

# > AVIMID<sup>®</sup> R POLYIMIDE COMPOSITE

TECHNICAL DATA SHEET



## DESCRIPTION

AVIMID<sup>®</sup> R is a high temperature, 581°F (305°C) Tg\*, thermoset polyimide resin with good 500°F (260°C) wet and 550°F (288°C) dry service capability. AVIMID R has outstanding thermal oxidative stability, excellent resistance to aircraft fluids and is tough, showing little micro-cracking during severe thermal cycling.

AVIMID R was formulated for prepreg autoclave vacuum bag processing but can be successfully compression molded both as a prepreg and in dry forms as neat resin or chopped-fiber molding compound. Unidirectional tape and woven prepreg of AMIMID R will retain tack and drape for 14 days at 70°F (21°C).

Standard autoclave or compression molding processes, to a final temperature of 680°F (360°C) will result in full Tg development/cure, with no need for any post-cure treatment. AVIMID R can be solution impregnated on a variety of fibers and fabrics.

## FEATURES & BENEFITS

- High Tg, 581°F (305°C)\*
- Non-MDA, PMR-15 alternative, no carcinogenic components
- 500°F (260°C) wet and 550°F (288°C) dry service capability
- Tough, micro-crack resistant resin
- Specified for jet engine use
- Autoclave or press-mold processing
- Available in a range of fibers and forms including tape, fabric, chopped fiber or neat resin
- No post-cure needed
- 680°F (360°C) final cure
- Shelf life of 12 months at 0°F (-18°C), 14 days at 70°F (21°C)

## SUGGESTED APPLICATIONS

- Jet engine components

\* **NOTE:** Tg data is not applicable for U.S. export control classification or licensing. For export-related information please contact us.

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### CHARACTERISTICS & PROPERTIES

Table 1 | Typical neat resin properties

Tensile Modulus @ RT, Msi (GPa)	0.52 (3.6)
Tensile Strength @ RT, ksi (MPa)	17.0 (120)
Failure Elongation, %	3.3
Fracture Toughness @ RT (G <sub>IC</sub> ), in-lb/in <sup>2</sup> (kJ/m <sup>2</sup> )	6.3 (1.1)
Moisture Saturation @ 160°F (71°C), wt %	2.8
DMA – T <sub>g</sub> , °F (°C) *	
Dry	585 (305)
Wet	253 (487)
Melt Viscosity @ 600°F (316°C), kPa.s (poise)	30 (3 x 10 <sup>5</sup> )
TOS Weight Loss @ 527°F (275°C), wt%	
900 hours	1.1
1800 hours	2.8

\* **NOTE:** T<sub>g</sub> data is not applicable for U.S. export control classification or licensing. For export-related information please contact us.

Table 2 | Typical Properties: T650-35 carbon fiber reinforced 8 harness satin fabric

Property	-67°F (-55°C)	71°F (22°C)	500°F (260°C)
<b>0° Tensile Properties, [0, 90]<sub>3S</sub></b>			
Strength, ksi (MPa)	125 (868)	125 (868)	109 (753)
Modulus, Msi (GPa)	8.79 (60.6)	8.73 (60.2)	9.20 (63.7)
<b>90° Tensile Properties, [90, 0]<sub>3S</sub></b>			
Strength, ksi (MPa)	122 (842)	122 (842)	104 (717)
Modulus, Msi (GPa)	9.37 (64.6)	9.25 (63.8)	9.25 (63.8)
<b>0° Compression Properties, [0,90]<sub>4S</sub></b>			
Strength, ksi (MPa)	124 (859)	118 (815)	52.2 (360)
<b>Open Hole Compression Properties, ([±45][0,90])<sub>4S</sub></b>			
Strength, ksi (MPa)	-	42.1 (290)	-

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**Table 3 | Typical Properties: T650-35 carbon fiber reinforced unidirectional tape (12K tow)**

Property	71°F (22°C)	350°F (177°C)	500°F (260°C)
<b>0° Tensile Properties, [0]<sub>8</sub></b>			
<b>Strength, ksi (MPa)</b>	300 (2.07)	-	-
<b>Modulus, Msi (GPa)</b>	21.8 (150)	-	-
<b>90° Tensile Properties, [0]<sub>16</sub></b>			
<b>Strength, ksi (MPa)</b>	7.83 (54.0)	-	6.25 (43.1)
<b>In-plane Shear Properties, [±45]<sub>3S</sub></b>			
<b>Strength, ksi (MPa)</b>	17.4 (120)	-	11.0 (75.8)
<b>Open Hole Compression Properties, [+45, 0, -45, 90]<sub>3S</sub></b>			
<b>Strength, ksi (MPa)</b>	47.0 (324)	37.4 (258)	-
<b>Compression After Impact, 1500 in-lb/in (2.7 kN/m)</b>			
<b>Strength, ksi (MPa)</b>	-	42.3 (292)	-
<b>Strain to Failure, %</b>	-	0.67	-
<b>Damage Area, in<sup>2</sup> (m<sup>2</sup> x 10<sup>4</sup>)</b>	-	0.65 (4.14)	-
<b>Interlaminar Shear Properties, [0]<sub>16</sub></b>			
<b>Strength, ksi (MPa)</b>	17 (120)	-	8.1 (56)

**Table 4 | Typical Properties: T650-35 carbon fiber reinforced**

Property	Exposure	Test Temperature °F(°C)	Property Retention, % of Original
<b>Wet, In-plane Shear Strength</b> All are 8HS [±45] <sub>3S</sub>	Humid air	73 (23)	96
	1000 hrs at 122°F (50°C) and 95% HR	500 (260)	90
	Skydrol 500 B-4 immersion for 1200 hrs at 500°F (260°C)	500 (260)	93
	ASTO 500 immersion for 1000 hrs at 392°F (200°C)	71 (22)	98
<b>In-plane Shear Strength</b> All are 8HS [±45] <sub>3S</sub>	1000 hrs at 500°F (260°C), 1 Atm. air	73 (23)	104
	1000 hrs at 500°F (260°C), 1 Atm. air	500 (260)	102
	6000 hrs at 500°F (260°C), 1 Atm. air	500 (260)	96
<b>Interlaminar Shear Strength</b> All are 8HS [0,90] <sub>4S</sub>	1000 hrs at 400°F (204°C), 1 Atm. air	450 (232)	103
	216 hrs at 450°F (232°C), 1 Atm. air	450 (232)	97
	5 hrs at 620°F (327°C), 1 Atm. air	450 (232)	97
<b>Glass Transition (T<sub>g</sub>)</b> All are [-45,0,+45,90] <sub>3S</sub>	Humid air, 2880 hrs at 160°F (71°C) and 95% HR	NA	100
	Water immersion for 2880 hrs at 160°F (71°C)	NA	100
	Water immersion for 9120 hrs at 71°F (22°C)	NA	100
<b>None of the exposures above resulted in any micro-cracking</b>			
<b>Level of Micro-cracking</b> All are 8HS [0,90] <sub>4S</sub>	Thermal cycling, 1 Atm. air, 2000 cycles, 73°F (23°C) to 550°F (288°C)	Original	0.0/in/ply
		Cycled	1.5/in/ply

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## APPLICATION NOTES

### Autoclave Manufacture

#### Autoclave Capability

- An autoclave capable of achieving 680°F (360°C), 200 psi (1.37 MPa) and vacuum of 28" Hg (709 mm Hg) at the bag with multiple vacuum ports is required. Chilled vacuum-line traps are needed for off-gas condensate collection.

#### Prepreg Handling and Use

- Before use remove AVIMID R from freezer and let set at room temperature for at least one hour
- Prepreg may be kept up to 14 days at ambient conditions if covered with an evaporation barrier
- Vacuum debulking is recommended every 4 – 6 plies for unitape and 1 – 2 plies for 8HS fabric
- Slight warming or application of a light ethanol spray can be used to improve tack and drape.

#### Tool and Bagging Set-up

- 2 mil (0.051 mm) Kapton<sup>®</sup> HN film bag
- 3 breather layers of style 7781 glass or equivalent
- 2 breather layers of style 120 glass or equivalent
- A bleed barrier is preferred, such as CPLD 26 (smooth side down)
- TX-1040 release pley (Teflon<sup>®</sup> coated glass fabric or suitable equivalent)
- Part/prepreg
- Tooling, properly treated for high temperature release. Mono-Coat E63 NODS has been found to be an excellent release when cured to 600°F (316°C). For graphite tooling a suitable sealer may be necessary.

#### Process Cycle

- Set vacuum at 2 – 4 inches Hg (63 – 127 mm Hg)
- Heat at 1.25°F (0.69°C) per minute to 482°F (250°C)
- Increase vacuum to full [at least 28 inches Hg (709 mm Hg)] when temperature reaches 437 ± 10°F (225 ± 5°C). Maintain full vacuum to end of cycle.
- Hold at 482°F (250°C) for 3 hours
- Heat at 2.0°F (1.11°C) per minute to 610°F (321°C)
- When leading thermocouple reaches 590°F (310°C) pressurize to 200 psi (1.378 MPa) at the rate of 10 – 20 psi (0.06 – 0.14 MPa) per minute
- Hold at 610 ± 10°F (321 ± 5°C) for 1 hour
- Heat at 1.0°F (0.56°C) to 680 ± 10°F (360 ± 5°C)
- Hold 3 hours at 680 ± 10°F (360 ± 5°C)
- Cool down at 1.0°F (0.56°C) from 680°F (360°C) to 482°F (250°C) and at a maximum rate thereafter
- Release pressure and vacuum when cool enough to remove from autoclave
- Total cycle time is 18.2 hours

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### PRODUCT HANDLING AND SAFETY

Cytec Engineered Materials recommends wearing clean, impervious gloves when working with polyimide resin systems to reduce skin contact and to avoid contamination of the product.

Materials Safety Data Sheets (MSDS) and product labels are available upon request and can be obtained from any Cytec Engineered Materials Office.

### DISPOSAL OF SCRAP MATERIAL

Disposal of scrap material should be in accordance with local, state, and federal regulations.

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