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_IC Value ..... 1.2 in-lb/in^2

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.

Properties	Condition (RTD, ETD, ETW)	Method	Results	
Tensile Strength 0°	RTD	ASTM D3039	70 ksi	483 MPa
Tensile Modulus 0°	RTD	ASTM D3039	3.2 Msi	22.1 GPa
Compressive Strength 0°	RTD	ASTM D6641	64 ksi	441 MPa
Compressive Modulus 0°	RTD	ASTM D6641	3 Msi	21 GPa
Flexural Strength 0°	RTD	ASTM D7264	86 ksi	593 MPa
Flexural Modulus 0°	RTD	ASTM D7264	3 Msi	21 GPa
Short Beam Shear Strength	RTD	ASTM D2344	8 ksi	55 MPa

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

Properties	Condition (RTD, ETD, ETW)	Method	Results	
Tensile Strength 0°	RTD	ASTM D3039	101 ksi	696.4 MPa
Tensile Modulus 0°	RTD	ASTM D3039	3.8 Msi	26.2 GPa
Tensile Strength 0°	ETD	ASTM D3039	84.8 ksi	584.7 MPa
Tensile Modulus 0°	ETD	ASTM D3039	3.5 Msi	21.4 GPa
Compressive Strength 0°	RTD	ASTM D6641	77.9 ksi	537.1 MPa
Compressive Modulus 0°	RTD	ASTM D6641	3.7 Msi	25.5 GPa
Compressive Strength 0°	ETD	ASTM D695	75.4 ksi	288.2 MPa
Compressive Modulus 0°	ETD	ASTM D695	4.0 Msi	21.4 GPa
Flexural Strength 0°	RTD	ASTM D7264	108 ksi	745 MPa
Flexural Modulus 0°	RTD	ASTM D7264	4.7 Msi	32 GPa
Flexural Strength 0°	ETD	ASTM D7264	73.8 ksi	509 MPa
Flexural Modulus 0°	ETD	ASTM D7264	4.1 Msi	28 MPa
Short Beam Shear Strength	RTD	ASTM D2344	8.6 ksi	59 MPa
Short Beam Shear Strength	ETD	ASTM D2344	5.7 Msi	39 GPa

ELECTRICAL LAMINATE PROPERTIES

Quartz Reinforcement	1.0 Mhz	10.0 Ghz
Dielectric Constant	3.19	3.20
Loss Tangent	0.001	0.004

E Fiberglass Reinforcement	1.0 Mhz	10.0 Ghz
Dielectric Constant	4.30	-
Loss Tangent	0.006	-

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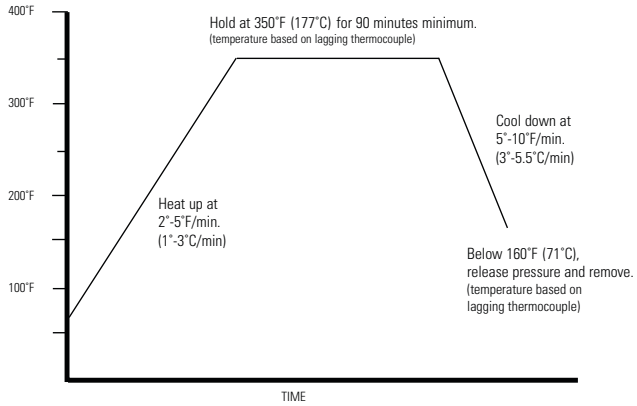
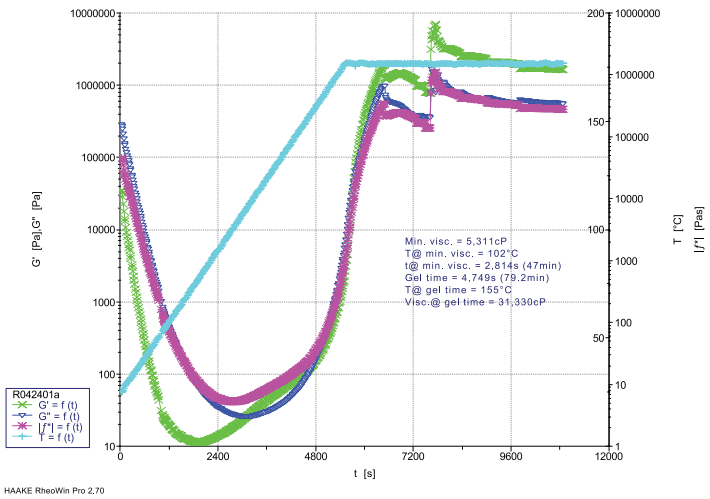
BTCY-1 CYANATE ESTER RESIN SYSTEM: Cure cycle



- Apply 25 inches Hg vacuum minimum.
- Apply 40 - 50 psig pressure to autoclave (optional).

Optional Post cure: Heat at 3°-5°F/min (2°-3°C/min) to 450°F (233°C), dwell at 450°F (233°C) for two hours minimum, cool at 5°-10°F (3-5.5°C/min) to 180°F (82°C) and remove.

BTCy-1, Lot# 060900-30C2, 3°F/min (1°C/min), 77°F-350°F (25°C-177°C) hold 90 min.



CYANATE ESTER PREPREG, ADHESIVE AND RESIN GUIDELINES AND HANDLING PROCEDURES

The following guidelines are provided to our customers for one specific purpose: to assure that all customers are aware of the manner by which to attain the best possible results from TenCate Advanced Composites (TCAC) cyanate ester products. These resin systems will provide sound composite hardware and structures if some simple procedures are followed. Keep in mind that these procedures are good practice for all composite prepreg and adhesive materials and should be used whenever possible.

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.

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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

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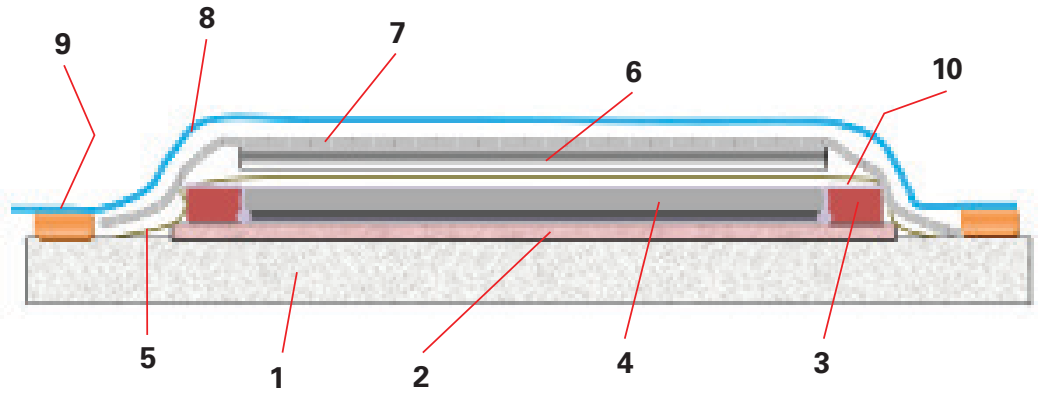
COMPOSITE LAMINATE STACKING SEQUENCE

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)



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