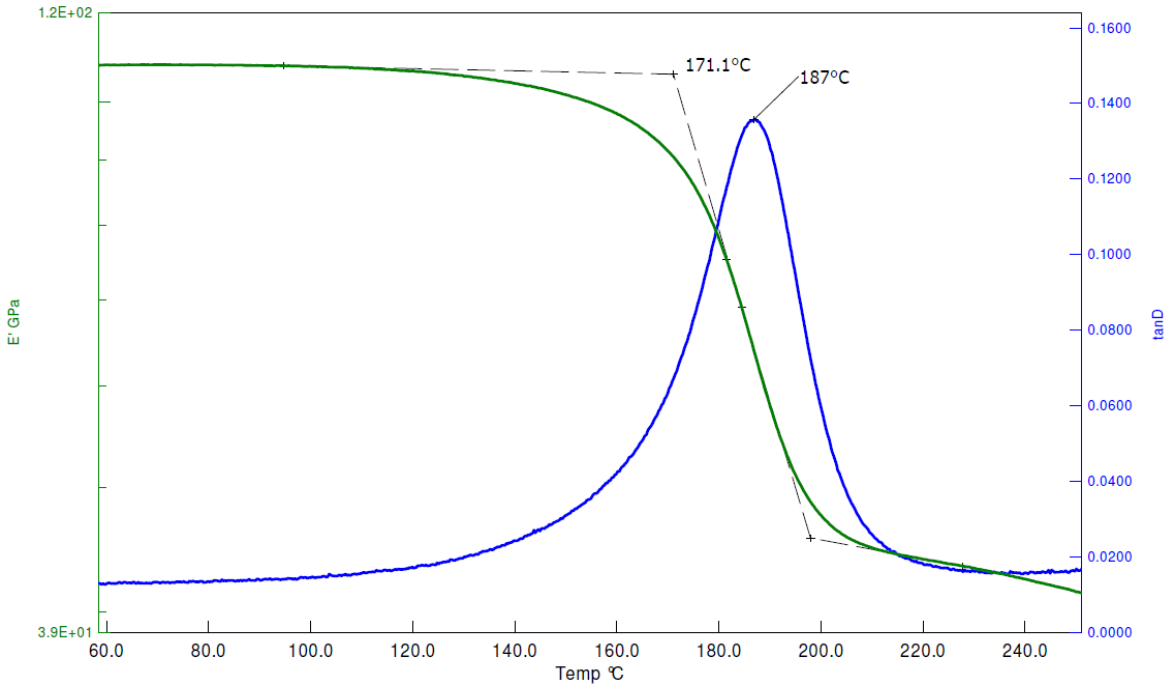
** Laminate after cure at 135°C for 2hours.*

*** Laminate after cure at 180°C for 2hours.*

**** Laminate conditioned at 71°C / 85%R.H until equilibrium.*

THERMO-MECHANICAL DMA ANALYSIS

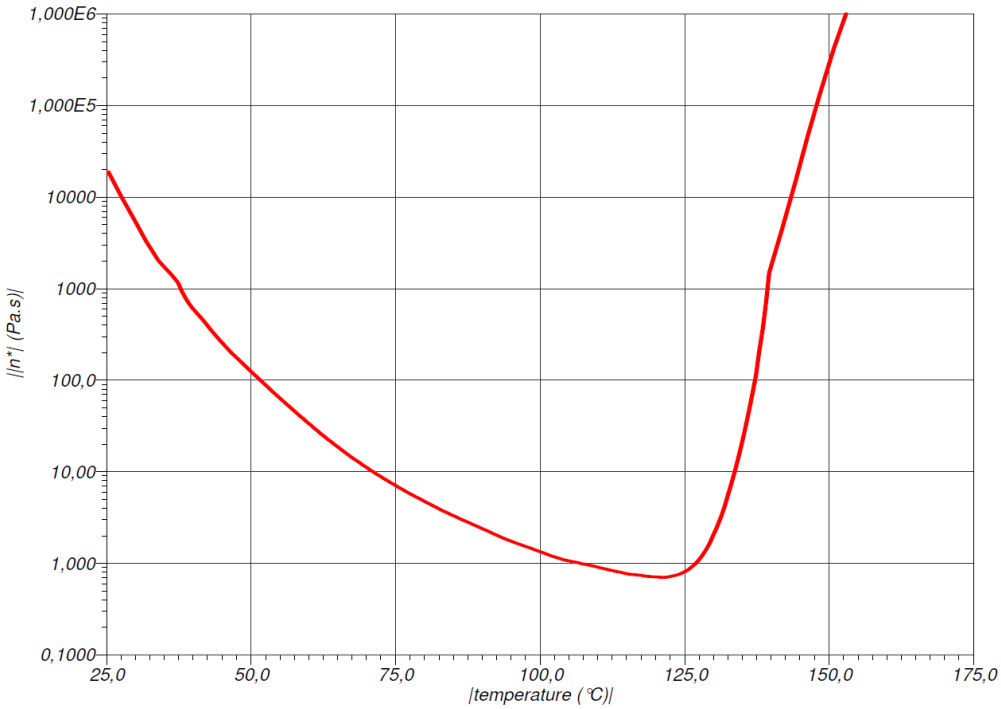
DMA trace of ER450 laminate cured in autoclave 2h@135°C.



DMA Analysis: modulus E' vs Temperature

Modulus E' evaluated under 2°C/min heating rate, 1Hz oscillating frequency.

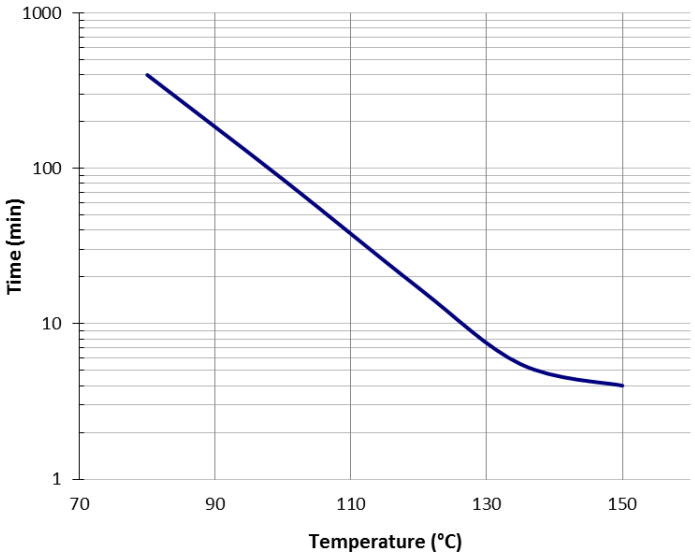
VISCOSITY PROFILE



Viscosity profile: temperature vs complex viscosity

Resin complex viscosity is measured under 3°C/min heating rate, 1Hz oscillating frequency.

GEL TIME



Temperature °C	Gel Time (min)
80	400
100	85
120	17
135	5,5
150	4

CURED PREPREG

MECHANICAL PROPERTIES OF UNIDIRECTIONAL PREPREG LAMINATES

Test carried out at room temperature
Cure condition: 2 hours @135°C
Values normalized to 60%Vf (except for PR, ILSS, IPSS and IPSM)

Cured Material Property	Test method	Units	Material		
			HS 150 T700SC 35%	IM 150 T800S 35%	HM 200 M46J 36%
Tensile Modulus	ASTM D3039	GPa	132	172	252
Tensile Strength		MPa	2281	3264	1996
Strain @ Break		%	1.65	-	0.72
Poisson's Ratio		-	0.25	0.37	0.24
Compressive Modulus	ASTM D6641	GPa	127	143	218
Compressive Strength	SACMA SRM 1R-94	MPa	1470	1445	969
In-Plane Shear Modulus	ASTM D3518	GPa	3.40	4.37	3.84
In-Plane Shear Strength		MPa	-	-	60.7
In-Plane Shear Strength @5%		MPa	67.3	79.4	-
Interlaminar Shear Strength	ISO 14130	MPa	90.5	95.9	80.8

HS 150 T700S: 150gsm Unidirectional Prepreg; 24K T700S fiber
IM 150 T800S: 150gsm Unidirectional Prepreg; 24K T800S fiber
HM 200 M46J: 200gsm Unidirectional Prepreg; 12K M46J fiber

MECHANICAL PROPERTIES OF FABRIC PREPREG LAMINATES

Test carried out at room temperature
Cure condition: 2 hours @135°C
Values normalized to 55%Vf (except for PR, ILSS, IPSS and IPSM)

Cured Material Property	Test method	Units	Material			
			CC206 T300 38%	CC384 T700SC 40%	CC204 T800H 40%	CC200 M46J 40%
Tensile Modulus	ASTM D3039	GPa	62.2	65.7	74.7	116
Tensile Strength		MPa	699	1102	1145	773
Strain @ Break		%	1.06	1.64	1.47	0.59
Poisson's Ratio		-	0.07	0.07	0.07	0.04
Compressive Modulus	ASTM D6641	GPa	58.7	61.6	71.7	100
Compressive Strength	SACMA SRM 1R-94	MPa	754	729	816	568
In-Plane Shear Modulus	ASTM D3518	GPa	3.52	4.22	4.16	4.03
In-Plane Shear Strength		MPa	110	94.5	113	81.5
In-Plane Shear Strength @5%		MPa	86.9	73.4	94.8	78.0
Interlaminar Shear Strength	ISO 14130	MPa	85.9	-	82.3	65.8

CC 206: 204gsm 2/2 Twill 3K T300 fiber
CC 384: 380gsm 2/2 Twill 12K T700S fiber
CC 204: 199gsm 2/2 Twill 6K T800H fiber
CC 200: 200gsm 2/2 Twill 6K M46J fiber

SAFETY CONSIDERATIONS

- Please consult the Material Safety Data Sheet.
- This product contains epoxy resin, and may cause allergic reaction.
- The use of latex gloves for handling is recommended.
- Waste material should be discarded following national law.

DELIVERY FORM AND PACKAGING

Custom widths, roll size, and packaging are available on request.

Prepreg fabrics: Supplied on 75 mm diameter cardboard cores with release paper on one side and polyethylene film separator on the other side.
Rolls are sealed plastic bags and packed in cardboard boxes.

Standard width: 100 cm or 127 cm.

Standard length: 50 m.

Unidirectional Prepreg: Supplied on 300 mm diameter cardboard cores with release paper on one side and smooth polyethylene film separator on the other side. Rolls are sealed in plastic bags and packed in cardboard boxes.

Standard width: 60cm, range from 30cm up to 105cm
Standard length: 100 m.

HANDLING AND CONDITIONING

- Store rolls at -18 °C, sealed in original packages.
- Shop life at 23°C refers to rolls sealed in original packages.
- Before using the prepreg, remove the roll from the freezer and let it warm up to room temperature for 6 hours sealed in its original package.

IMPORTANT NOTICE:

Details provided in this document have been obtained from carefully controlled samples; data are an overview of this product and should not be intended as technical specification.
Because the properties of this product can be significantly affected by the fabrication and testing techniques employed and since CIT does not control the conditions under which its products are tested and used, CIT cannot guarantee that the properties provided will be obtained with other processes and equipment.
CIT has the right to change any data or information when deemed appropriate.

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