BTCy-1 Resin System

**PRODUCT TYPE**
350°F (177°C) Cure Cyanate Ester

**TYPICAL APPLICATIONS**
- Aircraft
- Spacecraft
- High Temperature Radomes and Antennae
- Radar Transparent Structures
- Low Outgassing Applications
- BMI Replacement
- High Performance Electronic Substrates

**SHELF LIFE**
Tack Life
14 days tack life at 77°F (25°C)
Out Life
14 days out life 77°F (25°C)
Frozen Storage Life
6 months storage life at < 0°F (-18°C)

Tack life is the time during which the prepreg retains enough tack, drape and handling for easy component lay-up.
Out life is the maximum time allowed at room temperature before cure.

**PRODUCT DESCRIPTION**
BTCy-1 is a 350°F (177°C) curing cyanate ester and is an industry standard for use on satellite structure and radomes.

**PRODUCT BENEFITS/FEATURES**
- Good resistance to galvanic corrosion
- Low outgassing
- Low dielectric performance

**TYPICAL NEAT RESIN PROPERTIES**
Density.................................................................1.17 g/cc
Polymer Tg ..............................................................374°F (190°C) cured at 350°F (177°C)
                                                        461°F (238°C) after post cure
Moisture Absorption...........................................1% at 212°F (100°C) saturation
Dielectric Constant................................................2.7 - 2.8 (Flat to 18 GHz)
Loss Tangent..........................................................0.003
G, C Value ............................................................1.2 in-lb/in²
Outgassing (TML)....................................................0.36%
Outgassing (CVCM)..................................................0.00%
Outgassing (WVR)....................................................0.33%
Tensile Modulus....................................................0.57 Msi (3.93 GPa)
Poisson's Ratio........................................................0.48
Shear Modulus......................................................0.885 Msi (6.10 GPa)

**LAMINATE DATA - 7781 Fg REINFORCEMENT, 300 gsm FAW.**

<table>
<thead>
<tr>
<th>Properties</th>
<th>Condition (RTD, ETD, ETW)</th>
<th>Method</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength 0°</td>
<td>RTD</td>
<td>ASTM D3039</td>
<td>70 ksi  483 MPa</td>
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<tr>
<td>Tensile Modulus 0°</td>
<td>RTD</td>
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<td>3.2 Msi 22.1 GPa</td>
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<tr>
<td>Compressive Strength 0°</td>
<td>RTD</td>
<td>ASTM D6641</td>
<td>64 ksi  441 MPa</td>
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<tr>
<td>Compressive Modulus 0°</td>
<td>RTD</td>
<td>ASTM D6641</td>
<td>3 Msi   21 GPa</td>
</tr>
<tr>
<td>Flexural Strength 0°</td>
<td>RTD</td>
<td>ASTM D7264</td>
<td>86 ksi  593 MPa</td>
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<tr>
<td>Flexural Modulus 0°</td>
<td>RTD</td>
<td>ASTM D7264</td>
<td>3 Msi   21 GPa</td>
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<tr>
<td>Short Beam Shear Strength</td>
<td>RTD</td>
<td>ASTM D2344</td>
<td>8 ksi   55 MPa</td>
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</tbody>
</table>
BTCy-1 Resin System

**LAMINATE DATA - 4581 ASTROQUARTZ® III, 300 gsm FAW.**

<table>
<thead>
<tr>
<th>Properties</th>
<th>Condition (RTD, ETD, ETW)</th>
<th>Method</th>
<th>Results</th>
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<tbody>
<tr>
<td>Tensile Strength 0°</td>
<td>RTD</td>
<td>ASTM D3039</td>
<td>101 ksi 696.4 MPa</td>
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<tr>
<td>Tensile Modulus 0°</td>
<td>RTD</td>
<td>ASTM D3039</td>
<td>3.8 Msi 26.2 GPa</td>
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<tr>
<td>Tensile Strength 0°</td>
<td>ETD</td>
<td>ASTM D3039</td>
<td>84.8 ksi 584.7 MPa</td>
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<tr>
<td>Tensile Modulus 0°</td>
<td>ETD</td>
<td>ASTM D3039</td>
<td>3.5 Msi 21.4 GPa</td>
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<tr>
<td>Compressive Strength 0°</td>
<td>RTD</td>
<td>ASTM D6641</td>
<td>77.9 ksi 537.1 MPa</td>
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<tr>
<td>Compressive Modulus 0°</td>
<td>RTD</td>
<td>ASTM D6641</td>
<td>3.7 Msi 25.5 GPa</td>
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<tr>
<td>Compressive Strength 0°</td>
<td>ETD</td>
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<tr>
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<td>4.0 Msi 21.4 GPa</td>
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<td>Flexural Strength 0°</td>
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<td>Flexural Modulus 0°</td>
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<td>Flexural Strength 0°</td>
<td>ETD</td>
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<td>73.8 ksi 509 MPa</td>
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<tr>
<td>Flexural Modulus 0°</td>
<td>ETD</td>
<td>ASTM D7264</td>
<td>4.1 Msi 28 MPa</td>
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<tr>
<td>Short Beam Shear Strength</td>
<td>RTD</td>
<td>ASTM D2344</td>
<td>8.6 ksi 59 MPa</td>
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<tr>
<td>Short Beam Shear Strength</td>
<td>ETD</td>
<td>ASTM D2344</td>
<td>5.7 Msi 39 GPa</td>
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**ELECTRICAL LAMINATE PROPERTIES**

<table>
<thead>
<tr>
<th>Reinforcement</th>
<th>1.0 Mhz</th>
<th>10.0 Ghz</th>
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<tr>
<td>Quartz Reinforcement</td>
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<td>3.20</td>
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<tr>
<td>Loss Tangent</td>
<td>0.001</td>
<td>0.004</td>
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<tr>
<td>E Fiberglass Reinforcement</td>
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<td>-</td>
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<tr>
<td>Loss Tangent</td>
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**BTCy-1 Resin System**

**BTCy-1 CYANATE ESTER RESIN SYSTEM:** Cure cycle

- Heat up at 2°-5°F/min. (1°-3°C/min).
- Hold at 392°F (199°C) for 90 minutes minimum. (temperature based on lagging thermocouple).
- Cool down at 5°-10°F/min. (3°-6°C/min).
- Below 160°F (71°C), release pressure and remove. (temperature based on lagging thermocouple).

**FREEZER STORAGE**
Cyanate Esters (CE's) should always be sealed in an airtight bag and kept frozen below 10°F (-12°C) when not being used. A good safety measure is to have a bag of desiccant (Silica Moisture Absorber) in the core of the prepreg roll just in case a pin-hole in the bag or other problem occurs.

**MOISTURE ABSORPTION AND SENSITIVITY**
While very resistant to moisture absorption after cure, CE's can be adversely affected by moisture uptake prior to cure. For this reason, all materials must be “Thoroughly 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 to be exposed to atmosphere for long periods of time.

**HANDLING OF MATERIALS**
When handling any prepreg materials, one should always be wearing 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. This also guards against any dermatitis that could occur with certain users.
NON-METALLIC HONEYCOMB AND FOAM CORE USE
When using Non-Metallic honeycomb and foam core materials for sandwich structures, the materials should always be dried in an oven prior to layup to drive off any moisture that may be in the core. The material should then be cooled in the presence of a desiccant, to avoid any moisture uptake. Following this procedure, it is always a good idea to use the material as soon as possible to avoid re-hydration.

Recommended Core Dry Time/Temp: 250°F (121°C) for 3-4 Hours

SELF ADHESIVE PROPERTIES AND FILM ADHESIVE USE
TCAC cyanate ester resins have been formulated to have good self-adhesive properties to core materials. However, this should not be taken as a green light to eliminate a film adhesive from a cored, structural piece of hardware. This option has been given by TCAC for customers who are looking for the best electrical properties available by not using a film adhesive. TCAC recommends that the structural integrity be verified your specification prior to end item usage and takes no responsibility otherwise.

If this option is exercised, the following modified cure cycle has been found to work well.

1. Ramp the part to 150°F – 160°F (66°C– 71°C) (Keep Pressure <15 Psi)
2. Dwell for approximately 1 hour
3. Ramp the part to the dictated cure temperature for the resin and cure per the provided standard cure cycle.

LAY-UP AREA ENVIRONMENTAL CONTROLS
TCAC recommends that any composite or adhesive lay-up be performed in a clean area visibly free from dust. Any work surfaces should likewise be free of residue, dust or debris. No eating or smoking shall be allowed in the shop area. For radome materials, conductive materials shall not be allowed in the process area. The processing shop area should be maintained between 60°F to 90°F (16°C to 32°C) with a relative humidity of no greater than 70% rH.

PROCESSING METHODOLOGY
Cyanate esters can be processed using an Autoclave, Press, Pressclave, or Oven Cure/Vacuum Bag. For any application where the optimum properties are needed, TCAC recommends the use of an autoclave, or press especially for its BTCy–1 & BTCy-2 resin systems. This is due to the fact that air voids caused by vacuum bag/oven cure processing may darken upon post cure and create unsightly dark specs in the laminate. Although the structural deficit caused by these voids has not been assessed, it can most probably be assumed that the detriment would be no more than that caused by the voids themselves created via vacuum bag processing.

BAGGING FOR CURE
TCAC recommends that CE composite parts bagged for cure should be performed as follows.

1. Release the tool surface
2. Layup part using standard debulking procedures
3. Dam the edges of the part for cure
4. Place one ply of porous Teflon® or perforated Teflon® onto the bag surface of the part
5. Place bleeder layers over porous Teflon® material and trim to the part periphery
6. Place a non-porous layer of Teflon® over the part
7. Utilize a breather cloth to facilitate vacuum draw
8. Install vacuum bag on the tool for cure
9. Follow the provided TCAC cure cycle for the particular resin system
All data given is based on representative samples of the materials in question. Since the method and circumstances under which these materials are processed and tested are key to their performance, and TenCate Advanced Composites has no assurance of how its customers will use the material, the corporation cannot guarantee these properties.

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### BTCy-1 Resin System

**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
3. Silicone Edge Dams – 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 osy 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)