

# > PEKK THERMOPLASTIC POLYMER

TECHNICAL DATA SHEET



## DESCRIPTION

Cytec Engineered Materials PEKK composites consist of a matrix of poly(ether-ketone-ketone) polymer with aligned, continuous unidirectional fiber reinforcement. Typical fiber contents are 50 – 60% by volume. The tapes and ribbons are fully impregnated with a tailored fiber-matrix interface for optimal performance. Cytec also supplies custom laminates made from the tapes.

The polymer is semi-crystalline with a Tg of 318°F (159°C).\* The composites have good structural performance at temperatures in excess of 250°F (121°C). PEKK composites can be used in lightly loaded applications at temperatures up to 400°F (204°C) due to the semi-crystalline nature of the polymer.

PEKK composites possess outstanding flame, smoke and toxicity performance. They also have high toughness and damage tolerance. Laminates and parts can be fabricated from PEKK using a wide range of techniques including autoclave and press molding. Prepregs are offered in various grades of PEKK polymer optimized for select manufacturing methods. Information is available upon request for additional grades of PEKK to use in injection molding, sheet, film or fabric composites.

## FEATURES & BENEFITS

- Semi-crystalline, thermoplastic matrix
- Fully impregnated, unidirectional tape, ribbon and slit tape
- Tg of 318°F (159°C)\*
- Service temperature of 257°F (125°C) for structural applications; up to 400°F (204°C) in certain applications
- Structural properties
- High toughness and damage tolerance
- Manufacture parts using affordable non-autoclave processes
- Outstanding FST<sup>1</sup> and OSU<sup>2</sup> heat release properties
- Good resistance to a wide range of fluid environments
- Low moisture uptake, < 0.3 wt%<sup>3</sup>
- Indefinite shelf life at room temperature
- Recyclable

## SUGGESTED APPLICATIONS

Typical applications for Cytec Engineered Materials PEKK prepregs include aircraft structure, space components and other transportation and structural engineering components

\* **NOTE:** Tg data is not applicable for U.S. export control classification or licensing.  
For export-related information please contact us.

<sup>1</sup> Flame, smoke and toxicity

<sup>2</sup> Ohio State University

<sup>3</sup> Equilibrium, 85% RH, 160°F (71°C)

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### CHARACTERISTICS

Table 1 | Availability

| Form        | Fiber    | Resin Content<br>wt% | Fiber Areal Weight<br>g/m <sup>2</sup> | Weave Style | Cured Ply Thickness<br>inch |
|-------------|----------|----------------------|--|-------------|-----------------------------|
| Carbon Tape | AS4D 12K | 34                   | 145                                    | -           | 0.0055                      |

Nominal properties. Resin content may be modified to different specifications. Contact Cytec Technical Services for additional information.

Table 2 | Physical Properties

| Property   | Room Temperature          |
|------------|---------------------------|
| Shelf Life | Indefinite at 72°F (22°C) |
| Shop Life  | Indefinite at 72°F (22°C) |

Table 3 | Neat Resin Properties

| Property   | Room Temperature  |
|--|---|
| Density <sup>1</sup>   | 1.310 g/cm <sup>3</sup> (% crystalline = 30%)<br>1.278 g/cm <sup>3</sup> (% crystalline = 0%) |
| Tg dry *   | 318°F (159°C)   |
| Tg wet *   | 275°F (135°C)   |
| Tm (melt point)  | 639°F (337°C)   |
| <b>Tensile Properties (RT)<sup>2</sup></b><br>Strength<br>Modulus<br>Elongation  | 14.8 ksi (102 MPa)<br>0.65 Msi (4.5 GPa)<br>4%  |
| <b>Thermal Properties: Heat of Fusion</b><br>With 100% Crystalline<br>After Cooling at 20°C/min                              | 130 J/g<br>38.8 J/g   |
| <b>Flammability Properties</b><br>Heat Release Rate (OSU, Peak/Total)<br>Flammability Rating, UL-94<br>Limiting Oxygen Index | <65 kW/m <sup>2</sup> /<br><65 kW-min/m <sup>2</sup><br>V-0<br>40                             |

<sup>1</sup> Test method: ASTM D792

<sup>2</sup> Test method: ASTM D1708

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### PROPERTIES

**Table 4 | Composite Mechanical Properties: High strength [>650 ksi (4450 MPa) standard modulus [33 Msi (228 GPa) class] carbon fiber reinforced unidirectional tape**

| Properties                                    | Test Temperature |             |               |                      |
|---|------------------|-------------|---------------|----------------------|
|   | -67°F (-55°C)    | 75°F (24°C) | 250°F (121°C) | 250°F (121°C)<br>wet |
| <b>0° Tensile Properties</b>                  |                  |             |               |                      |
| Strength, ksi (MPa)                           | 372 (2561)       | 357 (2463)  | -             | -                    |
| Modulus, Msi (GPa)                            | 20.4 (141)       | 20.1 (139)  | -             | -                    |
| <b>90° Tensile Properties</b>                 |                  |             |               |                      |
| Strength, ksi (MPa)                           | -                | 8.9 (61)    | -             | 6.8 (47)             |
| Modulus, Msi (GPa)                            | -                | 1.5 (10.3)  | -             | 1.2 (8.2)            |
| <b>0° Compressive Properties</b>              |                  |             |               |                      |
| Strength, ksi (MPa)                           | -                | 217 (1493)  | 187 (1288)    | 163 (1125)           |
| Modulus, Msi (GPa)                            | -                | 18.4 (127)  | 18.5 (128)    | 18.9 (130)           |
| <b>90° Compressive Properties</b>             |                  |             |               |                      |
| Strength, ksi (MPa)                           | -                | 36.8 (254)  | 27.6 (190)    | 26.1 (180)           |
| <b>0° Flexural Properties</b>                 |                  |             |               |                      |
| Strength, ksi (MPa)                           | -                | 248 (1707)  | 200 (1376)    | -                    |
| Modulus, Msi (GPa)                            | -                | 18.4 (127)  | 18.3 (126)    | -                    |
| <b>In-plane Shear Properties</b>              |                  |             |               |                      |
| 0.2% Offset Shear Stress, ksi (MPa)           | -                | 7.6 (52.4)  | 5.0 (34.5)    | 3.6 (24.8)           |
| Modulus, Msi (GPa)                            | -                | 0.76 (5.2)  | 0.56 (3.8)    | 0.40 (2.8)           |
| <b>Open Hole Tension</b>                      |                  |             |               |                      |
| Strength, ksi (MPa)                           | 68 (466)         | 66 (452)    | -             | -                    |
| Modulus, Msi (GPa)                            | 8.1 (55.8)       | 7.8 (54.8)  | -             | -                    |
| <b>Open Hole Compression</b>                  |                  |             |               |                      |
| Strength, ksi (MPa)                           | -                | 48 (332)    | -             | 40 (275)             |
| Modulus, Msi (GPa)                            | -                | 7.6 (52.4)  | -             | 7.5 (51.7)           |
| <b>Compression After 1500 in-lb/in Impact</b> |                  |             |               |                      |
| Strength, ksi (MPa)                           | -                | 47 (327)    | -             | -                    |

Property values listed are typical for laminates with 60% fiber volume.

Wet = water immersion for 14 days at 160°F (71°C)

**Table 5 | Composite Thermal Properties**

| Toughness Property  | Room Temp. |
|---|------------|
| Melting Temperature T <sub>m</sub> , °F (°C) <sup>1</sup> | 639 (337)  |
| Glass Transition Temperature T <sub>g</sub> , °F (°C) *   | 318 (159)  |
| Crystallization Temperature, °F (°C) <sup>2</sup>         | 534 (279)  |

<sup>1</sup> Test method: DSC

<sup>2</sup> Cooling Rate = 10°C/min

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**Table 6 | Composite Flammability Properties**

| Toughness Property                            | Room Temp. |
|---|------------|
| Vertical burn drip time, sec                  | No Drip    |
| Vertical burn extinguishing time, sec         | 0          |
| OSU heat release peak, kW/m <sup>2</sup>      | <10        |
| OSU heat release total, kW-min/m <sup>2</sup> | <10        |
| NBS smoke density D <sub>s</sub> at 4 minutes | <10        |

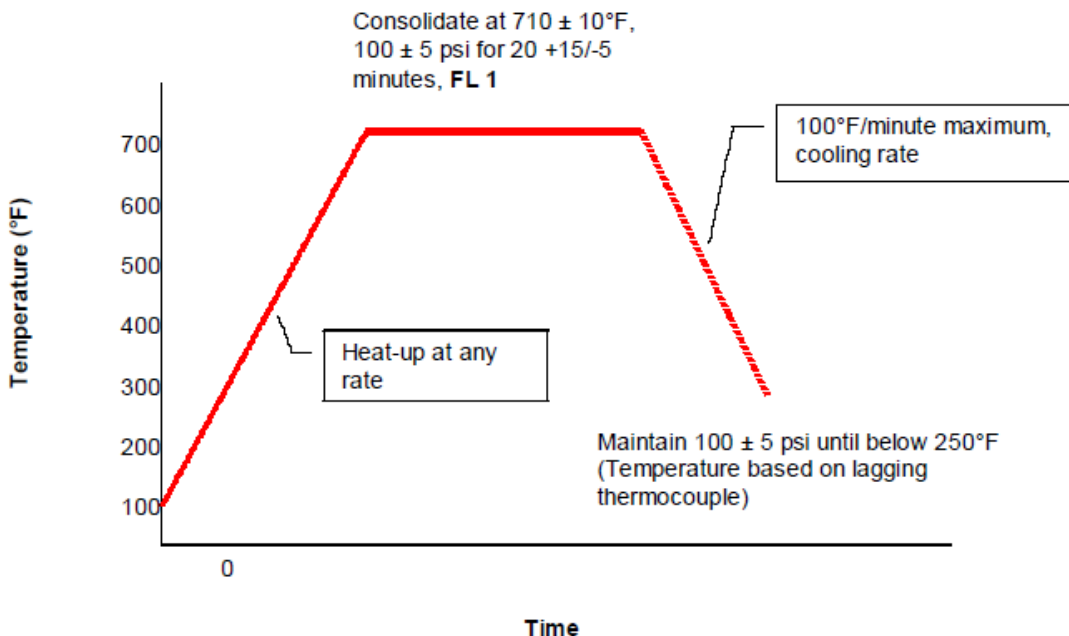
## APPLICATION NOTES

### Autoclave Consolidation

The recommended cycle for autoclave consolidation is shown in Figure 2. The recommended bagging scheme is shown in Figure 2. Recommended cure cycle is as follows:

1. Apply 22 inches Hg vacuum minimum to vacuum bag
2. Maintain full vacuum through the entire cycle
3. Heat to 710 ± 10°F at any rate
4. Ensure material/laminate is equilibrated at process temperature use lagging thermocouple and allow for material thickness where appropriate
5. Apply 100 ± 5 psi autoclave pressure when temperature reaches 710 ± 10°F
6. Hold at 710 ± 10°F and 100 ± 5 psi for 20 +10/-5 minutes
7. Cool down at a cooling rate of less than 100°F per minute
8. Maintain 100 ± 5 psi until below 250°F

FL 1 time at temperature is based on lagging thermocouple



**Figure 1 | Recommended Autoclave Consolidation Cycle for PEKK Composites**

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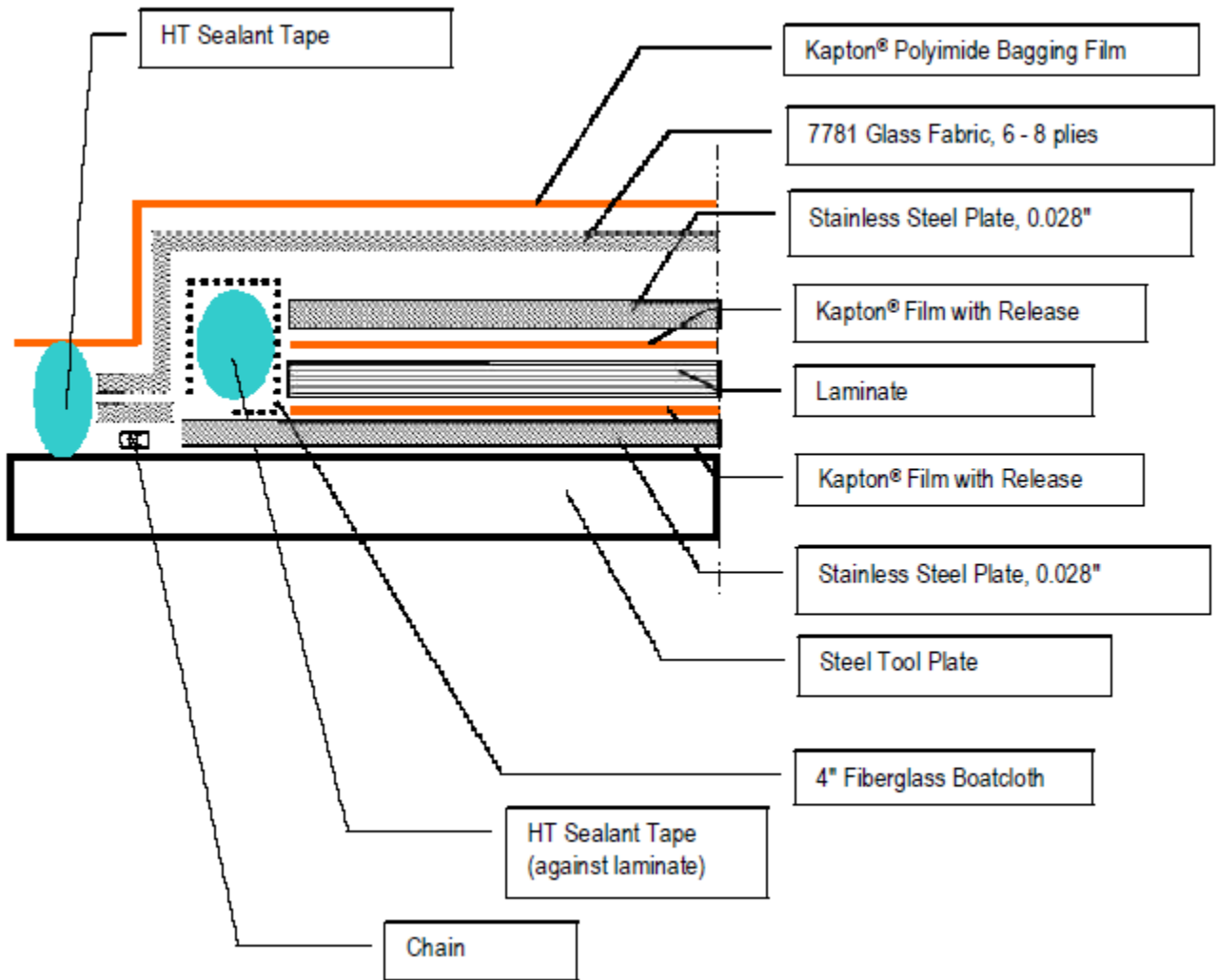


Figure 2 | Recommended Vacuum Bag Scheme

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## 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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