

321



250-300°F (120-150°C) High T_g Epoxy Resin System

Typical applications

General aviation
Aerospace
Industrial
Sporting goods

Out life

21 days at 70°F (21°C)

Shelf life

3 months at 40°F (4°C)
6 months at 0°F (-18°C)

Description

321 is a 250°F (120°C) to 300°F (150°C) cure, toughened, high T_g, controlled flow epoxy resin system. Versatile processing and excellent mechanical properties make 321 suitable for general aviation, aerospace, sporting goods and industrial markets. FAA approved (AGATE) design allowable database is available for specific material configurations.

Benefits/features

- High dry and wet T_g
- B-basis design allowable database
- Excellent mechanical properties
- Moderate tack
- Good toughness
- Controlled flow

Variants

- 321-1: Standard reinforced adhesive
- 321LS: Metal mesh reinforced adhesive

Application

The high T_g and excellent mechanical properties make 321 an ideal product for specific applications where products are required to retain their mechanical properties under demanding temperatures.

321 can be supplied with most commercially available fibers (carbon, quartz, aramid, S-glass, E-glass, etc.) in both woven form (designated as NB) and unidirectional tape (designated as NCT).

Woven fabrics are available in standard commercial widths up to 60 inches (1.5 m). Unitape widths up to 39 inches (1 m) are available in standard fiber weights ranging from 70-300 gsm (0.014-0.060 psf).

Recommended processing conditions

321 can be cured at temperatures from 250°F - 300°F (120°C - 150°C) depending on part size and complexity. Low, medium and high pressure molding techniques may be used for curing. Recommended cure cycle is 50 psi (345 kPa); 3°F (1.7°C)/min ramp to 275°F (135°C); hold for 60 minutes, cool to <140°F (60°C). Post curing at 325°F (163°C) is possible if higher T_g is required.

Please contact your account manager or MCCFC technical support to discuss specific applications.



MITSUBISHI CHEMICAL
CARBON FIBER AND COMPOSITES

Technical Data Sheet



Neat resin [values are average and do not constitute a specification]

| Property | Value |
|-----------------------------------|-----------|
| Gel time @ 275°F (135°C), minutes | 5 – 7 |
| Specific gravity | 1.22 |
| T _g (DMA, E'), °F (°C) | 300 (150) |

Mechanical data [values are average and do not constitute a specification]

34-700 CARBON UNITAPE

36%RC, autoclave cured, 80 psi, 60 minutes at 275°F, normalized to 60%FV

| Property | Test method | RT |
|--------------------------------------|-------------|-------------|
| 0° Tensile strength, ksi (MPa) | ASTM D3039 | 304 (2090) |
| 0° Tensile modulus, Msi (GPa) | | 18.7 (128) |
| 0° Compressive strength, ksi (MPa) | ASTM D695 | 230 (1580) |
| 0° Compressive modulus, Msi (GPa) | | 21.3 (146) |
| 0° Flexural strength, ksi (MPa) | ASTM D790 | 261 (1800) |
| 0° Flexural modulus, Msi (GPa) | | 18.2 (125) |
| Short beam shear strength, ksi (MPa) | ASTM D2344 | 15.5 (96.5) |

HEXCEL NAS-S CARBON UNITAPE [AGATE]

36%RC, vacuum bag cured, 100 minutes at 270°F, normalized by CPT=0.006 in [55%FV]

| Property | Test method | -65°F (-53°C) | RT | 175°F (79°C) wet* |
|--------------------------------------|-------------|---------------|------------|-------------------|
| 0° Tensile strength, ksi (MPa) | ASTM D3039 | 291 (2000) | 296 (2040) | 269 (1850) |
| 0° Tensile modulus, Msi (GPa) | | 19.0 (130) | 18.6 (128) | 18.6 (128) |
| Poisson's ratio | ASTM D3039 | - | 0.3 | - |
| 90° Tensile strength, ksi (MPa) | SACMA 1R-94 | 7.3 (50) | 7.1 (48) | 4.7 (32) |
| 90° Tensile modulus, Msi (GPa) | | 1.3 (8.9) | 1.2 (8.2) | 0.9 (6) |
| 0° Compressive strength, ksi (MPa) | SACMA 1R-94 | 196 (1350) | 172 (1180) | 124 (855) |
| 0° Compressive modulus, Msi (GPa) | | 17.0 (117) | 17.9 (123) | 17.7 (122) |
| 90° Compressive strength, ksi (MPa) | SACMA 1R-94 | 40 (270) | 32 (220) | 24 (160) |
| 90° Compressive modulus, Msi (GPa) | | 1.6 (11) | 1.6 (11) | 1.1 (7.5) |
| In-plane shear strength, ksi (MPa) | ASTM D5379 | 25 (170) | 21 (140) | 14 (96) |
| In-plane shear modulus, Msi (GPa) | | 0.7 (4) | 0.6 (4) | 0.5 (3) |
| Short beam shear strength, ksi (MPa) | SACMA 8R-94 | - | 13.1 (90) | - |

*145°F, 85% RH until equilibrium

AS4C-M 3K PLAINWEAVE CARBON FABRIC [AGATE]

42%RC, vacuum bag cured, 100 minutes at 270°F, normalized by CPT=0.0085 in [50%FV]

| Property | Test method | -65°F (-53°C) | RT | 175°F (79°C) wet* |
|--------------------------------------|-------------|---------------|----------|-------------------|
| 0° Tensile strength, ksi (MPa) | ASTM D3039 | 81 (550) | 87 (600) | 74 (510) |
| 0° Tensile modulus, Msi (GPa) | | 7.9 (54) | 9.3 (64) | 8.2 (56) |
| Poisson's ratio | SACMA 1R-94 | - | 0.06 | - |
| 0° Compressive strength, ksi (MPa) | | 79 (540) | 71 (480) | 57 (390) |
| 0° Compressive modulus, Msi (GPa) | SACMA 1R-94 | 7.8 (53) | 8.2 (56) | 8.4 (57) |
| In-plane shear strength, ksi (MPa) | | 18 (120) | 17 (110) | 11 (75) |
| In-plane shear modulus, Msi (GPa) | ASTM D5379 | 0.7 (4) | 0.6 (4) | 0.4 (2) |
| Short beam shear strength, ksi (MPa) | SACMA 8R-94 | - | 8.8 (60) | - |

*145°F, 85%RH until equilibrium

7781 E-GLASS FABRIC [AGATE]

38%RC, vacuum bag cured, 100 minutes at 270°F, normalized by CPT=0.0098 in [48%FV]

| Property | Test method | -65°F (-53°C) | RT | 175°F (79°C) wet* |
|--------------------------------------|-------------|---------------|----------|-------------------|
| 0° Tensile strength, ksi (MPa) | | 65 (440) | 62 (420) | 42 (280) |
| 0° Tensile modulus, Msi (GPa) | ASTM D3039 | 4.0 (27) | 4.1 (28) | 3.4 (23) |
| Poisson's ratio | | 0.16 | 0.14 | - |
| 0° Compressive strength, ksi (MPa) | | 97 (660) | 78 (530) | 56 (380) |
| 0° Compressive modulus, Msi (GPa) | SACMA 1R-94 | 3.9 (26) | 3.9 (26) | 3.8 (26) |
| In-plane shear strength, ksi (MPa) | | 23 (150) | 19 (131) | 13 (89) |
| In-plane shear modulus, Msi (GPa) | ASTM D5379 | 0.7 (4) | 0.6 (4) | 0.4 (2) |
| Short beam shear strength, ksi (MPa) | SACMA 8R-94 | - | 9.4 (64) | - |

*145°F, 85%RH until equilibrium

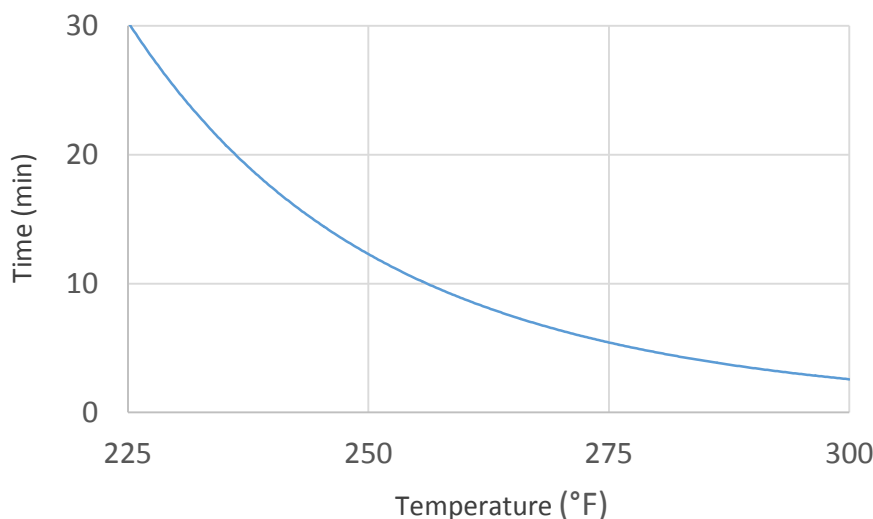
BIMAX-L™ ±45° BIAxIAL CARBON FABRIC

42%RC, autoclave cured, 80 psi, 90 minutes at 275°F, normalized to 60%FV

| Property | Test method | RT |
|--|-------------|-----------|
| 0° Tensile strength, ksi (MPa) | | 113 (779) |
| 0° Tensile modulus, Msi (GPa) | ASTM D3039 | 10 (69) |
| 0° Compressive strength, ksi (MPa) | | 111 (765) |
| 0° Compressive modulus, Msi (GPa) | ASTM D6641 | 8.9 (61) |
| 0° Flexural strength, ksi (MPa)* | | 33 (228) |
| 0° Flexural modulus, Msi (GPa)* | ASTM D790 | 2.0 (14) |
| 45° Longitudinal Tensile strength, ksi (MPa) | | 43 (296) |
| 45° Transverse Tensile strength, ksi (MPa) | ASTM D3039 | 43 (296) |
| 45° Compressive strength, ksi (MPa) | ASTM D6641 | 37 (255) |
| Short beam shear strength, ksi (MPa)* | ASTM D2344 | 7.2 (50) |

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Gel time vs temperature



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