

Advanced Materials

Matrimid[®] 5218* / Matrimid[®] 9725*

A Soluble Polyimide

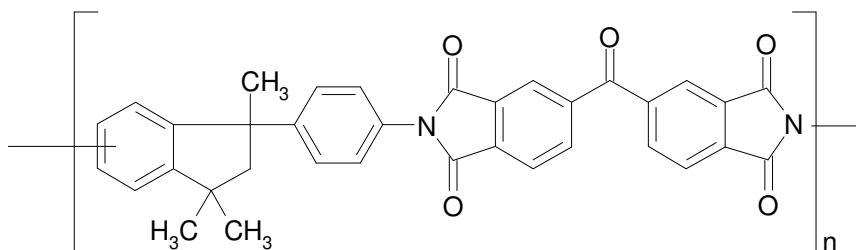
GENERAL

Matrimid[®] 5218 / Matrimid[®] 9725 is a soluble thermoplastic polyimide. It is fully imidized during manufacturing, eliminating the need for high temperature processing. Matrimid[®] 5218 / Matrimid[®] 9725 is soluble in a variety of common solvents. Evaporation of the solvents leaves a strong, durable, tough coating. Matrimid[®] 9725 is a micropulverized version of Matrimid[®] 5218.

CHEMICAL DESCRIPTION

Matrimid[®] 5218 / Matrimid[®] 9725 is a thermoplastic polyimide based on a proprietary diamine, 5(6)-amino-1-(4' aminophenyl)-1,3,-trimethylindane

CHEMICAL STRUCTURE



ADVANTAGES

- Fully imidized
- Does not require high temperatures for processing
- Soluble in a variety of common solvents
- Excellent adhesion
- Durable and tough films
- Excellent chemical resistance
- Very good thermal properties
- 100% solid powder

APPLICATIONS

- High temperature adhesives
- Composites
- Gas separation

* In addition to the brand name product denomination may show different appendices, which allows us to differentiate between our production sites: e.g., BD = Germany, US = United States, IN = India, CI = China, etc.. These appendices are in use on packaging, transport and invoicing documents. Generally the same specifications apply for all versions. Please address any additional need for clarification to the appropriate Huntsman contact.

TYPICAL PROPERTIES	Inherent viscosity ⁽¹⁾ , dl/g	0.62 - 0.68
	Volatile content ⁽²⁾ , %	0 - 1.5%
	For Matrimid 9725	
	Typical particle size range <106 μ	70 - 100%

(1) 0.5 in NM Pat 25 °C

(2) 2 gm sample heated to 260 °C for 45 minute

SPECIAL FEATURES

Matrimid[®] 5218 / Matrimid[®] 9725 is a soluble thermoplastic polyimide. There is no polyamic acid precursor in the product that would require a high temperature cure to convert to the imide form. This lack of amic acid groups allows relatively simple processing compared to conventional polyamic acid precursor polyimides. For example, when solutions of Matrimid[®] 5218 / Matrimid[®] 9725 are used for coating applications, the substrate need only be heated to a temperature and for a time sufficient to thoroughly remove the solvent. When the solvent has been removed, a strong, durable polyimide coating remains. By contrast, the more common polyamic acid precursor polyimides must be heated to high temperatures for long periods to convert the polyimide structure. This "curing" process evolves a water by-product and makes it very difficult to form pinhole-free coatings or void-free parts from those materials. No water is evolved in using Matrimid[®] 5218 because no curing (imidization) occurs during processing.

Matrimid[®] 5218 / Matrimid[®] 9725 has very unusual and desirable properties. Its high thermal stability and high glass transition temperature make Matrimid[®] 5218 / Matrimid[®] 9725 suitable for adhesive applications as well as matrix resin for composite applications. Figure 1 shows the change in modulus versus temperature of a neat resin molding based on Matrimid[®] 5218 (Dynamic Mechanical Analysis). Table 1 illustrates the adhesive properties of Matrimid[®] 5218 with a variety of substrates.

Matrimid[®] 5218 is soluble in many organic solvents and possesses excellent chemical resistance to water, steam, brine, acids, caustic and non-polar organic solvents, unlike other polyimides. As a soluble thermoplastic, Matrimid[®] 5218 / Matrimid[®] 9725 retains its solubility in certain polar organic solvents after processing, unless it has been thermally or chemically crosslinked before exposure to these solvents.

Matrimid[®] 5218 / Matrimid[®] 9725 is soluble in the following solvents. In general, 20 percent solutions are possible with these solvents.

Methylene chloride
Ethylene chloride
Chloroform
Tetrachloroethane
Tetrahydrofurane (THF)
Dioxane
Acetophenone
Cyclohexanone
m-Cresol
 γ -Butyrolactone
Dimethylformamide (DMF)
Dimethylacetamide (DMAC)
N-methylpyrrolidone (NMP)

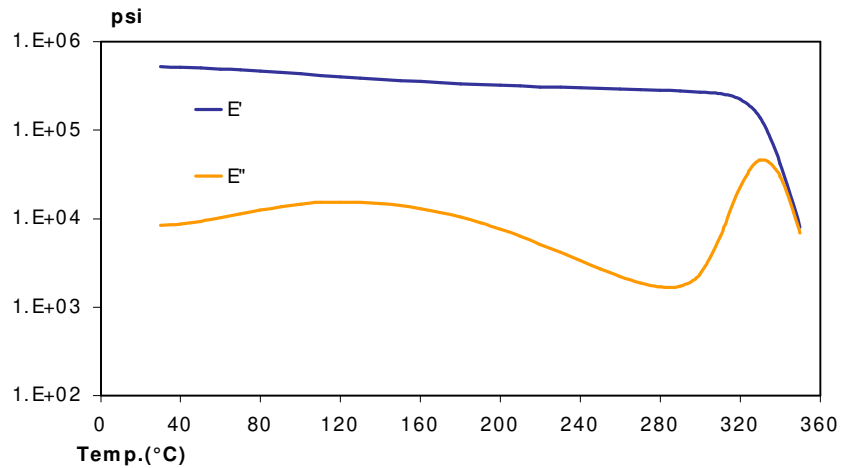
**SPECIAL FEATURES
(CONTINUED)**

**Table 1
Adhesive Properties**

Substrate	Adhesion
Aluminum ⁽³⁾ , mirror finish	Excellent
Aluminum, Alodine treated	Excellent
Steel, hot or cold rolled	Excellent
Stainless steel	Excellent
Brass	Excellent
Titanium	Excellent
Copper, untreated	Good
Copper, etched with (NH ₄) ₂ S ₂ O ₈	Excellent
Glass, untreated	Poor
Glass, aminosilane treated	Excellent
Ryton [®] PPS (Phillips) untreated	Poor
Ryton PPS (Phillips) acid etched	Excellent
Kapton [®] (Du Pont) untreated	Poor
Kapton (Du Pont) acid etched	Excellent

⁽³⁾ To obtain excellent adhesion to some aluminum surfaces a surfactant, such as 3M's Fluorad[®] FC 430, must be added to the polyimide varnish.

**Figure 1
Dynamic Mechanical Analysis of Matrimid 5218**



MECHANICAL PROPERTIES

Matrimid® 5218 Film

Machine-made film cast from a methylene chloride/Matrimid® 5218 solution.

Final drying temperature 240 °C by infrared heating rollers
 Film thickness 1 mil unoriented

Tensile strength, ksi

at break 12.4
 at yield 12.6

Elongation, %

at break 48.6
 at yield 6.9

Tensile modulus, ksi

420

Density, g/cm³ 1.2
 Refractive index 1.614
 Coefficient of linear expansion in/in/°C 2.8 x 10⁻⁵
 Moisture absorption at 51% R.H. (equilibrium), % 0.87

**MATRIMID® 5218/
 GRAPHITE PREPREG**

Formulation

Dissolve Matrimid® 5218 in γ -Butyrolactone solvent (20 percent solids). Use Hercules Magnamite AS4-12K graphite fibers to prepare unidirectional prepreg.

B-stage prepreg in an air circulating oven with temperature starting at 77°F, increasing to 400°F. Keep the prepreg at 400°F for 45 - 60 minutes. The prepreg should then have the solvent retention necessary for flow during composite fabrication.

A composite panel was prepared in the following manner:

Press mold: 500 - 600 °F @ 100 psi
 Cool down: to room temp. @ 100 psi
 Dwell time: 30 min @ 600 °F
 Post cure: 16 hrs. @ 600 °F
 (free standing)

Mechanical Properties @ 25°C

Fiber content, % 65
 Short beam shear strength, psi 11,000
 Fracture toughness G_{IC} in-lb/in² 4
 Tg (DMA), °C
 Dry 280
 Wet 265

Thermal Properties

Temp. (°F)	Time (Wks)	Weight Loss (%)	
		Neat Resin	Composite Molding
450	1	0	0.25
	4	0.12	0.73
	10	0.40	1.33
600	1	0.33	0.61
	4	0.70	1.41
	6	1.22	2.09

PACKAGING & STORAGE	Matrimid® 5218 is supplied in 50 pound drums and Matrimid® 9725 is supplied in 40 pound drums. The product has a minimum shelf life of one year when stored in unopened, sealed containers in a dry location at room temperature.
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HANDLING PRECAUTIONS**Personal hygiene***Safety precautions at workplace*

protective clothing	yes
gloves	essential
arm protectors	recommended when skin contact likely
goggles/safety glasses	yes

Skin protection

before starting work	Apply barrier cream to exposed skin
after washing	Apply barrier or nourishing cream

Cleansing of contaminated skin

Dab off with absorbent paper, wash with warm water and alkali-free soap, then dry with disposable towels. Do not use solvents

Disposal of spillage

Soak up with sawdust or cotton waste and deposit in plastic-lined bin

Ventilation

of workshop	Renew air 3 to 5 times an hour
of workplaces	Exhaust fans. Operatives should avoid inhaling vapours

FIRST AID

Contamination of the *eyes* by resin, hardener or mix should be treated immediately by flushing with clean, running water for 10 to 15 minutes. A doctor should then be consulted. Material smeared or splashed on the *skin* should be dabbed off, and the contaminated area then washed and treated with a cleansing cream (see above). A doctor should be consulted in the event of severe irritation or burns. Contaminated clothing should be changed immediately.

Anyone taken ill after *inhaling* vapours should be moved out of doors immediately. In all cases of doubt call for medical assistance.

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