Toray RS-3

Toray Advanced Composites

PRODUCT DATA SHEET

DESCRIPTION

Toray RS-3 is a modified cyanate ester prepreg resin developed to provide a good balance between toughness and high temperature/wet performance. RS-3 has been evaluated and qualified in the areas of satellite, airframe/missile, and dielectric structures. RS-3 is also available in several modified formulations including: RS-3C, a controlled-flow vacuum-bag/oven-cure version; and RS-3M, an extremely low-flow autoclave version.

FEATURES

- **True 177°C (350°F) service**
- **Large base of qualified applications**
- **Very low outgassing**
- **Simple 177°C (350°F) "epoxy-like" processing**
- **Low shrinkage during cure**
- **Autoclave and compression moldable**
- **Excellent balance of mechanical properties**
- **Low moisture absorption performance and good hot/wet performance**
- **Low microcracking from -212°C (-350°F) to 177°C (350°F)**
- **Low modulus loss after radiation**
- **Low dielectric constant and loss tangent exposure over wide thermal and electrical regions**

PRODUCT TYPE

177°C (350°F) Service Toughened Cyanate Ester Resin

TYPICAL APPLICATIONS

- Satellite structures
- Airframe/missile structures
- Electromagnetic/dielectric structures

SHELF LIFE

Tack Life:	14 days tack life at 25°C (77°F)
Out Life:	30 days at out life 25°C (77°F)
Frozen Storage Life:	12 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.

TYPICAL NEAT RESIN PROPERTIES

Density	1.19 g/cc
Dry T_g	191°C (375°F) cured at 177°C (350°F)
Dry T_g	254°C (490°F) post cured at 232°C (450°F)
Wet T_g*	249°C (480°F) post cured at 232°C (450°F)
Coefficient of Thermal Expansion	43 ppm/°C (24 ppm/°F)
Outgassing (TML)	0.22%
Outgassing (CVCM)	0.01%
Equilibrium Moisture Absorption	0.69%

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Contact us for more information:

North America/Asia/Pacific
e explore@toraytac-usa.com
t +1 408 465 8500

Europe/Middle East/Africa
e explore@toraytac-europe.com
t +44 (0)1773 530899

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Viscosity at:	70°C (58°F) 100°C (212°F) 145°C (293°F)	7370 cps 300 cps 200 cps
Tensile Strength	80 MPa (11.6 ksi)	
Tensile Modulus	3 GPa (0.43 Msi)	
Tensile Strain	4.9%	
Flexural Strength	126.9 MPa (18.4 ksi)	
Flexural Modulus	0.48 Msi (3.3)	
Fracture Toughness, G1C	2.1 in-lb/in^2	
Dielectric Constant (at 2-18 GHz)	2.67	
Loss Tangent	0.005	

** Wet properties determined after specimens exposed to 95% R.H. at 71°C (160°F) for 20 days.*

LAMINATE DATA USED M55J (6K)/RS-3 UDPP LAMINATE

Property	Condition	Method	Results	
Tensile Strength 0°	RTD	ASTM D 3039	1999 MPa	290 ksi
Tensile Modulus 0°	RTD	ASTM D 3039	318.5 GPa	46.2 Msi
Compressive Strength 0°	RTD	ASTM D 6641	889 MPa	129 ksi
Compressive Modulus 0°	RTD	ASTM D 6641	299.2 GPa	43.4 ksi
Compressive Strength 90°	RTD	ASTM D 6641	103 MPa	14.9 ksi
Compressive Modulus 90°	RTD	ASTM D 6641	5.7 GPa	0.82 Msi
Flexural Strength 0°	RTD	ASTM D 7264	1207 MPa	175 ksi
Flexural Modulus 0°	RTD	ASTM D 7264	289.6 GPa	42 Msi
Interlaminar Shear Strength	RTD	ASTM D 2344	75.2 MPa	10.9 ksi
In-Plane Shear Strength	RTD	ASTM D 3518	90 MPa	13 ksi
In-Plane Shear Modulus	RTD	ASTM D 3518	4.8 GPa	0.7 Msi
All properties normalized to 60% fiber volume except ILSS				

LAMINATE DATA USED S2-GLASS 6781/RS-3C FABRIC LAMINATE

Property	Condition	Method	Results	
Tensile Strength 0°	RTD	ASTM D 3039	616 MPa	89.3 ksi
Tensile Modulus 0°	RTD	ASTM D 3039	31.7 GPa	4.6 Msi
Flexural Strength 0°	RTD	ASTM D 7264	834 MPa	121 ksi
Flexural Modulus 0°	RTD	ASTM D 7264	37.2 GPa	5.4 Msi
Interlaminar Shear Strength	RTD	ASTM D 2344	65 MPa	9.4 ksi
All properties normalized to 60% fiber volume except ILSS				

PRODUCT DATA SHEET

LAMINATE DATA USED T-300 (1K)/RS-3 PLAIN WEAVE FABRIC LAMINATE

Property	Condition	Method	Results	
Tensile Strength 0°	RTD	ASTM D 3039	834 MPa	121 ksi
Tensile Modulus 0°	RTD	ASTM D 3039	66.9 GPa	9.7 Msi
Compressive Strength 0°	RTD	ASTM D 6641	814 MPa	118 ksi
Compressive Modulus 0°	RTD	ASTM D 6641	60.7 GPa	8.8 ksi
Flexural Strength 0°	RTD	ASTM D 7264	1020 MPa	148 ksi
Flexural Modulus 0°	RTD	ASTM D 7264	62.1 GPa	9 Msi
Interlaminar Shear Strength	RTD	ASTM D 2344	76 MPa	11 ksi
In-Plane Shear Strength	RTD	ASTM D 3518	139 MPa	20.2 ksi
In-Plane Shear Modulus	RTD	ASTM D 3518	4.8 GPa	0.7 Msi
Poisson's Ratio	RTD			0.3
All properties normalized to 60% fiber volume except ILSS and Poisson's Ratio				

LAMINATE DATA USED T300 (1K)/RS-3C 5HS WEAVE FABRIC LAMINATE

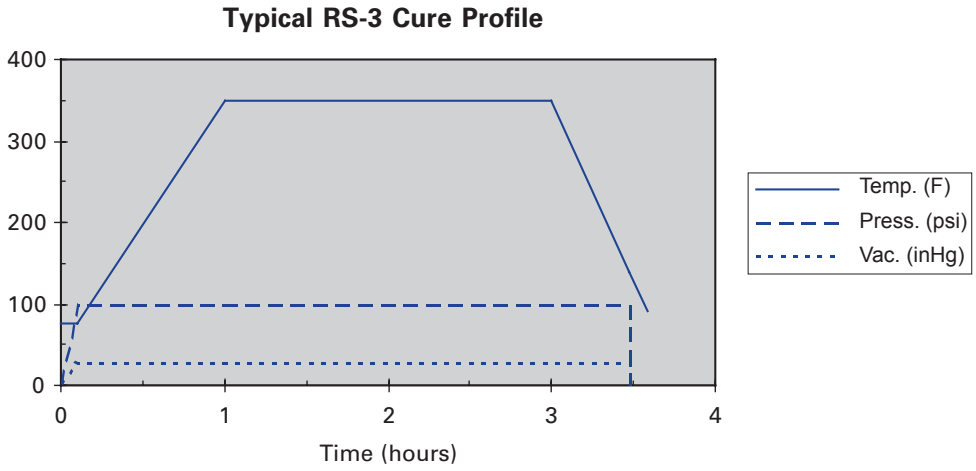
Property	Condition	Method	Results	
Flexural Strength 0°	RTD	ASTM D 7264	1124 MPa	163 ksi
Flexural Modulus 0°	RTD	ASTM D 7264	75 GPa	10.9 Msi
Interlaminar Shear Strength	RTD	ASTM D 2344	75.8 MPa	11 ksi
All properties normalized to 60% fiber volume except ILSS.				

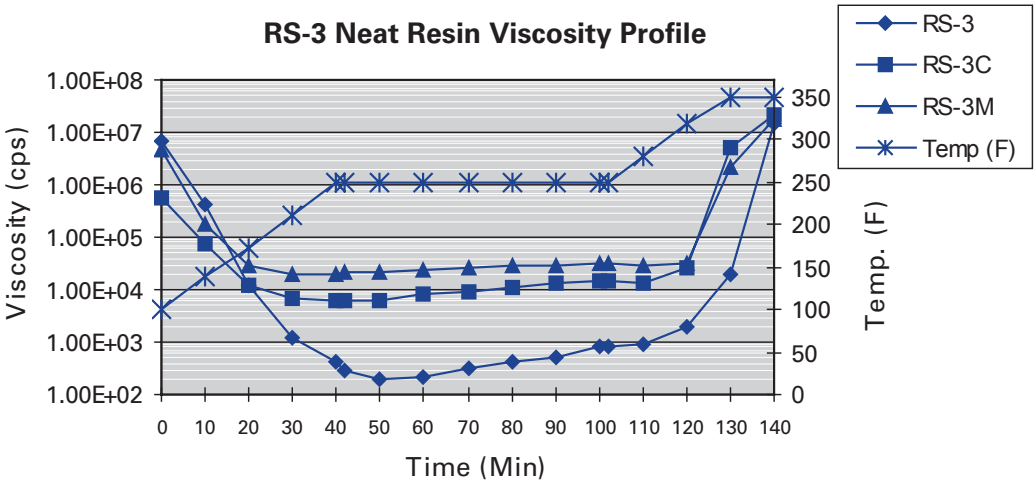
LAMINATE DATA USED T-300 (3K)/RS-3C 8HS WEAVE FABRIC LAMINATE

Property	Condition	Method	Results	
Compressive Strength 0°	RTD	ASTM D6641	722 MPa	112 ksi
Compressive Modulus 0°	RTD	ASTM D6641	66.9 GPa	9.7 ksi
Flexural Strength 0°	RTD	ASTM D7264	1076 MPa	156 ksi
Flexural Modulus 0°	RTD	ASTM D7264	75.8 GPa	11 Msi
Interlaminar Shear Strength	RTD	ASTM D2344	70 MPa	10.2 ksi
In-Plane Shear Strength	RTD	ASTM D3518	53.8 MPa	7.8 ksi
All properties normalized to 60% fiber volume except ILSS and Poisson's Ratio.				

TYPICAL CURE PARAMETERS

- Apply vacuum, pressurize to 45–100 psi.
- Heat to 177°C (350°F) (5°C/+10°F) at 2°C ± 1°C/min (5°F ± 3°F/min).
- Hold at 177°C (350°F) for 2 hours (+15 min/-0 min). Cool.
- May be post cured at 232°C (450°F) for 2 hours if higher temperature service is required.


Typical RS-3 Cure Profile
400
300
200
100
0
0
1
2
3
4
Time (hours)
Temp. (F)
Press. (psi)
Vac. (inHg)


RS-3 Neat Resin Viscosity Profile
1.00E+08
1.00E+07
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
Viscosity (cps)
350
300
250
200
150
100
50
0
Temp. (F)
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
Time (Min)
RS-3
RS-3C
RS-3M
Temp (F)

PRODUCT DATA SHEET

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^2 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.

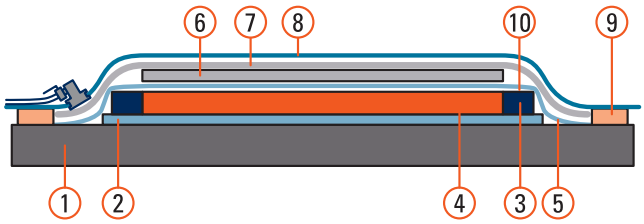


Figure 1

Toray Advanced Composites

18255 Sutter Blvd.
Morgan Hill, CA 95037, USA
t +1 408 465 8500

2450 Cordelia Road
Fairfield, CA 94534, USA
t +1 707 359 3400

Amber Drive, Langley Mill
Nottingham, NG16 4BE, UK
t +44 (0)1773 530899

www.toraytac.com
explore@toraytac-usa.com (North America/Asia/Pacific)
explore@toraytac-europe.com (Europe/Middle East/Africa)