

# > CYCOM<sup>®</sup> 5250-4 RTM RESIN SYSTEM

TECHNICAL DATA SHEET



## DESCRIPTION

CYCOM<sup>®</sup> 5250-4 RTM is a true one-part homogeneous BMI resin developed specifically for the resin transfer molding (RTM) process. IT reaches very low viscosity during transfer and maintains a low viscosity for several hours, thus providing the maximum capability to fabricate complex parts. Laminates fabricated from CYCOM 5250-4 RTM are capable of service temperatures up to 400°F (204°C), but its toughness and processability make it an ideal material for 180°F (82°C) temperature applications where epoxies are commonly used.

CYCOM 5250-4 RTM offers the highest open hole compression (OHC) value of any organic matrix resin while providing the highest level of toughness available in an RTM capable matrix resin.

## FEATURES & BENEFITS

- Excellent toughness
- Maximum continuous service temperature up to 400°F (204°C)
- Superior hot/wet properties at 160 to 375°F (71 to 190°C)
- Low viscosity during processing
- Low-tack, solid at room temperature provides ease of handling
- Low thermal conductivity
- Versatile cure, can be cured at 400°F (204°C) for 2 hours
- Out-time greater than 60 days at room temperature
- True one-part formulation
- Fully compatible CYCOM 5240-4 RTM low resin content prepregs and CYCOM 782 RTM binder coated fabrics are available for preform manufacture

## SUGGESTED APPLICATIONS

- Wing stabilizer spars
- Fuselage skins and stiffeners
- Low operating temperature, critical load-bearing components
- Engine components

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## CHARACTERISTICS

### Product Form

CYCOM 5250-4 RTM is available in one and five gallon containers in either aggregate for standard pump arrangements or as a solid block cast net to the container for use with a heated follower-plate pump arrangement. Both aggregate and solid product forms are de-volatilized and are fully homogeneous for simplified processing.

### Storage

Viscosity data indicates that room temperature storage for up to 6 months is possible with CYCOM 5250-4 RTM resin. However, it is recommended that storage be maintained below 0°F (-18°C) in sealed containers to maintain maximum processability. To prevent moisture pickup, a sealed container should not be opened until the resin reaches ambient temperature.

Table 1 | Neat Resin Characteristics

Property <sup>1</sup>	Standard Cure + Standard Postcure <sup>1</sup>	400°F (204°C) for 2 hours – no postcure
Cured resin density, lb/ft <sup>3</sup> (g/cm <sup>3</sup> )	0.045 (1.25)	0.045 (1.25)
T <sub>g</sub> , °F (°C) dry *	520 (271)	490 (254)
T <sub>g</sub> , °F (°C) wet*	405 (207)	390 (199)
Gel time at 350°F (177°C)	35 minutes nominal	

<sup>1</sup> Standard cure + standard postcure: 6 hours at 350 – 375°F (177 – 191°C) + 4 hours at 440°F (227°C)

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

### RDSII Dynamic Viscosity

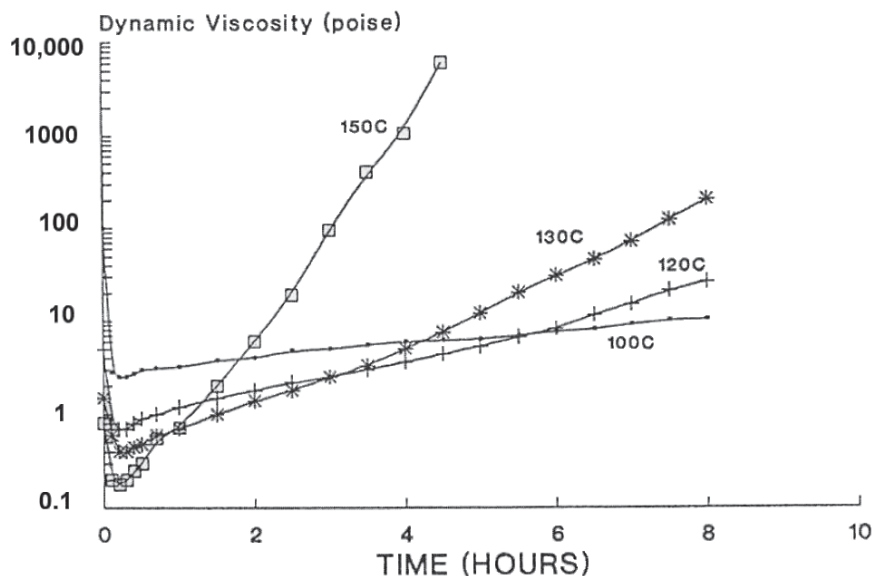


Figure 1 | RDSII Dynamic Viscosity for CYCOM 5250-4 RTM Resin System

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### PROPERTIES

Table 2 | Physical Properties<sup>1</sup>

Property	Standard Cure <sup>2</sup>	400°F (204°C) for 2 hours (no postcure)
<b>Solvent resistance 1000 hours at 160°F (71°C) exposure</b>		
<b>Weight gain (%)</b>		
Water	4.2	3.9
JP4	0.6	-
JP5	0.5	-
Hydraulic fluid (Skydrol)	0.6	-
Lubricant (ML-L-23699)	0.5	-
<b>170 hours at room temperature exposure</b>		
<b>Weight gain (%)</b>		
Paint stripper (Turco 5351)	1.8	-
M.E.K.	0.2	-
Anti-icing fluid	0.3	-
<b>Tensile properties at room temperature</b>		
Strength, ksi (MPa)	14.9 (103)	15.0 (104)
Modulus, ksi (GPa)	0.67 (4.6)	0.67 (4.6)
Strain, micro-in/in (%)	48000 (4.8)	48500 (4.9)
<b>Flexure properties at room temperature</b>		
Strength, ksi (MPa)	23.6 (163)	23.5 (162)
Strain, micor-in/in (%)	45000 (4.5)	45000 (4.5)
<b>Strain energy release rate, G<sub>1c</sub>, in-lb/in<sup>2</sup> (J/m<sup>2</sup>)</b>	0.80 (140)	-
<b>Notch sensitivity K<sub>1c</sub>, ksi-in<sup>1/2</sup> (MPa/m<sup>1/2</sup>)</b>	0.93 (0.85)	-
<b>Charpy impact, in-lb/in<sup>2</sup> (KJ/m<sup>2</sup>)</b>	97 (17)	-
<b>Coefficient of thermal expansion, in/in/°F</b>	44 x 10 <sup>-6</sup>	-

<sup>1</sup> Test procedures available upon request

<sup>2</sup> Standard cure + standard postcure: 6 hours at 350 – 375°F (177 – 191°C) + 4 hours at 440°F (227°C)

Table 3 | Post Cure Effect on Tg and Toughness

Cure condition	Dry Tg, °F,(°C)	Compression after impact <sup>2</sup> Toughness at cure condition (IM7-6K-4HS, 1500 in-lb/in)
350°F (177°C) for 6 hours	420 (216)	26 ksi (179 MPa)
375°F (191°C) for 4 hours	480 (249)	31 ksi (214 MPa)
400°F (204°C) for 2 hours	485 (252)	32 ksi (221 MPa)
410°F (210°C) for 6 hours <sup>1</sup>	505 (263)	32 ksi (221 MPa)
440°F (227°C) for 6 hours <sup>1</sup>	540 (282)	28 ksi (193 MPa)
470°F (243°C) for 6 hours <sup>1</sup>	580 (293)	27 ksi (186 MPa)

<sup>1</sup> Initial cure at 375°F (191°C) for 4 hours

<sup>2</sup> SACMA SRM 2, CAI laminate, F.V. = 58%

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**Table 4 | Mechanical Properties for T650-35-3K-PW and IM7-6K-4HS Fabrics (Standard Cure + Standard Post Cure)**

Test	Property	Test Condition	T650-35-3K-PW	IM7-6K-4HS
Flexure (ASTM D790)				
Warp (0°) Direction	Strength, ksi (MPa)	RT 350°F (177°C) Wet	155 (1068) 90 (620)	160 (1103) 91 (628)
	Modulus, msi (GPa)	RT 350°F (177°C) Wet	9.0 (62.1) 8.8 (60.7)	10.5 (72.4) 10.5 (72.4)
Fill (90°) Direction	Strength, ksi (MPa)	RT 350°F (177°C) Wet	148 (1020) 85 (586)	150 (1035) 88 (607)
	Modulus, msi (GPa)	RT 350°F (177°C) Wet	9.0 (62.1) 9.0 (62.1)	10.1 (69.7) 9.8 (67.6)
Short beam shear (ASTM D2344)				
Warp (0°) Direction	Strength, ksi (MPa)	RT 350°F (177°C) Wet	10.2 (70) 5.9 (41)	12.0 (82.8) 6.1 (42)
Open hole tensile				
[+,0,0,90,0]s, W/D = 6.0	Strength, ksi (MPa)	RT 350°F (177°C) Wet	- -	77 (530) 70 (484)
	Modulus, msi (GPa)	RT 350°F (177°C) Wet	- -	10.5 (72) 11.5 (79)
Compression after impact (SACMA SRM 2) 1500 in-lb/in impact				
[+,0,-,90]3s	Strength, ksi (MPa)	Room Temperature	32 (220)	34 (220)

F.V. = 58%

Wet = 1.1% weight gain

### RECOMMENDED PROCESSING OF BMI RESIN TRANSFER MOLDING SYSTEMS

CYCOM 5250-4 RTM resin system is formulated for use in RTM applications which require the use temperature and toughness of a modified BMI resin such as CYCOM 5250-4. The mechanical properties of CYCOM 5250-4 RTM are equivalent to CYCOM 5250-4 where comparisons of the two resins are possible.

Evaluation of processing of CYCOM 5250-4 RTM has been made through the fabrication of several test articles at major airframe facilities. Because BMI resin are solid at room temperature, specialized procedures are necessary to successfully transfer to the mold:

- For best viscosity control, the resin should be kept under refrigeration prior to use. When necessary, out-times of up to 30 days at room temperature are acceptable.
- Typically viscosity is 500 – 600 centipoise at 200°F (93°C) which is the recommended temperature for the resin holding reservoir.
- Liquification of the resin should be performed either by preheating at 160°F (71°C) or through the use of a 250°F (121°C) hotplate designed to allow flow of the resin into a holding reservoir maintained at 200°F (93°C).
- All components of the RTM equipment should be capable of controlled heating at 200°F (93°C) (posts, lines, molds and vent tubes). Rapid solidification of resin will occur in any unheated area. If heating of an area is not possible, continuous circulation of the resin must be utilized to avoid cooling and subsequent solidification of the resin.

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- The resin should be transferred to a mold or tool that has been preheated to 250 – 300°F (121 – 149°C) to maximize wet-out of the fibers. Voids are minimized by evacuating the mold prior to resin transfer. Pumping excess resin through the part to remove entrapped air has also been successful. However, the vent tubes must be heated to avoid solidification in the lines before pumping is complete.

The recommended cure cycle after resin transfer is 4 – 6 hours at 375°F (191°C) followed by 4 – 6 hours at 440°F (227°C) post cure which may be performed either on the tool or free-standing. To the best of our knowledge, this process produces RTM assemblies of highest quality with a minimum of voids.

## PRODUCT HANDLING AND SAFETY

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