



Adhesive Films and Preforms

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## T2521F

### THERMALLY CONDUCTIVE FILM

**Description:**

T2521 features good chemical, heat, and moisture resistance. T2521F will cure at temperatures above 130°C.

**Shelf Life: (Stored in dry conditions)**

One month @ 20°C    Three months @ 10°C    Six months @ -20°C    One year @ -40°C

**Uncured Properties**

| <u>Property</u>   | <u>Method</u>                 | <u>Value Obtained</u> |
|---|-------------------------------|-----------------------|
| Weight Loss at 150°C, TGA, 20°C/min, N <sub>2</sub> , %<br>at 200°C | ASTM D3850<br>and MIL-STD-883 | 0.05<br>0.15          |

**Cure Schedules:**

Cure Schedule: 60 minutes at 150°C

Alternate Cure Schedules: 90 minutes at 140°C, 15 minutes at 150°C plus 15 minutes at 180°C,  
120 minutes at 130°C, or 30 minutes at 165°C

**Cured Properties:**

| <u>Property</u>   | <u>Method</u>                 | <u>Value Obtained</u>   |
|---|-------------------------------|-------------------------|
| Color   | Visual                        | Cream                   |
| Specific Gravity  | ASTM D790                     | 2.1                     |
| Volume Resistivity at 25°C, Ohm-cm                                  | ASTM D257                     | >2.0 x 10 <sup>14</sup> |
| Tensile Shear Strength to Aluminum at 25°C, psi                     | ASTM D1002                    | 2100                    |
| Tensile Shear to Nickel at 25°C, psi                                | ASTM D1002                    | 2140                    |
| Tensile Shear to 316 SS at 25°C, psi                                | ASTM D1002 <sup>1</sup>       | 3600                    |
| Tensile Shear to 101 copper at 25°C, psi                            | ASTM D1002 <sup>1</sup>       | 4200                    |
| Tensile Shear to 260 Brass at 25°C, psi                             | ASTM D1002 <sup>1</sup>       | 5300                    |
| Tensile Shear to FR4 at 25°C, psi                                   | ASTM D1002 <sup>1</sup>       | 2840                    |
| Tensile Shear to Ultem® 1000 at 25°C, psi                           | ASTM D1002 <sup>1</sup>       | 650                     |
| Tensile Shear to PEEK <sup>1,2</sup>                                | ASTM D3163                    | 710 <sup>2</sup>        |
| Thermal Conductivity, W/m-°K  | ASTM E1461                    | 0.9                     |
| Thermal diffusivity, thickness = 1.0 mm, cm <sup>2</sup> /s-°K      | ASTM E1461                    | 0.0041                  |
| Specific Heat Capacity, J/g-°K                                      | ASTM E1461                    | 1.14                    |
| Glass Transition, loss modulus peak, °C                             | DMA                           | 130                     |
| Linear Coefficient of Thermal Expansion, x 10 <sup>-6</sup> /°C     |                               |                         |
| Alpha 1 (below T <sub>g</sub> )                                     | ASTM E831                     | 48                      |
| Alpha 2 (above T <sub>g</sub> )                                     | ASTM E831                     | 267                     |
| Weight Loss at 150°C, TGA, 20°C/min, N <sub>2</sub> , %<br>at 200°C | ASTM D3850<br>and MIL-STD-883 | 0.01<br>0.10            |
| at 300°C  | Section 3.8.5.1               | 0.32                    |

1 – Substrate tested using 0.125" thick substrates.

2 - PEEK etched using nanoflame®, Substrate Failure.

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**Chemical Resistance Chart**

| <b>Solvent</b>  | <b>Weight Gain (+)<br/>Loss (-) after 24<br/>hours at 25°C<br/>(%)</b> | <b>Weight Gain (+)<br/>Loss (-) after 48<br/>hours at 50°C<br/>(%)</b> |
|---|--|--|
| <b>Water/antifreeze, 50/50</b>                              | <b>0.6</b>   | <b>1.5</b>   |
| <b>Transmission Fluid</b>                                   | <b>0.6</b>   | <b>0.6</b>   |
| <b>Antifreeze</b>   | <b>0.6</b>   | <b>0.4</b>   |
| <b>Salt Water 1.4M</b>                                      | <b>0.6</b>   | <b>0.7</b>   |
| <b>Tap Water</b>  | <b>0.7</b>   | <b>0.8</b>   |
| <b>Deionized Water</b>                                      | <b>0.7</b>   | <b>0.9</b>   |
| <b>Ferric Nitrate/Water , pH2</b>                           | <b>0.8</b>   | <b>1.0</b>   |
| <b>Sodium Hydroxide/Water, pH12</b>                         | <b>0.7</b>   | <b>0.9</b>   |
| <b>Solution of 1 M Methanol, 1M sulfuric Acid, in water</b> | <b>0.7</b>   | <b>3.0</b>   |
| <b>N-Methyl-2-pyrrolidone</b>                               | <b>0.5</b>   | <b>19.0</b>  |
| <b>Acetone</b>  | <b>1.0</b>   | <b>5.8</b>   |
| <b>Isopropyl Alcohol</b>                                    | <b>0.1</b>   | <b>0.3</b>   |
| <b>Alconox® Water, Saturated solution</b>                   | <b>0.8</b>   | <b>0.9</b>   |
| <b>10 to 15 psi Steam, 24 hours</b>                         | <b>1.4</b>   |  |

All samples were 0.005 to 0.007 inches thick, 1 inch wide and 3 inches long. A modified ASTM D570 testing procedure was used. Due to the thin samples used adsorption numbers may be artificially inflated when compared to industrial standards for measuring chemical resistance.

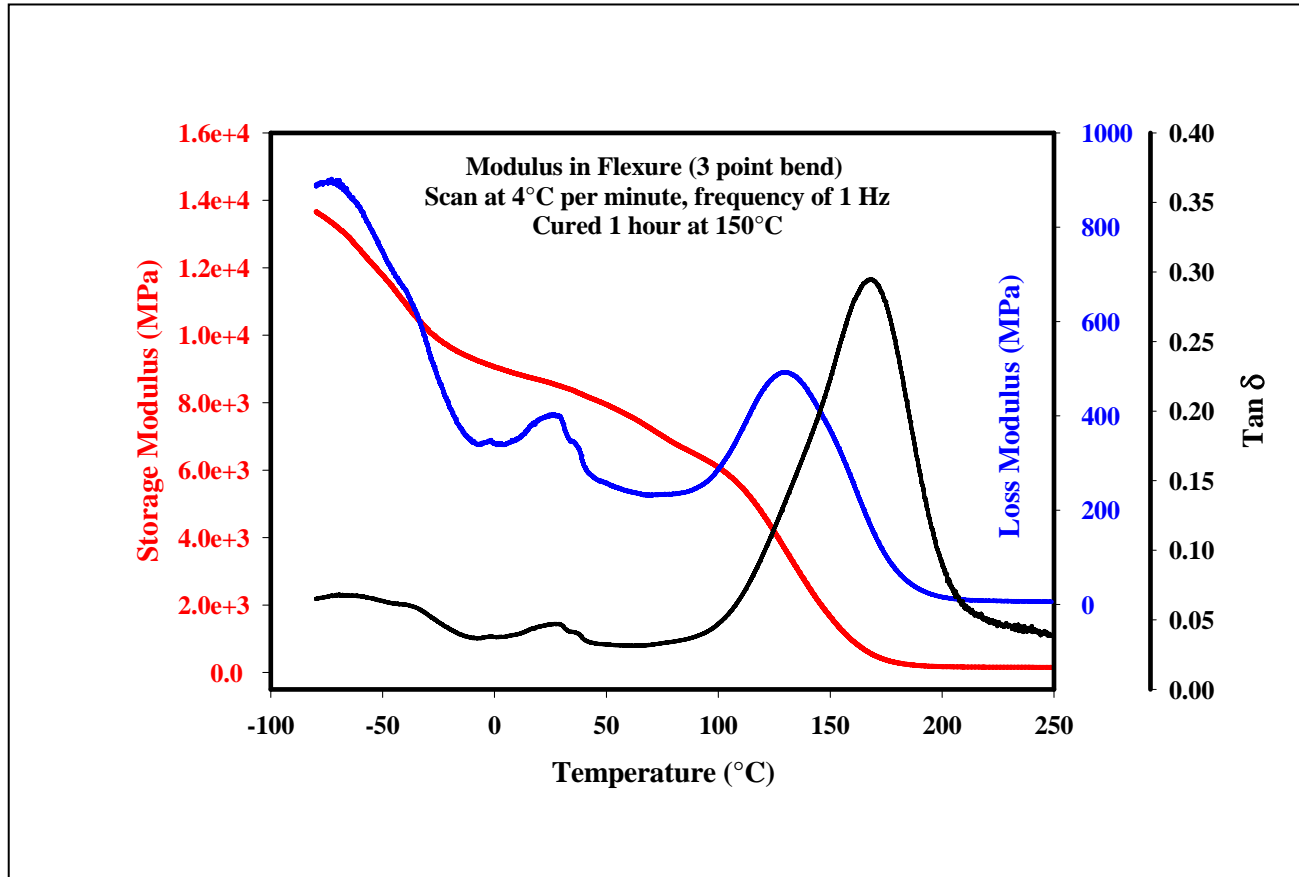
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### DMA Scans



### Modulus Data

| Property             | Temperature |       |       |       |
|----------------------|-------------|-------|-------|-------|
|                      | -80°C       | -40°C | 25°C  | 100°C |
| Storage Modulus, MPa | 13500       | 11000 | 8920  | 6080  |
| Loss Modulus, MPa    | 890         | 660   | 340   | 290   |
| Tan $\delta$         | 0.065       | 0.061 | 0.039 | 0.047 |

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