

## PRODUCT DATA SHEET

### DESCRIPTION

Toray TC890 high temperature polyimide prepreg system utilizes PROOF Research Advanced Composites Division 900HT resin system. TC890 is a high temperature, polyimide-based thermoset prepreg with outstanding dry property retention at 343°C (650°F), wet service property retention at 288°C (550°F), and short-term and intermittent service temperature capability to 427°C (800°F). TC890 has been successfully demonstrated in short term, transient heating applications to temperatures as high as 1300°F. TC890 is an excellent non-MDA replacement for high temperature PMR-15 applications. TC890 prepreg system is easily processable and thermally stable, exhibiting the highest glass transition temperature of commercially available structural matrices. This system displays exceptional toughness, excellent dielectric properties, and low toxicity.

### FEATURES

- ▶ **Excellent toughness**
- ▶ **Excellent dielectric properties**
- ▶ **Non-MDA based resin system**
- ▶ **High glass transition temperature, substantially higher than PMR-15 and AFRPE-4**

### PRODUCT TYPE

High Temperature Polyimide

### TYPICAL APPLICATIONS

- ▶ Jet engine components
- ▶ Heat shields
- ▶ High temperature leading edges/radomes
- ▶ Missiles
- ▶ Launch vehicles

### TYPICAL NEAT RESIN PROPERTIES

|                          |               |
|--------------------------|---------------|
| Density                  | 1.33 g/cc     |
| Dry T <sub>g</sub> (DMA) | 454°C (850°F) |

### SHELF LIFE

**Out Life:** 14 days (and up to 30 days) at ambient

**Frozen Storage Life:** 12 months at -18°C (< 0°F) or below

Out life is the maximum time allowed at ≤ 21°C (70°F) and ≤ 60% RH before cure.

\*Out life tested by SBS on a 15 cm x 15 cm (6" x 6") laminate, cured in an autoclave. Users will need to evaluate their own out life limits based on thickness, size, and complexity of their own parts.



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### ELECTRICAL PROPERTIES OF COMPOSITE LAMINATES

| TC890/6781HT Fg     | 10 GHz               | 30 GHz               |
|---------------------|----------------------|----------------------|
| Dielectric Constant | 3.3                  | 4.2                  |
| Loss Tangent        | < 0.010 <sup>1</sup> | < 0.010 <sup>1</sup> |
| TC890/4581 Quartz   | 10 GHz               | 30 GHz               |
| Dielectric Constant | 3.4                  | 3.4                  |
| Loss Tangent        | 0.003 <sup>2</sup>   | 0.004 <sup>2</sup>   |

<sup>1</sup> The loss tangent under focused beam testing is only accurate to 0.010. This material is less than 0.010.

<sup>2</sup> Tested per ASTM D 2520 method A, shorted WR-90 Waveguide.

This material represents one of Toray's best for high temperature, high energy radome applications.

### GLASS/QUARTZ FABRIC PROPERTIES

| Property                  | Condition | Method     | Results            |                    |
|---------------------------|-----------|------------|--------------------|--------------------|
|                           |           |            | 6781HT Fg          | 4581 Quartz        |
| Tensile Strength          | RTD       | ASTM D3039 | 541 MPa (78.5 ksi) | -                  |
| Tensile Modulus           | RTD       | ASTM D3039 | 34.5 GPa (5.0 Msi) | -                  |
| Tensile Strength          | ETD       | ASTM D3039 | 534 MPa (77.5 ksi) | -                  |
| Compression Strength      | RTD       | ASTM D6641 | 501 MPa (72.6 ksi) | 477 MPa (69.2 ksi) |
| Compression Modulus       | RTD       | ASTM D6641 | 33.1 GPa (4.8 Msi) | 28.3 GPa (4.1 Msi) |
| Compression Strength      | ETD       | ASTM D6641 | 341 MPa (49.5 ksi) | 340 MPa (49.4 ksi) |
| Short Beam Shear Strength | RTD       | ASTM D2344 | 61 MPa (8.8 ksi)   | 68 MPa (9.9 Msi)   |
| Short Beam Shear Strength | ETD       | ASTM D2344 | 42 MPa (6.1 ksi)   | 52 MPa (7.5 ksi)   |
| Flex Strength             | RTD       | ASTM D790  | 570 MPa (82.6 ksi) | -                  |
| Flex Modulus              | RTD       | ASTM D790  | 25.5 GPa (3.7 Msi) | -                  |

85 psi autoclave stepped cure with a final hold at 371°C (700°F) for 120 minutes

ETD is 288°C (550°F)

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### CARBON FABRIC PROPERTIES

| Property                  | Condition | Method      | Results   |          |
|---------------------------|-----------|-------------|-----------|----------|
| Tensile Strength          | RTD       | ASTM D3039  | 765 MPa   | 111 ksi  |
| Tensile Modulus           | RTD       | ASTM D3039  | 70.3 GPa  | 10.2 Msi |
| Tensile Strength          | ETD       | ASTM D3039  | 815 MPa   | 118 ksi  |
| Tensile Modulus           | ETD       | ASTM D3039  | 84.1 GPa  | 12.2 Msi |
| Compression Strength      | RTD       | ASTM D6641M | 644 MPa   | 93 ksi   |
| Compression Modulus       | RTD       | ASTM D6641M | 68.3 GPa  | 9.9 Msi  |
| Compression Strength      | ETD       | ASTM D6641M | 456 MPa   | 66 ksi   |
| Compression Modulus       | ETD       | ASTM D6641M | 63.1 GPa  | 9.2 Msi  |
| In-Plane Shear Strength   | RTD       | ASTM 3518   | 72.3 MPa  | 10.5 ksi |
| In-Plane Shear Strength   | ETD*      | ASTM 3518   | 78.1 MPa  | 11.3 ksi |
| 4-Pt Flexural Strength    | RTD       | ASTM D7264M | 673 MPa   | 98 ksi   |
| 4-Pt Flexural Modulus     | RTD       | ASTM D7264M | 133.1 GPa | 19.3 Msi |
| 4-Pt Flexural Strength    | ETD       | ASTM D7264M | 573 MPa   | 83 ksi   |
| 4-Pt Flexural Modulus     | ETD       | ASTM D7264M | 69.8 GPa  | 10.1 Msi |
| Bearing Response Strength | ETD       | ASTM D5961  | 501.6 MPa | 73 ksi   |
| SBS                       | RTD       | ASTM D2344  | 56 MPa    | 8.1 ksi  |
| SBS                       | ETD       | ASTM D2344  | 48 MPa    | 6.9 ksi  |
| TOS                       | N/A       | See Note 3  | 4.95%     |          |

**Notes**

- (1) Laminate data for Toray TC890 prepreg impregnated on T650-35 8HS 370 FAW fabric, 37% RC.
- (2) ETD is 288°C (550°F) unless noted. \*ETD for In-Plane Shear strength was 316°C (600°F).
- (3) 625°F/150 psia/ 125 hours.

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### CARBON FIBER UNIDIRECTIONAL PROPERTIES

| Property                        | Condition | Method             | Results            |                    |
|---------------------------------|-----------|--------------------|--------------------|--------------------|
|                                 |           |                    | T800GC-24K-91N     | T1100GC-24K-91N    |
| Tensile Strength 0°             | RTD       | ASTM D3039         | 3202 MPa (334 ksi) | 2723 MPa (395 ksi) |
| Tensile Modulus 0°              | RTD       | ASTM D3039         | 159 GPa (23 Msi)   | 159 GPa (23 Msi)   |
| Compression Strength 0°         | RTD       | SRM1/D695 modified | 1441 MPa (209 ksi) | -                  |
| Compression Modulus 0°          | RTD       | SRM1/D695 modified | 145 MPa (21 Msi)   | 166 MPa (24 Msi)   |
| Compression Strength 0°         | RTD       | ASTM D6641         | 1510 MPa (219 ksi) | 1634 MPa (237 ksi) |
| Compression Modulus 0°          | RTD       | ASTM D6641         | 152 MPa (22 Msi)   | 166 MPa (24 ksi)   |
| Short Beam Shear Strength 0°    | RTD       | ASTM D2344         | 119 MPa (17.2 ksi) | 141 MPa (20.4 ksi) |
| Short Beam Shear Strength 0°    | ETD 250°F | ASTM D2344         | 108 MPa (15.6 ksi) | 118 MPa (17.1 ksi) |
| Short Beam Shear Strength 0°    | ETD 450°F | ASTM D2344         | 85 MPa (12.3 ksi)  | 86 MPa (12.4 ksi)  |
| Short Beam Shear Strength 0°    | ETD 600°F | ASTM D2344         | 70 MPa (10.1 ksi)  | 69 MPa (10.0 ksi)  |
| Tg by DMA                       | Dry       | ASTM D7028         | 867                | 852                |
| Char Performance <sup>(1)</sup> | -         | TGA                | 88%                | 86%                |

Axial tension and compression properties normalized to 60% FV  
 85 psi autoclave stepped cure with a final hold at 371°C (700°F) for 120 minutes  
 T800GC = 145 gsm / 36% RC and T1100GC = 135 gsm / 36% RC  
<sup>(1)</sup> Char Yield - TGA N2 gas, 10°C/min, Final Temp: 1000°C

### CURE SCHEDULE

Call for details. This product requires a multi-hour cure at temperatures at or above 371°C (700°F).

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