PRODUCT DATA SHEET

TENCATE ADVANCED COMPOSITES

BTCy-1A Resin System

PRODUCT TYPE

350°F (177°C) Toughened Cyanate Ester Resin System

TYPICAL APPLICATIONS

- Aircraft
- Spacecraft
- High Temperature Radomes and Antennae
- Radar Transparent Structures
- Low Outgassing Applications
- High Performance Bonding Applications

SHELF LIFE

Tack Life
14 days tack life at 77°F (25°C)

Out Life
30 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-1A is a toughened version of TenCate Advanced Composites' popular BTCy-1 cyanate ester system. Its proprietary toughening mechanism and controllable flow make it an ideal product for use not only as a high performance prepreg resin system, but also as an accompanying resin system for film adhesives. BTCy-1A's straight-up, easy processing at 350°F (177°C) (under low pressures) reduces curing time and production costs, while the system's negligible volatile emission upon cure allows low void laminates.

PRODUCT BENEFITS/FEATURES

- Toughened resin system for improved impact resistance
- Controlled flow
- Robust processing window

TYPICAL NEAT RESIN PROPERTIES

Specific Gravity .... 1.15 g/cc
Tg .... 405°F (207 °C) after 400°F (204°C) post cure
365°F (185°C) cured at 350°F (177°C)
CTE .... 43 ppm/°F (77 ppm/°C)
Dielectric Constant .... 2.7 - 2.8 at 10 GHz
Loss Tangent .... 0.003 at 10 GHz
Moisture Absorption .... 1% at saturation

ELECTRICAL PROPERTIES OF COMPOSITE LAMINATES

BTCy-1A / 4581 Quartz	C / X Band 8 - 18 GHz	Ku / K Band 18 - 26.5 GHz	Ka Band 26.5 - 40 GHz	G & U Band 40 - 60 GHz
Dielectric Constant	3.23	3.18	3.19	3.18
Loss Tangent	<0.010*	<0.010*	<0.010*	<0.010*

** The loss tangent under focused beam testing is only accurate to 0.010. This material is less than 0.010. This material represents one of TenCate's best for high energy radome applications.*

LAMINATE DATA - IM-7 GRAPHITE UNIDIRECTIONAL LAMINATE.

Properties	Condition (RTD, ETD, ETW)	Method	Results	
Tensile Strength 0°	RTD	ASTM D3039	395 ksi	2723 MPa
Tensile Modulus 0°	RTD	ASTM D3039	24 Msi	165.5 GPa
Compressive Strength 0°	RTD	ASTM D6641	225 ksi	1551 MPa
Compressive Modulus 0°	RTD	ASTM D6641	23 Msi	159 GPa
Short Beam Shear (G12)	RTD	ASTM D3518	11.9 ksi	82.0 MPa

LAMINATE DATA- M55J PLAIN WEAVE FABRIC, 152 gsm FAW.

Properties	Condition (RTD, ETD, ETW)	Method	Results	
Tensile Strength 0°	RTD	ASTM D3039	116 ksi	802 MPa
Tensile Modulus 0°	RTD	ASTM D3039	25.7 Msi	177 GPa
Compressive Strength 0°	RTD	ASTM D6641	51.6 ksi	356 MPa
Compressive Modulus 0°	RTD	ASTM D6641	21.2 Msi	146.2 GPa
Flexural Strength 0°	RTD	ASTM D264	78.4 ksi	541 MPa
Flexural Modulus 0°	RTD	ASTM D7264	21.1 Msi	152.4 GPa
Short Beam Strength	RTD	ASTM D2344	6.6 ksi	45.5 MPa

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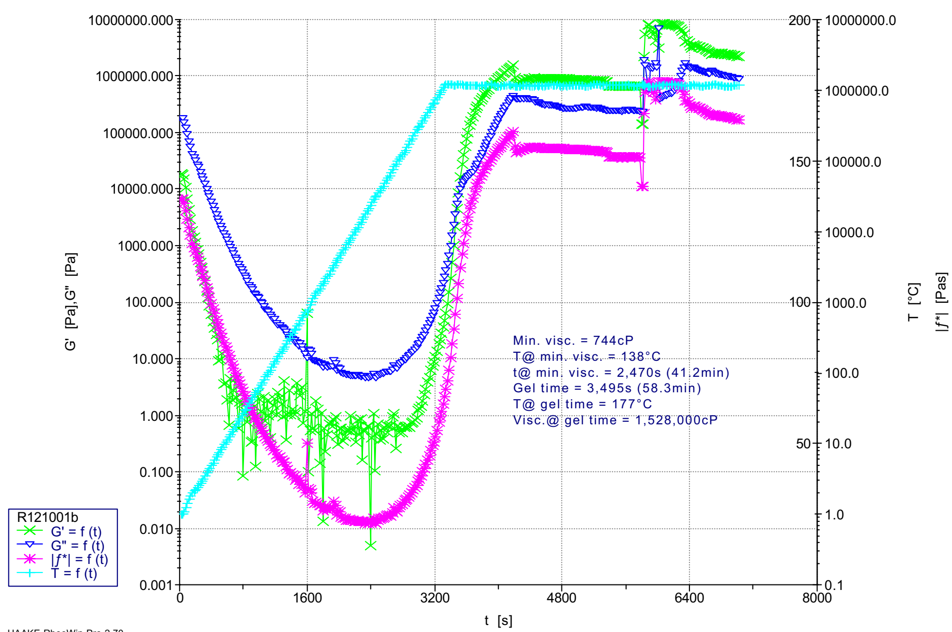
LAMINATE DATA - 4581 AQIII/BTCY-1A, 300 gsm FAW.

Properties	Condition (RTD, ETD, ETW)	Method	Cured at 350°F (177°C)	
Tensile Strength 0°	RTD	ASTM D3039	121 ksi	834 MPa
Tensile Modulus 0°	RTD	ASTM D3039	3.9 Msi	27 GPa
Tensile Strength 0°	ETD	ASTM D3039	113 ksi	779.1 MPa
Tensile Modulus 0°	ETD	ASTM D3039	3.7 Msi	25.5 GPa
Compressive Strength 0°	RTD	ASTM D6641	81 ksi	558 MPa
Compressive Modulus 0°	RTD	ASTM D6641	4.2 Msi	29.0 GPa
Compressive Strength 0°	ETD	ASTM D6641	52 ksi	359 MPa
Short Beam Strength	RTD	ASTM D2344	6.6 ksi	45.5 MPa

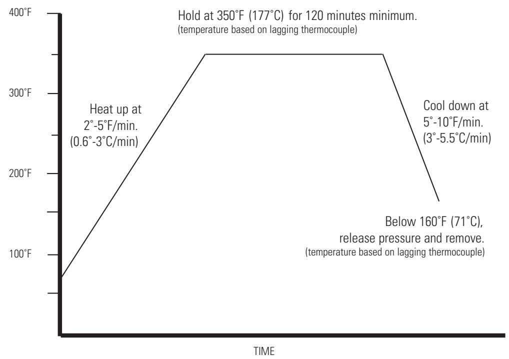
- ETD IS 285°F (141°C).
- Data normalized to 60% fiber volume except interlaminar shear strength.

BTCy-1A, Lot# 060401-5MC2, 5°F/min (2°C/min), 77°F-350°F (25°C-177°C) hold 90 min.



BTCy-1A Resin System

BTCY-1A CYANATE ESTER RESIN SYSTEM: Cure cycle



- Apply 25 inches Hg vacuum minimum.
- Apply 40 - 100 psi pressure to autoclave (optional*).

*Pressure at customer's discretion as required by their application

Post cure: Heat at 3°-5°F/min (2°-3°C/min) to 400°F (204°C), dwell at 400°F (204°C) for 60 minutes minimum, cool at 5°-10°F (3-5.5°C/min) to 180°F (82°C) and remove.

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 of the part. 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.

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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.

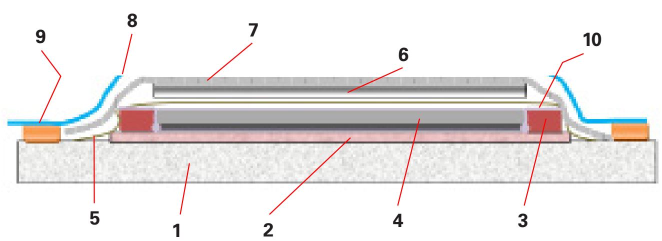
BAGGING FOR CURE

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

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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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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