

CYCOM® 2237

CYCOM® 2237 is a 600°F (316°C) curing polyimide resin system with a service temperature range up to 550°F (288°C) and is Syensqo's version of PMR-15. It is formulated for high temperature applications where low void content is critical. CYCOM® 2237 has an excellent overall balance of processing behavior, thermo-oxidative stability, and retention of properties in the 500 to 550°F (260 to 288°C) range. CYCOM® 2237's thermo-oxidative stability and micro-crack resistance make it ideal for jet engines and other fatigue loaded components like bypass ducts, gear box covers, transmission housings, vent tubes, fan stator and vane assemblies, nozzle flaps, core cowls, particle separator swirl frames, and compression molded bearings.

CYCOM® 2237 prepreg can be autoclave cured, vacuum bag processed, or compression molded.

CYCOM® 2237 is solution impregnated on a variety of fibers and fabrics. It is currently available on glass, quartz, and graphite reinforcement.

Features and Benefits

- High Tg, 640°F (338°C)
- Service temperature up to 550°F (288°C)
- Addition cure cross-linking mechanism
- Excellent handling characteristics
- Good product consistency
- Autoclave or press-mold processing
- Shelf life of 12 months at 0°F (-18°C)
- Shop life of 20 days at 80°F (27°C) and maximum 70% R.H.

CHARACTERISTICS

Table 1 | Physical Properties

| Property | Value | Test Method |
|---|---|-------------|
| Neat Resin Density, lb/in ³ (g/cm ³) | 0.047 (1.3) | ASTM D 792 |
| Neat Resin Tg, °F (°C) | 640 (338), dry 510 (266), wet | ASTM D 7028 |
| Shelf Life | 12 months at or below 0°F (-18°C) | |
| Shop Life | 20 days at or below 80°F (27°C) and maximum 70% R.H. | |

Table 2 | Product Availability

| Property | Description |
|-------------|------------------------|
| Carrier | Carbon, Glass, Quartz |
| Roll Width | 12, 60 in (30, 152 cm) |
| Roll Length | 50, 60 yd (46, 55 m) |



Table 3 | CYCOM® 2237 Neat Resin Mechanical Properties

| Property | Value | Test Method |
|---|------------|-------------|
| Tensile Modulus, ksi (MPa) | 5.6 (39) | ASTM D 638 |
| Tensile Strength, ksi (MPa) | 0.57 (3.9) | ASTM D 638 |
| Failure Elongation, % | 1.5 | ASTM D 638 |
| Fracture Toughness, lbf/in (kJ/m ²) | 1.6 (0.28) | ASTM D 3433 |
| Moisture Saturation at 71°C (160°F), weight % | 4.4 | ASTM D 5229 |
| TOS Weight Loss at 527°F (275°C), weight % ⁽¹⁾ | | ASTM D 4102 |
| 800 hours | 2.5 | |
| 1400 hours | 4.2 | |

(1) TOS based upon weight loss of cured composite laminate. Specimens dried at 250°F (121°C) to constant weight.

PROPERTIES

Table 4 | CYCOM® 2237 Mechanical Properties: 4581 Astroquartz Fabric Reinforced

| Property | Test Condition | Value | Test Method |
|---|------------------------------|------------------------|-------------|
| Glass Transition Temperature, °F (°C) | 75°F (24°C), Dry | 628 (331) | ASTM D 7028 |
| Warp Tensile Strength, ksi (MPa) ⁽¹⁾ | 75°F (24°C) 550°F (288°C) | 112 (772) 81 (558) | ASTM D 638 |
| Warp Tensile Modulus, msi (GPa) ⁽¹⁾ | 75°F (24°C) 550°F (288°C) | 4.5 (31) 4.3 (30) | ASTM D 638 |
| Fill Tensile Strength, ksi (MPa) ⁽¹⁾ | 75°F (24°C) | 100 (689) | ASTM D 638 |
| Fill Tensile Modulus, msi (GPa) ⁽¹⁾ | 75°F (24°C) | 4.3 (30) | ASTM D 638 |
| Warp Compressive Strength, ksi (MPa) ⁽¹⁾ | 75°F (24°C) 550°F (288°C) | 118 (813) 71 (489) | ASTM D 695 |
| Warp Compressive Modulus, msi (GPa) ⁽¹⁾ | 75°F (24°C) 550°F (288°C) | 4.9 (34) 4.6 (32) | ASTM D 695 |
| Fill Compressive Strength, ksi (MPa) ⁽¹⁾ | 75°F (24°C) 550°F (288°C) | 103 (710) 67 (462) | ASTM D 695 |
| Fill Compressive Modulus, msi (GPa) ⁽¹⁾ | 75°F (24°C) 550°F (288°C) | 4.7 (32) 4.4 (30) | ASTM D 695 |
| In-Plane Shear Strength, ksi (MPa) ⁽²⁾ | 75°F (24°C) 550°F (288°C) | 19.3 (133) 9.7 (67) | ASTM D 3518 |

(1) Lay-Up: [0]8. Normalized to 60% fiber volume

(2) Lay Up: [(+45/-45)]2S



Table 5 | CYCOM® 2237 Mechanical Properties: T650-35 Carbon Fiber 8-Harness Satin Fabric Reinforced

| Property | Test Condition | Value | Test Method |
|---|----------------|------------|-------------|
| Glass Transition Temperature, °F (°C) | 75°F (24°C) | 627 (330) | ASTM D 7028 |
| Warp Tensile Strength, ksi (MPa) ⁽¹⁾ | 75°F (24°C) | 138 (951) | ASTM D 638 |
| | 550°F (288°C) | 121 (834) | |
| Warp Tensile Modulus, msi (GPa) ⁽¹⁾ | 75°F (24°C) | 10.4 (72) | ASTM D 638 |
| | 550°F (288°C) | 11 (77) | |
| Fill Tensile Strength, ksi (MPa) ⁽¹⁾ | 75°F (24°C) | 145 (999) | ASTM D 638 |
| | 550°F (288°C) | 119 (820) | |
| Fill Tensile Modulus, msi (GPa) ⁽¹⁾ | 75°F (24°C) | 10.6 (73) | ASTM D 638 |
| | 550°F (288°C) | 12 (83) | |
| Warp Compressive Strength, ksi (MPa) ⁽¹⁾ | 75°F (24°C) | 116 (800) | ASTM D 695 |
| | 550°F (288°C) | 88 (607) | |
| Warp Compressive Modulus, msi (GPa) ⁽¹⁾ | 75°F (24°C) | 9.3 (64) | ASTM D 695 |
| | 550°F (288°C) | 9.7 (67) | |
| Fill Compressive Strength, ksi (MPa) ⁽¹⁾ | 75°F (24°C) | 104 (717) | ASTM D 695 |
| | 550°F (288°C) | 66 (455) | |
| Fill Compressive Modulus, msi (GPa) ⁽¹⁾ | 75°F (24°C) | 9.3 (64) | ASTM D 695 |
| | 550°F (288°C) | 9.3 (64) | |
| In-Plane Shear Strength, ksi (MPa) ⁽²⁾ | 550°F (288°C) | 8.8 (61) | ASTM D 3518 |
| Iosipescu Shear Strength, ksi (MPa) | 75°F (24°C) | 11.6 (80) | ASTM D 5379 |
| | 550°F (288°C) | 5.9 (41) | |
| Iosipescu Shear Modulus, msi (GPa) | 75°F (24°C) | 0.68 (4.6) | ASTM D 5379 |
| | 550°F (288°C) | 0.43 (2.9) | |
| Short Beam Shear Strength, ksi (MPa) | 75°F (24°C) | 8.4 (58) | ASTM D 2344 |
| | 550°F (288°C) | 7 (48) | |
| Interlaminar Shear Strength, ksi (MPa) | 75°F (24°C) | 7.5 (52) | ASTM C 1425 |
| | 550°F (288°C) | 5.7 (39) | |

(1) Lay-Up: [0]8. Normalized to 60% fiber volume

(2) Lay Up: [(+45/-45)]2S

Table 6 | CYCOM® 2237 Mechanical Properties: G30-500 12K Unidirectional Tape Reinforced

| Property | Test Condition | Value | Test Method |
|--------------------------------------|----------------|------------|-------------|
| Short Beam Shear Strength, ksi (MPa) | 75°F (24°C) | 18.4 (127) | ASTM D 2344 |
| | 600°F (316°C) | 10 (69) | |
| Flexural Strength, ksi (MPa) | 75°F (24°C) | 267 (1840) | ASTM D 790 |
| | 600°F (316°C) | 172 (1190) | |

Table 7 | CYCOM® 2237 Mechanical Properties: 6781 Fiberglass Fabric Reinforced

| Property | Test Condition | Value | Test Method |
|--------------------------------------|----------------|-----------|-------------|
| Compressive Strength, ksi (MPa) | 600°F (316°C) | 49 (338) | ASTM D 695 |
| Short Beam Shear Strength, ksi (MPa) | 75°F (24°C) | 10.6 (73) | ASTM D 2344 |
| | 600°F (316°C) | 6.4 (44) | |
| Flexural Strength, ksi (MPa) | 75°F (24°C) | 127 (876) | ASTM D 790 |
| | 600°F (316°C) | 80 (552) | |
| Flexural Modulus, msi (GPa) | 75°F (24°C) | 4.1 (28) | ASTM D 790 |
| | 600°F (316°C) | 3.8 (26) | |



PROCESSING

Guidelines for Thawing Out

On removal of sealed prepreg from 0°F (-18°C) storage, ensure that the material is allowed to thaw fully to room temperature prior to unsealing. This avoids condensation. Typically a 60 yd. (55 m) roll of prepreg requires about 8-12 hours thawing.

Lay Up Procedure

The following figures show recommended lay-ups for CYCOM® 2237.

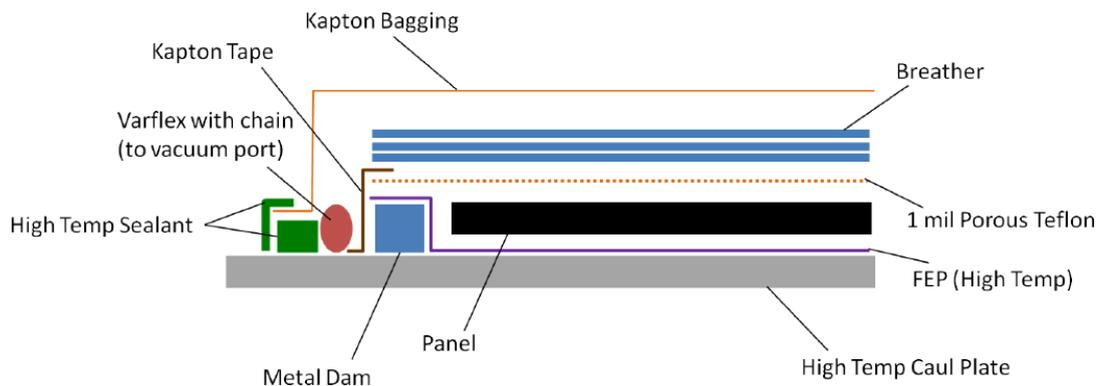


Figure 1 | Recommended lay-up procedure for CYCOM® 2237

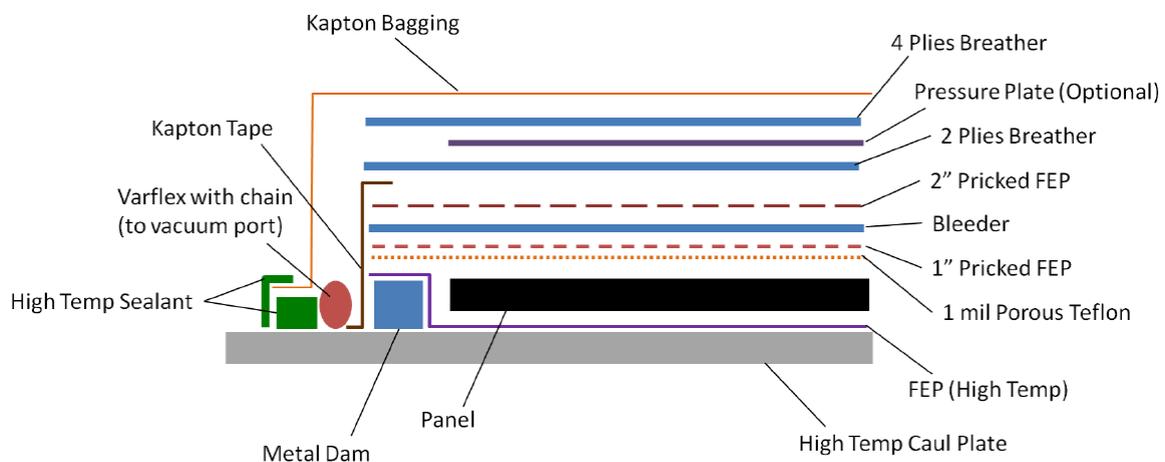


Figure 2 | Alternate recommended lay-up procedure for CYCOM® 2237



Recommended Cure Cycle

| | |
|------------------------------|--|
| Laminate Cure Cycle | Apply 2-6 in Hg vacuum Heat from 75°F (24°C) to 425°F ± 10°F (218°C ± 6°C) at 0.5-3°F (0.3-1.7°C)/minute. At 300°F ± 10°F (149°C ± 6°C), apply full vacuum, 24 in Hg minimum. Hold at 425°F ± 10°F (218°C ± 6°C) for 180-210 minutes. Heat from 425°F (218°C) to 475°F ± 10°F (246°C ± 6°C) at 0.5-3°F (0.3-1.7°C)/minute. At 450-475°F (232-246°C) apply 200 ± 10 psi (1.38 ± 0.07 MPa) pressure at 15-20 psi (0.1-0.14 MPa)/minute. Hold at 475°F ± 10°F (246°C ± 6°C) for 30-55 minutes. Heat from 475°F (246°C) to 600°F ± 10°F (316°C ± 6°C) at a rate of 0.5-3°F (0.3-1.7°C)/minute. Hold at 600°F ± 10°F (316°C ± 6°C) for 180-210 minutes. Cool under pressure to below 400°F (204°C) at 2-5°F (1-3°C)/minute. Release pressure and vent vacuum. Cool to below 160°F (71°C) at 2-5°F (1-3°C)/minute prior to removing from autoclave. |
| Post Cure (Free Standing) | Heat from 75°F (24°C) to 550°F ± 10°F (288°C ± 6°C) at 10-15°F (5.6-8.3°C)/minute. Hold at 550°F ± 10°F (288°C ± 6°C) for 5 hours. Heat from 550°F ± 10°F (288°C ± 6°C) to 600°F ± 10°F (316°C ± 6°C) at 0.5-1°F (0.3-0.6°C)/minute. Hold at 600°F ± 10°F (316°C ± 6°C) for 10 hours. Cool to below 160°F (71°C) at 2-5°F (1-3°C)/minute. |

Recommended Consumables

The table below provides a list of consumable processing materials recommended for use with CYCOM® 2237.

Table 8 | Processing Materials

| | |
|-------------------------|-----------------------------------|
| Sealant Tape | SM5160 |
| Release Film | MR-FILM |
| Release Fabric | 200TFP-1, FF03PM, FF05PM, FF10PM |
| Breather/Bleeder Fabric | RC-3500HT |
| Peel Ply | 70000 |
| Bagging Film | VAC-PAK® HT 620, VAC-PAK® UHT 750 |
| Adhesive Tape | Series 6325 |

HEALTH & SAFETY

Please refer to the product SDS for safe handling, personal protective equipment recommendations and disposal considerations.

