

> AVIMID[®] N POLYIMIDE COMPOSITE

TECHNICAL DATA SHEET



DESCRIPTION

AVIMID[®] N is a high temperature, post-curable, 775°F (413°C) Tg* thermoplastic polyimide composite with wet service capability up to 630°F (332°C) and dry service capability of 700°F (370°C). AVIMID N has the industry's best thermal oxidative resistance of all organic matrices and is the preferred product when high temperature durability is needed. It is a very tough composite system and has favorable dielectric properties making it well suited for missile and turbine engine applications.

AVIMID N was formulated to be a non-MDA, high temperature composite that would allow the use of typical safety/health procedures and personal protection equipment (PPE). It can be compression molded into low void parts to meet demanding aerospace requirements or alternatively processed in a vacuum bag autoclave process to meet more flexible requirements usually seen in non-aerospace applications.

AVIMID N is solution impregnated on a variety of fibers and fabrics that result in prepregs that retain their tack and drape for up to 6 days at 70°F (21°C). Tack can be regenerated or enhanced in a limited way by spraying the prepreg with ethanol. The prepreg has a shelf life of 12 months from date of manufacture when stored at 0°F (-18°C).

FEATURES & BENEFITS

- Most thermal oxidatively stable polyimide composite
- Post-curable Tg as high as 775°F (413°C)*
- Non-MDA system; no carcinogenic components
- Service temperature 630°F (332°C) wet and 700°F (370°C) dry
- Tough, micro-crack resistant resin
- Low and favorable dielectric properties
- Autoclave or compression moldable
- Shelf life of 12 months at 0°F (-18°C). 6 days at 70°F (21°C)
- Specified for turbine engine and industrial use

SUGGESTED APPLICATIONS

- Turbine engine components
- Missile 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

Outstanding thermal oxidative stability

Because of its unique chemical makeup, AVIMID N is one of the most thermal oxidatively stable organic polymer systems known. Isothermal aging tests in flowing air at 600°F (316°C) demonstrate less than 2% weight loss after 670 hours of continuous exposure.

Significantly tougher than most organic matrix polymers

Being linear and amorphous, AVIMID N polyimide is significantly tougher than most organic matrix polymers and it retains its toughness over a far greater temperature range. Refer to Table 1.

Table 1 | Fracture toughness of neat resin at 73°F (23°C)

Resin	Fracture Toughness	
	ft-lb/ft ²	J/m ²
Epoxy	5.6	82
Bismaleimide	7.1	104
Thermid 600	14.4	210
PMR-15	15.8	230
AVIMID N	164.5	2400

This excellent toughness manifests itself in composite structures by greatly reducing or eliminating surface cracking, even after exposure to high temperature, and replacing brittle fracture type failure modes with ductile energy-absorbing failure modes.

Table 2 | NR-150 resin properties

Property	Value
Tensile strength, MPa	110
Tensile modulus, GPa	4.1
Elongation, %	6
Density, g/cc	1.45
Glass transition temperature (Tg), °C *	340 – 355 ¹

¹ As molded plaque

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Typical Mechanical Properties

Table 3 | Short beam shear strength: 16 ply graphite unidirectional uniweave (G30-500), Tg = 785°F (418°C) *

Temperature, °F (°C)	Short Beam Shear Strength, ksi (MPa)
75 (24)	14.3 (98.6)
425 (218)	8.9 (61.4)
600 (316)	6.7 (46.2)
680 (360)	5.6 (38.6)

Table 4 | 0° flexural strength/modulus: 16 ply graphite unidirectional uniweave (G30-500), Tg = 775°F (413°C) *

Temperature, °F (°C)	Flex Strength, ksi (MPa)	Flex Modulus, msi (GPa)
75 (24)	213 (1469)	16.1 (111)
400 (204)	129 (889)	15.0 (103)
630 (332)	99 (683)	14.9 (103)
630 (332) wet	44 (303)	14.6 (101)

Table 5 | 0° flexural strength/modulus: 16 ply graphite uniweave (G30-500), quasi-isotropic (0, 90, ±45)

Temperature, °F (°C)	Flex Strength, ksi (MPa)	Flex Modulus, msi (GPa)
75 (24)	77.0 (531)	7.8 (54)
630 (332)	53.8 (371)	7.1 (49)

Table 6 | In-plane shear strength/modulus: 16 ply graphite uniweave (G30-500), bias (±45), Tg = 785°F (418°C) *

Temperature, °F (°C)	Strength, ksi (MPa)	Modulus, msi (GPa)
75 (24)	12.7 (88)	0.81 (5.6)

Table 7 | Tensile strength/modulus: 10 ply graphite uniweave (G30-500), Tg = 775°F (°C) *

Orientation	Temperature, °F (°C)	Strength, ksi (MPa)	Modulus, msi (GPa)
0° tensile	630 (332)	177 (1220)	19.1 (132)
	630 (332) wet	180 (1241)	21.7 (150)
90° tensile	75 (24)	14.5 (100)	2.55 (17.6)
	630 (332)	13.8 (95)	2.33 (16.1)

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Table 8 | Tensile strength/modulus: 16 ply graphite uniweave (G30-500), quasi-isotropic (0, 90, ±45), Tg = 775°F (413°C) *

Temperature, °F (°C)	Strength, ksi (MPa)	Modulus, msi (GPa)
75 (24)	65.1 (449)	7.3 (50)
400 (204)	70.0 (483)	7.1 (49)
630 (332)	67.0 (462)	7.2 (50)
630 (332) wet	69.4 (479)	6.1 (42)

Table 9 | Compressive strength/modulus: 16 ply graphite uniweave (G30-500), quasi-isotropic (0, 90, ±45), Tg = 775°F (413°C) *

Temperature, °F (°C)	Strength, ksi (MPa)	Modulus, msi (GPa)
75 (24)	61.1 (421)	6.9 (48)

Table 10 | Compressive strength/modulus: 16 ply graphite unidirectional uniweave (G30-500), Tg = 710°F (377°C) *

Temperature, °F (°C)	Strength, ksi (MPa)	Modulus, msi (GPa)
75 (24)	129 (889)	16.3 (112)
630 (332)	52.6 (363)	-
630 (332) wet	34.6 (239)	-

Table 11 | Interlaminar fracture toughness (G_{IC}): 16 ply graphite uniweave (G30-500), Tg = 785°F (418°C) *

Temperature, °F (°C)	G _{IC} , in-lb/in ²
75 (24)	3.6
600 (316)	3.9
650 (343)	4.1

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APPLICATION NOTES

Compression Molding of Avimid N Prepreg Flat Panels

Tooling: Picture frame mold made from tooling steel

1. Place debulked prepreg lay-up in tool ensuring the lay-up edges do not touch the tool frame
2. Locate the picture frame in middle of the press with the top ram placed diagonally on the mold.
3. Close the press to touch pressure.
4. Set the press to 300°F (149°C)
5. Once the panel reaches 275 ± 20°F (135 ± 11°C) start the timer
6. Devolatilize for 2 hours (+ 1 hours/ - 0 hours)
7. Put the top ram into the mold and cure according to the following cycle:
 - a. Ramp the press to 740 ± 10°F (393 ± 6°C) at 5°F (3°C) per minute or 50°F (28°C) per minute
 - b. When the panel reaches 550 ± 10°F (288 ± 6°C) apply 1000 psi (6.9 MPa)
 - c. When the panel reaches 625 ± 10°F (329 ± 6°C) apply 4000 psi (27.6 MPa)
 - d. When the panel reaches 725 ± 10°F (385 ± 6°C) hold for 4 hours ± 15 minutes
 - e. Cool under pressure until mold is below 350°F (177°C)
 - f. Open press, remove mold and carefully remove panel from mold.

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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