

> FM[®] 2555 CYANATE ESTER FILM ADHESIVE

TECHNICAL DATA SHEET



DESCRIPTION

FM[®] 2555 is a 350°F (177°C) cure, 440°F (227°C) post-cure modified cyanate ester film adhesive. This adhesive has good high temperature properties with low dielectric constant and low loss tangent electrical properties.

Other products in this cyanate ester family include CYCOM[®] 5575-2 glass- and quartz- reinforced prepreg, FM[®] 2525 adhesive and FM[®] 6555-1 and BR[®] 6565 syntactic foams.

FEATURES & BENEFITS

- One of a family of compatible products based on second-generation cyanate ester chemistry
- Low dielectric constant and loss tangent for radome applications
- Suitable for bonding both metals and composites; co-cures with most 350°F (177°C) cure prepregs
- Service temperature -67° to 450°F (-55° to 232°C); good high temperature adhesion
- Low out-gassing

SUGGESTED APPLICATIONS

- Honeycomb sandwich construction
- Metal-to-metal bonding
- Composite-to-metal bonding
- Composite-to-composite bonding
- 350°F (177°C) cure satellite structure applications

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CHARACTERISTICS

Table 1 | Physical Properties

Shelf Life	Six months at 0°F (-18°C) Three months at 40°F (4°C) 30+ days at 75°F (24°C)
Storage	Storage in excess of six months at 0°F (-18°C) or three months at 40°F (4°C) in sealed container To prevent moisture pickup sealed container should not be opened until the adhesive reaches ambient temperature
Shop Life	In excess of 21 days at room temperature
Gel Time	5 minutes nominal at 350°F (177°C) 14 minutes nominal at 300°F (149°C) 150 minutes nominal at 250°F (121°C)
Volatiles	Less than 1%
Tg, dry	450°F (232°C)
Out-gassing (ASTM E595)	TML 0.25 CVCM 0.001 WVR 0.30
CTE	Room temperature to 400°F (204°C) Without post-cure 37.5 With post-cure 42.8

Table 2 | Electrical Properties

Dielectric constant/loss tangent 10 GHz	2.80/0.002 at 77°F (25°C) 2.81/0.003 at 400°F (204°C)
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PROPERTIES

Table 3 | Mechanical Properties: Standard cure, metal bonding¹

Property	Test Temperature °F (°C)	Strength psi (MPa)	Specimen
Lap shear Metal-to-metal	Room Temp	2700 (18.62)	2024/T3 FPL etch
	250 (121)	3000 (20.68)	
	350 (177)	2600 (17.93)	
	450 (232)	3000 (20.68)	
	500 (260)	2500 (17.24)	
	600 (316)	2000 (13.79)	
Lap shear Metal-to-metal	-67 (-55)	3100 (21.37)	2024/T3 FPL etch Phosphoric acid anodize
	Room Temp	3000 (20.68)	
	250 (121)	3300 (22.75)	
	350 (177)	3000 (20.68)	
	450 (232)	3300 (22.75)	
	500 (260)	3700 (25.51)	
Flatwise tensile Metal skins-to-honeycomb core	-67 (-55)	1000 (6.895)	0.020 inch thick 2024/T3 aluminum skins 5052 1/4 inch, 7.9 density, 0.5 inch thick core FPL etch Phosphoric acid anodize
	Room Temp	950 (6.550)	
	250 (121)	810 (5.585)	
	350 (177)	850 (5.861)	
	450 (232)	650 (4.482)	

¹FM 2555 film adhesives at 0.060 psf

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Table 4 | Mechanical Properties: Standard cure, composite bonding¹

Property	Test Temperature °F (°C)	Strength psi (MPa)	Specimen
Flatwise tensile	Room Temp	325 (2.241) core failure	CYCOM [®] 5575-2/7781 HRH-10 core 4 lb. density 3/16 inch cell 1 inch thick Co-cure
	Room Temp	600 (4.137) core failure	CYCOM [®] 5575-2/7781 HRH-10 core 6 lb. density 3/16 inch cell 1 inch thick Co-cure
Flatwise tensile	Room Temp	900 (6.205) cohesive failure	CYCOM [®] 5575-2/7781 HRP core 4 lb. density 3/16 inch cell 1 inch thick Co-cure
	Room Temp	1300 (8.963) cohesive failure	CYCOM [®] 5575-2/7781 HRP core 8 lb. density 3/16 inch cell 1 inch thick Co-cure
Flatwise tensile	Room Temp	500 (3.447) core failure	CYCOM [®] 5575-2/7781 HRH-327 core 4 lb. density 3/16 inch cell 1 inch thick Co-cure

Table 5 | Mechanical properties: Standard cure, composite bonding, continued

Property	Test Temperature °F (°C)	CYCOM [®] 5250-3/6781 psi (MPa)	CYCOM [®] 5575-2/7781 psi (MPa)	CYCOM [®] 5208/3K70PW psi (MPa)
Double lap shear Precured composite- to-composite	-67 (-55)	3100 (21.37)	3000 (20.68)	2600 (17.93)
	Room Temp.	3200 (22.06)	3400 (23.44)	2800 (19.31)
	Room Temp., wet ²	3000 (20.68)	-	-
	250 (121)	3500 (24.13)	3900 (26.89)	3800 (26.20)
	250 (121), wet	2900 (19.99)	-	-
	350 (177)	3700 (25.51)	4100 (28.27)	-
	350(177), wet	2700 (18.62)	-	-

¹ FM 2555 film adhesives at 0.060 psf

² Wet conditioning: 72 hour water boil

Note: Cyttec recommends drying all non-metallic core prior to bonding

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Table 6 | Mechanical Properties: Standard cure, thermal aging

Property	Conditioning	Test Temperature		
		Room Temp	250 °F (121°C)	400°F (204°C)
Lap Shear, psi (MPa) Metal-to-metal bonding 2024/T3, FPL etch	None	2700 (18.62)	3000 (20.68)	2600 (17.93)
	72 hour water boil	2800 (19.31)	3800 (26.20)	3600 (24.82)
	7 days hydraulic oil	3400 (23.44)	3900 (26.89)	3900 (26.89)
	7 days JP4	3700 (25.51)	3900 (26.89)	3900 (26.89)
	30 days 5% salt spray at 95°F (35°C)	3300 (22.75)	3400 (23.44)	3600 (24.82)
	30 days at 95% RH, 160°F (71°C)	2800 (19.31)	3200 (22.06)	3900 (26.89)

Table 7 | Mechanical Properties: Standard cure, environmental resistance

Property	Conditioning	Test Temperature		
		Room Temp	250 °F (121°C)	400°F (204°C)
Lap Shear, psi (MPa) Metal-to-metal bonding 2024/T3, FPL etch	None	2700 (18.62)	3000 (20.68)	2600 (17.93)
	500 hours at 350°F (177°C)	3700 (25.51)	3700 (25.51)	4200 (28.96)
	1000 hours at 350°F (177°C)	3200 (22.06)	3400 (23.44)	3200 (22.06)
	3000 hours at 350°F (177°C)	2400 (16.55)	2600 (17.93)	2400 (16.55)
Flatwise Tensile, psi (MPa) Metal-to-metal bonding FPL etch 5052 1/4 inch cell, 7.9 density core	None	950 (6.550)	910 (6.274)	910 (6.274)
	500 hours at 350°F (177°C)	640 (4.413)	550 (3.792)	770 (5.309)
	1000 hours at 350°F (177°C)	720 (4.964)	680 (4.688)	740 (5.102)
	3000 hours at 350°F (177°C)	700 (4.826)	560 (3.861)	630 (4.344)

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APPLICATION NOTES

Cure Cycle

Recommended cure cycle for FM 2555 is as follows:

Pressure	Full vacuum, 26 in. Hg (88 kPa) and 15 to 45 psi (103 to 310 kPa) autoclave pressure Vent at 20 psi (139 kPa)
Heat up	Room temperature to 350°F (177°C) at 2 to 5°F (1 to 3°C) per minute
Hold	350 ± 10°F (177 ± 5.5°C) for 240 minutes
Cool down	Under pressure to less than 140°F (60°C)
Post-cure	440°F (227°C) for 120 minutes

For recommendations on other cure cycles and processes contact your CYTEC Technical Service representative.

Surface Preparation for Cured Composite Substrates

Most high-performance composites employ removable peel ply of nylon or Dacron fabric. Good bonding can be achieved with no surface preparation. Remove the peel ply and bond immediately.

For surfaces without peel ply:

- Lightly sand the surface to be bonded using 240 to 280 grit sandpaper
- Clean the surface using a clean, lint-free cotton cloth and MEK or acetone
- Dry thoroughly at room temperature before bonding

Surface Preparation for Aluminum Skins

A clean, dry, grease-free surface is required for optimum performance. FM 2555 can be used with all standard cleaning techniques involving solvent degreasing, alkaline cleaning, surface abrading, chemical deoxidizing, alodining, anodizing and/or priming. General guidance can be found in ASTM D 2651.

Best results for aluminum are obtained by a five step procedure of solvent degreasing, alkaline cleaning, chemical deoxidizing (etching), phosphoric acid anodizing¹ and priming with BR[®] 6747-1, Metlbond 6725-1 or BR[®] 127 primer.

Surface Preparation for Aluminum Core

No cleaning is necessary unless the core has been contaminated by foreign matter. If contaminated, degrease with MEK or vapor degrease.

Surface Preparation for Other Substrates

Information concerning the surface treatment of substrates other than aluminum is given in MIL-A-9067.

¹ Boeing patent 4,085,012; April 18, 1978. It is now being used by a large number of aircraft manufacturers due to the improved surface bond durability it provides.

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Bonding Procedure

1. Remove FM 2555 from refrigerated storage and allow it to reach room temperature before unpacking
2. Remove either of the interliners and place the adhesive against the surface to be bonded. Care should be taken to prevent air entrapment between the film adhesive and substrate, especially in large bond areas.
3. If additional tack is desired, the adhesive may be heated to as high as 140°F (60°C) without altering the adhesive properties. Before heat tacking, be sure the film is in the proper position as removal will be difficult.
4. Remove the other interliner and complete the assembly.

PRODUCT HANDLING AND SAFETY

Cytec Engineered Materials recommends wearing clean, impervious gloves when working with cyanate ester 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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