DESCRIPTION
Toray BT250E-1 resin system is a 121°C (250°F) cure epoxy prepreg system with excellent toughness and strength. It provides an outstanding surface finish under vacuum-bag/oven-cure only. The resin system, which is self-adhesive to honeycomb and foam core, is MIL-R-9300 qualified and makes a great choice for many applications in the low-to-medium-service temperature range.

FEATURES
- Excellent system for out of autoclave cure
- Toughened for good impact resistance
- MIL-R-9300 qualified
- Ideal for low-to-medium service temperature applications

PRODUCT TYPE
121°C (250°F) Cure, Epoxy Prepreg System

TYPICAL APPLICATIONS
- Secondary aircraft structures
- Radomes with glass, quartz, and Kevlar®
- Reflectors
- Sporting goods
- Knee braces and other related medical items
- General purpose composites

SHELF LIFE
- Tack Life: Up to 30 days at ambient
- Out Life: Up to 30 days at ambient
- Frozen Storage Life: 12 months at -18°C (< 0°F)

Tack life is the time during which the prepreg retains enough tack, drape, and handling for component lay-up.

Out life is the maximum time allowed at ambient temperature before cure. *Ambient is 18–22°C (65–72°F)

*Out life tested by SBS on 8-ply 15 x 15 cm (6 x 6”) fabric laminate, cured in an out-of-autoclave/vacuum-bag only (OOA/VBO) environment with 914–948 mbar (27–28 inHg). Users may need to separately evaluate out life limits on thicker, larger, and more complex parts.

TYPICAL NEAT RESIN PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>1.17 g/cc</td>
</tr>
<tr>
<td>T&lt;sub&gt;s&lt;/sub&gt;</td>
<td>125°C (257°F)</td>
</tr>
<tr>
<td>Dielectric Constant</td>
<td>3.0 at 10 GHz</td>
</tr>
<tr>
<td>Loss Tangent</td>
<td>0.019 at 10 GHz</td>
</tr>
<tr>
<td>Moisture Absorption</td>
<td>2.0% after 24 hr water boil</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>75 MPa (10.9 ksi)</td>
</tr>
<tr>
<td>Tensile Modulus</td>
<td>3 GPa (0.44 Msi)</td>
</tr>
<tr>
<td>Tensile Strain</td>
<td>2.5%</td>
</tr>
<tr>
<td>Compression Strength</td>
<td>115 MPa (16.7 ksi)</td>
</tr>
<tr>
<td>Compression Modulus</td>
<td>2.8 GPa (0.4 Msi)</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>156 MPa (22.6 ksi)</td>
</tr>
<tr>
<td>Flexural Modulus</td>
<td>3.4 GPa (0.50 Msi)</td>
</tr>
<tr>
<td>Flexural Strain</td>
<td>5.5%</td>
</tr>
<tr>
<td>CTE</td>
<td>71 ppm/°C (39 ppm/°F)</td>
</tr>
<tr>
<td>Dielectric Constant at 10 GHz on 4581 quartz</td>
<td>3.26</td>
</tr>
<tr>
<td>Loss Tangent at 10 GHz on 4581 quartz</td>
<td>0.0081</td>
</tr>
</tbody>
</table>

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ELECTRICAL PROPERTIES OF COMPOSITE LAMINATES

<table>
<thead>
<tr>
<th>Property</th>
<th>Condition</th>
<th>Methods</th>
<th>Results A</th>
<th>Results B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric Constant</td>
<td></td>
<td></td>
<td>4.52</td>
<td>4.84</td>
</tr>
<tr>
<td>Loss Tangent</td>
<td></td>
<td></td>
<td>0.019</td>
<td>0.018</td>
</tr>
</tbody>
</table>

MECHANICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Condition</th>
<th>Methods</th>
<th>Results A</th>
<th>Results B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength 0°</td>
<td>RTD</td>
<td>ASTM D 3039</td>
<td>767 MPa</td>
<td>797 MPa</td>
</tr>
<tr>
<td>Tensile Modulus 0°</td>
<td>RTD</td>
<td>ASTM D 3039</td>
<td>57.3 GPa</td>
<td>59.0 GPa</td>
</tr>
<tr>
<td>Compressive Strength 0°</td>
<td>RTD</td>
<td>ASTM D 3410</td>
<td>55.2 GPa</td>
<td>57.7 GPa</td>
</tr>
<tr>
<td>Compressive Modulus 0°</td>
<td>RTD</td>
<td>ASTM D 3410</td>
<td>518 MPa</td>
<td>570 MPa</td>
</tr>
<tr>
<td>Flexural Strength 0°</td>
<td>RTD</td>
<td>ASTM D 7264</td>
<td>51.2 GPa</td>
<td>53.6 GPa</td>
</tr>
<tr>
<td>Flexural Modulus 0°</td>
<td>RTD</td>
<td>ASTM D 7264</td>
<td>752 MPa</td>
<td>790 MPa</td>
</tr>
<tr>
<td>Short Beam Shear Strength</td>
<td>RTD</td>
<td>ASTM D 2344</td>
<td>61.9 MPa</td>
<td>63.5 MPa</td>
</tr>
</tbody>
</table>

*All properties normalized to 60% fiber volume except ILSS. (Fiber volume 40–50%)

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BT250E-1 Epoxy Prepreg: Cure cycle

- Apply 25 inHg vacuum minimum.
- Apply 1–3.4 bar, 30–100 psi pressure to autoclave (optional).

Hold at 127°C (260°F) for 2 hours minimum.
*Part must be dwell at this temp. Oven temperature may not reflect actual part temperature.

Below 71°C (160°F), release pressure and remove. (Temperature based on lagging thermocouple)

Heat up at 1–3°C (2°–5°F)/min

BT250E-1, Lot# 041801-3.3M2, 1.6°C (3°F)/min, 25°C–121°C (77°F–250°F), hold 60 min
EPOXY PREPREG, ADHESIVE, AND RESIN GUIDELINES AND HANDLING PROCEDURES
The following guidelines are provided to our customers to assure that best practices are used to attain the best results from Toray Advanced Composites epoxy products. Keep in mind that these procedures represent best practices for all composite prepreg and adhesive materials.

FREEZER STORAGE
Epoxy resin materials have good shelf life at room temperature; however, the life and performance of the material is best preserved with the following basic guidelines. Refer to the shelf life included in the product certifications. The epoxy material should be sealed in an airtight bag and kept frozen below -18°C (0°F) when not being used for longest life and most consistent performance. A good safety measure is to have a bag of desiccant (silica moisture absorber) in the core of the prepreg roll to assure the best protection from moisture ingestion.

MOISTURE ABSORPTION AND SENSITIVITY
While very resistant to moisture absorption after cure, epoxies can be adversely affected by moisture uptake prior to cure. For this reason, all materials must be completely thawed to room temperature prior to opening the sealed bag to avoid condensation on the material. Also, it is good practice to keep prepreg and in-process hardware in a sealed bag or vacuum bag if it will be exposed to the atmosphere for long periods of time.

HANDLING OF MATERIALS
When handling any prepreg materials, one should always wear clean, powder-free latex gloves. This will assure that no hand oils are transferred to the prepreg and/or composite during processing. The presence of oils in the part could lead to problems in both mechanical and electrical performance of the part. This also guards against dermatitis that may occur with some users.

NONMETALLIC HONEYCOMB AND FOAM CORE USE
When using nonmetallic honeycomb and foam core materials for sandwich structures, the materials should always be dried in an oven prior to lay-up to drive off any moisture that may be in the core. The core should be cooled in the presence of a desiccant to avoid moisture uptake. Following drying, it is always best to use the material as soon as possible. Recommended core dry time/temp: 121°C (250°F) for 3–4 hours.

DEBULK LAY-UP MATERIAL SEQUENCE FROM TOOL SURFACE TO BAGGING MATERIALS
1. Bottom Tool
2. Non-porous FEP
3. Prepreg
4. Porous TX1040
5. Non-porous FEP
6. Caul plate
7. Breather (woven or thick breather)
8. Vacuum bag
9. Repeat above procedure

A robust debulking procedure is necessary to minimize entrapped air between plies as shown in Figure 1. Vacuum level should be at least at 27 inHg. BT250E-1 was debulked at ambient every 4 plies for 5–10 minutes. An additional ply of porous Teflon coated glass (TX1040) was used to help with the removal of entrapped air, and it was replaced every 2–3 cycles.
TYPICAL COMPOSITE LAMINATE STACKING SEQUENCE

List of Materials
1. Tool – aluminum, steel, Invar, composite (tool plates must be release coated or film covered).
2. Release coat or film – Frekote 700NC or 770NC, FEP, TEDLAR
   Lay-up part using standard debulking procedures
3. Silicone edge dams for cure – slightly thicker than laminate
4. Laminate
5. Release coat or film – Frekote 700NC or 770NC, FEP, TEDLAR
6. Caul plate – aluminum, steel, Invar, silicone rubber sheet (metal caul plates must be release coated or wrapped)
7. 2.2 oz/yd² polyester breather, 1 or more
8. Vacuum bag
9. Vacuum sealant
10. Glass yarn string (alternatively or additionally breather may wrap over top of dam to contact edge)

Follow the provided Toray Advanced Composites cure cycle for the particular resin system.

Figure 1