



HexPly® M56

180°C (350°F) out-of-autoclave curing matrix



Product Data Sheet

Description

HexPly® M56 is a high performance epoxy matrix developed for out-of-autoclave curing of composite aircraft structures.

Benefits and Features

- Matrix specifically formulated for vacuum pressure only cure
- Product formats designed to optimise fibre volume
- Available as carbon UD tape, woven carbon, woven glass and metallic meshes
- 30 days room temperature tack life
- Excellent drape and tack
- Suitable for ATL and AFP processing

Product Forms

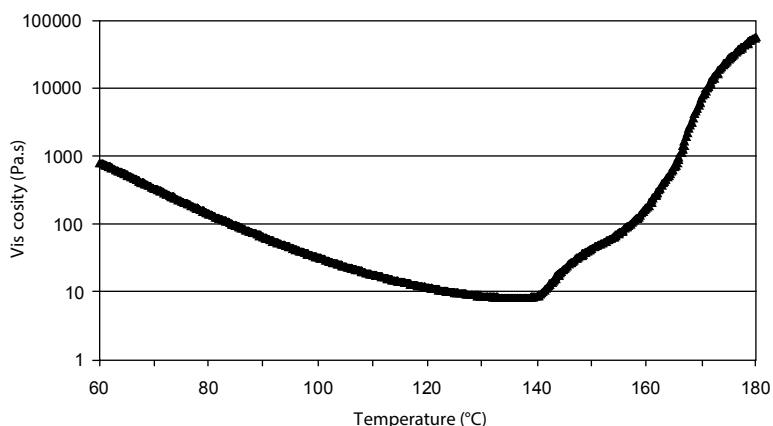
Woven carbon:	M56/40%/280H5/AS4-3K	M56/40%/193PW/AS4-3K
	M56/40%/285T2/AS4C-6K	
UD carbon tape:	M56/35%/UD134/AS7-12K	M56/35%/UD268/IM7-12K
Woven glass:	M56/37%/7781	

Alternative fibres, reinforcement weights, resin contents, weave styles and metallic meshes for lightning strike protection can all be considered.

Resin Matrix Properties

Rheology

1°C/min heat-up rate





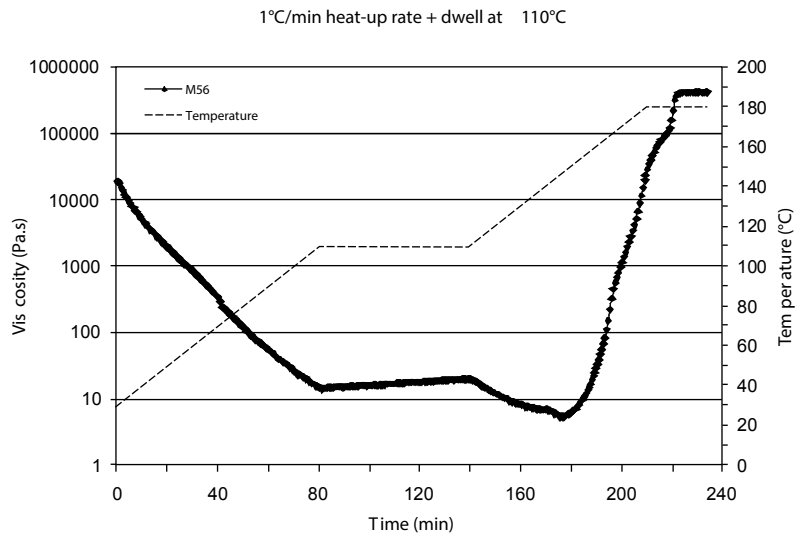
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Cure Cycle Viscosity Profiles



Prepreg Lay-up

To achieve the best laminate quality, the first ply should be vacuum debulked to the mould at room temperature.

Vacuum debulking of subsequent plies may be necessary to ensure removal of air trapped during the lay-up process.

The frequency of debulking depends on part size and complexity.

After the final de-bulk, the rounded edges of the component need to be cut away to re-open air paths.



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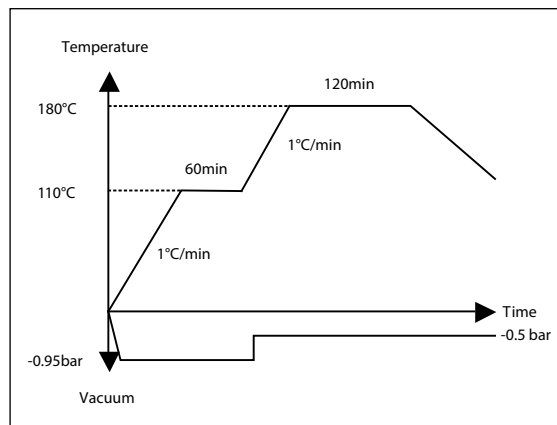


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Prepreg Curing Conditions

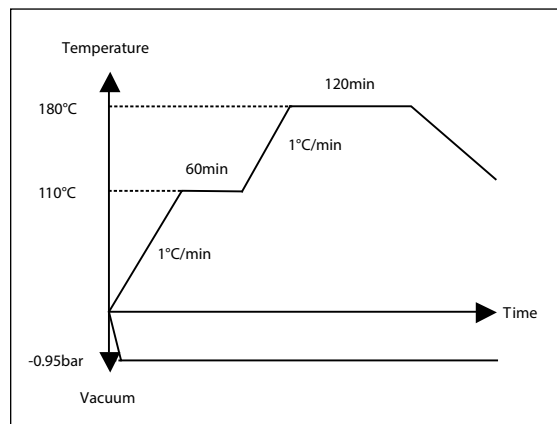
Typical Oven Cure Monolithic Part

1. Apply full vacuum (-0.95bar)
2. Ramp at 1 - 3°C/min to 110 ± 5°C
3. Hold at 110 ± 5°C for 60 ± 5min
4. Reduce vacuum to -0.5bar
5. Ramp at 1 - 3°C/min to 180 ± 5°C
6. Hold at 180 ± 5°C for 120 ± 5min
7. Cool at 2 - 5°C/min under vacuum
8. Release vacuum when laminate temperature is below 40°C



Typical Oven Cure Sandwich Structure – Honeycomb or Foam

1. Apply full vacuum (-0.95bar)
2. Ramp at 1 - 3°C/min to 110 ± 5°C
3. Hold at 110 ± 5°C for 60 ± 5min
4. Ramp at 1 - 3°C/min to 180 ± 5°C
5. Hold at 180 ± 5°C for 120 ± 5min
6. Cool at 2 - 5°C/min under vacuum
7. Release vacuum when laminate temperature is below 40°C



Defined heat-up rates will vary depending on the autoclave dimensions, the mass of tooling used and the size of the component to be manufactured.



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Cured Prepreg Properties

Property	Units	M56/40% /280H5/ AS4-3K	M56/40% /285T2/ AS4C-6K	M56/40% /193PW/ AS4-3K
Fibre		AS4	AS4C	AS4
Weave		5HS	2 x 2T	PW
Fibre Mass	g/m ²	280	285	193
	(oz/yd ²)	(8.25)	(8.40)	(5.67)
Nominal Prepreg Mass	g/m ²	467	475	322
	(oz/yd ²)	(13.76)	(14.00)	(9.48)
Measured Cured Ply Thickness	mm	0.292	0.316	0.214
	(inch)	(0.0115)	(0.0124)	(0.0084)
Measured Calculated Fibre Volume	%	50.5	50.3	50.1
Cured Resin Density	g/cm ³	1.21		
	(lbs/ft ³)	(75.54)		
Fibre Density	g/cm ³	1.79	1.79	1.79
	(lbs/ft ³)	(112)	(112)	(112)
Measured Calculated Laminate Density	g/cm ³	1.50	1.50	1.50
	(lbs/ft ³)	(93.6)	(93.6)	(93.6)

Test	Units	M56/40%/280H5/ AS4-3K	M56/40%/285T2/ AS4C-6K	M56/40%/193PW/ AS4-3K
Glass Transition Temp. (Ext. onset E')	°C	193	194	219
	(°F)	(379)	(381)	(426)
Method		EN6032		ASTM D1640
Tensile Strength	MPa	897	787	924
	(ksi)	(130)	(114)	(134)
Tensile Modulus	GPa	68.2	67.0	65.9
	(msi)	(9.89)	(9.72)	(9.56)
Method		EN2597B		ASTM D3039
Compression Strength	MPa	852	807	848
	(ksi)	(124)	(117)	(123)
Compression Modulus	GPa	58.6	58.0	61.5
	(msi)	(8.50)	(8.41)	(8.92)
Method		EN2850 B		SACMA-1R
ILSS	MPa	69.2	65.0	74.1
	(ksi)	(10.0)	(9.4)	(10.8)
Method		EN 2563		
In-plane Shear Strength	MPa	121	99.0	128
	(ksi)	(17.5)	(14.4)	(18.6)
In-plane Shear Modulus	GPa	4.10	3.70	3.50
	(msi)	(0.59)	(0.54)	(0.51)
Method		EN6031		ASTM D3518

Note:

These are average values showing typical data and not guaranteed minimum values.

Comments:

Data generated following oven cure at 180°C (356°F) for 120min with 60min dwell at 110°C (230°F)

Measured cured ply thickness figures are based on zero bleed

Fabric samples were tested in the warp direction

Tension and Compression data normalised to Vf = 60% for UD carbon, 56% for woven carbon & 48% for woven glass Cured Prepreg Properties



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Cured Prepreg Properties (continued)

Property	Units	M56/35%/UD268/ IM7-12K	M56/35%/UD134/ AS7-12K	M56/37%/7781
Fibre		IM7	AS7	E-glass
Weave		UD	UD	8HS
Fibre Mass	g/m ²	268	134	300
	(oz/yd ²)	(7.90)	(3.95)	(8.84)
Nominal Prepreg Mass	g/m ²	394	206	476
	(oz/yd ²)	(11.60)	(6.07)	(14.03)
Measured Cured Ply Thickness	mm	0.2530	0.134	0.263
	(inch)	(0.0100)	(0.0053)	(0.0104)
Theoretical Calculated Fibre Volume	%	58.8	56.2	44.6
Cured Resin Density	g/cm ³	1.21		
	(lbs/ft ³)	(75.54)		
Fibre Density	g/cm ³	1.78	1.79	2.54
	(lbs/ft ³)	(111)	(112)	(159)
Measured Calculated	g/cm ³	1.53	1.53	1.81
Theoretical Calculated Laminate Density	(lbs/ft ³)	(95.5)	(95.5)	(112)

Test	Units	M56/35%/UD268/ IM7-12K	M56/35%/UD134/ AS7-12K	M56/37%/7781
Glass Transition Temp. (Ext. onset E')	°C	204	197	211
	(°F)	(399)	(387)	(412)
Method		EN6032		
Tensile Strength	MPa	2730	2330	470
	(ksi)	(396)	(338)	(68.2)
Tensile Modulus	GPa	182	141	25.0
	(msi)	(26.4)	(20.4)	(3.63)
Method		EN2597 B		
Compression Strength	MPa	1550	1308	-
	(ksi)	(225)	(190)	-
Compression Modulus	GPa	156	129	-
	(msi)	(22.6)	(18.7)	-
Method		EN2850 B		
ILSS	MPa	98.6	94.4	67.0
	(ksi)	(14.3)	(13.7)	(9.72)
Method		EN2563		
In-plane Shear Strength	MPa	81	115	-
	(ksi)	(11.8)	(16.7)	-
In-plane Shear Modulus	GPa	4.50	4.10	-
	(msi)	(0.65)	(0.59)	-
Method		EN6031		

Note:

These are average values showing typical data and not guaranteed minimum values.

Comments:

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Measured cured ply thickness figures are based on zero bleed

Fabric samples were tested in the warp direction

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Prepreg Storage Life

Tack Life:	30 days at 23°C (73°F)
Out Life:	35 days at 23°C (73°F)
Shelf Life:	18 months at -18°C (0°F) (<i>maximum from date of manufacture</i>)

Definitions

Shelf Life:	The maximum storage life for HexPly® prepreg, from date of manufacture, when stored continuously, in a sealed moisture-proof bag, at -18°C (0°F). To accurately establish the exact expiry date, consult the box label.
Tack Life:	The time, at room temperature, during which prepreg retains enough tack for easy component lay-up.
Out Life:	The maximum accumulated time allowed at room temperature between removal from the freezer and cure.

HexPly® M56 prepregs should be stored as received in a cool dry place or in a refrigerator. After removal from refrigerator storage, prepreg should be allowed to reach room temperature before opening the polythene bag, to prevent condensation (a full roll in its packaging can take up to 48 hours).

Precautions For Use

A Safety Data Sheet is available for this product. The usual precautions when handling uncured synthetic resins and fibrous materials should be observed. The use of clean, disposable, inert gloves provides protection for the operator and avoids contamination of material and components.

For more information

Hexcel is a leading worldwide supplier of composite materials to aerospace and industrial markets. Our comprehensive range includes:

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|------------------------------------|--|---|
| ● HexTow® carbon fibers | ● HexFlow® RTM resins | ● Engineered core |
| ● HexForce® reinforcements | ● HexBond™ adhesives | ● Engineered products |
| ● HiMax® multiaxial reinforcements | ● HexTool® tooling materials | ● Polyspeed® laminates & pultruded profiles |
| ● HexPly® prepregs | ● HexWeb® honeycombs | ● HexAM® additive manufacturing |
| ● HexMC®-i molding compounds | ● Acousti-Cap® sound attenuating honeycomb | |

For U.S. quotes, orders and product information call toll-free 1-800-688-7734. For other worldwide sales office telephone numbers and a full address list, please go to:

<https://www.hexcel.com/contact>

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