

## PRODUCT DATA SHEET

### DESCRIPTION

Toray EX-1522 is a high performance toughened modified epoxy resin system. The material displays both excellent mechanical and thermal properties, in addition to very low moisture absorption. EX-1522 has a flammability rating of V-0, which lends itself to usage in low flammability applications. EX-1522's ideal electrical properties make it a lower cost option for radome, antennas, and other critical electrical applications. Finally, EX-1522 is an outstanding resin selection for use where self-adhesion to honeycomb without the use of a film adhesive is desirable. This resin bonds to honeycomb under vacuum or pressure cure and displays cohesive honeycomb failure during destructive testing.

### FEATURES

- ▶ Robust processing under vacuum, autoclave, or press
- ▶ Low dielectric and loss tangent for radome applications
- ▶ Low flammability, V-0
- ▶ Self-adhesive to core
- ▶ Lower cost vs. cyanate ester resins
- ▶ Low outgassing for space/satellite applications

### PRODUCT TYPE

177°C (350°F) Cure\* Toughened Epoxy Resin System

### TYPICAL APPLICATIONS

- ▶ Aircraft structures
- ▶ Space structures
- ▶ Radomes and antennas
- ▶ Reflectors
- ▶ Low observables
- ▶ Radar transparent structures

### SHELF LIFE

<b>Tack Life:</b>	14 days at 25°C (77°F)
<b>Out Life:</b>	21 days at 25°C (77°F)
<b>Frozen Storage Life:</b>	6 months at -18°C (< 0°F)

Tack life is the time during which the prepreg retains enough tack, drape and handling for easy component lay-up.

Out life is the maximum time allowed at room temperature before cure.

\* May be cured at 121°C/250°F or 150°C/300°F

### TYPICAL NEAT RESIN PROPERTIES

Density	1.36–1.46 g/cc								
Moisture Absorption	1.2% at saturation after 100 hr water boil								
Flammability	V-0								
Dry T <sub>g</sub> with 121°C/250°F cure	126°C (259°F)								
Wet T <sub>g</sub> with 121°C/250°F cure	123°C (253°F)								
Dry T <sub>g</sub> with 149°C/300°F cure	169°C (336°F)								
Wet T <sub>g</sub> with 149°C/300°F cure	159°C (318°F)								
Dry T <sub>g</sub> with 177°C/350°F cure	180°C (356°F)								
Wet T <sub>g</sub> with 177°C/350°F cure	166°C (331°F)								
CTE	88 ppm/°C (49 ppm/°F)								
	Outgassing (ASTM E595)	<table border="1"> <tr> <td>TML</td> <td>0.28%</td> </tr> <tr> <td>CVCM</td> <td>0.01%</td> </tr> <tr> <td>WVR</td> <td>0.16%</td> </tr> <tr> <td>TML-WVR</td> <td>0.12%</td> </tr> </table>	TML	0.28%	CVCM	0.01%	WVR	0.16%	TML-WVR
TML	0.28%								
CVCM	0.01%								
WVR	0.16%								
TML-WVR	0.12%								
Dielectric Constant	2.8 (at 10 GHz)								
Loss Tangent	0.008 (at 10 GHz)								
JP4 Fuel Resistance	No effect after 30 days at 25°C (77°F)								
Tensile Strength	66.2 MPa (9.6 ksi)								
Tensile Modulus	4 GPa (0.58 Msi)								



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### NEAT RESIN PROPERTIES

Tensile Strength	66.2 MPa (9.6 ksi)
Tensile Modulus	4 GPa (0.58 Msi)
Compression Strength	147.5 MPa (21.4 ksi)
Compression Modulus	3.7 GPa (0.53 Msi)
Poisson's Ratio	0.48

Flexural Strength	155.8 MPa (22.6 ksi)
Flexural Modulus	3.6 GPa (0.52 Msi)
Flexural Strain	5.5%
Thermal Conductivity	0.170 W/m*K

### ELECTRICAL PROPERTIES OF COMPOSITE LAMINATES

EX-1522 / 4581 Quartz	C/X Band 8–18 GHz	Ku/K Band 18–26.5 GHz	Ka Band 26.5–40 GHz	Q & U Band 40–60 GHz
Dielectric Constant	3.35	3.31	3.31	3.31
Loss Tangent	< 0.010*	< 0.010*	< 0.010*	< 0.010*

EX-1522 / 7781 Fg	C/X Band 8–18 GHz	Ku / K Band 18–26.5 GHz	Ka Band 26.5–40 GHz	Q & U Band 40–60 GHz
Dielectric Constant	4.72	4.67	4.66	4.64
Loss Tangent	0.012	0.013	0.010	0.011

\*The loss tangent under focused beam testing is only accurate to 0.010. This material is less than 0.010. This material represents one of Toray's best for high energy radome applications.

### LAMINATE DATA—4581 AQIII WOVEN FABRIC REINFORCEMENT. 288gsm FAW

Property	Condition	Method	Results	
Tensile Strength 90°	RTD	ASTM D 3039	614 MPa	89 ksi
Tensile Modulus 90°	RTD	ASTM D 3039	26.8 GPa	3.89 Msi
Tensile Strength 90°	ETW	ASTM D 3039	439 MPa	63.7 ksi
Tensile Modulus 90°	ETW	ASTM D 3039	26.1 GPa	3.79 ksi
Compressive Strength 0°	RTD	ASTM D 695	572 MPa	82.9 ksi
Compressive Modulus 0°	RTD	ASTM D 695	30.1 GPa	4.37 Msi
Compressive Strength 0°	ETW	ASTM D 695	501 MPa	72.7 ksi
Compressive Modulus 0°	ETW	ASTM D 695	28.8 GPa	4.17 Msi
Compressive Strength 90°	RTD	ASTM D 695	621 MPa	90.1 ksi
Compressive Modulus 90°	RTD	ASTM D 695	29.2 GPa	4.2 Msi
Compressive Strength 90°	ETW	ASTM D 695	557 MPa	80.8 ksi
Compressive Modulus 90°	ETW	ASTM D 695	27.8 GPa	4.0 Msi
Flexural Strength 0°	RTD	ASTM D 764	862 MPa	125 ksi
Flexural Modulus 0°	RTD	ASTM D 764	26.9 GPa	3.9 Msi
Short Beam Shear	RTD	ASTM D 2344	76.5 MPa	11.1 ksi
Short Beam Shear	ETW	ASTM D 2344	70.3 MPa	10.2 ksi

ETW is 71°C (±3°C)/160°F (±5°F) 85% RH until saturated

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### TYPICAL CURE PARAMETERS

- ▶ Apply full vacuum > 25 inHg, reduce vacuum to 9 inHg.
- ▶ Add autoclave pressure to 25 psi, heat 1°C/min (2°F/min) to 127°C (260°F), hold for 3 hours.
- ▶ Reduce pressure to 15 psi, then heat to 179°C (355°F) for 3 hours, cool 3°C/min (5°F/min) to 66°C (150°F) then release vacuum and pressure.

### ALTERNATIVE CURE PARAMETERS, Alternate Cure 1–121°C/ 250°F cure\*

- ▶ Apply full vacuum (> 25 inHg) and perform leak check. Reduce vacuum to 9 inHg.
- ▶ Apply 25 psi of autoclave pressure, heat 1°C/min (2°F/min) to 121°C (250°F), hold for 4 hours.
- ▶ Cool at 3°C/min (5°F/min) to 65°C (150°F), then release vacuum and pressure.

### ALTERNATIVE CURE PARAMETERS, Alternate Cure 2 - 150°C/300°F cure\*

- ▶ Apply full vacuum (> 25 inHg) and perform leak check. Reduce vacuum to 9 inHg.
- ▶ Apply 25 psi of autoclave pressure, heat 1°C/min (2°F/min) to 150°C (300°F), hold for 4 hours.
- ▶ Cool at 3°C/min (5°F/min) to 65°C (150°F), then release vacuum and pressure.

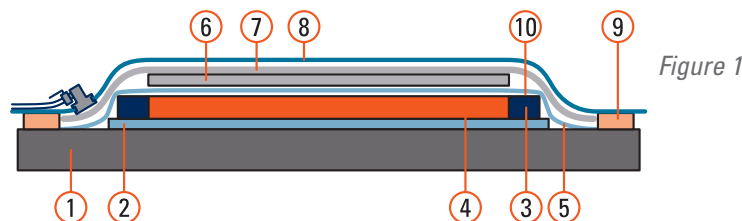
\* T<sub>g</sub>'s differ under alternate cures. See page 1 for measured T<sub>g</sub>'s.

### TYPICAL COMPOSITE LAMINATE STACKING SEQUENCE

#### List of Materials

1. Tool – aluminum, steel, Invar, composite (tool plates must be release coated or film covered).
2. Release coat or film – Frekote 700NC or 770NC, FEP, TEDLAR Lay-up part using standard debulking procedures
3. Silicone edge dams for cure – slightly thicker than laminate
4. Laminate
5. Release coat or film – Frekote 700NC or 770NC, FEP, TEDLAR
6. Caul plate – aluminum, steel, Invar, silicone rubber sheet (metal caul plates must be release coated or wrapped)
7. 2.2 oz/yd<sup>2</sup> polyester breather, 1 or more
8. Vacuum bag
9. Vacuum sealant
10. Glass yarn string (alternatively or additionally breather may wrap over top of dam to contact edge)

Follow the provided Toray Advanced Composites cure cycle for the particular resin system.



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