



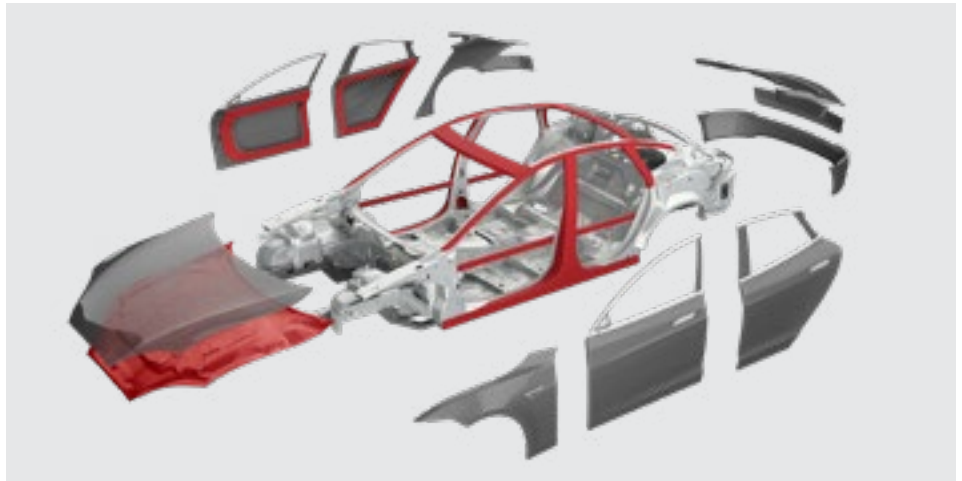
Dow Polyurethanes

VORAFUSE™ Epoxy Intermediates for Pre-preg Solutions

When combined with carbon fiber or glass fiber fabric, VORAFUSE™ epoxy intermediates offer improved handling and rapid cycle times for compression molding of composite parts for structural applications. VORAFUSE™ can be tailored to specific tack, glass-transition temperature and cure profiles required for high performance applications.

Meeting OEM emissions and fuel efficiency requirements is a difficult challenge when working with conventional materials such as steel or aluminum. Epoxy-fiber composites exhibit competitive strength and stiffness at much lower density, enabling the production of components that can function alongside traditional metal parts in an efficient hybrid construction.

VORAFUSE™ is designed to work in out-of-autoclave processes like compression molding to achieve fast cycle times for automotive applications. The intermediates were developed with a range of surface tack to match handling constraints involved in typical laminate construction and exhibit significant room temperature shelf life. This feature allows for flexibility on the production floor to deal with equipment down time, and the ability to avoid onsite freezer storage.



Typical applications for VORAFUSE™ include:

- Door inners
- Hood inners
- A, B and C pillars
- Roof rails

VORAFUSE™ can be:

- Cured in two to five minutes for high volume manufacturing
- Used to enable automated manufacturing solutions

- Manufactured in a variety of fabric configurations, including uni-directional tape as well as woven, braided or non-crimp fabric at a range of areal weights

The VORAFUSE™ P6300 resin system is designed for high volume manufacturing with no tack for robot handling of 2D and 3D pre-forms and compression molding. VORAFUSE™ P6100 is formulated to accommodate diverse manufacturing scenarios from autoclave to out-of-autoclave processing on lower-cost tooling for medium to low volume applications.

VORAFUSE™ Capabilities Overview

	VORAFUSE™ P6300	VORAFUSE™ P6100
Tack	Tack Free	Adjustable Tack
Autoclave Capable	No	Yes
Compression Mold	Yes	Yes
Cure Time (min) Compression Mold	2-5	3-5
Automation Capable	Yes	Limited
Shelf Life Room Temp (weeks) as Pre-preg	14	7

Sample Pre-preg Based on VORAFUSE™ and Carbon Fiber

	VORAFUSE™ P6300	VORAFUSE™ P6100
Pre-preg Areal Weight	314 gsm	Adjustable Tack
Autoclave Capable	38 wt% (47 vol%)	Yes
Shelf Life	14 weeks (25°C) based on microcalorimetry experiments	7 weeks at 25°C
	7 weeks (23°C), 50% RH based on chamber storage and materials testing	

	VORAFUSE™ P6300	VORAFUSE™ P6100
Property	Press molding	Headed plate or oven/vac bag
Autoclave Capable	38 wt% (47 vol%)	Yes
Typical Laminate	12 Plies of 186 g UD Pre-preg (2.5 mm thickness)	12 Plies of 186 g UD Pre-preg (2.5 mm thickness)
Cure Temperature	150°C	135°C
Cure Dwell Time	3 min	25 min
Cure Pressure	13 to 20 MPa	-0.1 MPa

Sample Pre-preg Based on VORAFUSE™ and Carbon Fiber

Property	VORAFUSE™ P6300	VORAFUSE™ P6100	Units	Test Method
0° Tensile Strength	1625	1940	MPa	ASTM
0° Tensile Modulus	119	68.2	GPa	D3039
0° Compressive Strength	1110	943	MPa	ASTM
0° Compressive Modulus	107	103	GPa	D6641
90° Tensile Strength	57.2	30.5	MPa	ASTM
90° Tensile Modulus	7.9	7.4	GPa	D3039
90° Compressive Strength	200	165	MPa	ASTM
90° Compressive Modulus	8.6	9.1	GPa	D6641
In-plane Shear Strength	66.8	107	MPa	ASTM
In-plane Shear Modulus	3.5	3.9	GPa	D5318

ABOUT DOW

Dow is a leading global provider of collaborative solutions and advanced materials for original equipment manufacturers, tier suppliers, aftermarket customers and commercial transportation manufacturers. Our materials focus includes structural, elastic and rubber-to-substrate adhesive solutions; polyurethane foams and acoustical management solutions; films; fluids; and innovative composite technologies. Offices and application development centers are located around the world to ensure regionalized technical, engineering and commercial support for customers and industry groups. For additional information, visit dow.com.

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