TenCate BT250E-6 IM7 GP 12k Unitape 148 gsm 33% RC Qualification Material Property Data Report

FAA Special Project Number: TD03019RC-R

NCAMP Test Report Number: CAM-RP-2015-038 N/C

Report Date: October 25, 2017

Testing Facility:
National Institute for Aviation Research
Wichita State University
1845 N. Fairmount
Wichita, KS 67260-0093

Test Panel Fabrication Facility:
Advanced Technologies Inc. (ATI)
875 Middle Ground Blvd
Newport News, VA 23606

Prepared by: Vinsensius Tanoto

Digitally signed by Vinsensius Tanoto
DN: cn=Vinsensius Tanoto, o=NIAR, ou=NCAMP, email=vxtanoto@niar.wichita.edu, c=US
Date: 2018.01.19 14:09:05 -06'00'

Vinsensius Tanoto

Reviewed by: Evelyn Lian

Digitally signed by Evelyn Lian
DN: cn=Evelyn Lian, o=NIAR/NCAMP, ou=NIAR/NCAMP, email=evelyn@niar.wichita.edu, c=US
Date: 2018.01.19 14:22:46 -06'00'

Evelyn Lian

Rachael Andrulonis

Digitally signed by Rachael Andrulonis
DN: cn=Rachael Andrulonis, o=Wichita State University - NIAR, ou, email=rachael@niar.wichita.edu, c=US
Date: 2018.01.30 10:02:59 -05'00'

Rachael Andrulonis

Approved by: Ed Hooper

Digitally signed by Ed Hooper
DN: cn=Ed Hooper, o=Aviation Consultant, Inc., ou=NCAMP AER, email=edhooper@cox.net, c=US
Date: 2018.01.19 14:09:14 -06'00'

Ed Hooper (NCAMP AER)

REVISIONS:

Rev	By	Date	Pages Revised or Added
N/C	Vinsensius Tanoto	10/25/2017	Document Initial Release

TABLE OF CONTENTS

List of Tables

List of Figures

1. Introduction

1.1 Scope

The test methods and results described in this document are intended to provide basic composite properties essential to most methods of analysis and are consistent with CMH-17-1G—Composite Materials Handbook for Polymer Matrix Composites. This report contains material property data of common usefulness to wide range of projects. The lamina material property data have been generated with FAA oversight through FAA Special Project Number TD03019RC-R, and also meet the requirements of NCAMP Standard Operating Procedure NSP 100; the test panels and test specimens have been inspected by an FAA Designated Airworthiness Representative (DAR) and the testing has been witnessed by an FAA Designated Engineering Representative (DER). However, the data may not fulfill all the needs of any specific company's program; specific properties, environments, laminate architecture, and loading situations may require additional testing.

The use of NCAMP material and process specifications do not guarantee material or structural performance. Material users should be actively involved in evaluating material performance and quality including, but not limited to, performing regular purchaser quality control tests, performing periodic equivalency/additional testing, participating in material change management activities, conducting statistical process control, and conducting regular supplier audits.

The applicability of NCAMP material property data, material allowables, and specifications must be evaluated on case-by-case basis by aircraft companies and certifying agencies. NCAMP assumes no liability whatsoever, expressed or implied, related to the use of the material property data, material allowables, and specifications.

This report contains material property data only. Statistical analysis of the data including the calculations of b-basis values is given in a separate report TenCate Advance Composites IM7 GP Unitape with BT250E-6 Resin Material Allowables Statistical Analysis Report, NCP-RP-2015-019 Rev N/C. The qualification material was procured to Erickson Air-Crane (EAC) Material Specification ES0095 Revision B dated May 22, 2013. An equivalent NCAMP Material Specification NMS 250/1 Rev Initial Release dated January 2, 2018 has been created, which contains specification limits that are derived from guidelines in DOT/FAA/AR-03/19. The qualification test panels were cured in accordance with Erickson Air-Crane (EAC) Process Specification ES0098 Revision A dated June 15, 2011. An equivalent NCAMP Process Specification NPS 81250 baseline “C” Cure Cycle Rev Initial Release dated October 20, 2017 has been created. The Erickson Air-Crane (EAC) test plan EAC2027 Rev D was used for this qualification program.

Part fabricators that wish to utilize the material property data, allowables, and specifications may be able to do so by demonstrating the capability to reproduce the original material properties; a process known as equivalency. More information about

this equivalency process including the test statistics and its limitations can be found in Section 6 of DOT/FAA/AR-03/19 and Section 8.4.1 of CMH-17-1G. The applicability of equivalency process must be evaluated on program-by-program basis by the applicant and certifying agency. The applicant and certifying agency must agree that the equivalency test plan along with the equivalency process described in Section 6 of DOT/FAA/AR-03/19 and Section 8.4.1 of CMH-17-1G are adequate for the given program.

Aircraft companies should not use the data published in this report without specifying NCAMP Material Specification NMS 250/1. NMS 250/1 may have additional requirements that are listed in its prepreg process control document (PCD), fiber specification, fiber PCD, and other raw material specifications and PCDs which impose essential quality controls on the raw materials and raw material manufacturing equipment and processes. *Aircraft companies and certifying agencies should assume that the material property data published in this report is not applicable when the material is not procured to NMS* 250*/1.* NMS 250/1 is a free, publicly available, non-proprietary aerospace industry material specification.

The data in this report is intended for general distribution to the public, either freely or at a price that does not exceed the cost of reproduction (e.g. printing) and distribution (e.g. postage).

1.2 Symbols

ν_{12}^{t}	major Poisson's ratio, tension
$\mu\varepsilon$	micro-strain
E_1^{c}	compressive modulus, longitudinal / warp direction
E_1^{t}	tensile modulus, longitudinal / warp direction
E_2^{c}	compressive modulus, transverse / fill direction
E_2^{t}	tensile modulus, transverse / fill direction
F_1^{cu}	ultimate compressive strength, longitudinal / warp direction
F_1^{tu}	ultimate tensile strength, longitudinal / warp direction
F_2^{cu}	ultimate compressive strength, transverse / fill direction
F_2^{tu}	ultimate tensile strength, transverse / fill direction
SBS	short beam strength
ν_{12}^{c}	major Poisson's Ratio, compression
ν_{21}^{c}	minor Poisson's Ratio, compression
$F_{12}^{s5\%\ strain}$	in-plane shear strength at 5% strain
F_{12}^{smax}	in-plane shear peak strength before 5% strain
$F_{12}^{s0.2\%}$	in-plane shear strength at 0.2% offset
G_{12}^{s}	in-plane shear modulus

Superscripts

c	compression
cu	compression ultimate
s	shear
su	shear ultimate
t	tension
tu	tension ultimate

Subscripts

1	axis; longitudinal / warp direction (parallel to warp direction of reinforcement)
2	axis; transverse / fill direction (parallel to fill direction of reinforcement)
12	in-plane

Acronyms and Definitions

ASTM	American Society for Testing and Materials
B – Basis	95% lower confidence limit on the tenth population percentile
CV	Coefficient of variation
CTD	cold temperature dry
CPT	cured ply thickness
ETD	elevated temperature dry
ETW	elevated temperature wet
Gr/Ep	graphite/epoxy
norm	normalized
RTD	room temperature dry
SACMA	Suppliers of Advanced Composite Materials Association
SRM	SACMA Recommended Method
Tply	thickness divided by the number of plies provides the thickness average per specimen
wet	specimen with an “equilibrium” moisture content
T, RH	temperature, relative humidity

1.3 NIAR–Specimen Naming Format

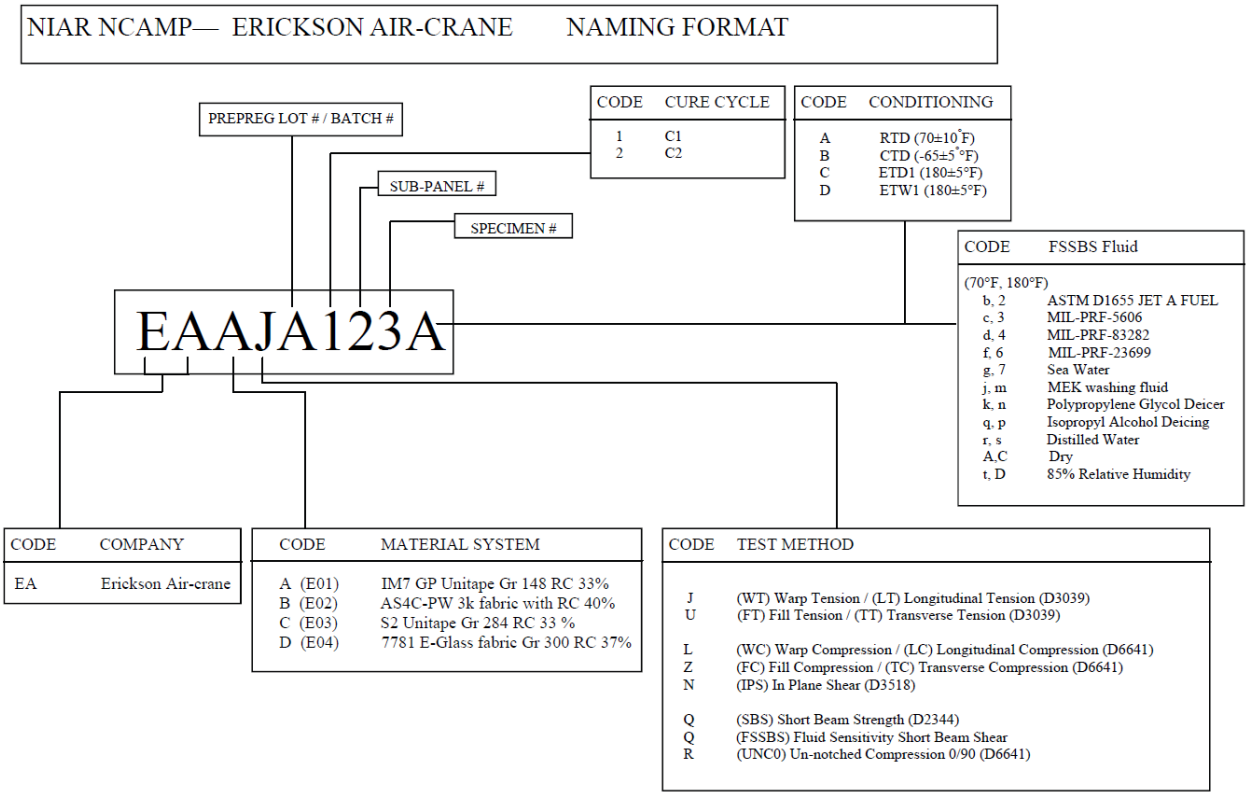


Figure 1-1: Naming Format

1.4 References

ASTM Standards

All testing was in accordance with nationally recognized standards, methods and procedures. Specific mechanical property test methods applicable to the test program in this document include:

- ASTM D2344/D2344M-00(2006) – Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates
- ASTM D3039/D3039M-08 – Standard Test Method for Tensile Properties of Polymer Matrix Composite Materials
- ASTM D3518/D3518M-94(2007) – Standard Test Method for In-Plane Shear Response of Polymer Matrix Composite Materials by Tensile Test of a ± 45º Laminate In-Plane Shear Strength and Modulus
- ASTM D6641/D6641M-01e1(2009) – Standard Test Method for Determining the Compressive Properties of Polymer Matrix Composite Laminates Using a Combined Loading Compression (CLC) Test Fixture
- ASTM D7028-07e1 – Standard Test Method for Glass Transition Temperature (DMA Tg) of Polymer Matrix Composites by Dynamic Mechanical Analysis (DMA)

1.5 Methodology

1.5.1 Process Definition

For each combination of test, batch and condition, the specimens were selected from minimum two separate panels cured separately as shown in Figure 1-2 unless otherwise specified.

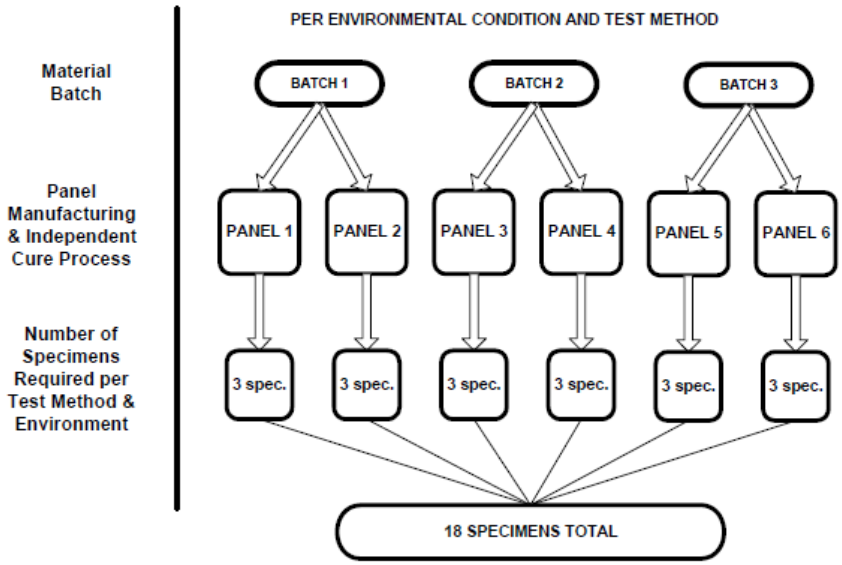


Figure 1-2: Specimen Selection Methodology

All panels were fabricated in accordance with Erickson Air-Crane (EAC) Process Specification ES0098 which is equivalent to NCAMP Process Specification NPS 81250 baseline “C” Cure Cycle, caul plate is used.

In order to facilitate individual specimen trace ability, individual specimen numbering and/or skewed lines were written or drawn across each sub-panel as shown in Figure 1-3.

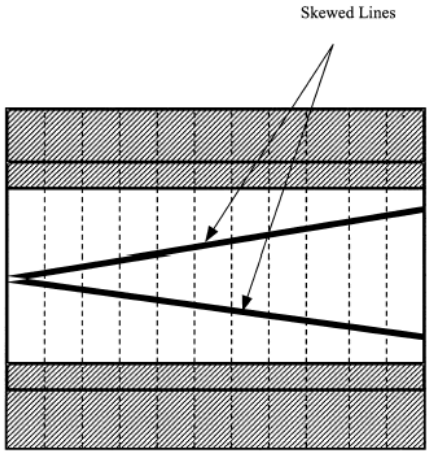


Figure 1-3: Specimen Traceability Line

1.5.2 Specimen & Testing Details

1.5.2.1 Tabbing

Longitudinal Tension coupons were tabbed (beveled) with Henkel Loctite EA 9394 and ±45° Glass tabstock.

1.5.2.2 Specimen Dimensions & Test Configuration

For SBS specimens, a span of 4T was used where T was the average thickness of six qualification panels. The same T was used to compute the width and length of the specimen.

Unless otherwise specified, a tolerance of ±5°F applied to all temperature conditions specified in this document.

1.5.2.3Specimen Strain Device Used

Corresponding Gage ID can be obtained from Appendix 1 of EAC2027 Rev D.

Uniaxial gages were used on:

- All CTD Tension specimens
- Two RTD Tension specimens for obtaining full stress strain curves
- All conditions of combined loading compression specimens

Biaxial gages were used on:

- All conditions of IPS specimens

Uniaxial Extensometers were used on:

- All RTD and ETW Tension specimens

1.5.3 Test Matrix

The table below shows the lay-ups and test matrices used for lamina level testing.

Layup	Test Type and Direction	Property	Number of Batches x No. of Panels x No. of Specimens			
			Test Temperature/Moisture Condition			
			CTD	RTD (4)	ETD	ETW
$[0]_8$	ASTM D3039 0° Tension	Strength, Modulus and Poisson's Ratio	3x2x3	3x2x3		3x2x3
$[0]_{20}$	ASTM D6641 0° Compression	Strength and Modulus	3x2x3	3x2x3 (1)		3x2x3
$[90]_{16}$	ASTM D3039 90° Tension	Strength and Modulus	3x2x3	3x2x3		3x2x3
$[90]_{20}$	ASTM D6641 90° Compression	Strength and Modulus	3x2x3	3x2x3 (1)		3x2x3 (3)
$[90/0/90]_7$	ASTM D6641 0° Compression (5)	Strength and Modulus	3x2x3	3x2x3 (1)	1x2x3	3x2x3 (3)
$[45/-45]_{4S}$	ASTM D3518 In-Plane Shear (2)	Strength and Modulus	3x2x3	3x2x3		3x2x3
$[0]_{45}$	ASTM D2344 Short Beam	Strength	3x2x3	3x2x3	3x2x3	3x2x3

Table 1-1: Lamina Level Test Matrix

Note 1: Back-to-back strain gages are needed on the first two specimens . If no buckling is observed, the remaining modulus specimens will require a strain gage on one side of the specimens only. An appropriate extensometer may be used in place of the strain gage.

Note 2: Once the samples have reached 5% of the full scale testing strain level, the actuator/crosshead displacement rate can be increased by four times the initial rate. Continue testing at the higher strain rate until ultimate failure is observed.

Note 3: Since strain gages are used for modulus measurement, a separate set of 18 un-gaged specimens must be used for strength measurement; because the strain gage and its protective coating may prevent moisture absorption in the gage area.

Note 4: At least two specimens must be gaged to obtain full stress-strain curve to failure. An appropriate extensometer may be used in place of the strain gage for the remaining specimens.

Note 5: Derive the 0° lamina compressive strength $F^{cu}_{0^o\,plies}$ as follows. This method is selected by the user and FAA.

$$F^{cu}_{0^o\,plies} = F^{cu}_{0^o/90^o}\frac{E_1}{E_{0^o/90^o}}$$

Where:

$F^{cu}_{0^o\,plies}$ = 0° ply Strength

$F^{cu}_{0^o/90^o}$ = 0°/90° or 90°/0° cross-ply laminate strength

E_1 = 0° Modulus

$E_{0^o/90^o}$ = 0°/90° or 90°/0° cross-ply laminate modulus

1.5.4 Cured Laminate Physical Testing

The properties in Table 1-2 were determined for each panel used for test coupons with the exception of Tg by DMA which were conducted on one laminate per batch from each oven cure conducted where that batch is present. The tests were performed by the National Institute for Aviation Research (NIAR) Composites Laboratory under the supervision of NCAMP.

Property	**Condition/Method** (Note 1)	**Min Replicates per panel**
Cured Ply Thickness	ASTM D3171-06 (Method II)	All data from mechanical test specimens
Laminate Density	ASTM D792-08	3
Fiber Volume, % by Volume	ASTM D3171-06 (Note 2)	3
Resin Content, % by Weight	ASTM D3171-06 (Note 2)	3
Ultrasonic Through Transmission, C-Scan	CP6121 (Note 3)	1
Glass Transition Temperature, Tg by DMA flexural loading	Dry and Wet – ASTM D7028	1 Dry, 1 Wet

Table 1-2: Physical Testing Matrix

Note 1: Where the applicable standard allows variations in specimen form or test method, the specific parameters to be used will be specified in the test work instructions and reported in the final test report.

Note 2: Method II, except for laminates of materials where actual fiber weight is not accurately known prior to impregnation, as in the case for unidirectional materials. For these materials, in order to verify Method II is accurate, a minimum of 12 samples per batch shall be tested by Method I, Procedure B.

Note 3: CP6121 is equivalent to MIL-HDBK-787A. Five MHz is preferred for solid laminates. Panels with anomaly should be segregated. Microscopy images may be taken from questionable areas. NIAR must be involved in the review of all C-scans.

1.5.5 Environmental Conditioning

The following tests were performed by the NIAR Composites Laboratory under the supervision of NCAMP.

CTD = -65±5°F, dry
RTD = 70±10°F, dry
ETD = 180±5°F, dry
ETW = 180±5°F, wet

Within each test method and test environment, the failure mode was evaluated immediately after each test by a delegated FAA DER or ACO engineer or an NCAMP staff engineer. All tested specimens were digitally photographed after each test in order to pictorially document failure modes.

For dry testing, specimens were dried at 160°F±5°F for 120 to 130 hours. After drying, specimens were kept in a desiccator until mechanical testing. Alternatively, the specimens may have been left in ambient laboratory condition for a maximum of 14 days until mechanical testing (no drying was required if specimens were tested within 14 days from the date they were cured). Ambient laboratory condition is defined as 70°F±10°F. Since moisture absorption and desorption rate for epoxy is very slow at ambient temperature, there was no requirement to maintain relative humidity levels.

For wet conditioning, specimens were dried at 160°F±5°F for 120 to 130 hours minimum before being conditioned to equilibrium at 160°F±5°F and 85% ± 5%. Effective moisture equilibrium is achieved when the average moisture content of the traveler specimen changes by less than 0.02% for two consecutive determinations which are 7 ±0.5 days apart and may be expressed by:

$$\frac{W_i - W_{i-1}}{W_b} < 0.0002$$

Where:

W_i = weight at current time
W_{i-1} = weight at previous time
W_b = baseline weight prior to conditioning

When representative specimens could not be measured to determine the moisture content (due to size, fastener and tab effects), traveler coupons of at least 1” by 1” by specimen thickness and weighing at least 15 grams were used to establish weight gain measurements. If the specimens or traveler coupons pass the criteria for two consecutive readings which are 7 ±0.5 days apart, the specimens were kept in the environmental chamber for up to an additional 60 days. Alternatively, the specimens may have been removed from the environmental chamber and placed in a sealed plastic bag along with a moist cotton towel for a maximum of 14 days until mechanical testing. Strain-gaged specimens were removed from the controlled environment for a maximum of 2 hours for application of gages in ambient laboratory conditions.

1.5.6 Non-ambient Testing

The chamber was of adequate size so that all test fixtures and load frame grips were contained within the chamber.

For elevated temperature testing, the temperature chamber, test fixture, and grips were preheated to the specified temperature. Each specimen was heated to the required test temperature as verified by a thermocouple in direct contact with and taped to the specimen gage section. The heat-up time of the specimen did not exceed 5 minutes, unless otherwise specified in individual test summary sheets. The test was started 5^{+1}_{-0} minutes after the specimen reached the test temperature. During the test, the temperature, as measured on the specimen, was within ±5°F of the required test temperature.

For subzero temperature testing, each specimen was cooled to the required test temperature as verified by a thermocouple in direct contact with and taped to the specimen gage section. The test started 5^{+1}_{-0} **.** minutes after the specimen reached the test temperature. During the test, the temperature, as measured on the specimen, was within ±5°F of the required test temperature.

For wet specimens, the moisture loss was determined by subjecting representative specimens to the same amount of time required to heat-up and fail the specimens. For filled-hole or bearing specimens, fasteners were removed prior to conducting moisture loss measurements. For tabbed specimens, representative coupons without tabs and having the same number of plies were used to conduct the moisture loss measurements. A minimum of one specimen or representative coupon was used to measure the moisture loss for every combination of test temperature and stacking sequence.

1.5.7 Fluid Sensitivity Screening

Table 1-3 lists the requirements for fluid sensitivity screening, which requires ASTM D2344 Short Beam Strength testing on $[0°]_{45}$ lamina level specimens dried at 160°F±5°F for 120 to 130 hours before being subjected to the conditions indicated, five replicates per fluid and one cure cycle. Specimens were cleaned with a dry towel prior to the tests. In addition to short beam strength, load versus displacement curves were plotted to aid in the identification of matrix/resin softening. Since load versus displacement curves are influenced by test machine and fixture compliance, all the tests were performed with the identical machine and fixture, through a single setup. Experience suggests that for the vast majority of epoxy resins, water is the fluid with the most deleterious effect on properties. Should screening tests for fluid sensitivity indicate this to be the case, further testing of this type might be unnecessary since exposure to water moisture to equilibrium level is an inherent part of the multi batch allowables test program. However, users must evaluate the applicability of the exposure conditions and time on case-by-case basis. For example, the exposure condition for jet fuel may not fully represent the condition of integral fuel tanks.

Extended Contact:	Exposure	Test Condition	Code
ASTM D1655 Jet A Fuel (other jet fuel may be used but its type must be reported)	90 days min. @ 70°F±10°F	70°F	FS12RT
	90 days min. @ 70°F±10°F	180°F	FS12ET
MIL-PRF-5606 Hydraulic Oil	90 days min. @ 70°F±10°F	70°F	FS13RT
	90 days min. @ 70°F±10°F	180°F	FS13ET
MIL-PRF-83282 Hydraulic Oil	90 days min. @ 70°F±10°F	70°F	FS14RT
	90 days min. @ 70°F±10°F	180°F	FS14ET
MIL-PRF-23699, Class STD Engine Oil	90 days min. @ 70°F±10°F	70°F	FS16RT
	90 days min. @ 70°F±10°F	180°F	FS16ET
Sea Water (ASTM D1141 or equiv.)	90 days min. @ 70°F±10°F	70°F	FS17RT
	90 days min. @ 70°F±10°F	180°F	FS17ET
Short Duration Contact:			
MEK washing fluid. ASTM D740	90 minutes min. @ 70°F±10°F	70°F	FS21RT
	90 minutes min. @ 70°F±10°F	180°F	FS21ET
Polypropylene Glycol Deicer (Type I) SAE AMS 1424	90 minutes min. @ 70°F±10°F	70°F	FS22RT
	90 minutes min. @ 70°F±10°F	180°F	FS22ET
Isopropyl Alcohol Deicing Agent (TT-I-735)	48±4 hours @70°F±10°F	70°F	FS23RT
	48±4 hours @70°F±10°F	180°F	FS23ET
Control Tests:			
Distilled Water	90 days min. at 70°F±10°F	70°F	FS31RT
	90 days min. at 70°F±10°F	180°F	FS31ET
Dry (1)	Dry per section 1.5.5	70°F	FS32RT
	Dry per section 1.5.5	180°F	FS32ET
85% Relative Humidity (1)	Per section 1.5.5	70°F	FS33RT
	Per section 1.5.5	180°F	FS33ET

Note 1: Test results from Table 1-1 may be used in lieu of the control test results if the material is from the same batch.

Table 1-3: Fluid Sensitivity Matrix

1.5.8 Normalization Procedures

Most lamina level tension and compression strength and modulus properties, and all laminate level properties were normalized according to nominal cured ply thickness. Lamina level properties that were not normalized include 90º tensile strength and modulus (unidirectional only), 90º compressive strength and modulus (unidirectional only), in-plane shear strength and modulus, Poisson's ratio, SBS, and ILT. After normalizing, data scatter reduced or remained the same. If data scatter increased significantly after normalizing, the reason was investigated. Wherever properties are normalized, both measured and normalized data were reported.

For unidirectional materials the fiber areal weight cannot be measured in advance of impregnation, hence Method I of ASTM D3171, utilizing acid digestion, will be used to verify the CPT method in accordance with note (2) of Table 1-2.

Method I Fiber Volume (%vol) is 58.253 and Method 2 Fiber Volume (%vol) is 57.941. By comparing Fiber Volume values obtained from Method I and Method II, the values are deemed close enough therefore the FAW is close to the nominal of ~148 gsm. Based on the FAW data from TenCate (Avg ~148 gsm) and our Method I Phys test data (Avg. void content ~ 1.36%) it is appropriate to use the CPT Method for normalization.

The theoretically calculated cured ply thickness was 0.0055 inches. The experimentally measured cured ply thickness of 0.0058 inches has been used as the nominal cured ply thickness (CPT) for normalization purpose. This has been done at the request of the material supplier. The following normalization formula was used:

Normalized Value = Measured Value x Measured CPT / Nominal CPT.

1.5.9 Conformity

The 3-batch qualification panels have been fabricated according to the requirements of the test plan and conformed by an FAA DAR. The test specimens and test setup have also been conformed by an FAA DAR.

Testing was witnessed by an FAA DER. Mechanical testing was carried out at the National Institute for Aviation Research, Wichita State University.

1.5.10 Material Pedigree Information

The PMC Data Collection Template includes the material pedigree information required, such as material and batch information, as well as panel fabrication record, environmental conditioning, test equipment, and test procedures.

2. Test Results

2.1 Lamina Level Test Summary

Prepreg Material:	TenCate BT250E-6 IM7 GP 12k Unitape Gr 148gsm 33% RC			**TenCate BT250E-6 IM7 GP 12k Unitape Gr 148gsm 33% RC Lamina Properties Summary**	
Material Specification:	NMS 250/1				
Process Specification:	NPS 81250				
Fiber:	IM7 12k Unitape	**Resin:**	TenCate BT250E-6		
Tg(dry):	281.24 ºF	**Tg(wet):**	241.92 ºF	**Tg METHOD:**	ASTM D7028

	Batch 1	Batch 2	Batch 3		
Date of fiber manufacture	January 29, 2011	August 26, 2010	April 14, 2011	**Date of testing**	Nov 2011 - Apr 2012
Date of resin manufacture *	March 8, 2011	May 10, 2011	May 10, 2011	**Date of data submittal**	July 30, 2012
Date of prepreg manufacture	March 15, 2011	May 17, 2011	May 19, 2011		
Date of composite manufacture		Jun 2011 - Jul 2011			

LAMINA MECHANICAL PROPERTY SUMMARY
Data reported as: Normalized & Measured
(Normalized by CPT=0.0058 inch)

	CTD Mean		RTD Mean		ETD Mean		ETW Mean	
	Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
F_1^{tu} [ksi]	353.063	356.822	346.642	355.785			326.785	329.872
E_1^t [Msi]	22.334	22.576	22.015	22.603			22.922	23.133
ν_{12}^t		0.322		0.309				0.324
F_2^{tu} [ksi]		5.957		5.701				2.249
E_2^t [Msi]		1.364		1.248				0.939
F_1^{cu} [ksi] from UNC0 **	221.839	223.275	205.905	213.784			137.700	139.077
E_1^c [Msi]	20.308	20.430	19.426	20.228			19.401	19.804
F_2^{cu} [ksi]		33.194		27.527				14.267
E_2^c [Msi]		1.420		1.340				1.099
UNC0 Strength [ksi]	86.009	85.971	78.244	79.747	63.676	65.748	53.636	53.636
UNC0 Modulus [Msi]	7.874	7.866	7.382	7.546	7.431	7.621	7.557	7.638
$F_{12}^{s0.2\%}$ [ksi]		8.849		6.709				3.617
$F_{12}^{s5\%strain}$ [ksi]		12.706		10.084				5.137
G_{12}^s [Msi]		0.733		0.629				0.383
SBS [ksi]		12.422		9.874		8.029		5.171

*** Three unique resin lots were used, two of the resin lots were produced on the same day.**

**** Derived from cross-ply.**

Table 2-1: Lamina Summary Data

2.2 Individual Test Summaries

2.2.1 Longitudinal Tension Properties (LT)

Material:	TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%						**Tension, 1-axis** TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33% [0]8		
Resin content:	32.76 % wt		**Comp. density:**	1.522 g/cc					
Fiber volume:	57.70 % vol								
Ply count:	8								
Test method:	ASTM D 3039-08		**Modulus calculation:** 1000 to 3000 microstrain						
Normalized by:	0.0058	in. CPT							
			CTD		**RTD**		**ETW**		
Test Temperature [°F]			-65		70		180		
Moisture Conditioning			Dry		Dry		Equilbrium		
Equilbrium at T, RH							160 F,85%		
Source code			EAAJX XXXB		EAAJX XXXA		EAAJX XXXD		
			Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	
F_1^{tu} [ksi]	**Mean**		353.063	356.822	346.642	355.785	326.785	329.872	
	Minimum		303.912	311.751	299.503	320.699	268.436	276.480	
	Maximum		390.946	398.533	407.777	410.397	375.915	383.350	
	C.V.(%)		7.543	7.494	8.259	7.283	9.897	10.161	
	No. Specimens		22		22		22		
	No. Prepreg Lots		3		3		3		
E_1^t [Msi]	**Mean**		22.334	22.576	22.015	22.603	22.922	23.133	
	Minimum		20.081	19.938	20.525	21.377	21.530	21.897	
	Maximum		23.399	23.427	23.506	23.918	23.977	24.451	
	C.V.(%)		3.122	3.238	4.107	2.823	2.639	2.637	
	No. Specimens		19		22		22		
	No. Prepreg Lots		3		3		3		
ν_{12}^t	**Mean**			0.322		0.309		0.324	
	No. Specimens		16		21		20		
	No. Prepreg Lots		3		3		3		

2.2.2 Transverse Tension Properties (TT)

Material:	TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%						**Tension, 2-axis** TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33% [90]16		
Resin content:	32.58 % wt		**Comp. density:**	1.527 g/cc					
Fiber volume:	58.05 % vol								
Ply count:	16								
Test method:	ASTM D 3039-08		**Modulus calculation:**	1000 to 3000 microstrain					
Normalized by:	NA								
		CTD		**RTD**		**ETW**			
Test Temperature [°F]		-65		70		180			
Moisture Conditioning		Dry		Dry		Equilbrium			
Equilbrium at T, RH						160 F,85%			
Source code		EAAUX XXXB		EAAUX XXXA		EAAUX XXXD			
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**		
F_2^{tu} **[ksi]**	**Mean**		5.957		5.701		2.249		
	Minimum		4.424		4.573		1.682		
	Maximum		7.017		6.832		2.798		
	C.V.(%)		13.027		9.754		11.845		
	No. Specimens		23		21		21		
	No. Prepreg Lots		3		3		3		
E_2^t **[Msi]**	**Mean**		1.364		1.248		0.939		
	Minimum		1.339		1.219		0.859		
	Maximum		1.397		1.291		1.005		
	C.V.(%)		1.430		1.492		4.713		
	No. Specimens		18		21		21		
	No. Prepreg Lots		3		3		3		

2.2.3 Longitudinal Compression Properties (LC)

Material:	TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%						**Compression, 1-axis** TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33% [0]20		
Resin content:	33.15 % wt		**Comp. density:**	1.521 g/cc					
Fiber volume:	57.35 % vol								
Ply count:	20								
Test method:	ASTM D 6641-09		**Modulus calculation:**	1000 to 3000 microstrain					
Normalized by:	0.0058	in. CPT							
			CTD		**RTD**		**ETW**		
Test Temperature [°F]			-65		70		180		
Moisture Conditioning			Dry		Dry		Equilbrium		
Equilbrium at T, RH							160 F,85%		
Source code			EAALX XXXB		EAALX XXXA		EAALX XXXD		
			Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	
E_1^c [Msi]	**Mean**		20.308	20.430	19.426	20.228	19.401	19.804	
	Minimum		18.221	19.341	18.562	19.762	15.861	16.436	
	Maximum		21.004	21.896	20.662	20.987	21.854	22.111	
	C.V.(%)		3.328	2.719	3.313	1.741	7.823	7.459	
	No. Specimens		18		18		21		
	No. Prepreg Lots		3		3		3		

2.2.4 Transverse Compression Properties (TC)

Material:	TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%					**Compression, 2-axis** TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33% [90]20			
Resin content:	32.26 % wt	**Comp. density:**	1.527 g/cc						
Fiber volume:	58.34 % vol								
Ply count:	20								
Test method:	ASTM D 6641-09	**Modulus calculation:**	1000 to 3000 microstrain						
Normalized by:	NA								
		CTD		**RTD**		**ETW**			
Test Temperature [°F]		-65		70		180			
Moisture Conditioning		Dry		Dry		Equilbrium			
Equilbrium at T, RH						160 F,85%			
Source code		EAAZX XXXB		EAAZX XXXA		EAAZX XXXD			
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**		
F_2^{cu} **[ksi]**	**Mean**		33.194		27.527		14.267		
	Minimum		26.212		22.367		12.970		
	Maximum		40.379		31.136		15.844		
	C.V.(%)		11.482		7.550		4.865		
	No. Specimens		23		23		21		
	No. Prepreg Lots		3		3		3		
E_2^c **[Msi]**	**Mean**		1.420		1.340		1.099		
	Minimum		1.331		1.256		1.040		
	Maximum		1.520		1.410		1.171		
	C.V.(%)		3.604		2.819		3.454		
	No. Specimens		18		19		21		
	No. Prepreg Lots		3		3		3		

2.2.5 In-Plane Shear Properties (IPS)

Material:	TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%						**In-Plane Shear** TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33% [45/-45]4S		
Resin content:	32.54 % wt		**Comp. density:**	1.527 g/cc					
Fiber volume:	58.11 % vol								
Ply count:	16								
Test method:	ASTM D 3518-07		**Modulus calculation:**	2000 to 6000 microstrain					
Normalized by:	NA								
		CTD		**RTD**		**ETW**			
Test Temperature [°F]		-65		70		180			
Moisture Conditioning		Dry		Dry		Equilbrium			
Equilbrium at T, RH						160 F,85%			
Source code		EAANX XXXB		EAANX XXXA		EAANX XXXD			
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**		
$F_{12}^{s0.2\%}$ [ksi]	**Mean**		8.849		6.709		3.617		
	Minimum		8.603		6.415		3.325		
	Maximum		9.124		6.857		3.849		
	C.V.(%)		1.344		1.619		3.726		
	No. Specimens		21		21		21		
	No. Prepreg Lots		3		3		3		
$F_{12}^{s5\%strain}$ [ksi]	**Mean**		12.706		10.084		5.137		
	Minimum		11.893		9.663		4.666		
	Maximum		13.128		10.385		5.482		
	C.V.(%)		2.484		2.296		3.955		
	No. Specimens		16		20		21		
	No. Prepreg Lots		3		3		3		
G_{12}^{S} [Msi]	**Mean**		0.733		0.629		0.383		
	Minimum		0.697		0.594		0.335		
	Maximum		0.760		0.645		0.415		
	C.V.(%)		2.113		2.041		4.366		
	No. Specimens		21		21		21		
	No. Prepreg Lots		3		3		3		

2.2.6 "33/0/67" Unnotched Compression 0 Properties (UNC0)

Material:	TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%							**Unnotched Compression 0/90** TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33% [90/0/90]7	
Resin content:	33.01 % wt		**Comp. density:**	1.521 g/cc					
Fiber volume:	57.46 % vol								
Ply count:	21								
Test method:	ASTM D 6641-09		**Modulus calculation:**	1000 to 3000 microstrain					
Normalized by:	0.0058	in. CPT							
		CTD		**RTD**		**ETD**		**ETW**	
Test Temperature [°F]		-65		70		180		180	
Moisture Conditioning		Dry		Dry		Dry		Equilbrium	
Equilbrium at T, RH								160 F,85%	
Source code		EAARX XXXB		EAARX XXXA		EAARX XXXC		EAARX XXXD	
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
UNC0 Strength [ksi]	**Mean**	86.009	85.971	78.244	79.747	63.676	65.748	53.636	53.636
	Minimum	74.874	73.768	66.557	67.619	59.003	62.193	47.575	48.562
	Maximum	97.686	97.080	84.262	88.646	69.635	73.728	59.325	58.842
	C.V.(%)	7.150	6.945	5.929	6.027	6.122	6.224	5.691	5.764
	No. Specimens	21		21		8		23	
	No. Prepreg Lots	3		3		1		3	
UNC0 Modulus [Msi]	**Mean**	7.874	7.866	7.382	7.546	7.431	7.621	7.557	7.638
	Minimum	7.255	7.402	6.817	6.926	7.137	7.270	7.129	7.124
	Maximum	8.164	8.174	7.841	7.903	7.687	7.869	8.010	8.097
	C.V.(%)	3.376	2.671	3.488	3.627	2.934	3.351	3.362	3.141
	No. Specimens	18		18		6		21	
	No. Prepreg Lots	3		3		1		3	

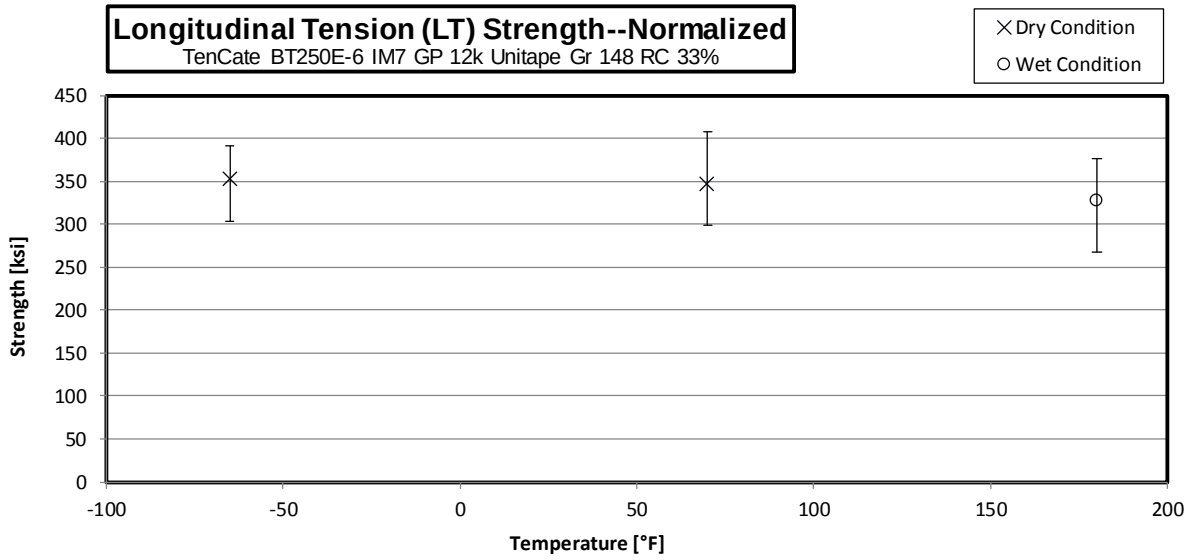
2.2.7 Lamina Short-Beam Strength Properties (SBS)

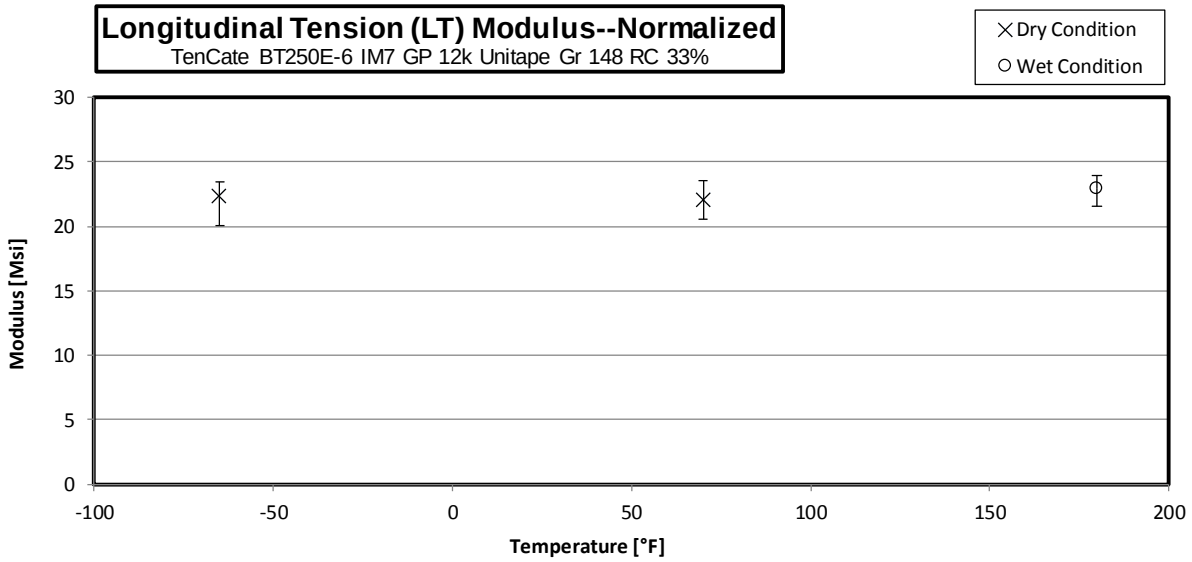
Material:	TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%					**Short-Beam Strength** TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33% [0]45		
Resin content:	32.26 % wt	**Comp. density:**	1.533 g/cc					
Fiber volume:	58.58 % vol							
Ply count:	45							
Test method:	ASTM D 2344-06							
Normalized by:	NA							
		CTD		**RTD**		**ETD**		**ETW**
Test Temperature [°F]		-65		70		180		180
Moisture Conditioning		Dry		Dry		Dry		Equilbrium
Equilbrium at T, RH								160 F,85%
Source code		EAAQX XXXB		EAAQX XXXA		EAAQX XXXC		EAAQX XXXD
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
SBS [ksi]	**Mean**		12.422		9.874		8.029		5.171
	Minimum		9.811		8.236		7.026		4.404
	Maximum		14.800		11.417		8.762		5.922
	C.V.(%)		11.151		9.291		7.488		9.229
	No. Specimens		21		21		22		21
	No. Prepreg Lots		3		3		3		3

3. Individual Test Charts

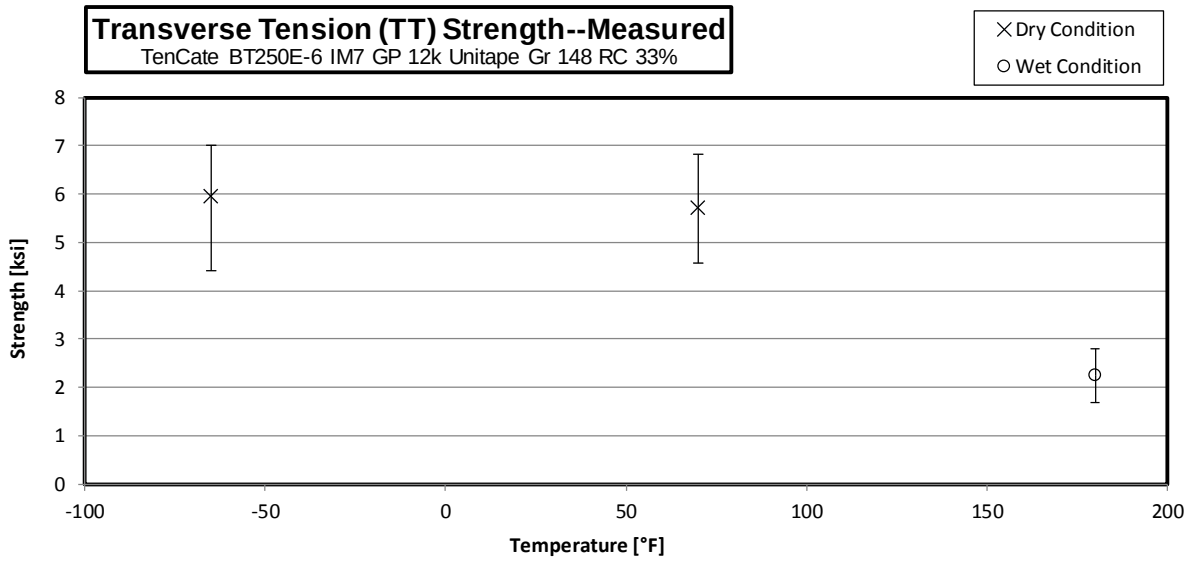
These charts combine all three batches of data and plot the minimum and maximum modulus and strength range based on the test temperature.

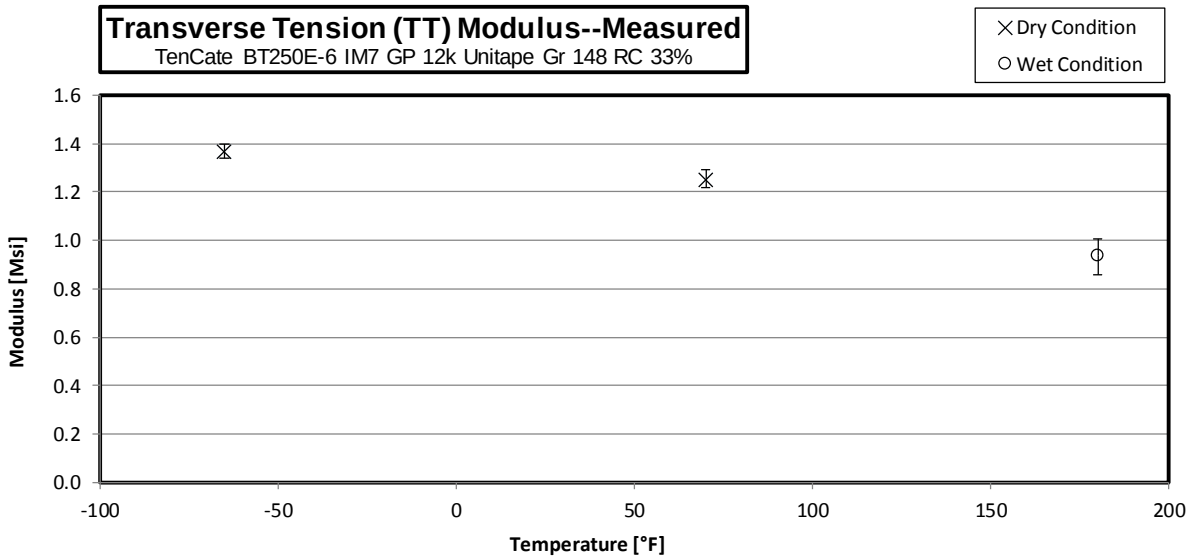
3.1 Longitudinal Tension Properties (LT)



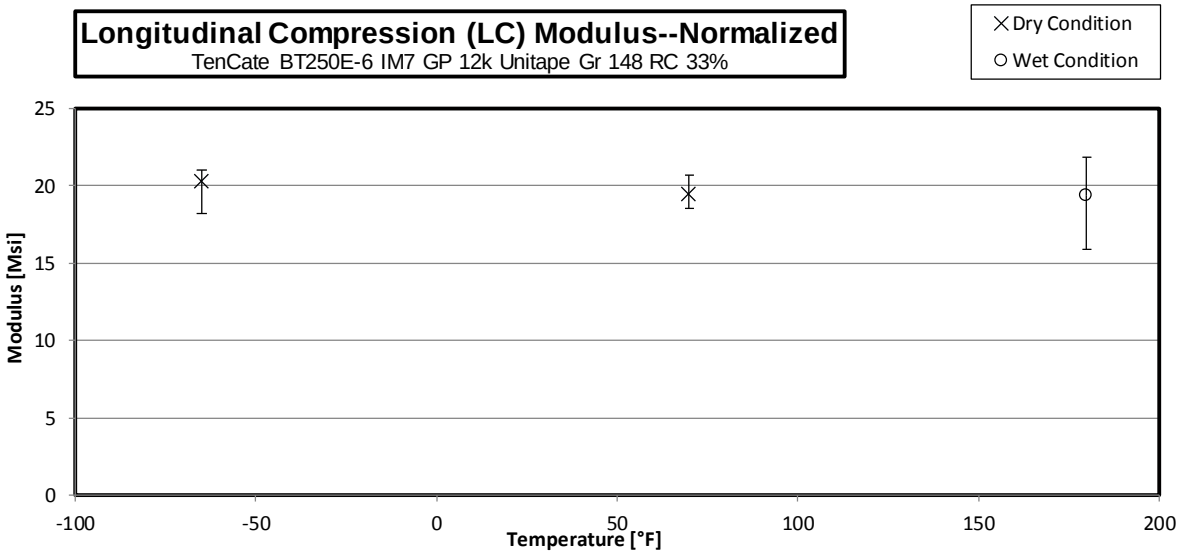


3.2 Transverse Tension Properties (TT)

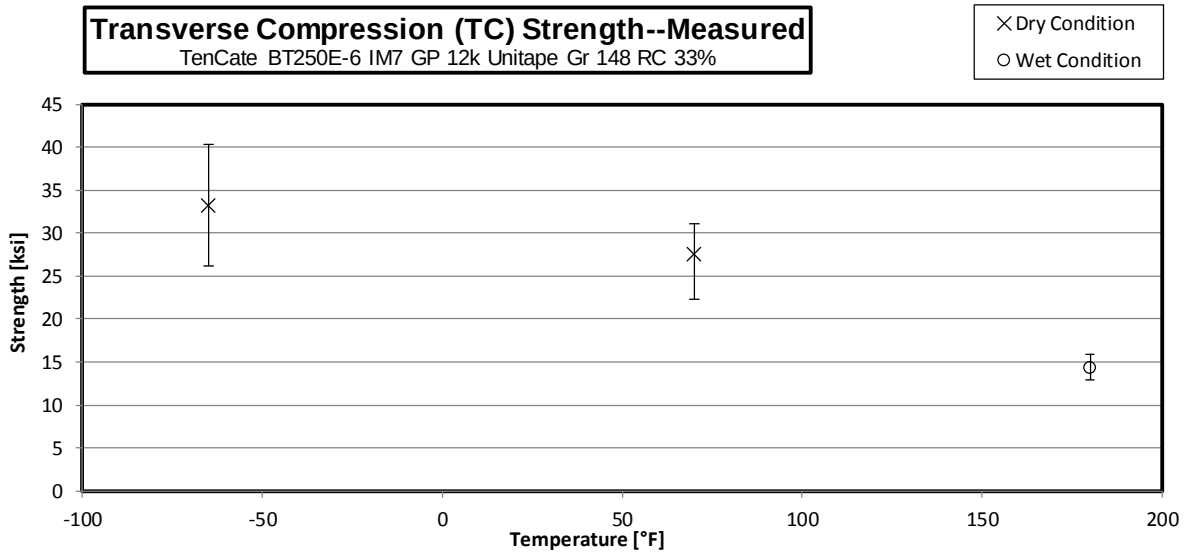


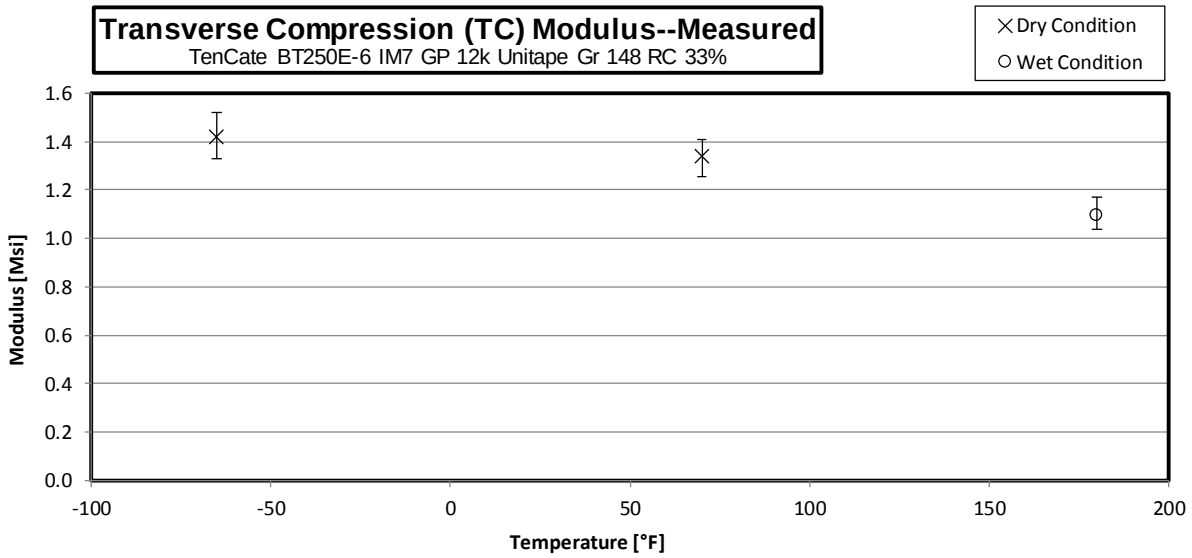


3.3 Longitudinal Compression Properties (LC)

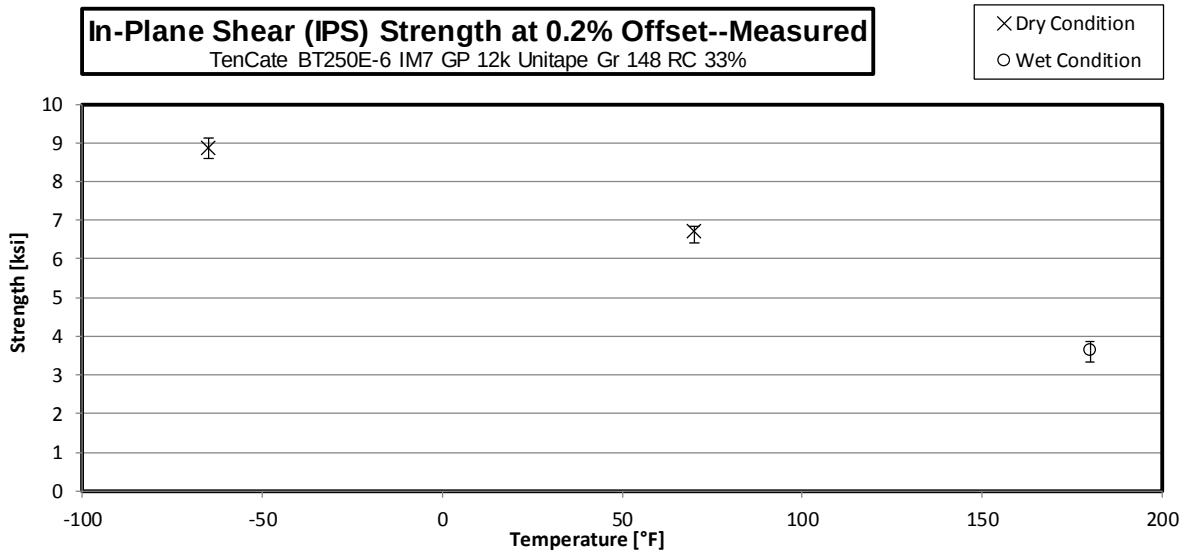


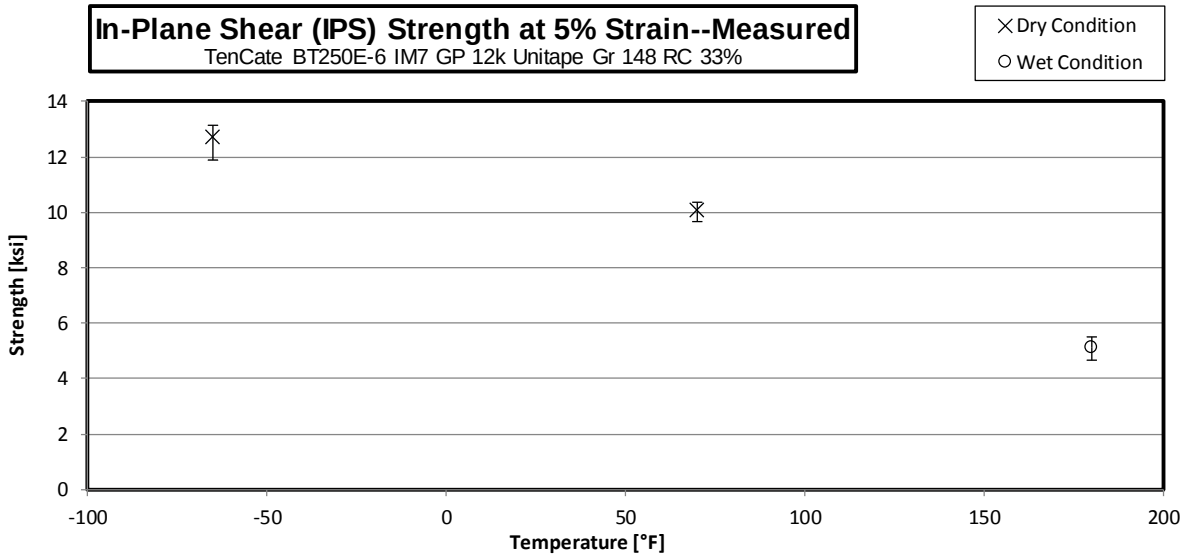
3.4 Transverse Compression Properties (TC)

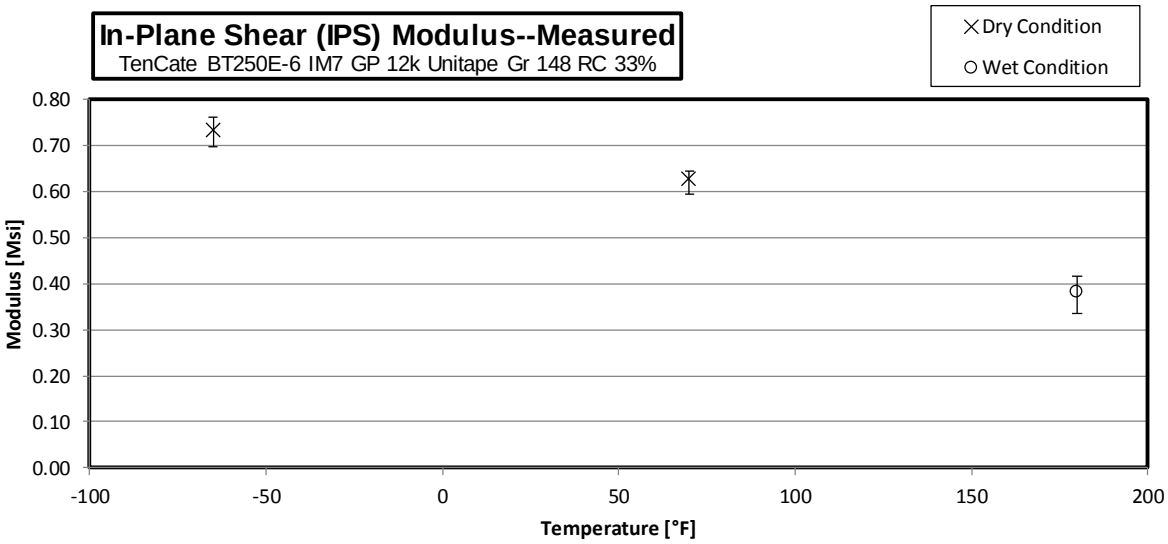




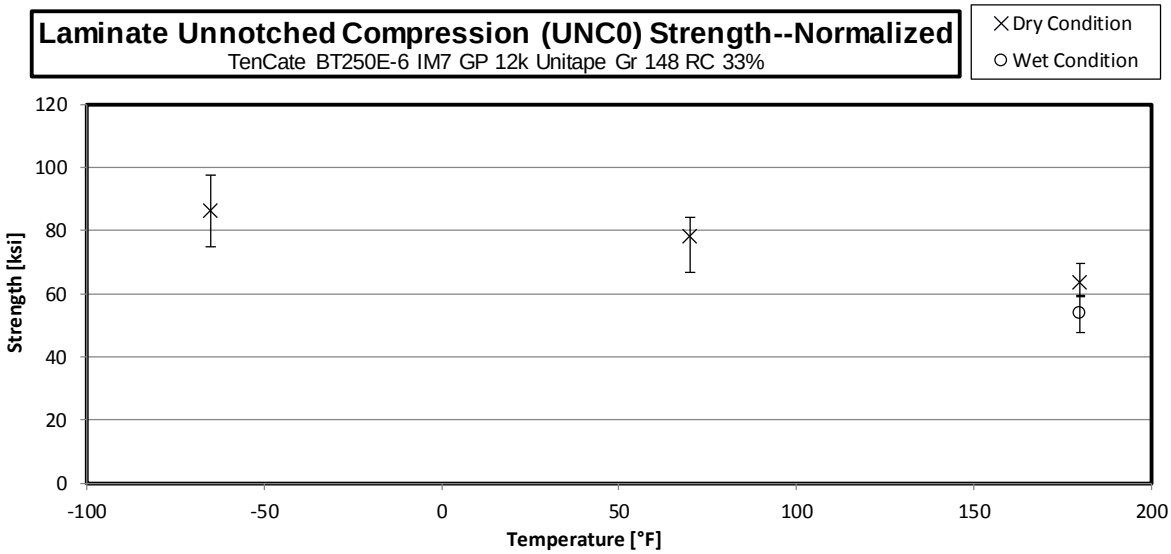
3.5 In-Plane Shear Properties (IPS)

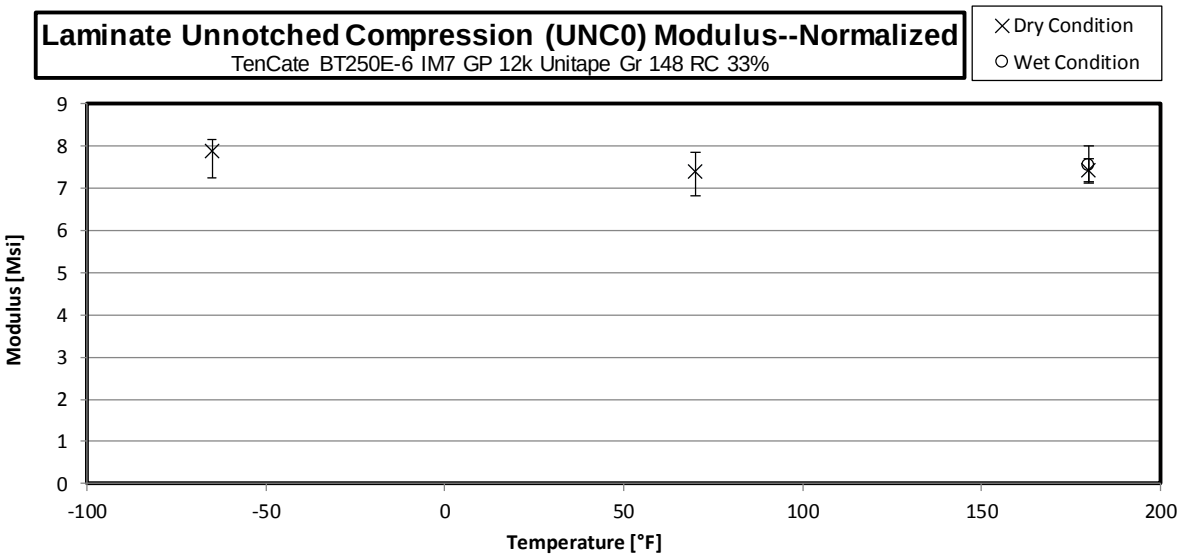




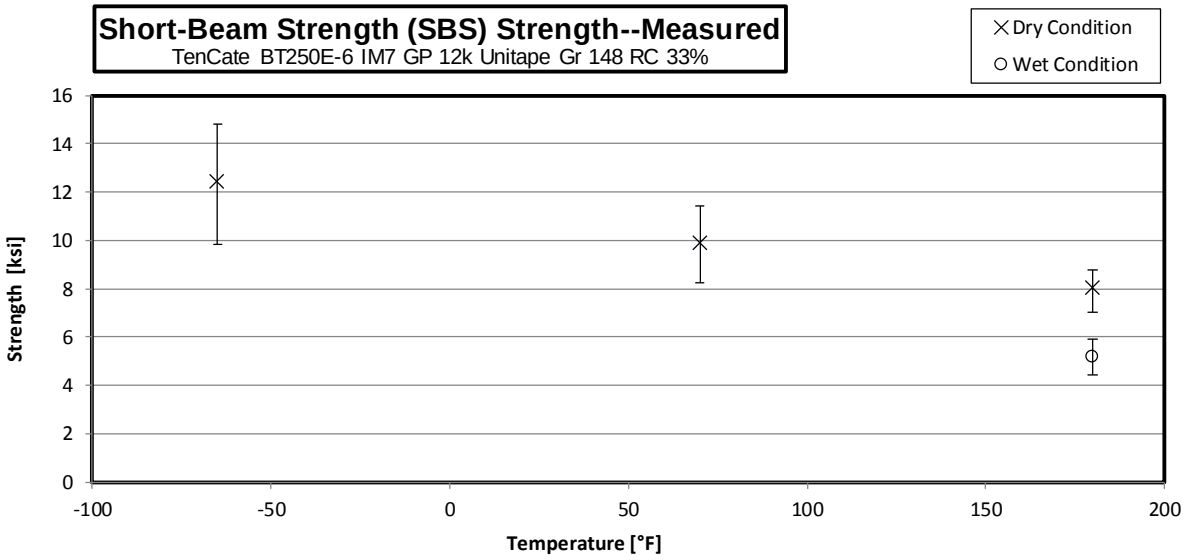

In-Plane Shear (IPS) Modulus--Measured
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Dry Condition
Wet Condition
Modulus [Msi]
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-100
-50
0
50
100
150
200
Temperature [°F]

3.6 "33/0/67" Unnotched Compression 0 Properties (UNC0)





3.7 Lamina Short-Beam Shear Properties (SBS)



4. Individual Test Data

4.1 Longitudinal Tension Properties (LT)

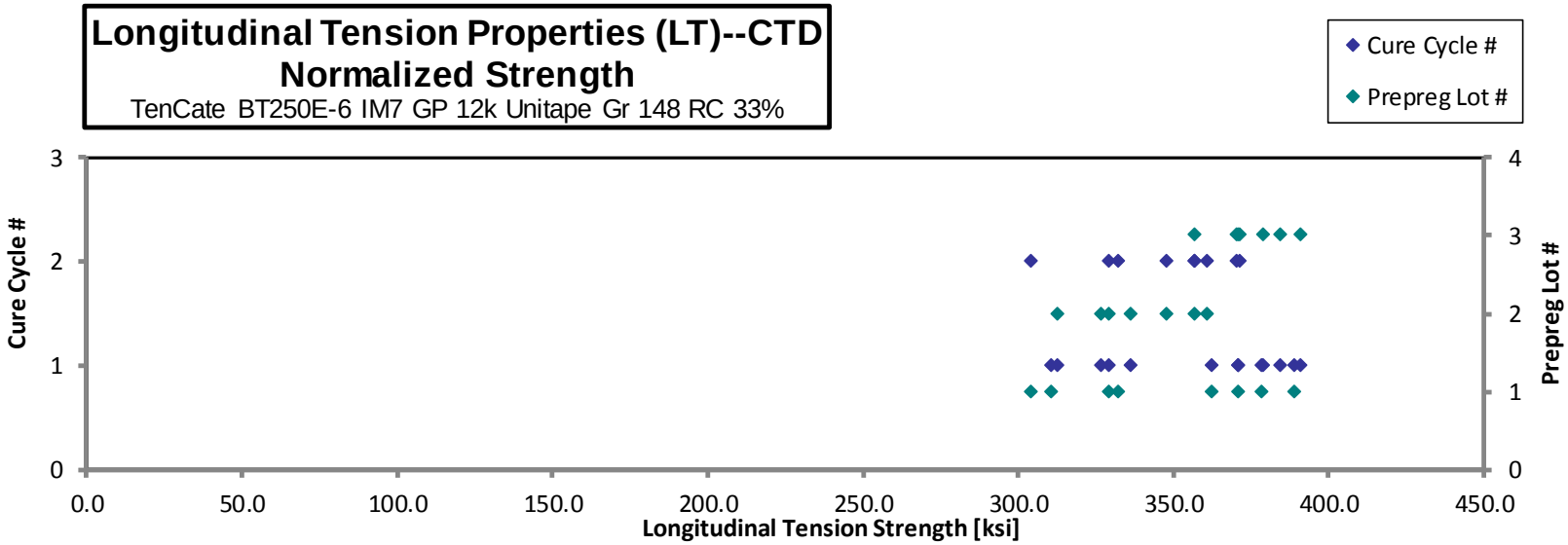
Longitudinal Tension Properties (LT)--CTD
Strength & Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

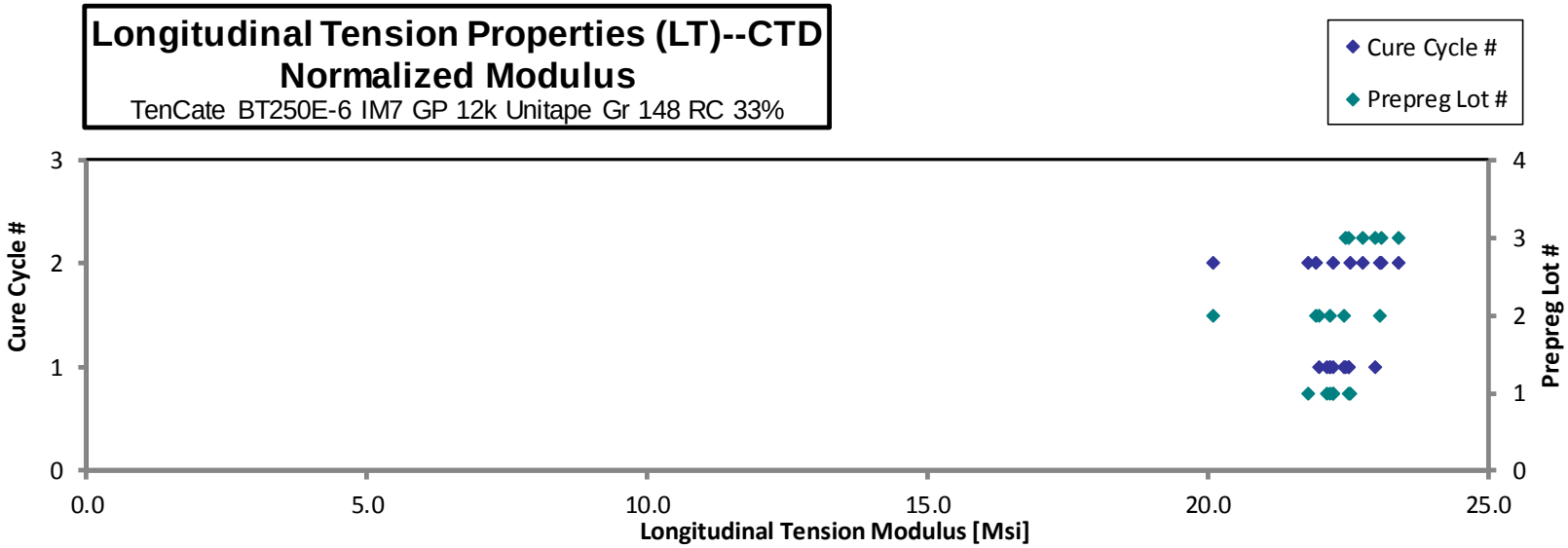
normalizing t_{ply} [in]
0.0058

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
EAAJA116B	A	C1	1	1	394.024	22.821	0.319	0.046	8	XGM	0.0057	388.646	22.510
EAAJA117B	A	C1	1	1	373.435	22.790	0.328	0.045	8	XGM	0.0056	362.168	22.103
EAAJA118B	A	C1	1	1	316.402	22.664	0.338	0.046	8	XGM	0.0057	310.265	22.224
EAAJA118B	A	C1	1	1	385.860	22.603	0.327	0.046	8	XGM	0.0057	378.375	22.165
EAAJA119B*	A	C1	1	1	381.467			0.045	8	XGM	0.0056	370.780	
EAAJA215B	A	C2	1	2	311.751	22.350	0.312	0.045	8	XGM	0.0057	303.912	21.788
EAAJA216B	A	C2	1	2	336.147	23.023	0.356	0.045	8	XGM	0.0057	329.023	22.535
EAAJA217B	A	C2	1	2	339.217	22.690	0.308	0.045	8	XGM	0.0057	332.150	22.217
EAAJB116B	B	C1	2	1	316.650	22.276	0.311	0.046	8	XGM	0.0057	312.328	21.972
EAAJB117B	B	C1	2	1	339.558	22.384	0.324	0.046	8	XGM	0.0057	336.143	22.159
EAAJB118B	B	C1	2	1	330.422	22.510	0.309	0.046	8	XGM	0.0058	329.235	22.429
EAAJB119B*	B	C1	2	1	328.237			0.046	8	SGM	0.0058	326.704	
EAAJB215B	B	C2	2	2	354.005	19.938	**	0.047	8	SGM/XGM	0.0058	356.548	20.081
EAAJB216B	B	C2	2	2	346.302	22.975	**	0.047	8	XGM	0.0058	347.546	23.058
EAAJB217B	B	C2	2	2	361.351	21.959	**	0.046	8	XGM	0.0058	360.702	21.920
EAAJC116B	C	C1	3	1	380.545	22.626	0.289	0.046	8	XGM	0.0058	378.495	22.504
EAAJC117B	C	C1	3	1	381.816	23.129	0.321	0.045	8	XGM	0.0056	370.707	22.456
EAAJC118B	C	C1	3	1	398.533	23.427	0.314	0.046	8	XGM	0.0057	390.946	22.981
EAAJC119B*	C	C1	3	1	383.265			0.047	8	XGM	0.0058	384.366	
EAAJC215B	C	C2	3	2	368.514	23.282	0.323	0.047	8	XGM	0.0058	370.368	23.399
EAAJC216B	C	C2	3	2	353.085	22.850	0.353	0.047	8	XGM	0.0059	356.636	23.079
EAAJC217B	C	C2	3	2	369.493	22.650	0.323	0.047	8	XGM	0.0058	371.351	22.764

* Specimen was not gaged and tested for strength only.
** Poissons ratio not reported due to non linear/anomalous data.

Average	**356.822**	**22.576**	**0.322**	**$Average_{norm}$**	**0.0057**	**353.063**	**22.334**
Standard Dev.	**26.740**	**0.731**	**0.017**	**$Standard\ Dev._{norm}$**		**26.633**	**0.697**
Coeff. of Var. [%]	**7.494**	**3.238**	**5.219**	**Coeff. of Var. $[\%]_{norm}$**		**7.543**	**3.122**
Min.	**311.751**	**19.938**	**0.289**	**Min.**	**0.0056**	**303.912**	**20.081**
Max.	**398.533**	**23.427**	**0.356**	**Max.**	**0.0059**	**390.946**	**23.399**
Number of Spec.	**22**	**19**	**16**	**Number of Spec.**	**22**	**22**	**19**


Longitudinal Tension Properties (LT)--CTD
Normalized Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
Longitudinal Tension Strength [ksi]


Longitudinal Tension Properties (LT)--CTD
Normalized Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
5.0
10.0
15.0
20.0
25.0
Longitudinal Tension Modulus [Msi]

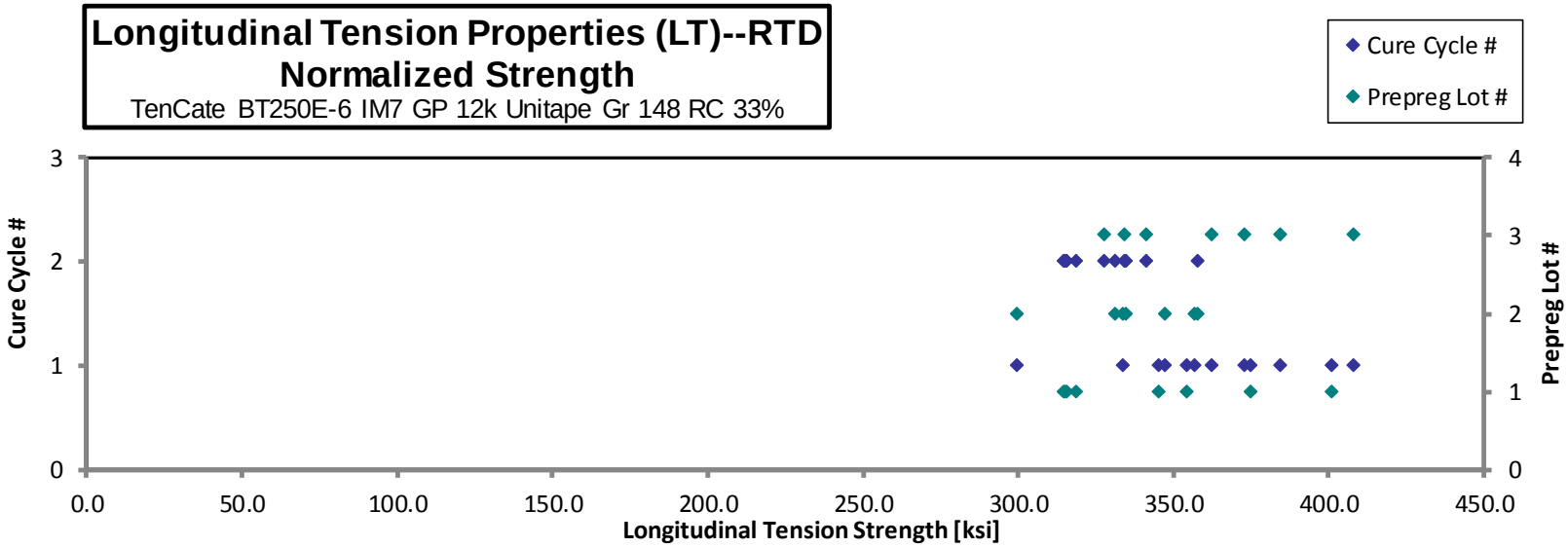
Longitudinal Tension Properties (LT)--RTD
Strength & Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

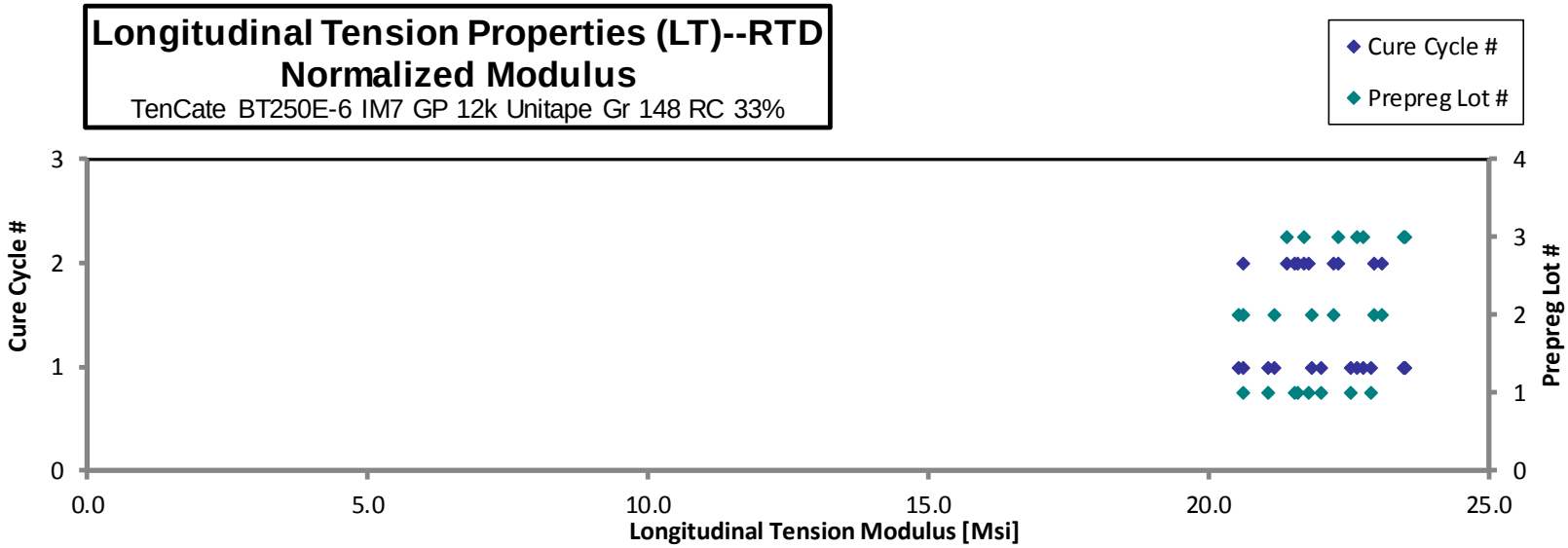
normalizing t_{ply} [in]: 0.0058

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
EAAJA111A	A	C1	1	1	372.011	22.702	0.327	0.043	8	XGM	0.0054	345.152	21.063
EAAJA112A	A	C1	1	1	396.349	23.286	0.340	0.044	8	XGM	0.0055	374.851	22.023
EAAJA113A	A	C1	1	1	361.394	23.006	0.306	0.045	8	XGM	0.0057	354.124	22.543
EAAJA114A	A	C1	1	1	410.397	23.442	0.301	0.045	8	XGM	0.0057	400.963	22.903
EAAJA211A	A	C2	1	2	334.322	21.926	0.313	0.044	8	XGM	0.0055	314.628	20.634
EAAJA212A	A	C2	1	2	332.825	22.767	0.291	0.044	8	XGM	0.0055	315.610	21.589
EAAJA213A	A	C2	1	2	327.050	22.372	*	0.045	8	XGM	0.0056	314.715	21.528
EAAJA214A	A	C2	1	2	331.085	22.680	0.294	0.045	8	XGM	0.0056	318.241	21.800
EAAJB111A	B	C1	2	1	320.699	21.977	0.302	0.043	8	XGM	0.0054	299.503	20.525
EAAJB112A	B	C1	2	1	345.527	21.377	0.321	0.045	8	XGM	0.0056	333.488	20.632
EAAJB113A	B	C1	2	1	350.553	21.382	0.311	0.046	8	XGM	0.0057	347.153	21.175
EAAJB114A	B	C1	2	1	359.743	22.045	0.303	0.046	8	XGM	0.0057	356.512	21.847
EAAJB211A	B	C2	2	2	341.968	22.730	0.300	0.045	8	XGM	0.0057	334.475	22.232
EAAJB212A	B	C2	2	2	330.333	22.919	0.319	0.046	8	XGM	0.0058	330.926	22.960
EAAJB213A	B	C2	2	2	353.471	22.829	0.307	0.047	8	XGM	0.0059	357.406	23.083
EAAJC111A	C	C1	3	1	372.974	23.513	0.310	0.046	8	XGM	0.0058	372.438	23.479
EAAJC112A	C	C1	3	1	368.277	23.918	0.306	0.046	8	XGM	0.0057	361.927	23.506
EAAJC113A	C	C1	3	1	383.274	22.714	0.312	0.046	8	XGM	0.0058	383.963	22.755
EAAJC114A	C	C1	3	1	407.777	22.639	0.306	0.046	8	XGM	0.0058	407.777	22.639
EAAJC211A	C	C2	3	2	342.661	22.382	0.307	0.044	8	XGM	0.0055	327.645	21.401
EAAJC212A	C	C2	3	2	348.730	22.203	0.303	0.045	8	XGM	0.0057	340.838	21.701
EAAJC213A	C	C2	3	2	335.846	22.457	0.309	0.046	8	XGM	0.0058	333.795	22.320

*Poissons ratio not reported due to anomalous data.

Average	**355.785**	**22.603**	**0.309**	**$Average_{norm}$**	**0.0056**	**346.642**	**22.015**
Standard Dev.	**25.912**	**0.638**	**0.011**	**$Standard\ Dev._{norm}$**		**28.628**	**0.904**
Coeff. of Var. [%]	**7.283**	**2.823**	**3.562**	**Coeff. of Var. [%]$_{norm}$**		**8.259**	**4.107**
Min.	**320.699**	**21.377**	**0.291**	**Min.**	**0.0054**	**299.503**	**20.525**
Max.	**410.397**	**23.918**	**0.340**	**Max.**	**0.0059**	**407.777**	**23.506**
Number of Spec.	**22**	**22**	**21**	**Number of Spec.**	**22**	**22**	**22**


Longitudinal Tension Properties (LT)--RTD
Normalized Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
Longitudinal Tension Strength [ksi]


Longitudinal Tension Properties (LT)--RTD
Normalized Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
5.0
10.0
15.0
20.0
25.0
Longitudinal Tension Modulus [Msi]

Longitudinal Tension Properties (LT)--ETW
Strength & Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

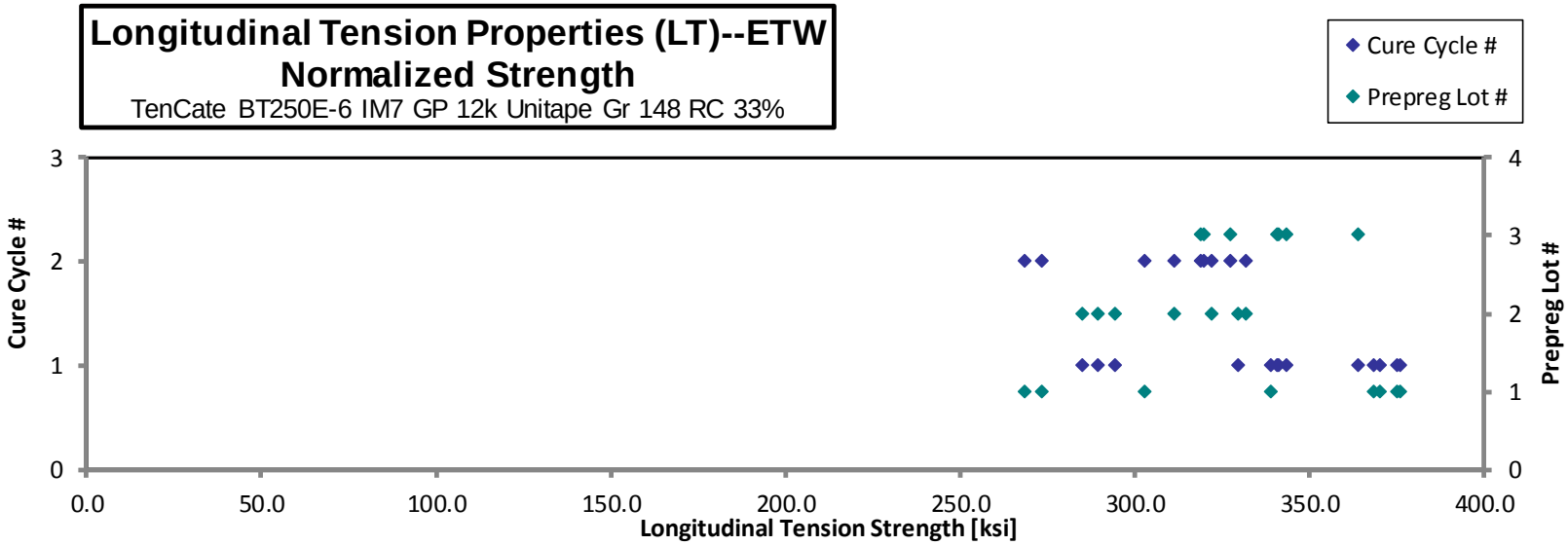
normalizing t_{ply} [in]
0.0058

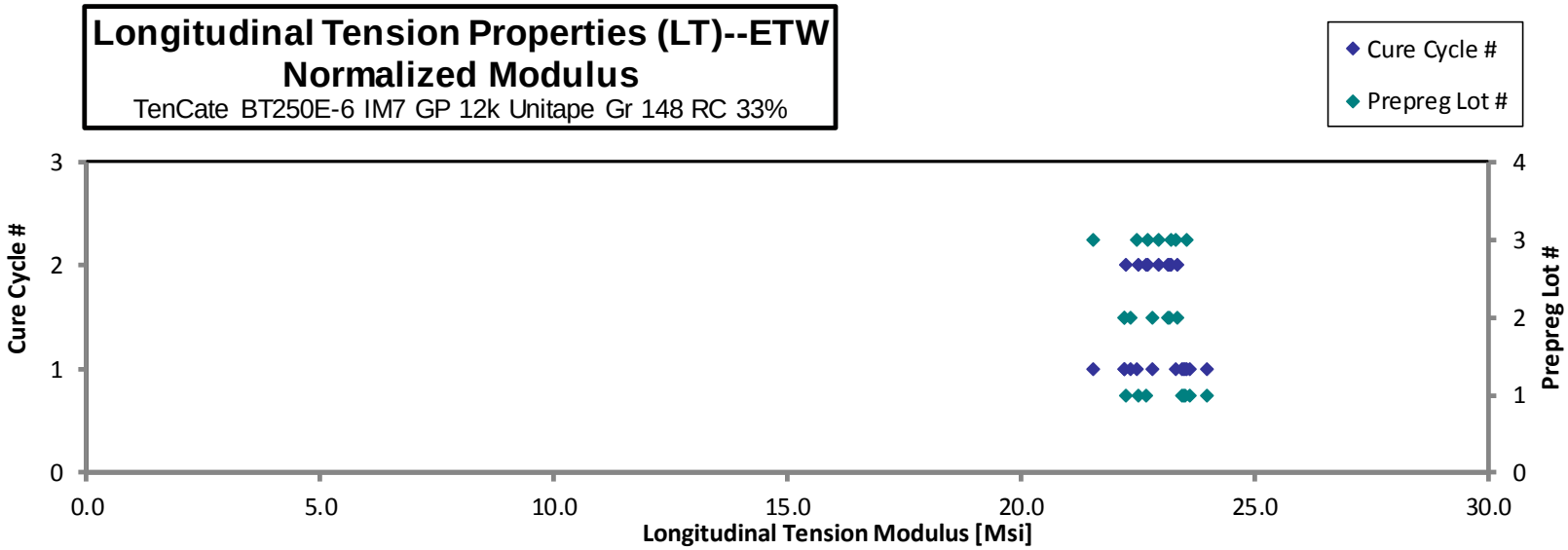
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
EAAJA11BD	A	C1	1	1	383.350	24.451	0.367	0.046	8	XGM/SGM	0.0057	375.915	23.977
EAAJA11CD	A	C1	1	1	343.949	23.849	*	0.046	8	XGM/SGM	0.0057	338.637	23.481
EAAJA11DD	A	C1	1	1	372.266	23.691	0.334	0.046	8	XGM/SGM	0.0057	368.388	23.444
EAAJA11ED	A	C1	1	1	371.575	23.612	0.316	0.046	8	XGM/SGM	0.0058	369.973	23.510
EAAJA11FD	A	C1	1	1	379.119	23.884	0.283	0.046	8	XGM/SGM	0.0057	374.898	23.618
EAAJA219D	A	C2	1	2	278.456	23.102	0.261	0.046	8	XGM/SGM	0.0057	273.055	22.654
EAAJA21AD	A	C2	1	2	276.480	22.904	0.336	0.045	8	XGM/SGM	0.0056	268.436	22.238
EAAJA21BD	A	C2	1	2	311.270	23.111	*	0.045	8	XGM/SGM	0.0056	302.884	22.488
EAAJB11BD	B	C1	2	1	284.546	22.173	0.312	0.046	8	XGM/SGM	0.0058	285.057	22.213
EAAJB11CD	B	C1	2	1	293.106	22.245	0.316	0.047	8	XGM/SGM	0.0058	294.369	22.341
EAAJB11DD	B	C1	2	1	285.876	22.513	0.321	0.047	8	XGM/SGM	0.0059	289.367	22.788
EAAJB11ED	B	C1	2	1	324.718	21.897	0.323	0.047	8	XGM/SGM	0.0059	329.500	22.219
EAAJB219D	B	C2	2	2	311.539	23.157	0.330	0.046	8	XGM/SGM	0.0058	311.203	23.132
EAAJB21AD	B	C2	2	2	332.475	23.235	0.331	0.046	8	XGM/SGM	0.0058	331.639	23.177
EAAJB21BD	B	C2	2	2	320.651	23.258	0.317	0.047	8	XGM/SGM	0.0058	321.803	23.341
EAAJC11BD	C	C1	3	1	343.636	23.720	0.312	0.046	8	XGM/SGM	0.0058	340.797	23.524
EAAJC11CD	C	C1	3	1	364.268	23.355	0.340	0.046	8	XGM/SGM	0.0058	363.613	23.313
EAAJC11DD	C	C1	3	1	360.415	22.610	0.331	0.044	8	XGM/SGM	0.0055	343.197	21.530
EAAJC11ED	C	C1	3	1	350.747	23.098	0.362	0.045	8	XGM/SGM	0.0056	341.046	22.460
EAAJC219D	C	C2	3	2	319.205	23.169	0.350	0.046	8	XGM/SGM	0.0058	319.549	23.194
EAAJC21AD	C	C2	3	2	328.673	23.023	0.300	0.046	8	XGM/SGM	0.0058	327.375	22.932
EAAJC21BD	C	C2	3	2	320.875	22.869	0.343	0.046	8	XGM/SGM	0.0058	318.570	22.705

*Poissons ratio not reported due to anomalous data.

Average	**329.872**	**23.133**	**0.324**
Standard Dev.	**33.519**	**0.610**	**0.025**
Coeff. of Var. [%]	**10.161**	**2.637**	**7.629**
Min.	**276.480**	**21.897**	**0.261**
Max.	**383.350**	**24.451**	**0.367**
Number of Spec.	**22**	**22**	**20**

$Average_{norm}$	**0.0057**	**326.785**	**22.922**
$Standard\ Dev._{norm}$		**32.341**	**0.605**
$Coeff.\ of\ Var.\ [\%]_{norm}$		**9.897**	**2.639**
Min.	**0.0055**	**268.436**	**21.530**
Max.	**0.0059**	**375.915**	**23.977**
Number of Spec.	**22**	**22**	**22**


Longitudinal Tension Properties (LT)--ETW
Normalized Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
Longitudinal Tension Strength [ksi]


Longitudinal Tension Properties (LT)--ETW
Normalized Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
5.0
10.0
15.0
20.0
25.0
30.0
Longitudinal Tension Modulus [Msi]

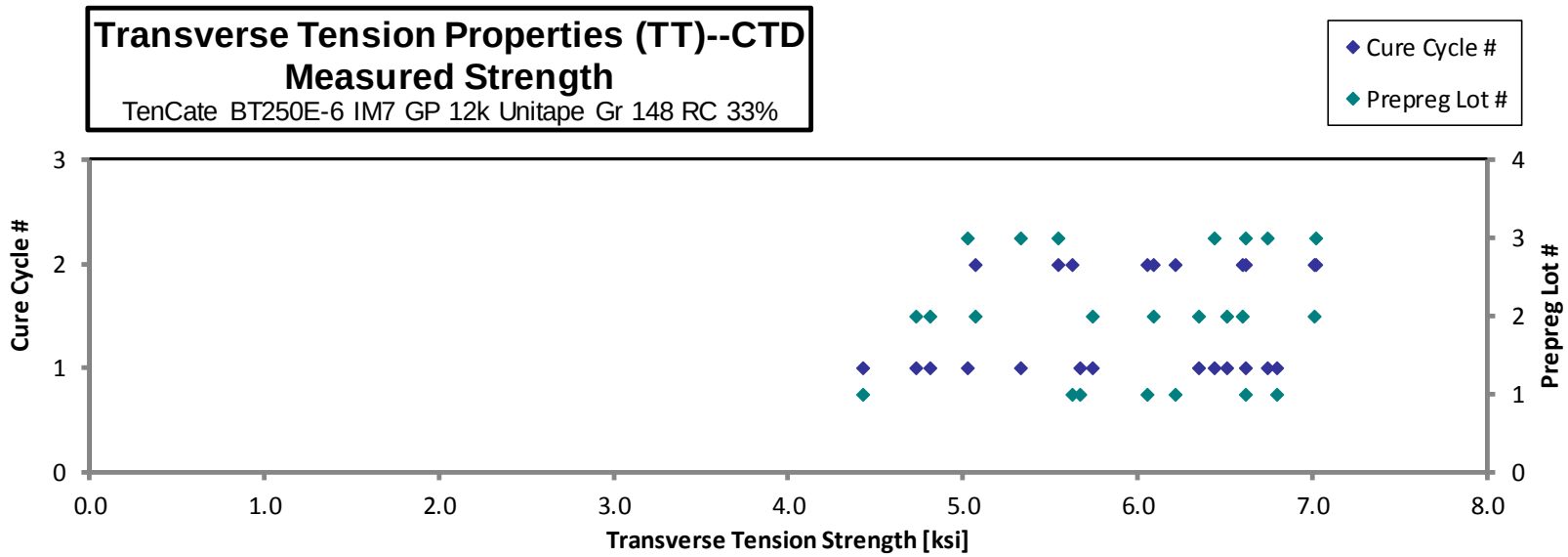
4.2 Transverse Tension Properties (TT)

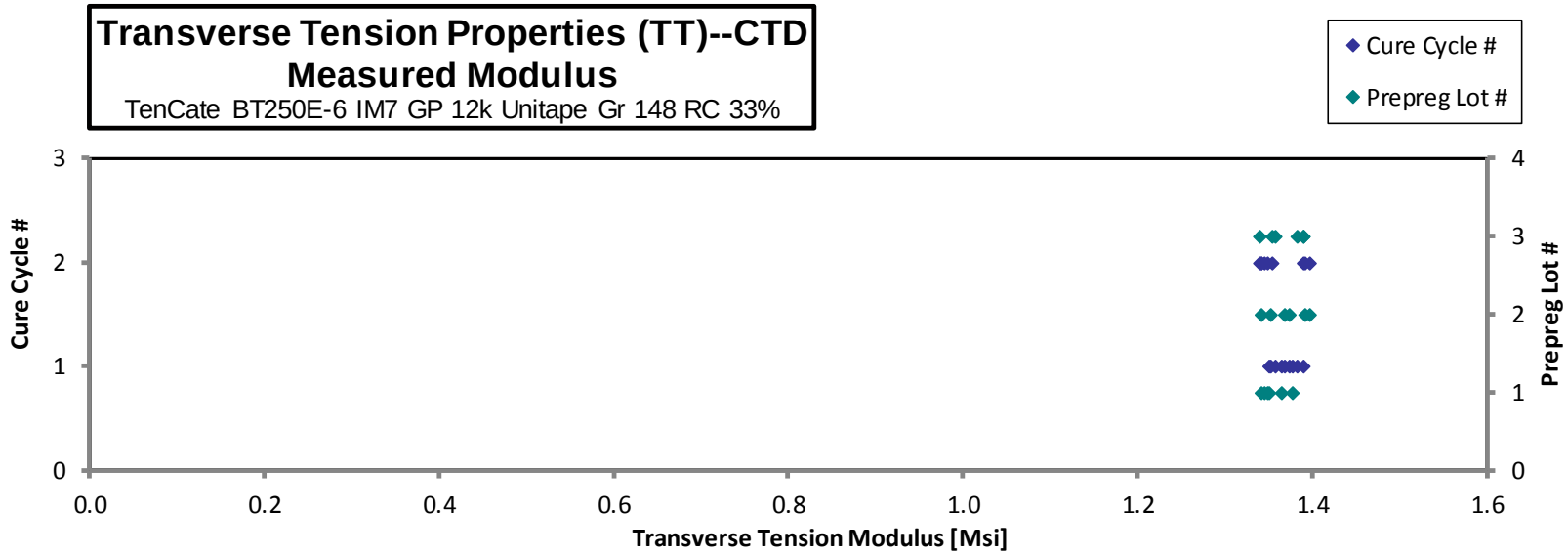
Transverse Tension Properties (TT)--CTD
Strength & Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode
EAAUA116B	A	C1	1	1	6.612	1.351	0.090	16	0.0056	LAT
EAAUA117B	A	C1	1	1	4.424	1.365	0.091	16	0.0057	LWB
EAAUA118B	A	C1	1	1	5.672	1.376	0.090	16	0.0056	LGM
EAAUA119B*	A	C1	1	1	6.796		0.087	16	0.0054	LAT
EAAUA215B	A	C2	1	2	5.623	1.344	0.090	16	0.0056	LGM
EAAUA216B	A	C2	1	2	6.055	1.341	0.090	16	0.0056	LWT
EAAUA217B	A	C2	1	2	6.216	1.349	0.088	16	0.0055	LGM
EAAUB116B	B	C1	2	1	4.729	1.368	0.093	16	0.0058	LAB
EAAUB117B	B	C1	2	1	6.349	1.352	0.093	16	0.0058	LAB
EAAUB118B	B	C1	2	1	6.508	1.373	0.093	16	0.0058	LAT
EAAUB119B*	B	C1	2	1	5.739		0.092	16	0.0057	LAT
EAAUB11AB*	B	C1	2	1	4.808		0.093	16	0.0058	LAB
EAAUB215B	B	C2	2	2	5.073	1.341	0.094	16	0.0058	LAT
EAAUB216B	B	C2	2	2	6.597	1.397	0.092	16	0.0057	LWB
EAAUB217B	B	C2	2	2	6.086	1.391	0.093	16	0.0058	LGM
EAAUB218B*	B	C2	2	2	7.010		0.093	16	0.0058	LGM
EAAUC116B	C	C1	3	1	6.438	1.389	0.091	16	0.0057	LGM
EAAUC117B	C	C1	3	1	5.330	1.357	0.092	16	0.0057	LGM
EAAUC118B	C	C1	3	1	6.743	1.382	0.092	16	0.0057	LGM
EAAUC119B*	C	C1	3	1	5.023		0.092	16	0.0057	LAT
EAAUC215B	C	C2	3	2	7.017	1.339	0.092	16	0.0057	LAB
EAAUC216B	C	C2	3	2	6.619	1.354	0.092	16	0.0057	LAB
EAAUC217B	C	C2	3	2	5.543	1.390	0.091	16	0.0057	LGM

* Specimen was not gaged and tested for strength only.

Average	**5.957**	**1.364**	**Average**	**0.0057**
Standard Dev.	**0.776**	**0.020**	**Standard Dev.**	
Coeff. of Var. [%]	**13.027**	**1.430**	**Coeff. of Var. [%]**	
Min.	**4.424**	**1.339**	**Min.**	**0.0054**
Max.	**7.017**	**1.397**	**Max.**	**0.0058**
Number of Spec.	**23**	**18**	**Number of Spec.**	**23**


Transverse Tension Properties (TT)--CTD
Measured Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
Transverse Tension Strength [ksi]
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
0
1
2
3
4

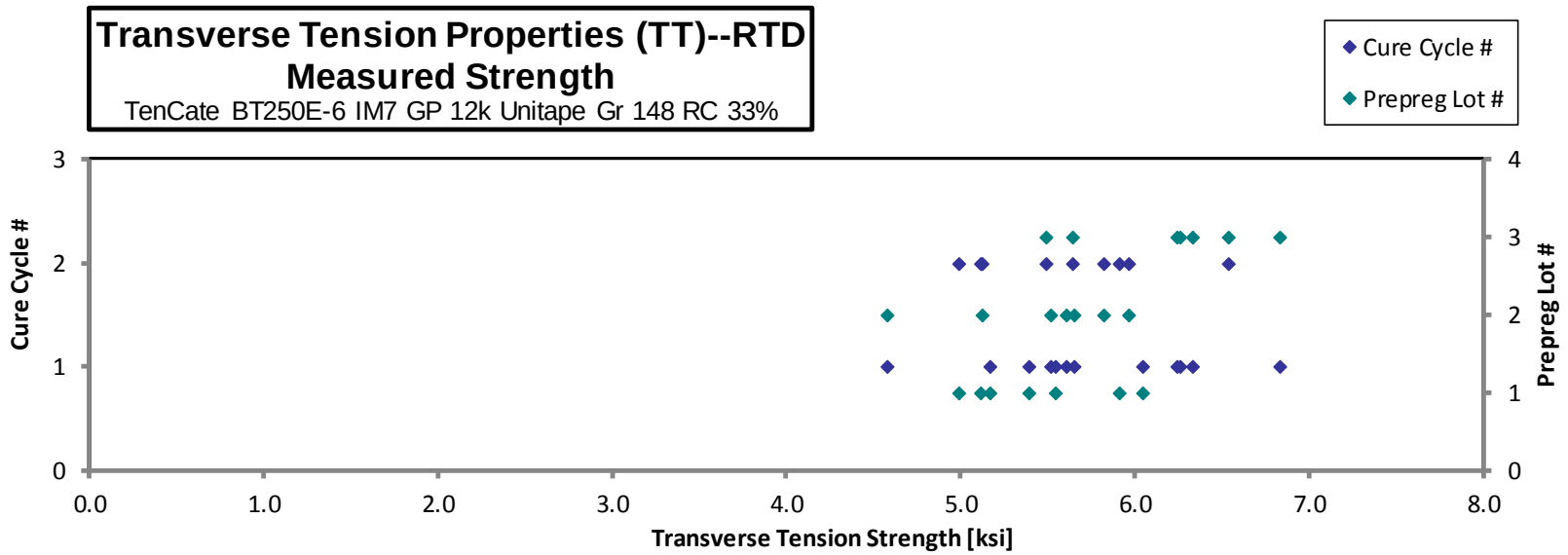

Transverse Tension Properties (TT)--CTD
Measured Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
Transverse Tension Modulus [Msi]
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
0
1
2
3
4

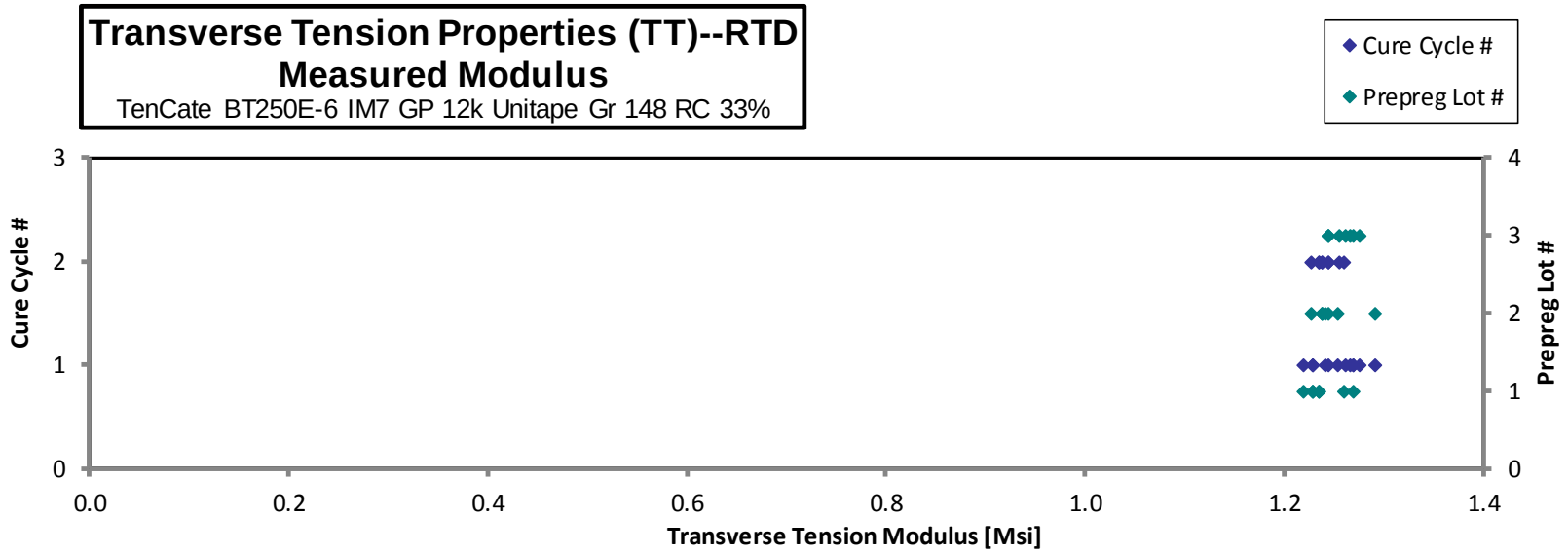
Transverse Tension Properties (TT)--RTD
Strength & Modulus

TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode
EAAUA111A	A	C1	1	1	5.387	1.268	0.089	16	0.0056	LAT
EAAUA112A	A	C1	1	1	5.541	1.228	0.092	16	0.0057	LAB
EAAUA113A	A	C1	1	1	5.167	1.219	0.091	16	0.0057	LAT
EAAUA114A	A	C1	1	1	6.040	1.229	0.090	16	0.0056	LWB
EAAUA211A	A	C2	1	2	5.910	1.259	0.089	16	0.0055	LAB
EAAUA212A	A	C2	1	2	4.984	1.235	0.090	16	0.0056	LAB
EAAUA213A	A	C2	1	2	5.111	1.234	0.090	16	0.0056	LGM
EAAUB111A	B	C1	2	1	5.652	1.291	0.091	16	0.0057	LAT
EAAUB112A	B	C1	2	1	5.608	1.254	0.092	16	0.0058	LAB
EAAUB113A	B	C1	2	1	5.513	1.244	0.093	16	0.0058	LAB
EAAUB114A	B	C1	2	1	4.573	1.241	0.093	16	0.0058	LGM
EAAUB211A	B	C2	2	2	5.127	1.238	0.093	16	0.0058	LGM
EAAUB212A	B	C2	2	2	5.964	1.226	0.094	16	0.0059	LGM
EAAUB213A	B	C2	2	2	5.818	1.237	0.094	16	0.0058	LAT
EAAUC111A	C	C1	3	1	6.832	1.275	0.091	16	0.0057	LWB
EAAUC112A	C	C1	3	1	6.326	1.266	0.092	16	0.0057	LGM
EAAUC113A	C	C1	3	1	6.258	1.260	0.092	16	0.0057	LAB
EAAUC114A	C	C1	3	1	6.243	1.270	0.091	16	0.0057	LAB
EAAUC211A	C	C2	3	2	5.642	1.254	0.091	16	0.0057	LAB
EAAUC212A	C	C2	3	2	5.491	1.243	0.092	16	0.0058	LGM
EAAUC213A	C	C2	3	2	6.539	1.244	0.092	16	0.0058	LWB

Average	**5.701**	**1.248**	**Average**	**0.0057**
Standard Dev.	**0.556**	**0.019**	**Standard Dev.**	
Coeff. of Var. [%]	**9.754**	**1.492**	**Coeff. of Var. [%]**	
Min.	**4.573**	**1.219**	**Min.**	**0.0055**
Max.	**6.832**	**1.291**	**Max.**	**0.0059**
Number of Spec.	**21**	**21**	**Number of Spec.**	**21**


Transverse Tension Properties (TT)--RTD
Measured Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
Transverse Tension Strength [ksi]
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
0
1
2
3
4


Transverse Tension Properties (TT)--RTD
Measured Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
Transverse Tension Modulus [Msi]
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0
1
2
3
4

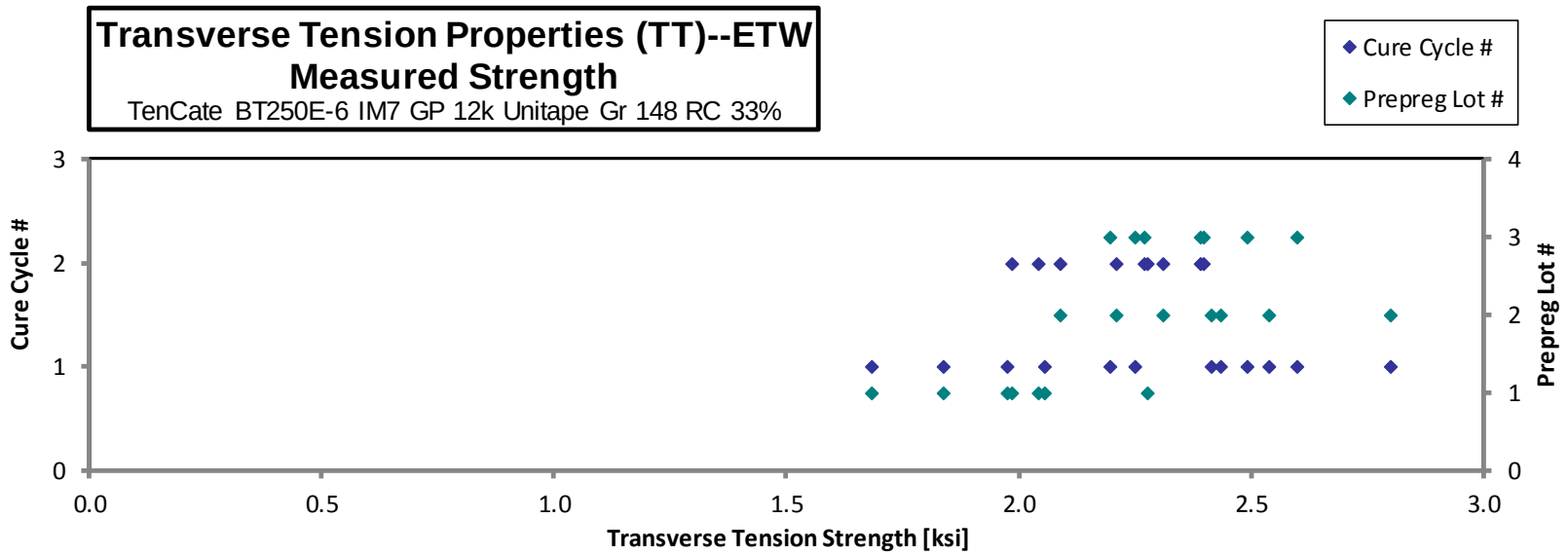
Transverse Tension Properties (TT)--ETW
Strength & Modulus

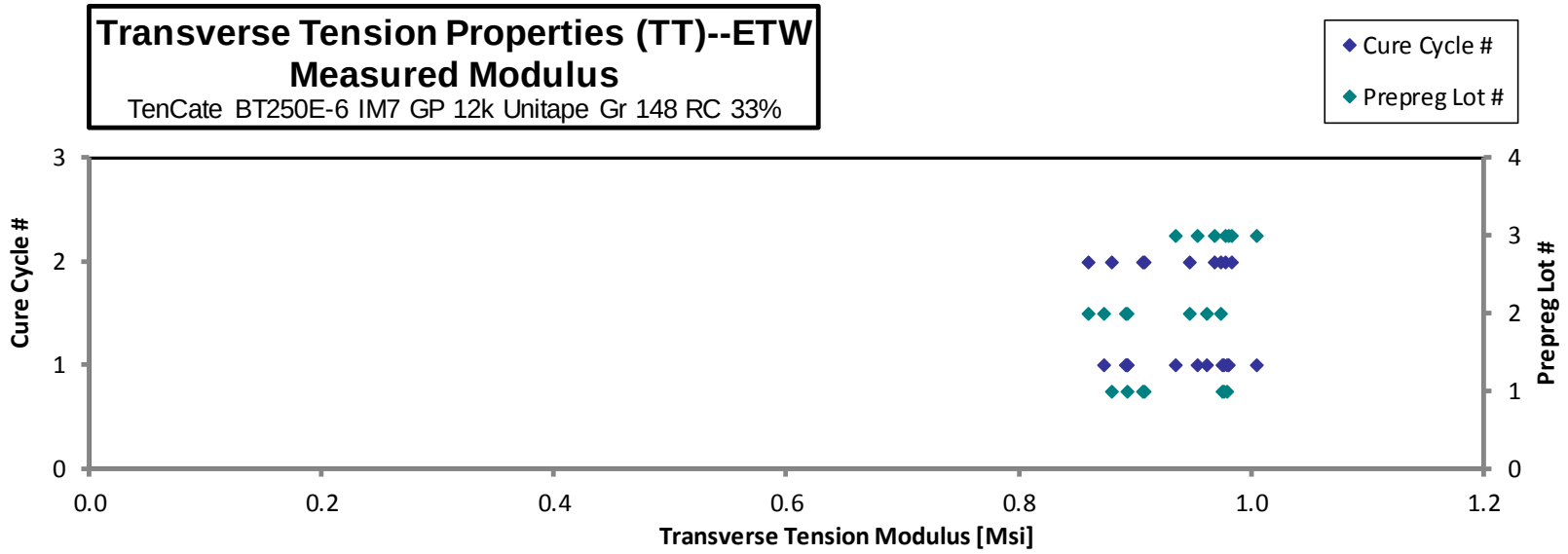
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode
EAAUA11BD	A	C1	1	1	1.839	0.979	0.089	16	0.0056	LWT
EAAUA11CD	A	C1	1	1	1.973	0.975	0.089	16	0.0056	LGM
EAAUA11DD	A	C1	1	1	1.682	0.893	0.088	16	0.0055	LGM
EAAUA11ED	A	C1	1	1	2.056	0.976	0.088	16	0.0055	LAT
EAAUA21AD	A	C2	1	2	2.278	0.907	0.090	16	0.0056	LGM
EAAUA21BD	A	C2	1	2	2.041	0.880	0.090	16	0.0056	LAT
EAAUA21CD	A	C2	1	2	1.985	0.908	0.090	16	0.0056	LGM
EAAUB11BD*	B	C1	2	1	2.798	0.893	0.094	16	0.0059	LGM / LWB
EAAUB11CD	B	C1	2	1	2.414	0.873	0.095	16	0.0059	LAB
EAAUB11DD	B	C1	2	1	2.433	0.892	0.094	16	0.0059	LAB
EAAUB11ED	B	C1	2	1	2.538	0.961	0.094	16	0.0058	LAT
EAAUB219D	B	C2	2	2	2.089	0.859	0.093	16	0.0058	LGM
EAAUB21AD	B	C2	2	2	2.209	0.947	0.094	16	0.0059	LWT
EAAUB21BD	B	C2	2	2	2.309	0.973	0.093	16	0.0058	LGM
EAAUC11BD	C	C1	3	1	2.196	0.953	0.092	16	0.0058	LAT
EAAUC11CD	C	C1	3	1	2.599	1.005	0.092	16	0.0057	LAT
EAAUC11DD	C	C1	3	1	2.491	0.935	0.092	16	0.0057	LAT
EAAUC11ED	C	C1	3	1	2.251	0.981	0.092	16	0.0058	LAT
EAAUC219D	C	C2	3	2	2.269	0.968	0.092	16	0.0057	LGM
EAAUC21AD	C	C2	3	2	2.389	0.978	0.092	16	0.0058	LWB
EAAUC21BD	C	C2	3	2	2.397	0.983	0.092	16	0.0057	LGM

*All modulus values <u>except</u> * were calculated from a smaller strain range (instead of 1000-3000 με). Specimens failed before reaching 3000 με.*

Average	**2.249**	**0.939**	**Average**	**0.0057**
Standard Dev.	**0.266**	**0.044**	**Standard Dev.**	
Coeff. of Var. [%]	**11.845**	**4.713**	**Coeff. of Var. [%]**	
Min.	**1.682**	**0.859**	**Min.**	**0.0055**
Max.	**2.798**	**1.005**	**Max.**	**0.0059**
Number of Spec.	**21**	**21**	**Number of Spec.**	**21**


Transverse Tension Properties (TT)--ETW
Measured Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Transverse Tension Strength [ksi]


Transverse Tension Properties (TT)--ETW
Measured Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Transverse Tension Modulus [Msi]

4.3 Longitudinal Compression Properties (LC)

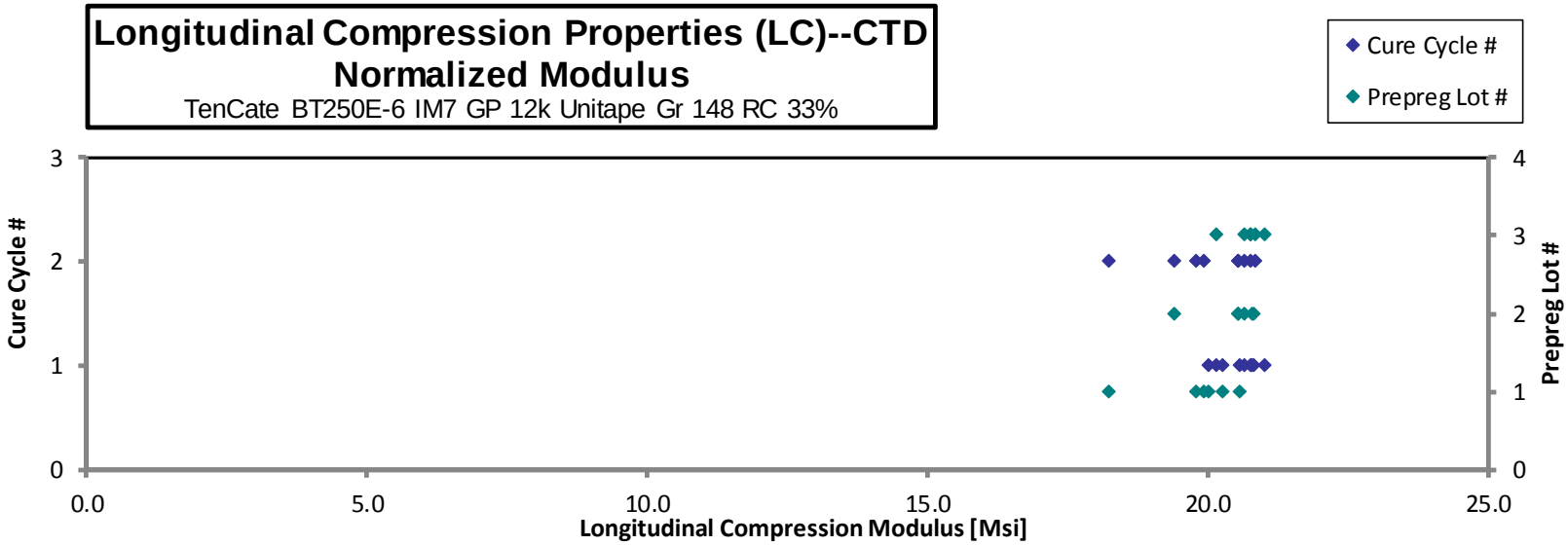
Longitudinal Compression Properties (LC)--CTD
Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

normalizing t_{ply} [in]
0.0058

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Modulus_{norm}$ [Msi]
EAALA116B	A	C1	1	1	20.218	0.115	20	N/A	0.0057	19.992
EAALA117B	A	C1	1	1	20.282	0.116	20	N/A	0.0058	20.264
EAALA118B	A	C1	1	1	20.558	0.116	20	N/A	0.0058	20.562
EAALA215B	A	C2	1	2	20.038	0.115	20	N/A	0.0058	19.928
EAALA216B	A	C2	1	2	19.845	0.116	20	N/A	0.0058	19.783
EAALA217B	A	C2	1	2	19.664	0.107	20	N/A	0.0054	18.221
EAALB116B	B	C1	2	1	20.530	0.118	20	N/A	0.0059	20.809
EAALB117B	B	C1	2	1	20.479	0.118	20	N/A	0.0059	20.768
EAALB118B	B	C1	2	1	20.427	0.117	20	N/A	0.0059	20.638
EAALB215B	B	C2	2	2	20.637	0.115	20	N/A	0.0058	20.531
EAALB216B	B	C2	2	2	19.341	0.116	20	N/A	0.0058	19.386
EAALB217B	B	C2	2	2	21.896	0.109	20	N/A	0.0054	20.541
EAALC116B	C	C1	3	1	21.104	0.115	20	N/A	0.0058	21.004
EAALC117B	C	C1	3	1	20.821	0.116	20	N/A	0.0058	20.752
EAALC118B	C	C1	3	1	20.241	0.115	20	N/A	0.0058	20.136
EAALC215B	C	C2	3	2	20.546	0.117	20	N/A	0.0058	20.652
EAALC216B	C	C2	3	2	20.541	0.117	20	N/A	0.0059	20.752
EAALC217B	C	C2	3	2	20.572	0.117	20	N/A	0.0059	20.829

Average	**20.430**	
Standard Dev.	**0.556**	
Coeff. of Var. [%]	**2.719**	
Min.	**19.341**	
Max.	**21.896**	
Number of Spec.	**18**	

$Average_{norm}$	**0.0058**	**20.308**
$Standard\ Dev._{norm}$		**0.676**
$Coeff.\ of\ Var.\ [\%]_{norm}$		**3.328**
Min.	**0.0054**	**18.221**
Max.	**0.0059**	**21.004**
Number of Spec.	**18**	**18**


Longitudinal Compression Properties (LC)--CTD
Normalized Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
5.0
10.0
15.0
20.0
25.0
Longitudinal Compression Modulus [Msi]

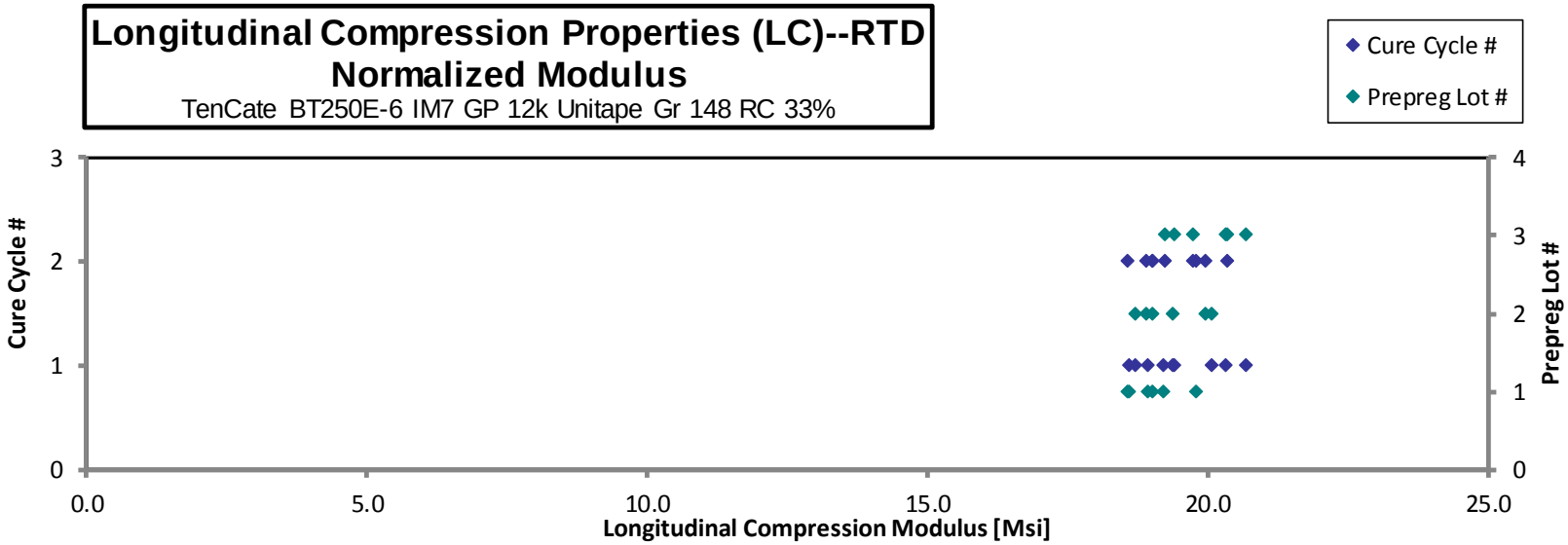
Longitudinal Compression Properties (LC)--RTD
Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

normalizing t_{ply} [in]
0.0058

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Modulus_{norm}$ [Msi]
EAALA111A	A	C1	1	1	19.899	0.108	20	N/A	0.0054	18.595
EAALA112A	A	C1	1	1	20.068	0.109	20	N/A	0.0055	18.915
EAALA113A	A	C1	1	1	20.090	0.111	20	N/A	0.0055	19.190
EAALA211A	A	C2	1	2	19.815	0.109	20	N/A	0.0054	18.562
EAALA212A	A	C2	1	2	19.894	0.111	20	N/A	0.0055	18.990
EAALA213A	A	C2	1	2	20.370	0.113	20	N/A	0.0056	19.791
EAALB111A	B	C1	2	1	19.762	0.110	20	N/A	0.0055	18.693
EAALB112A	B	C1	2	1	20.062	0.112	20	N/A	0.0056	19.368
EAALB113A	B	C1	2	1	20.317	0.115	20	N/A	0.0057	20.069
EAALB211A	B	C2	2	2	20.149	0.109	20	N/A	0.0055	18.992
EAALB212A	B	C2	2	2	19.792	0.111	20	N/A	0.0055	18.899
EAALB213A	B	C2	2	2	20.532	0.113	20	N/A	0.0056	19.961
EAALC111A	C	C1	3	1	20.212	0.111	20	N/A	0.0056	19.389
EAALC112A	C	C1	3	1	20.813	0.113	20	N/A	0.0057	20.299
EAALC113A	C	C1	3	1	20.987	0.114	20	N/A	0.0057	20.662
EAALC211A	C	C2	3	2	20.336	0.110	20	N/A	0.0055	19.221
EAALC212A	C	C2	3	2	20.374	0.112	20	N/A	0.0056	19.732
EAALC213A	C	C2	3	2	20.627	0.114	20	N/A	0.0057	20.336

Average	**20.228**	
Standard Dev.	**0.352**	
Coeff. of Var. [%]	**1.741**	
Min.	**19.762**	
Max.	**20.987**	
Number of Spec.	**18**	

$Average_{norm}$	**0.0056**	**19.426**
$Standard\ Dev._{norm}$		**0.644**
$Coeff.\ of\ Var.\ [\%]_{norm}$		**3.313**
Min.	**0.0054**	**18.562**
Max.	**0.0057**	**20.662**
Number of Spec.	**18**	**18**


Longitudinal Compression Properties (LC)--RTD
Normalized Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
5.0
10.0
15.0
20.0
25.0
Longitudinal Compression Modulus [Msi]

Longitudinal Compression Properties (LC)--ETW
Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

normalizing t_{ply} [in]
0.0058

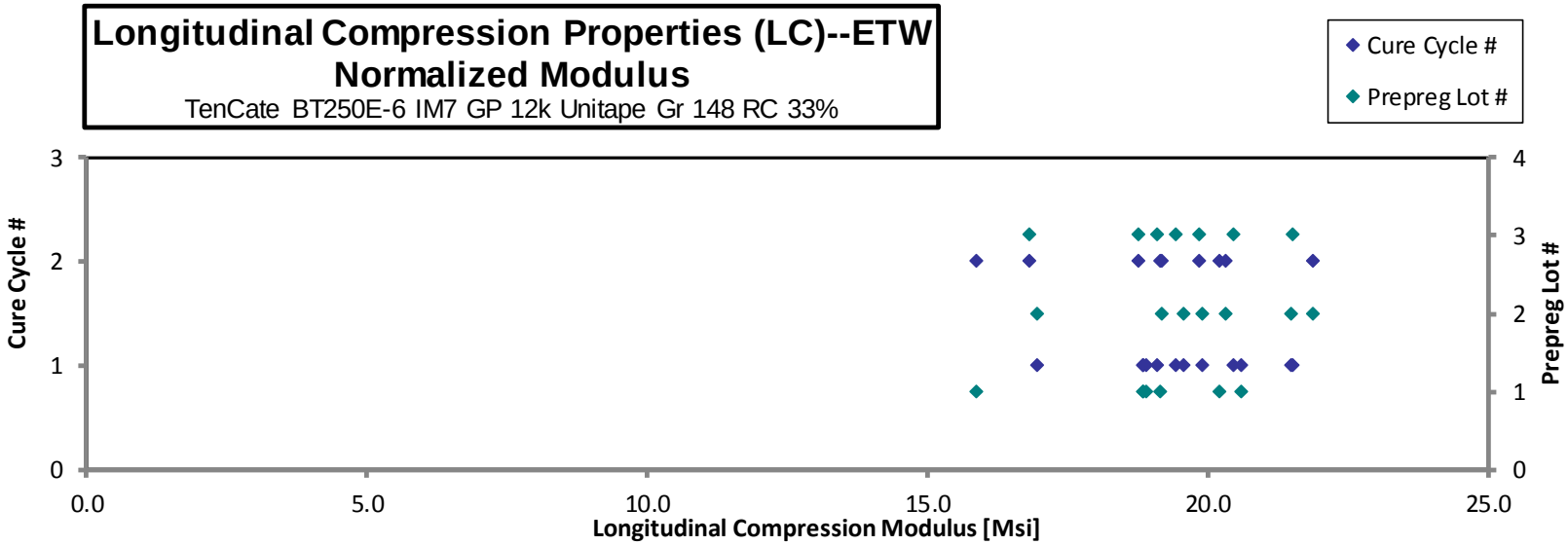
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Modulus_{norm}$ [Msi]
EAALA11BD	A	C1	1	1	19.768	0.111	20	**	0.0055	18.840
EAALA11CD	A	C1	1	1	21.406	0.112	20	N/A	0.0056	20.599
EAALA11DD	A	C1	1	1	19.509	0.112	20	N/A	0.0056	18.886
EAALA11ED	A	C1	1	1	19.295	0.113	20	N/A	0.0057	18.829
EAALA219D*	A	C2	1	2	16.436	0.112	20	N/A	0.0056	15.861
EAALA21AD	A	C2	1	2	20.572	0.114	20	N/A	0.0057	20.209
EAALA21BD	A	C2	1	2	19.319	0.115	20	N/A	0.0057	19.146
EAALB11BD*	B	C1	2	1	17.455	0.113	20	N/A	0.0056	16.947
EAALB11CD	B	C1	2	1	19.996	0.113	20	N/A	0.0057	19.552
EAALB11DD	B	C1	2	1	20.086	0.115	20	N/A	0.0057	19.889
EAALB11ED	B	C1	2	1	21.609	0.115	20	N/A	0.0058	21.485
EAALB219D	B	C2	2	2	20.936	0.112	20	N/A	0.0056	20.299
EAALB21AD	B	C2	2	2	19.563	0.114	20	N/A	0.0057	19.175
EAALB21BD	B	C2	2	2	22.111	0.115	20	N/A	0.0057	21.854
EAALC11BD	C	C1	3	1	19.343	0.114	20	N/A	0.0057	19.080
EAALC11CD	C	C1	3	1	20.547	0.116	20	N/A	0.0058	20.461
EAALC11DD	C	C1	3	1	19.470	0.116	20	N/A	0.0058	19.428
EAALC11ED	C	C1	3	1	21.594	0.115	20	N/A	0.0058	21.496
EAALC219D	C	C2	3	2	19.710	0.110	20	N/A	0.0055	18.754
EAALC21AD	C	C2	3	2	20.303	0.113	20	N/A	0.0057	19.824
EAALC21BD*	C	C2	3	2	16.860	0.116	20	N/A	0.0058	16.802

* Strain data examined. No anomalies were found.

** Specimens failed around 2300 microstrain.

Average	**19.804**	
Standard Dev.	**1.477**	
Coeff. of Var. [%]	**7.459**	
Min.	**16.436**	
Max.	**22.111**	
Number of Spec.	**21**	

$Average_{norm}$	**0.0057**	**19.401**
$Standard\ Dev._{norm}$		**1.518**
$Coeff.\ of\ Var.\ [\%]_{norm}$		**7.823**
Min.	**0.0055**	**15.861**
Max.	**0.0058**	**21.854**
Number of Spec.	**21**	**21**


Longitudinal Compression Properties (LC)--ETW
Normalized Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
5.0
10.0
15.0
20.0
25.0
Longitudinal Compression Modulus [Msi]

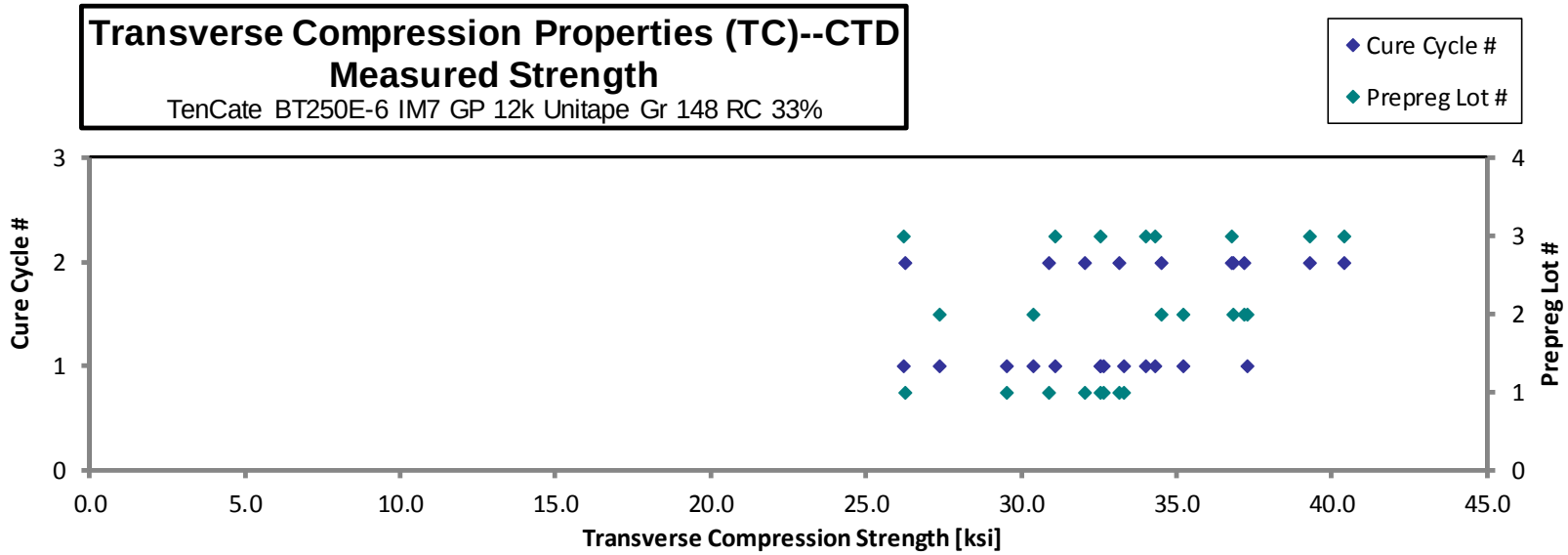
4.4 Transverse Compression Properties (TC)

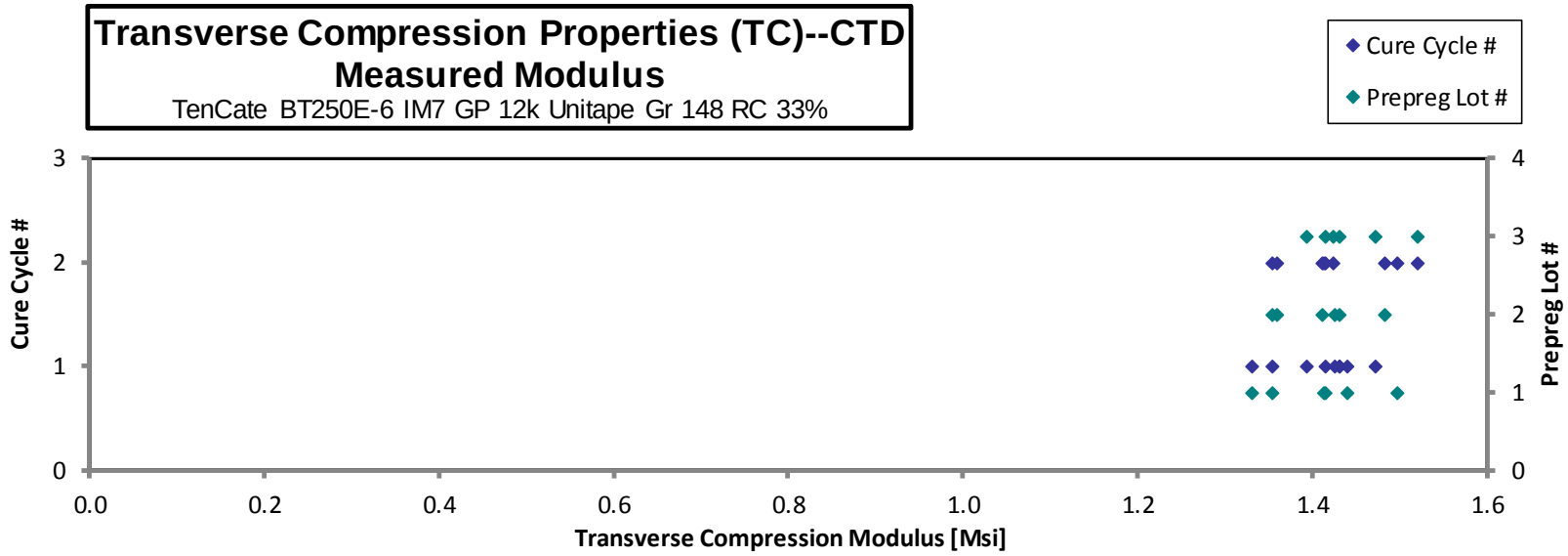
Transverse Compression Properties (TC)--CTD
Strength & Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode
EAAZA117B	A	C1	1	1	33.305	1.415	0.111	20	0.0056	BGM
EAAZA118B	A	C1	1	1	32.559	1.440	0.112	20	0.0056	BGM
EAAZA119B	A	C1	1	1	29.540	1.331	0.112	20	0.0056	BGM
EAAZA11AB*	A	C1	1	1	32.635		0.112	20	0.0056	BGM
EAAZA216B	A	C2	1	2	26.243	1.413	0.113	20	0.0056	BGM
EAAZA217B	A	C2	1	2	33.148	1.496	0.111	20	0.0056	BGM
EAAZA218B	A	C2	1	2	30.896	1.353	0.112	20	0.0056	BGM
EAAZA219B*	A	C2	1	2	32.012		0.111	20	0.0056	BGM
EAAZB116B	B	C1	2	1	30.355	1.353	0.114	20	0.0057	BGM
EAAZB117B	B	C1	2	1	27.352	1.426	0.114	20	0.0057	BGM
EAAZB118B	B	C1	2	1	35.227	1.430	0.114	20	0.0057	BGM
EAAZB119B*	B	C1	2	1	37.285		0.113	20	0.0057	BGM
EAAZB216B	B	C2	2	2	34.482	1.360	0.114	20	0.0057	BGM
EAAZB217B	B	C2	2	2	36.790	1.483	0.115	20	0.0057	BGM
EAAZB218B	B	C2	2	2	37.180	1.411	0.114	20	0.0057	BGM
EAAZC116B	C	C1	3	1	26.212	1.431	0.115	20	0.0058	BGM
EAAZC117B	C	C1	3	1	32.529	1.393	0.115	20	0.0058	BGM
EAAZC118B	C	C1	3	1	34.273	1.472	0.115	20	0.0058	BGM
EAAZC119B*	C	C1	3	1	31.053		0.115	20	0.0058	BGM
EAAZC11AB*	C	C1	3	1	33.975		0.114	20	0.0057	BGM
EAAZC216B	C	C2	3	2	36.743	1.414	0.113	20	0.0057	BGM
EAAZC217B	C	C2	3	2	40.379	1.520	0.114	20	0.0057	BAT
EAAZC218B	C	C2	3	2	39.294	1.424	0.113	20	0.0057	BGM

* Specimen was not gaged and tested for strength only.

Average	**33.194**	**1.420**	**Average**	**0.0057**
Standard Dev.	**3.811**	**0.051**	**Standard Dev.**	
Coeff. of Var. [%]	**11.482**	**3.604**	**Coeff. of Var. [%]**	
Min.	**26.212**	**1.331**	**Min.**	**0.0056**
Max.	**40.379**	**1.520**	**Max.**	**0.0058**
Number of Spec.	**23**	**18**	**Number of Spec.**	**23**


Transverse Compression Properties (TC)--CTD
Measured Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
Transverse Compression Strength [ksi]


Transverse Compression Properties (TC)--CTD
Measured Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
Transverse Compression Modulus [Msi]

Transverse Compression Properties (TC)--RTD
Strength & Modulus

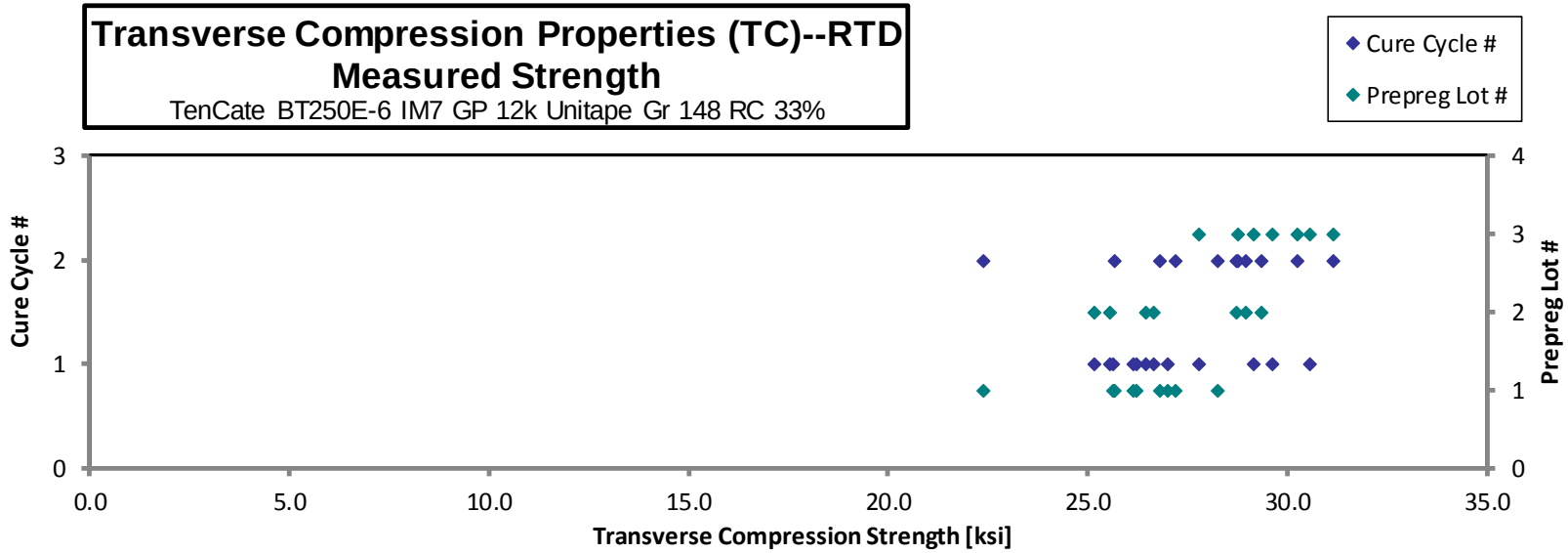
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

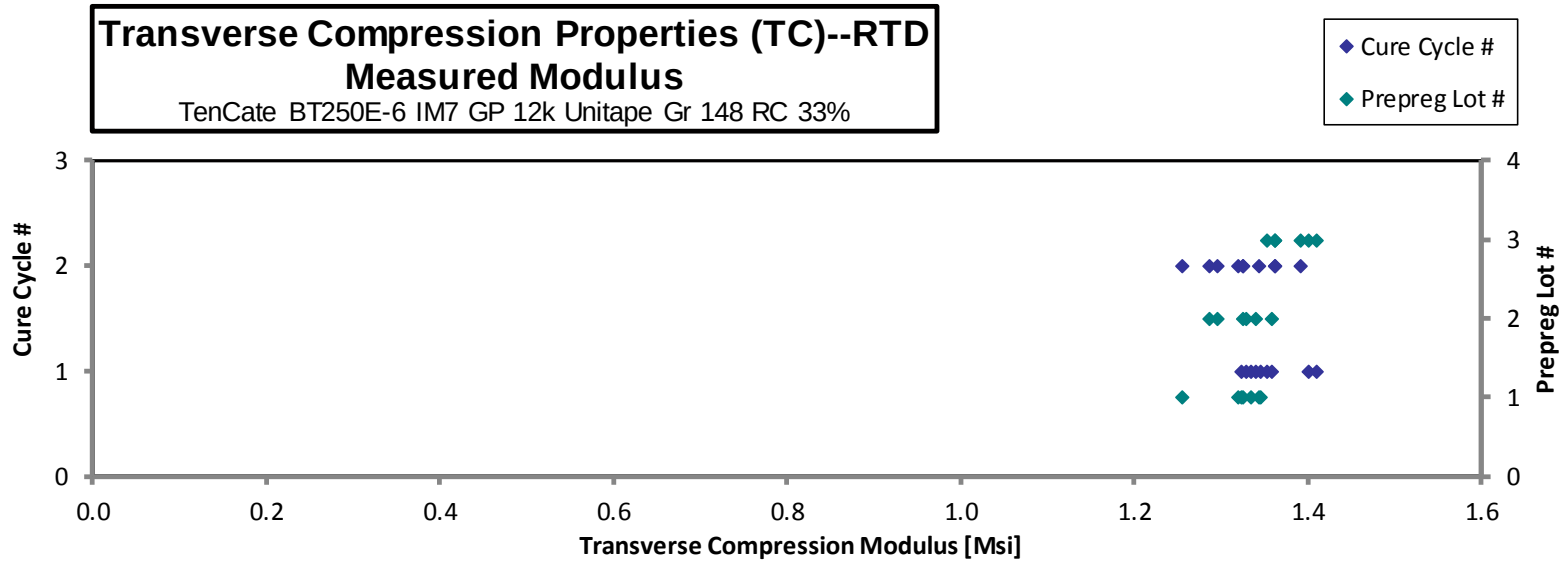
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode
EAAZA111A	A	C1	1	1	25.626	1.345	0.109	20	0.0054	BGM
EAAZA112A	A	C1	1	1	26.991	1.333	0.110	20	0.0055	HAB
EAAZA113A	A	C1	1	1	26.197	1.323	0.111	20	0.0055	BGM
EAAZA114A*	A	C1	1	1	26.128		0.112	20	0.0056	BGM/HAT
EAAZA211A	A	C2	1	2	27.185	1.343	0.109	20	0.0055	BGM
EAAZA212A	A	C2	1	2	28.249	1.325	0.110	20	0.0055	BGM
EAAZA213A	A	C2	1	2	26.797	1.320	0.111	20	0.0056	BAB/HAT
EAAZA214A**	A	C2	1	2	22.367	1.256	0.112	20	0.0056	BGM
EAAZA215A*	A	C2	1	2	25.671		0.113	20	0.0056	BGM
EAAZB111A	B	C1	2	1	26.453	1.357	0.111	20	0.0056	BGM
EAAZB112A	B	C1	2	1	25.541	1.328	0.113	20	0.0056	BGM
EAAZB113A	B	C1	2	1	26.620	1.339	0.113	20	0.0057	BGM
EAAZB114A*	B	C1	2	1	25.144		0.114	20	0.0057	BGM
EAAZB211A	B	C2	2	2	29.326	1.326	0.112	20	0.0056	BGM
EAAZB212A	B	C2	2	2	28.712	1.296	0.113	20	0.0057	BGM
EAAZB213A	B	C2	2	2	28.938	1.287	0.114	20	0.0057	BGM
EAAZC111A	C	C1	3	1	30.531	1.410	0.113	20	0.0056	HGM
EAAZC112A	C	C1	3	1	29.607	1.353	0.113	20	0.0057	HAB
EAAZC113A	C	C1	3	1	29.141	1.400	0.114	20	0.0057	HAB/HAT
EAAZC114A*	C	C1	3	1	27.766		0.115	20	0.0057	HAB
EAAZC211A	C	C2	3	2	31.136	1.363	0.111	20	0.0056	BGM
EAAZC212A	C	C2	3	2	30.242	1.390	0.113	20	0.0056	BGM
EAAZC213A	C	C2	3	2	28.764	1.362	0.113	20	0.0056	BGM

* Specimen was not gaged and tested for strength only.

** Specimen investigated and no reason found to omit data.

Average	**27.527**	**1.340**	**Average**	**0.0056**
Standard Dev.	**2.078**	**0.038**	**Standard Dev.**	
Coeff. of Var. [%]	**7.550**	**2.819**	**Coeff. of Var. [%]**	
Min.	**22.367**	**1.256**	**Min.**	**0.0054**
Max.	**31.136**	**1.410**	**Max.**	**0.0057**
Number of Spec.	**23**	**19**	**Number of Spec.**	**23**

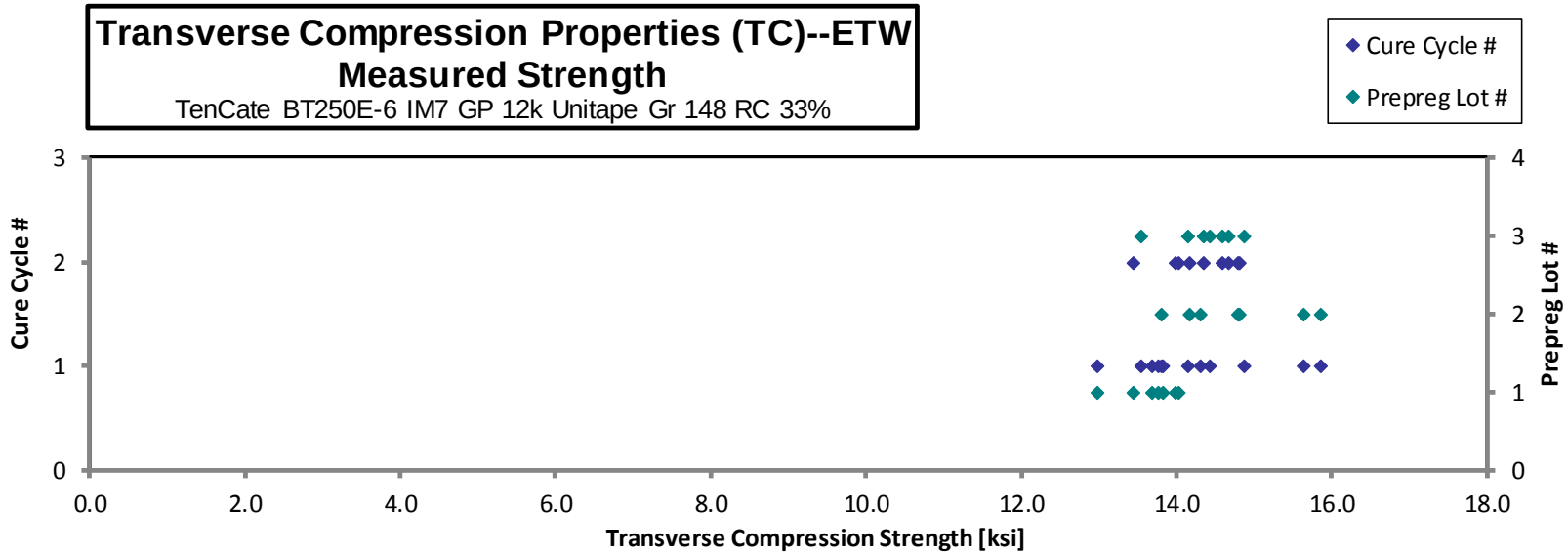

Transverse Compression Properties (TC)--RTD
Measured Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
Transverse Compression Strength [ksi]

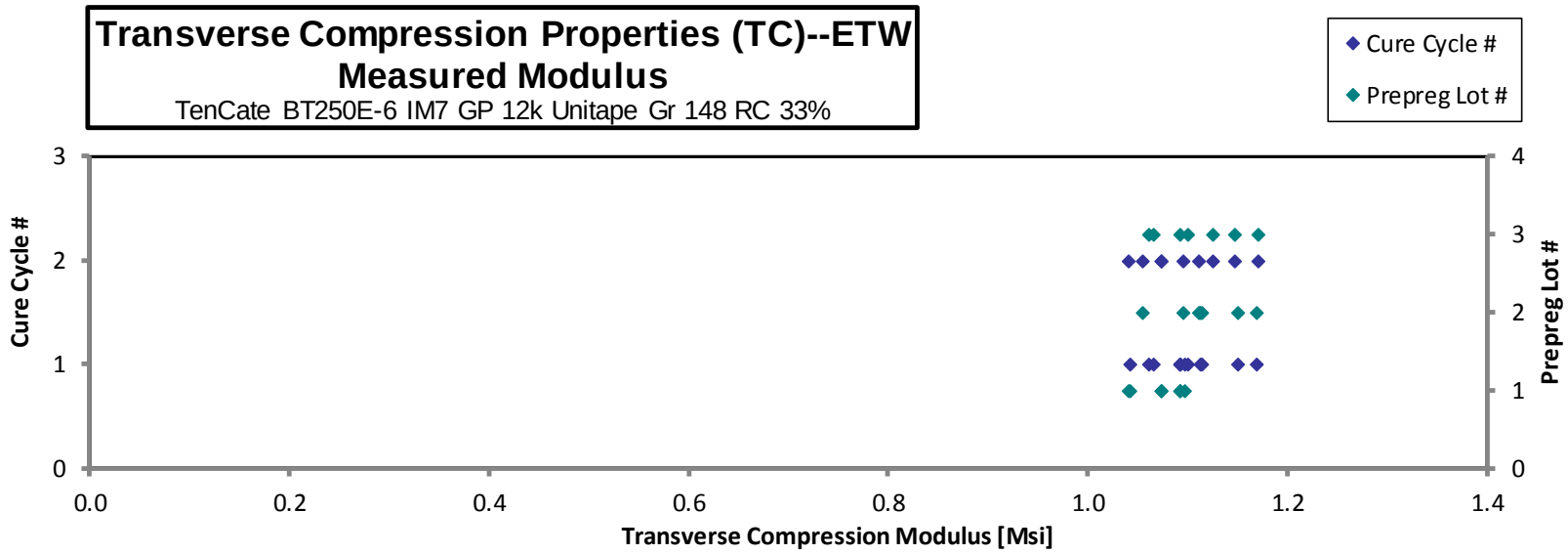

Transverse Compression Properties (TC)--RTD
Measured Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
Transverse Compression Modulus [Msi]

Transverse Compression Properties (TC)--ETW
Strength & Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode
EAAZA11BD	A	C1	1	1		1.092	0.108	20	0.0054	HGM
EAAZA11CD	A	C1	1	1		1.093	0.111	20	0.0055	HGM
EAAZA11DD	A	C1	1	1		1.097	0.111	20	0.0055	HGM
EAAZA11ED	A	C1	1	1		1.042	0.113	20	0.0056	HGM[1] / HIT[2]
EAAZA11FD	A	C1	1	1	12.970		0.112	20	0.0056	HGM
EAAZA11GD	A	C1	1	1	13.687		0.112	20	0.0056	BGM
EAAZA11HD	A	C1	1	1	13.767		0.112	20	0.0056	HAB
EAAZA11ID	A	C1	1	1	13.816		0.111	20	0.0056	HGM
EAAZA21BD	A	C2	1	2		1.074	0.110	20	0.0055	HGM
EAAZA21CD	A	C2	1	2		1.073	0.111	20	0.0056	HGM
EAAZA21DD	A	C2	1	2		1.040	0.112	20	0.0056	HGM
EAAZA21ED	A	C2	1	2	13.985		0.112	20	0.0056	BAT
EAAZA21FD	A	C2	1	2	14.025		0.112	20	0.0056	HGM
EAAZA21GD	A	C2	1	2	13.446		0.113	20	0.0056	BAT
EAAZB11BD	B	C1	2	1		1.169	0.111	20	0.0056	BGM
EAAZB11CD	B	C1	2	1		1.150	0.113	20	0.0056	HGM
EAAZB11DD	B	C1	2	1		1.113	0.114	20	0.0057	HGM
EAAZB11ED	B	C1	2	1		1.113	0.114	20	0.0057	HGM
EAAZB11FD	B	C1	2	1	15.633		0.115	20	0.0057	BGM
EAAZB11GD	B	C1	2	1	15.844		0.115	20	0.0057	HGM
EAAZB11HD	B	C1	2	1	13.790		0.114	20	0.0057	HGM
EAAZB11ID	B	C1	2	1	14.311		0.114	20	0.0057	BGM
EAAZB21BD	B	C2	2	2		1.095	0.113	20	0.0056	BGM
EAAZB21CD	B	C2	2	2		1.055	0.114	20	0.0057	HGM
EAAZB21DD	B	C2	2	2		1.111	0.114	20	0.0057	HGM
EAAZB21ED	B	C2	2	2	14.784		0.114	20	0.0057	BGM
EAAZB21FD	B	C2	2	2	14.810		0.115	20	0.0057	HGM
EAAZB21GD	B	C2	2	2	14.171		0.114	20	0.0057	HGM
EAAZC11BD	C	C1	3	1		1.092	0.114	20	0.0057	HGM
EAAZC11CD	C	C1	3	1		1.100	0.114	20	0.0057	HGM
EAAZC11DD	C	C1	3	1		1.066	0.115	20	0.0057	BGM
EAAZC11ED	C	C1	3	1		1.061	0.116	20	0.0058	HGM
EAAZC11FD	C	C1	3	1	14.871		0.115	20	0.0058	HGM
EAAZC11GD	C	C1	3	1	13.545		0.115	20	0.0058	HGM
EAAZC11HD	C	C1	3	1	14.138		0.115	20	0.0058	HGM
EAAZC11ID	C	C1	3	1	14.415		0.115	20	0.0058	HGM
EAAZC21BD	C	C2	3	2		1.146	0.111	20	0.0055	BGM
EAAZC21CD	C	C2	3	2		1.171	0.112	20	0.0056	HGM
EAAZC21DD	C	C2	3	2		1.125	0.112	20	0.0056	HGM
EAAZC21ED	C	C2	3	2	14.665		0.113	20	0.0057	BGM
EAAZC21FD	C	C2	3	2	14.345		0.113	20	0.0057	HGM
EAAZC21GD	C	C2	3	2	14.589		0.113	20	0.0057	BGM

Average	**14.267**	**1.099**	**Average**	**0.0057**
Standard Dev.	**0.694**	**0.038**	**Standard Dev.**	
Coeff. of Var. [%]	**4.865**	**3.454**	**Coeff. of Var. [%]**	
Min.	**12.970**	**1.040**	**Min.**	**0.0054**
Max.	**15.844**	**1.171**	**Max.**	**0.0058**
Number of Spec.	**21**	**21**	**Number of Spec.**	**42**


Transverse Compression Properties (TC)--ETW
Measured Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Transverse Compression Strength [ksi]


Transverse Compression Properties (TC)--ETW
Measured Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Transverse Compression Modulus [Msi]

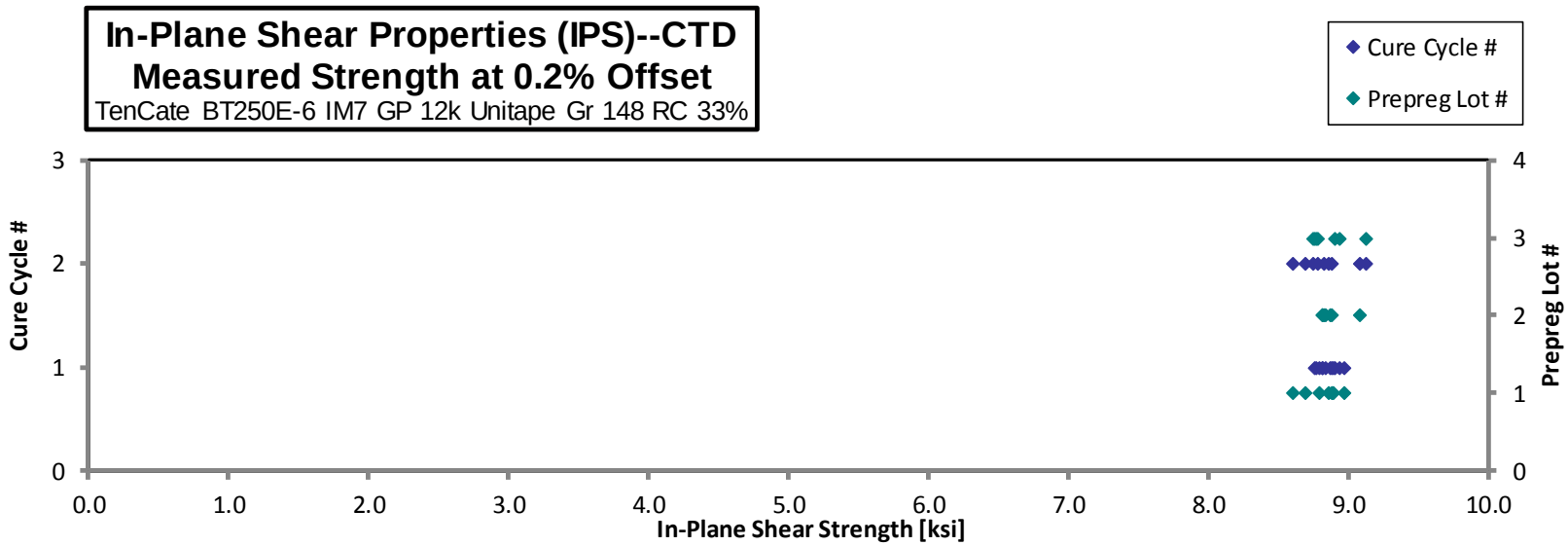
4.5 In-Plane Shear Properties (IPS)

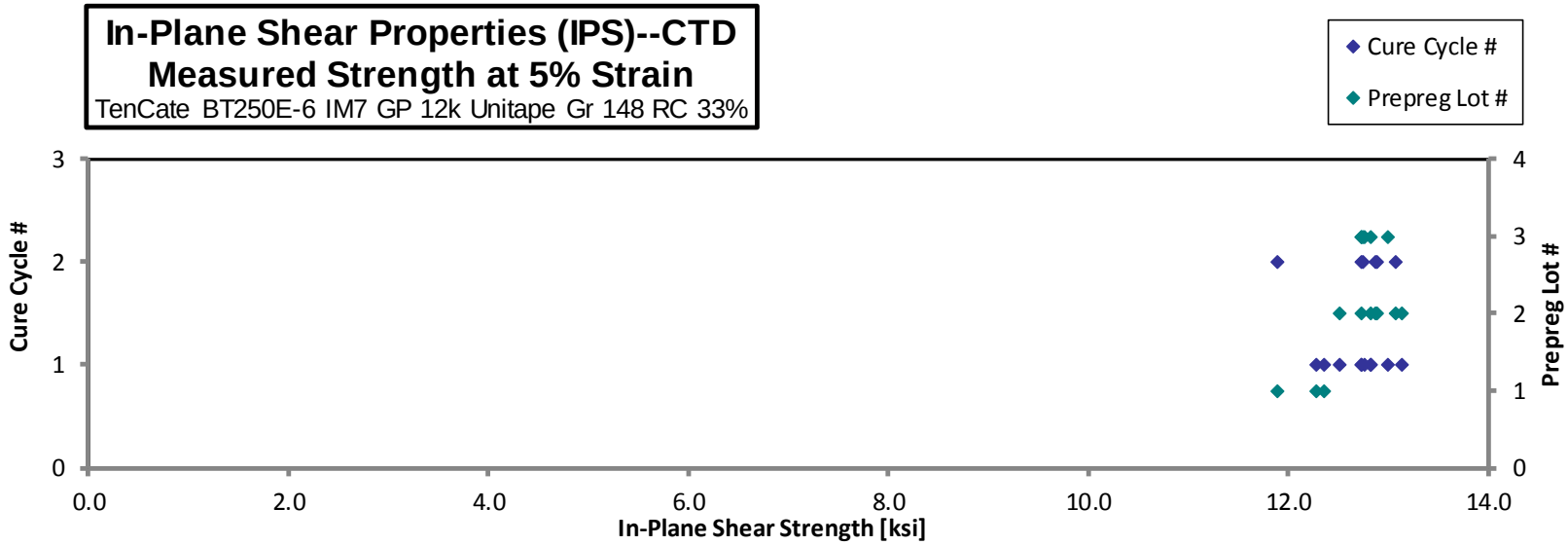
In-Plane Shear Properties (IPS)--CTD
Strength & Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

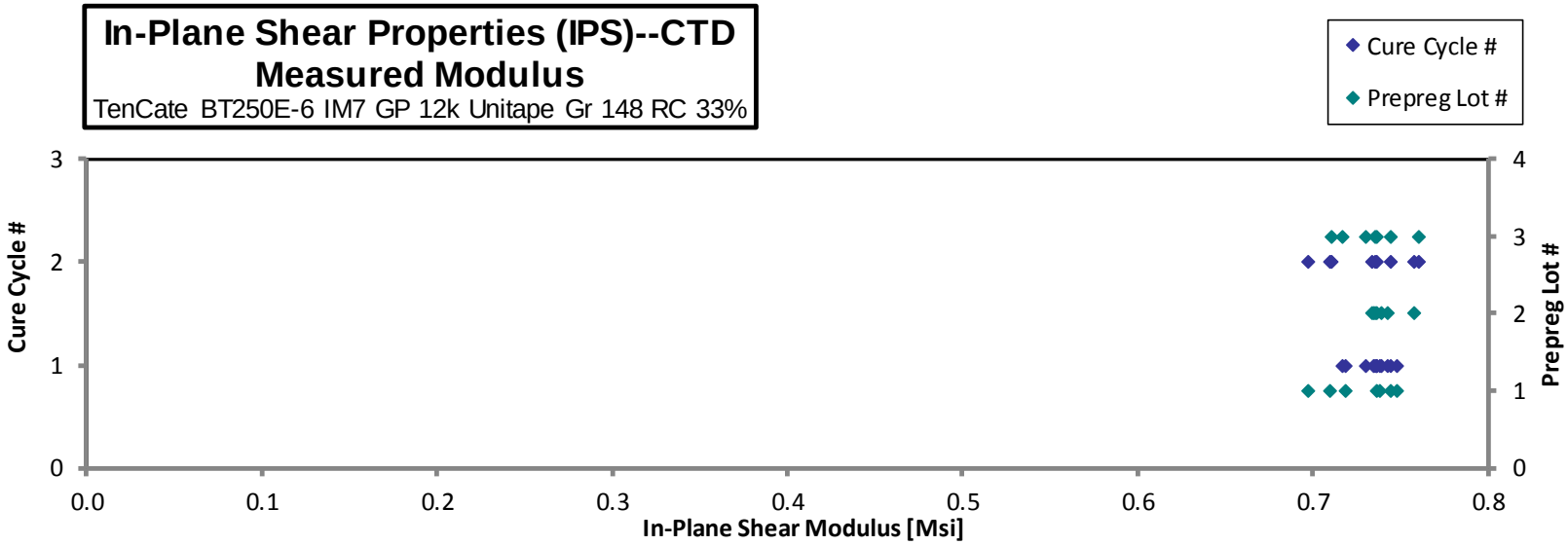
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	0.2% Offset Strength [ksi]	Strength at 5% Strain [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]
EAANA116B	A	C1	1	1	8.881	12.352	0.736	0.088	16	0.0055
EAANA118B*	A	C1	1	1	8.787		0.718	0.089	16	0.0055
EAANA119B*	A	C1	1	1	8.974		0.748	0.087	16	0.0054
EAANA11AB	A	C1	1	1	8.894	12.273	0.738	0.090	16	0.0056
EAANA215B	A	C2	1	2	8.688	11.893	0.710	0.090	16	0.0056
EAANA216B*	A	C2	1	2	8.603		0.697	0.090	16	0.0056
EAANA217B*	A	C2	1	2	8.861		0.744	0.089	16	0.0055
EAANB116B	B	C1	2	1	8.866	12.509	0.736	0.092	16	0.0058
EAANB117B	B	C1	2	1	8.836	12.734	0.738	0.092	16	0.0058
EAANB118B	B	C1	2	1	8.810	12.814	0.735	0.092	16	0.0058
EAANB119B	B	C1	2	1	8.816	13.128	0.743	0.092	16	0.0057
EAANB215B	B	C2	2	2	8.878	12.877	0.734	0.093	16	0.0058
EAANB216B	B	C2	2	2	9.083	13.067	0.758	0.092	16	0.0058
EAANB217B	B	C2	2	2	8.830	12.875	0.736	0.092	16	0.0058
EAANC116B	C	C1	3	1	8.761	12.821	0.735	0.092	16	0.0058
EAANC117B	C	C1	3	1	8.768	12.753	0.717	0.093	16	0.0058
EAANC118B	C	C1	3	1	8.936	12.732	0.730	0.092	16	0.0058
EAANC119B	C	C1	3	1	8.901	12.998	0.744	0.091	16	0.0057
EAANC215B	C	C2	3	2	8.785	12.728	0.736	0.093	16	0.0058
EAANC216B	C	C2	3	2	8.745	12.746	0.710	0.093	16	0.0058
EAANC217B*	C	C2	3	2	9.124		0.760	0.092	16	0.0057

* Strength at 5% strain is not available because strain gage failed prior to reaching 5% strain.

Average	**8.849**	**12.706**	**0.733**	**Average**	**0.0057**
Standard Dev.	**0.119**	**0.316**	**0.016**	**Standard Dev.**	
Coeff. of Var. [%]	**1.344**	**2.484**	**2.113**	**Coeff. of Var. [%]**	
Min.	**8.603**	**11.893**	**0.697**	**Min.**	**0.0054**
Max.	**9.124**	**13.128**	**0.760**	**Max.**	**0.0058**
Number of Spec.	**21**	**16**	**21**	**Number of Spec.**	**21**


In-Plane Shear Properties (IPS)--CTD
Measured Strength at 0.2% Offset
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
In-Plane Shear Strength [ksi]
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0
1
2
3
4


In-Plane Shear Properties (IPS)--CTD
Measured Strength at 5% Strain
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
In-Plane Shear Strength [ksi]
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
0
1
2
3
4

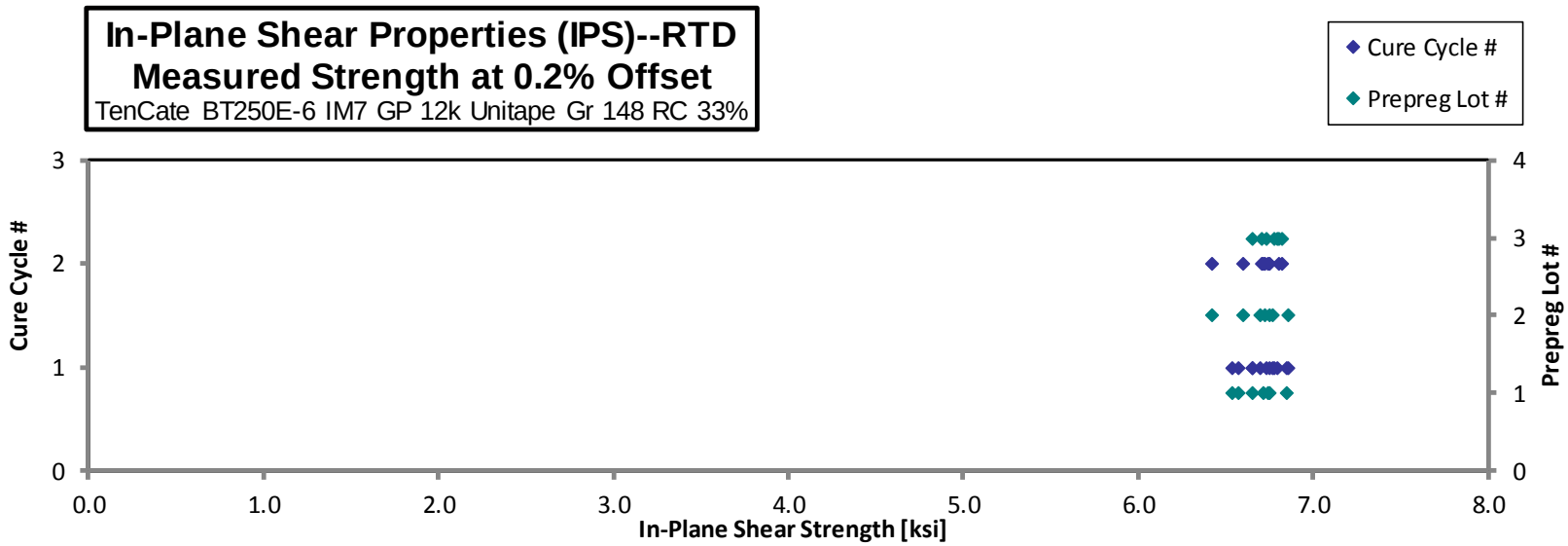

In-Plane Shear Properties (IPS)--CTD
Measured Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
In-Plane Shear Modulus [Msi]
0
1
2
3
4
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8

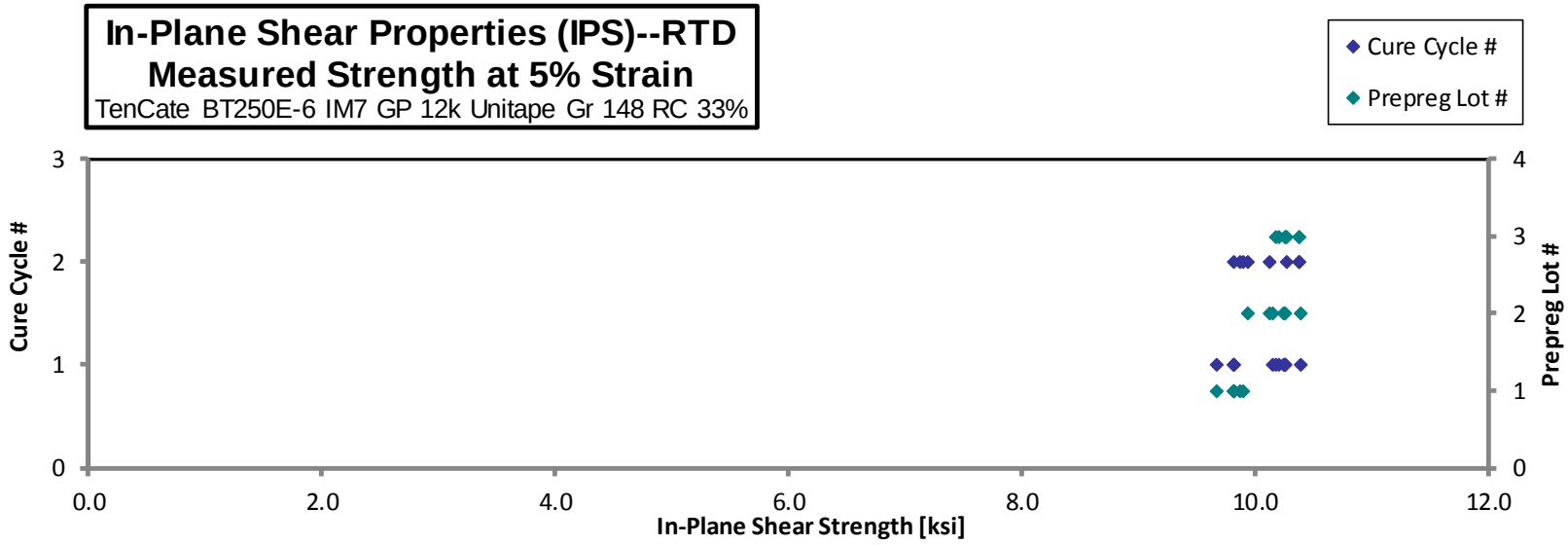
In-Plane Shear Properties (IPS)--RTD
Strength & Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

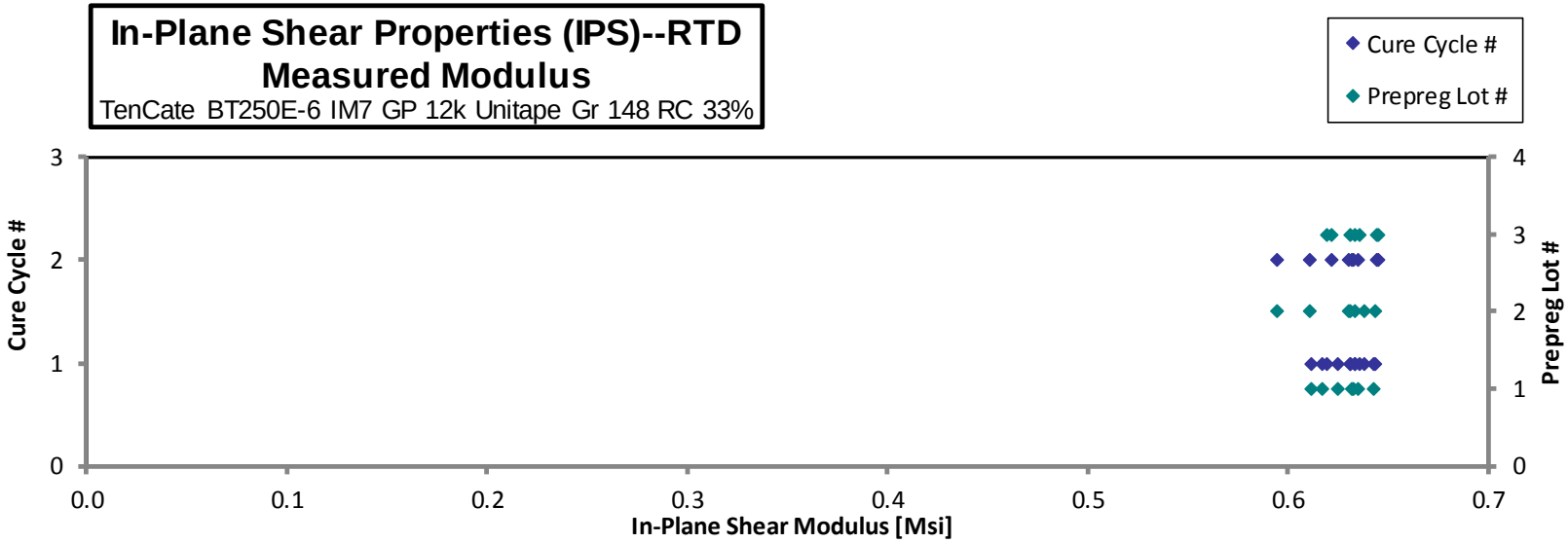
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	0.2% Offset Strength [ksi]	Strength at 5% Strain [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]
EAANA111A	A	C1	1	1	6.844	9.809	0.643	0.087	16	0.0055
EAANA112A	A	C1	1	1	6.536	9.810	0.611	0.088	16	0.0055
EAANA113A	A	C1	1	1	6.653	9.818	0.625	0.089	16	0.0056
EAANA114A	A	C1	1	1	6.570	9.663	0.617	0.089	16	0.0056
EAANA211A	A	C2	1	2	6.717	9.809	0.631	0.089	16	0.0056
EAANA212A	A	C2	1	2	6.740	9.895	0.633	0.089	16	0.0056
EAANA213A	A	C2	1	2	6.745	9.869	0.635	0.089	16	0.0055
EAANB111A	B	C1	2	1	6.694	10.151	0.631	0.091	16	0.0057
EAANB112A	B	C1	2	1	6.746	10.244	0.633	0.092	16	0.0058
EAANB113A	B	C1	2	1	6.857	10.385	0.643	0.092	16	0.0058
EAANB114A	B	C1	2	1	6.767	10.262	0.638	0.093	16	0.0058
EAANB211A	B	C2	2	2	6.415	9.929	0.594	0.092	16	0.0058
EAANB212A	B	C2	2	2	6.597	10.118	0.610	0.093	16	0.0058
EAANB213A*	B	C2	2	2	6.718		0.630	0.093	16	0.0058
EAANC111A	C	C1	3	1	6.732	10.176	0.631	0.091	16	0.0057
EAANC112A	C	C1	3	1	6.772	10.252	0.633	0.092	16	0.0057
EAANC113A	C	C1	3	1	6.794	10.261	0.635	0.091	16	0.0057
EAANC114A	C	C1	3	1	6.655	10.197	0.619	0.091	16	0.0057
EAANC211A	C	C2	3	2	6.806	10.372	0.645	0.091	16	0.0057
EAANC212A	C	C2	3	2	6.822	10.377	0.645	0.092	16	0.0058
EAANC213A	C	C2	3	2	6.706	10.273	0.622	0.093	16	0.0058

* Strength at 5% strain is not available because strain gage failed prior to reaching 5% strain.

Average	**6.709**	**10.084**	**0.629**	**Average**	**0.0057**
Standard Dev.	**0.109**	**0.232**	**0.013**	**Standard Dev.**	
Coeff. of Var. [%]	**1.619**	**2.296**	**2.041**	**Coeff. of Var. [%]**	
Min.	**6.415**	**9.663**	**0.594**	**Min.**	**0.0055**
Max.	**6.857**	**10.385**	**0.645**	**Max.**	**0.0058**
Number of Spec.	**21**	**20**	**21**	**Number of Spec.**	**21**


In-Plane Shear Properties (IPS)--RTD
Measured Strength at 0.2% Offset
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
In-Plane Shear Strength [ksi]

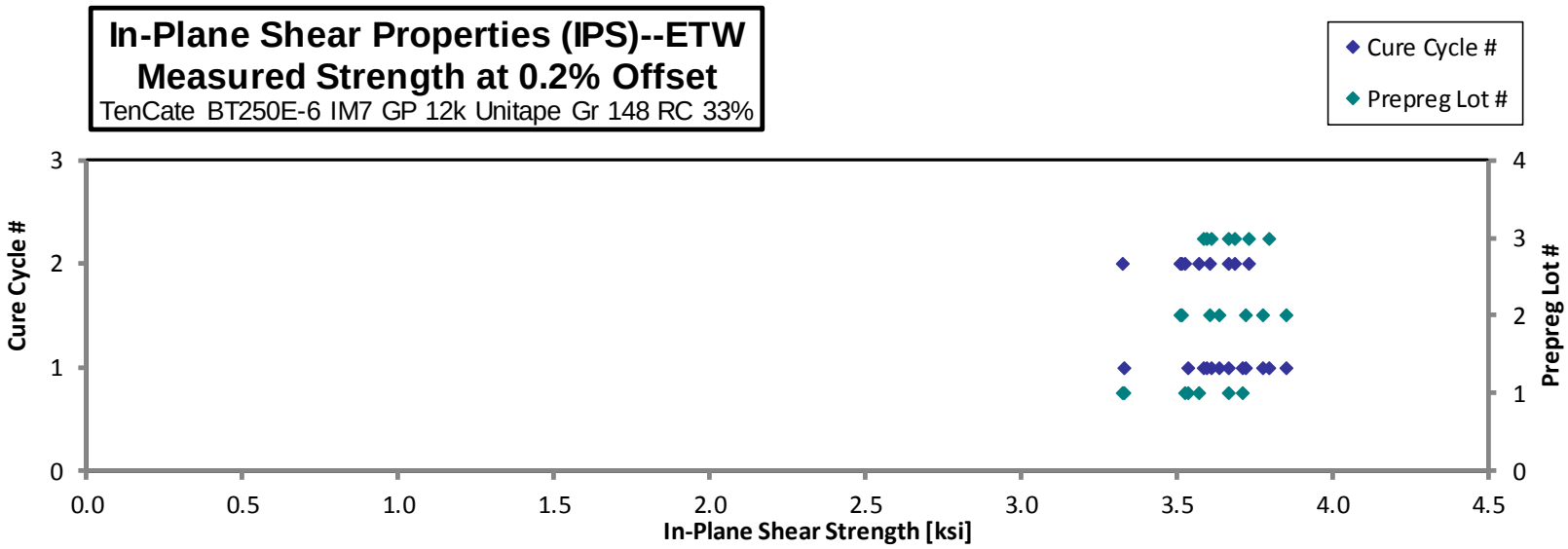

In-Plane Shear Properties (IPS)--RTD
Measured Strength at 5% Strain
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
2.0
4.0
6.0
8.0
10.0
12.0
In-Plane Shear Strength [ksi]

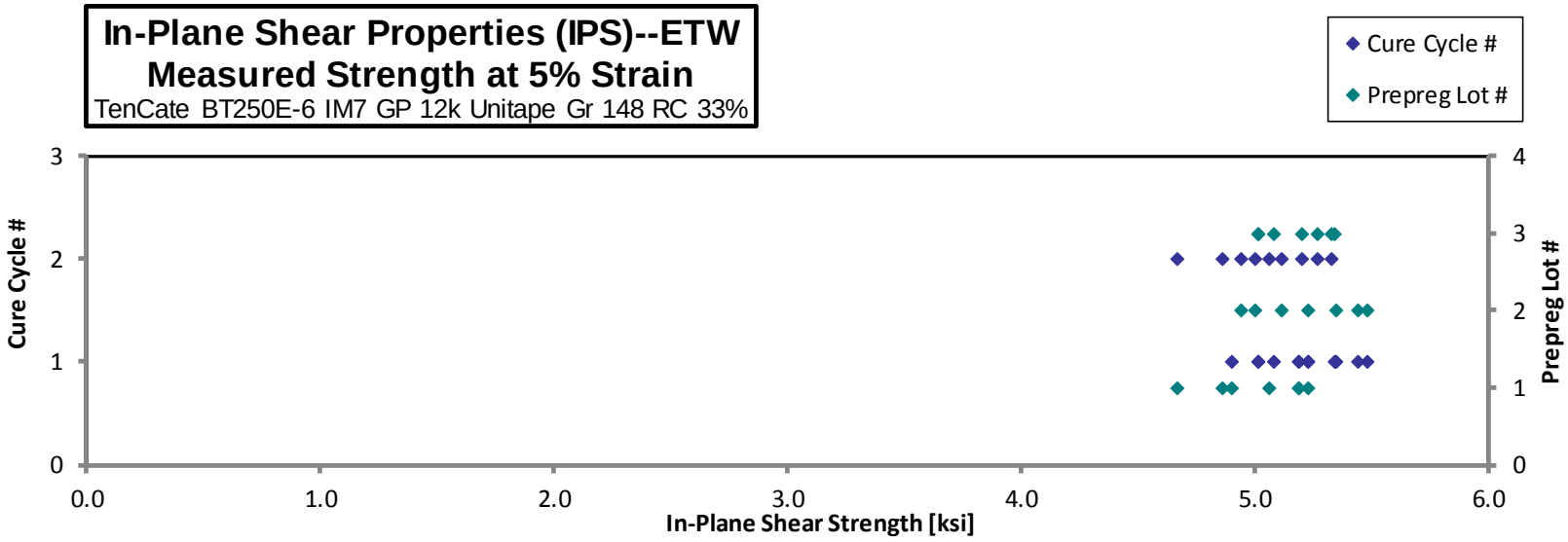

In-Plane Shear Properties (IPS)--RTD
Measured Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
In-Plane Shear Modulus [Msi]
0
1
2
3
4
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7

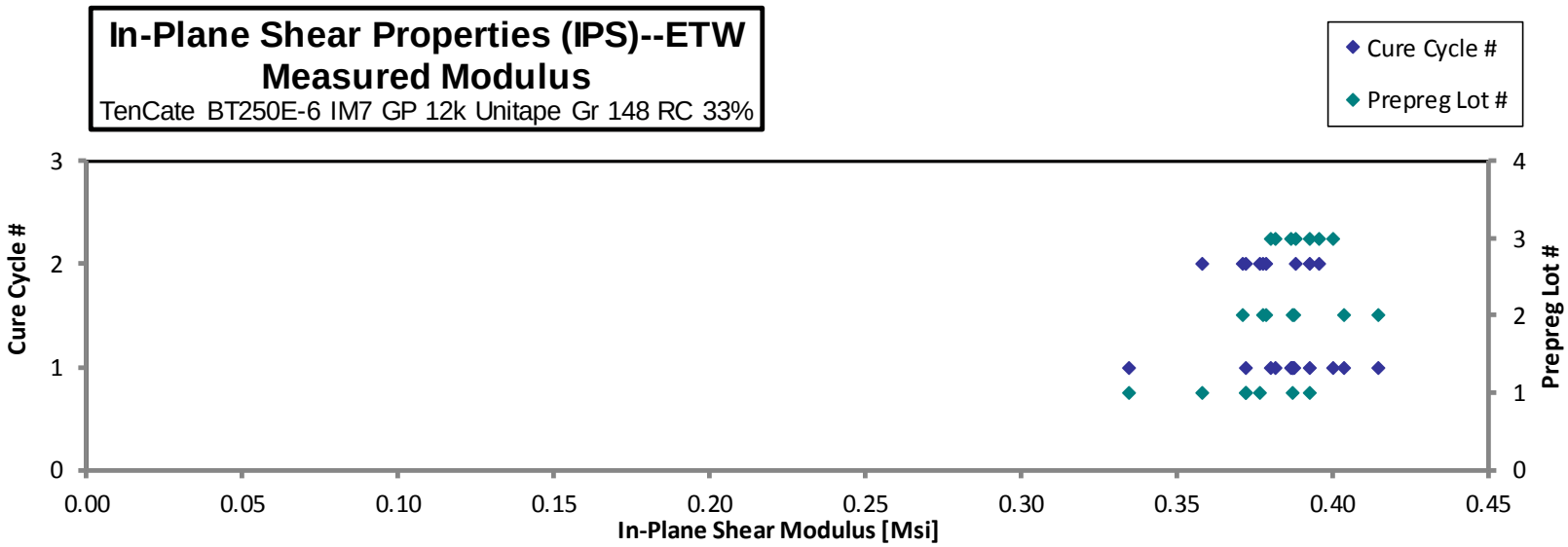
In-Plane Shear Properties (IPS)--ETW
Strength & Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	0.2% Offset Strength [ksi]	Strength at 5% Strain [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]
EAANA11BD	A	C1	1	1	3.331	5.191	0.335	0.089	16	0.0056
EAANA11CD	A	C1	1	1	3.667	5.189	0.387	0.090	16	0.0056
EAANA11DD	A	C1	1	1	3.710	5.229	0.392	0.090	16	0.0056
EAANA11ED	A	C1	1	1	3.533	4.900	0.372	0.090	16	0.0056
EAANA219D	A	C2	1	2	3.573	5.062	0.377	0.089	16	0.0056
EAANA21AD	A	C2	1	2	3.325	4.666	0.358	0.089	16	0.0055
EAANA21BD	A	C2	1	2	3.525	4.862	0.372	0.089	16	0.0056
EAANB11BD	B	C1	2	1	3.778	5.482	0.415	0.092	16	0.0058
EAANB11CD	B	C1	2	1	3.723	5.349	0.387	0.093	16	0.0058
EAANB11DD	B	C1	2	1	3.638	5.225	0.387	0.093	16	0.0058
EAANB11ED	B	C1	2	1	3.849	5.439	0.404	0.092	16	0.0058
EAANB219D	B	C2	2	2	3.606	5.117	0.379	0.093	16	0.0058
EAANB21AD	B	C2	2	2	3.516	4.998	0.371	0.093	16	0.0058
EAANB21BD	B	C2	2	2	3.511	4.944	0.377	0.093	16	0.0058
EAANC11BD	C	C1	3	1	3.797	5.339	0.400	0.093	16	0.0058
EAANC11CD	C	C1	3	1	3.586	5.011	0.381	0.092	16	0.0058
EAANC11DD	C	C1	3	1	3.595	5.011	0.380	0.093	16	0.0058
EAANC11ED	C	C1	3	1	3.613	5.078	0.387	0.092	16	0.0057
EAANC219D	C	C2	3	2	3.686	5.265	0.393	0.092	16	0.0058
EAANC21AD	C	C2	3	2	3.666	5.199	0.388	0.093	16	0.0058
EAANC21BD	C	C2	3	2	3.733	5.330	0.396	0.092	16	0.0058

Average	**3.617**	**5.137**	**0.383**	**Average**	**0.0057**
Standard Dev.	**0.135**	**0.203**	**0.017**	**Standard Dev.**	
Coeff. of Var. [%]	**3.726**	**3.955**	**4.366**	**Coeff. of Var. [%]**	
Min.	**3.325**	**4.666**	**0.335**	**Min.**	**0.0055**
Max.	**3.849**	**5.482**	**0.415**	**Max.**	**0.0058**
Number of Spec.	**21**	**21**	**21**	**Number of Spec.**	**21**


In-Plane Shear Properties (IPS)--ETW
Measured Strength at 0.2% Offset
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
In-Plane Shear Strength [ksi]
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
0
1
2
3
4


In-Plane Shear Properties (IPS)--ETW
Measured Strength at 5% Strain
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
In-Plane Shear Strength [ksi]
0.0
1.0
2.0
3.0
4.0
5.0
6.0
0
1
2
3
4


In-Plane Shear Properties (IPS)--ETW
Measured Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
In-Plane Shear Modulus [Msi]
0
1
2
3
4
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45

4.6 "33/0/67" Unnotched Compression 0 Properties (UNC0)

Laminate Unnotched Compression Properties (UNC0)--CTD
Strength & Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

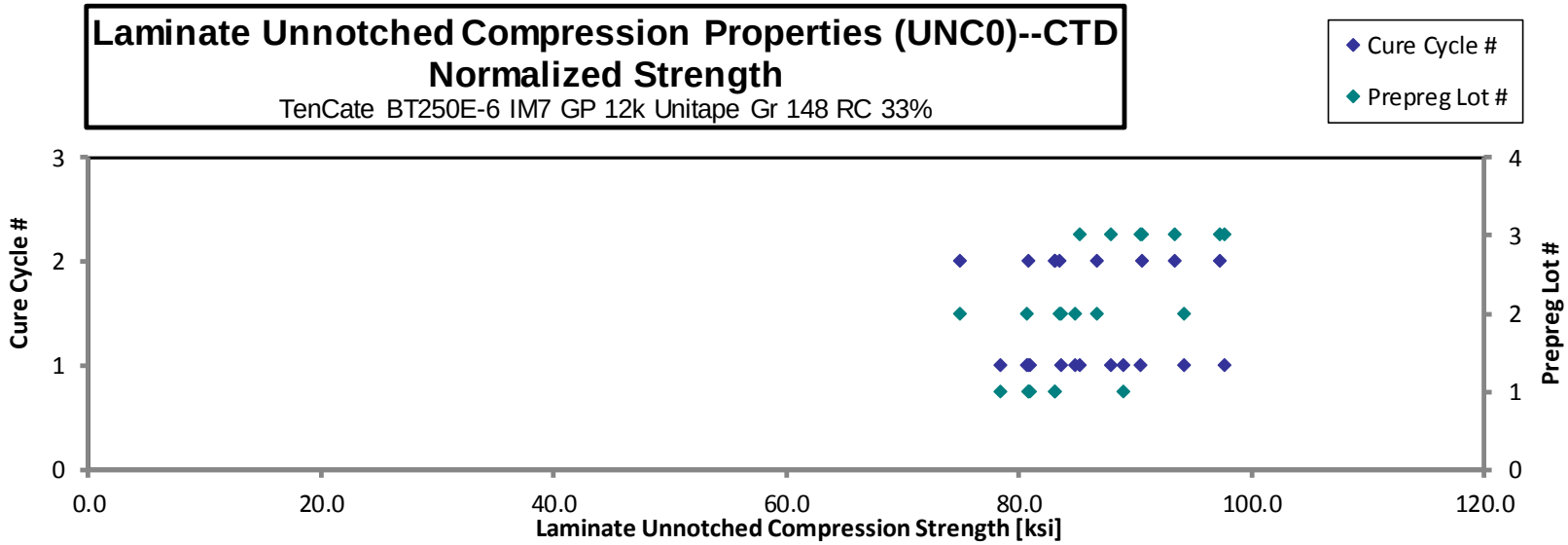
normalizing t_{ply} [in]
0.0058

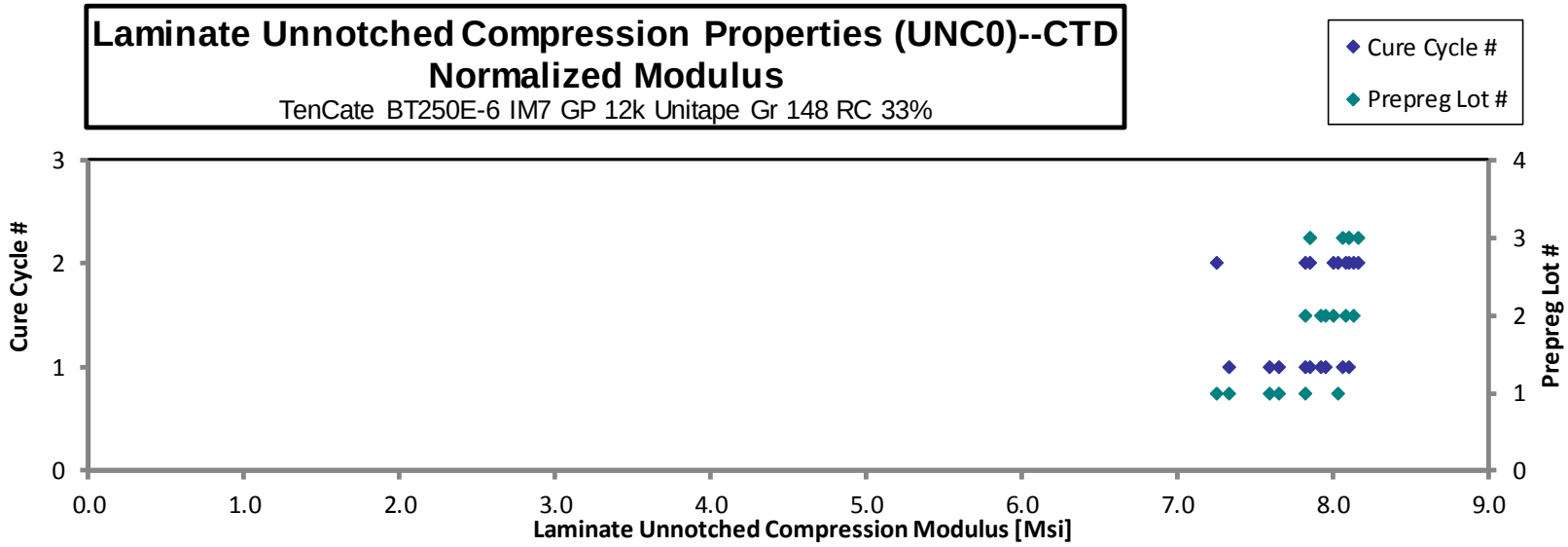
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
EAARA116B	A	C1	1	1	79.696	7.446	0.120	21	BGM	0.0057	78.420	7.327
EAARA117B	A	C1	1	1	90.311	7.706	0.120	21	BGM	0.0057	88.930	7.588
EAARA118B	A	C1	1	1	82.350	7.785	0.120	21	BGM	0.0057	80.964	7.654
EAARA119B*	A	C1	1	1	82.410		0.119	21	BAB	0.0057	80.829	
EAARA215B	A	C2	1	2	84.547	7.968	0.120	21	BAB	0.0057	82.985	7.821
EAARA216B	A	C2	1	2	84.493	8.174	0.120	21	BGM	0.0057	83.027	8.032
EAARA217B	A	C2	1	2	82.397	7.402	0.119	21	BAB	0.0057	80.765	7.255
EAARB116B	B	C1	2	1	83.673	7.820	0.123	21	HIT/BGM	0.0059	84.764	7.922
EAARB117B	B	C1	2	1	82.443	7.719	0.124	21	BGM	0.0059	83.594	7.827
EAARB118B	B	C1	2	1	79.737	7.860	0.123	21	BGM	0.0059	80.686	7.953
EAARB119B*	B	C1	2	1	93.151		0.123	21	HGM	0.0059	94.174	
EAARB215B	B	C2	2	2	73.768	7.883	0.124	21	BAB	0.0059	74.874	8.001
EAARB216B	B	C2	2	2	85.138	7.989	0.124	21	BGM	0.0059	86.641	8.130
EAARB217B	B	C2	2	2	82.026	7.951	0.124	21	BAB	0.0059	83.424	8.087
EAARC116B	C	C1	3	1	84.174	7.970	0.123	21	HGM	0.0059	85.142	8.061
EAARC117B	C	C1	3	1	97.009	8.043	0.123	21	BGM	0.0058	97.686	8.100
EAARC118B	C	C1	3	1	87.328	7.809	0.123	21	BGM	0.0058	87.848	7.856
EAARC119B*	C	C1	3	1	90.182		0.122	21	BGM	0.0058	90.395	
EAARC215B	C	C2	3	2	97.080	7.837	0.122	21	BGM	0.0058	97.210	7.847
EAARC216B	C	C2	3	2	90.284	8.084	0.122	21	BGM	0.0058	90.506	8.104
EAARC217B	C	C2	3	2	93.189	8.151	0.122	21	BGM	0.0058	93.332	8.164

* Specimen was not gaged and tested for strength only.

Average	**85.971**	**7.866**	
Standard Dev.	**5.971**	**0.210**	
Coeff. of Var. [%]	**6.945**	**2.671**	
Min.	**73.768**	**7.402**	
Max.	**97.080**	**8.174**	
Number of Spec.	**21**	**18**	

$Average_{norm}$	**0.0058**	**86.009**	**7.874**
$Standard\ Dev._{norm}$		**6.150**	**0.266**
$Coeff.\ of\ Var.\ [\%]_{norm}$		**7.150**	**3.376**
Min.	**0.0057**	**74.874**	**7.255**
Max.	**0.0059**	**97.686**	**8.164**
Number of Spec.	**21**	**21**	**18**


Laminate Unnotched Compression Properties (UNC0)--CTD
Normalized Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
20.0
40.0
60.0
80.0
100.0
120.0
Laminate Unnotched Compression Strength [ksi]


Laminate Unnotched Compression Properties (UNC0)--CTD
Normalized Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
Laminate Unnotched Compression Modulus [Msi]

Laminate Unnotched Compression Properties (UNC0)--RTD
Strength & Modulus

TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

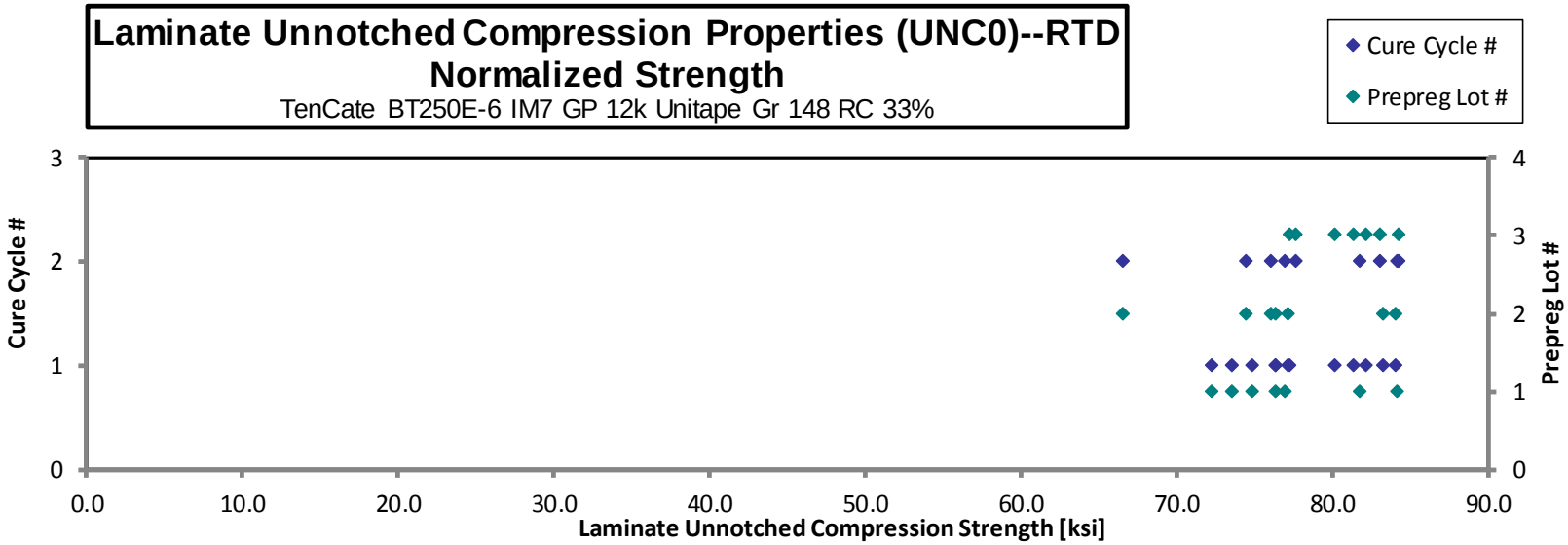
normalizing t_{ply} [in]
0.0058

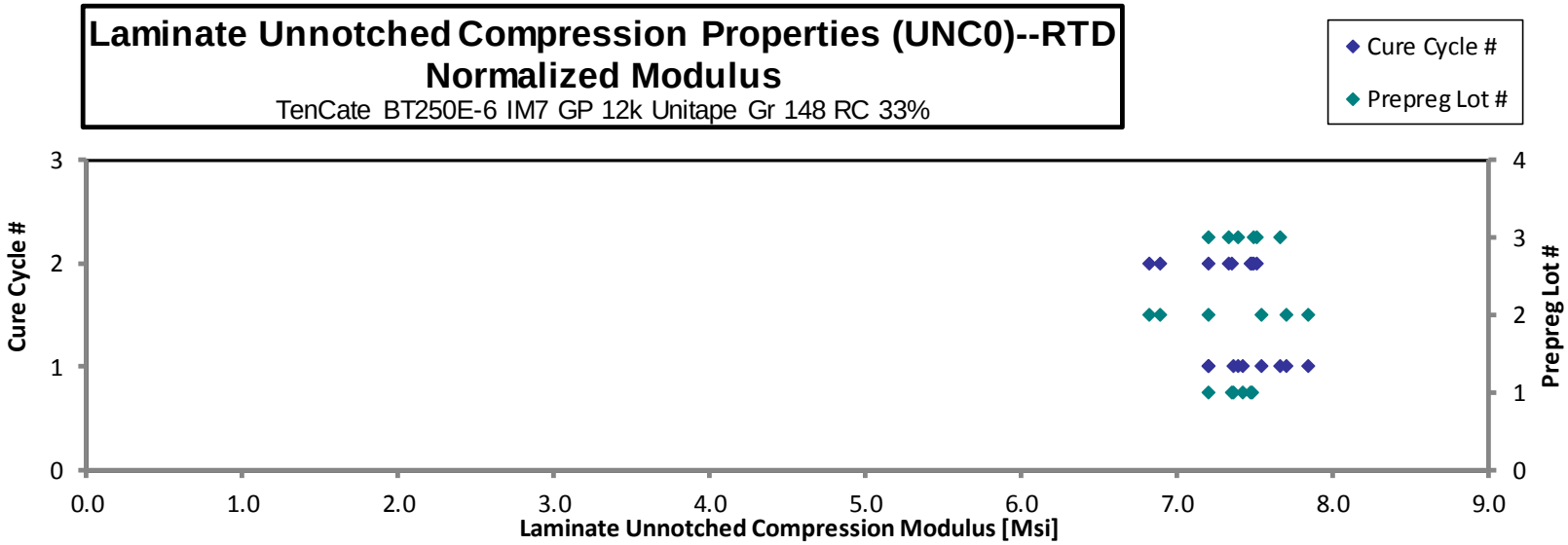
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
EAARA111A	A	C1	1	1	79.742	7.671	0.114	21	BGM	0.0054	74.857	7.201
EAARA112A	A	C1	1	1	79.467	7.735	0.117	21	BGM	0.0056	76.295	7.426
EAARA113A	A	C1	1	1	74.920	7.635	0.117	21	BGM	0.0056	72.206	7.358
EAARA115A*	A	C1	1	1	75.067		0.119	21	BGM	0.0057	73.527	
EAARA211A	A	C2	1	2	88.646	7.743	0.116	21	BGM	0.0055	84.161	7.351
EAARA212A	A	C2	1	2	80.130	7.779	0.117	21	BGM	0.0056	76.947	7.470
EAARA213A	A	C2	1	2	84.174	7.707	0.118	21	HGM	0.0056	81.730	7.483
EAARB111A	B	C1	2	1	85.395	7.738	0.119	21	BGM	0.0057	83.221	7.541
EAARB112A	B	C1	2	1	76.921	7.903	0.121	21	BGM	0.0058	76.313	7.841
EAARB113A	B	C1	2	1	83.783	7.681	0.122	21	BGM	0.0058	83.998	7.701
EAARB114A*	B	C1	2	1	76.390		0.123	21	BGM	0.0059	77.111	
EAARB211A**	B	C2	2	2	67.619	6.926	0.120	21	BGM/ HGM	0.0057	66.557	6.817
EAARB212A	B	C2	2	2	75.250	6.968	0.120	21	BGM	0.0057	74.439	6.893
EAARB213A	B	C2	2	2	76.047	7.205	0.122	21	BGM	0.0058	75.992	7.200
EAARC111A	C	C1	3	1	82.756	7.335	0.120	21	BGM	0.0057	81.287	7.205
EAARC112A	C	C1	3	1	77.735	7.432	0.121	21	BGM	0.0058	77.256	7.387
EAARC113A	C	C1	3	1	82.017	7.657	0.122	21	BGM	0.0058	82.118	7.666
EAARC114A*	C	C1	3	1	79.607		0.123	21	BGM	0.0058	80.130	
EAARC211A	C	C2	3	2	79.687	7.521	0.119	21	BGM	0.0057	77.650	7.329
EAARC212A	C	C2	3	2	85.821	7.629	0.120	21	BGM	0.0057	84.262	7.491
EAARC213A	C	C2	3	2	83.517	7.553	0.121	21	BGM	0.0058	83.063	7.512

* Specimen was not gaged and tested for strength only.

** Data point investigated. Nothing anomalous found, but dry spots were noted on the specimen before test.

Average	**79.747**	**7.546**		**Average$_{norm}$**	**0.0057**	**78.244**	**7.382**
Standard Dev.	**4.807**	**0.274**		**Standard Dev.$_{norm}$**		**4.639**	**0.257**
Coeff. of Var. [%]	**6.027**	**3.627**		**Coeff. of Var. [%]$_{norm}$**		**5.929**	**3.488**
Min.	**67.619**	**6.926**		**Min.**	**0.0054**	**66.557**	**6.817**
Max.	**88.646**	**7.903**		**Max.**	**0.0059**	**84.262**	**7.841**
Number of Spec.	**21**	**18**		**Number of Spec.**	**21**	**21**	**18**


Laminate Unnotched Compression Properties (UNC0)--RTD
Normalized Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
Laminate Unnotched Compression Strength [ksi]


Laminate Unnotched Compression Properties (UNC0)--RTD
Normalized Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
Laminate Unnotched Compression Modulus [Msi]

Laminate Unnotched Compression Properties (UNC0)--ETD
Strength & Modulus

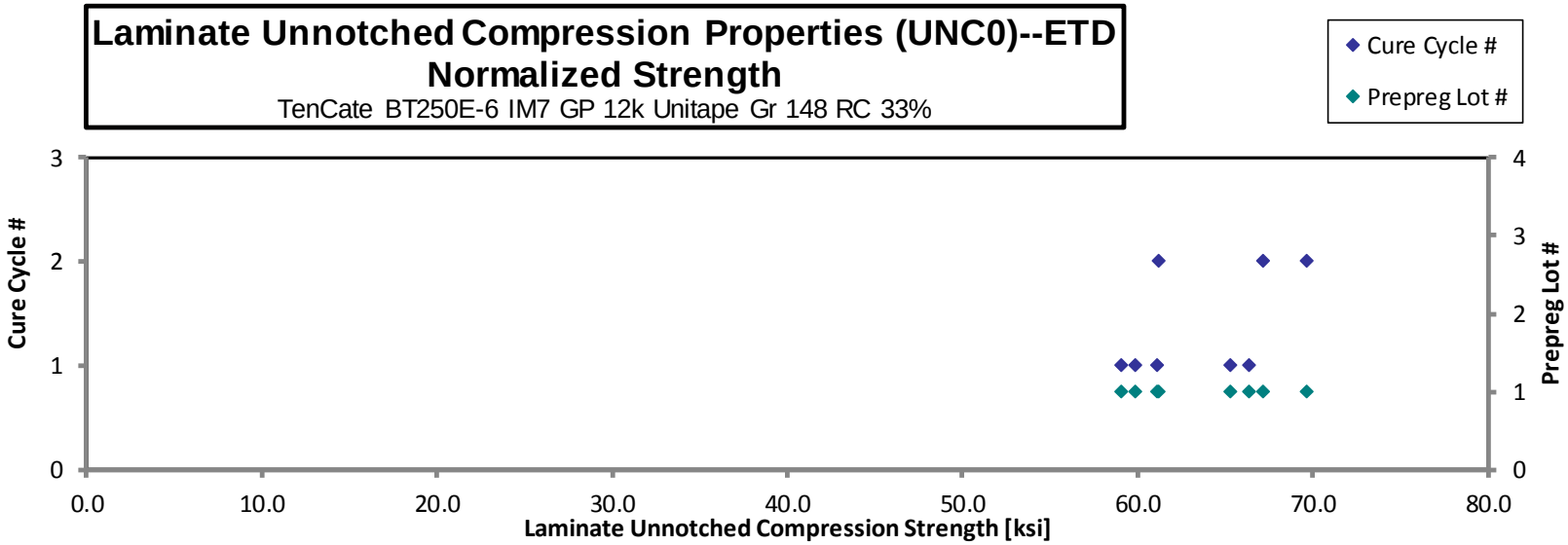
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

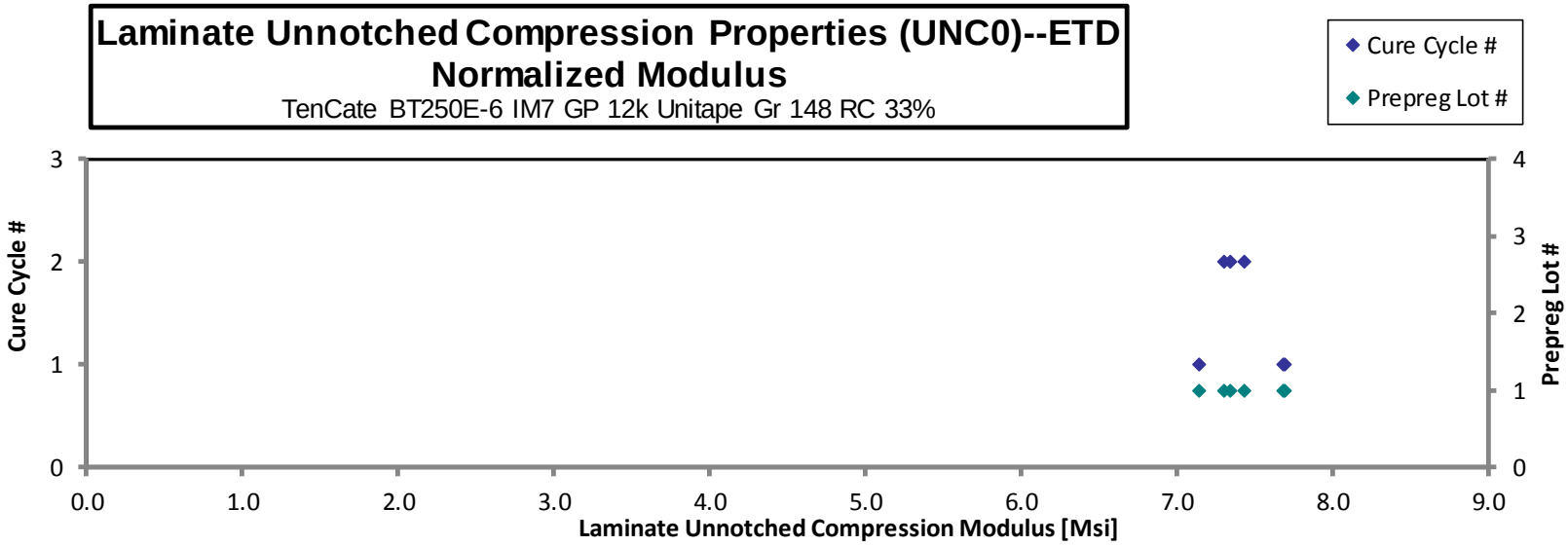
normalizing t_{ply} [in]
0.0058

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
EAARA11BC	A	C1	1	1	67.710	7.837	0.119	21	BGM	0.0057	66.355	7.680
EAARA11CC	A	C1	1	1	66.453	7.829	0.120	21	BAT / HIT	0.0057	65.246	7.687
EAARA11DC	A	C1	1	1	62.193	7.270	0.120	21	HIT / BAT	0.0057	61.050	7.137
EAARA11EC*	A	C1	1	1	62.723		0.115	21	HIT/BAB	0.0055	59.003	
EAARA11FC*	A	C1	1	1	62.527		0.117	21	BAB / HIB	0.0056	59.845	
EAARA219C	A	C2	1	2	62.438	7.454	0.119	21	HIT/BGM	0.0057	61.189	7.305
EAARA21AC	A	C2	1	2	68.211	7.468	0.120	21	BAT	0.0057	67.084	7.344
EAARA21BC	A	C2	1	2	73.728	7.869	0.115	21	BAT	0.0055	69.635	7.432

* Specimen was not gaged and tested for strength only.

Average	**65.748**	**7.621**	**$Average_{norm}$**	**0.0056**	**63.676**	**7.431**
Standard Dev.	**4.092**	**0.255**	**Standard $Dev._{norm}$**		**3.898**	**0.218**
Coeff. of Var. [%]	**6.224**	**3.351**	**Coeff. of Var. $[\%]_{norm}$**		**6.122**	**2.934**
Min.	**62.193**	**7.270**	**Min.**	**0.0055**	**59.003**	**7.137**
Max.	**73.728**	**7.869**	**Max.**	**0.0057**	**69.635**	**7.687**
Number of Spec.	**8**	**6**	**Number of Spec.**	**8**	**8**	**6**


Laminate Unnotched Compression Properties (UNC0)--ETD
Normalized Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
Laminate Unnotched Compression Strength [ksi]


Laminate Unnotched Compression Properties (UNC0)--ETD
Normalized Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
Laminate Unnotched Compression Modulus [Msi]

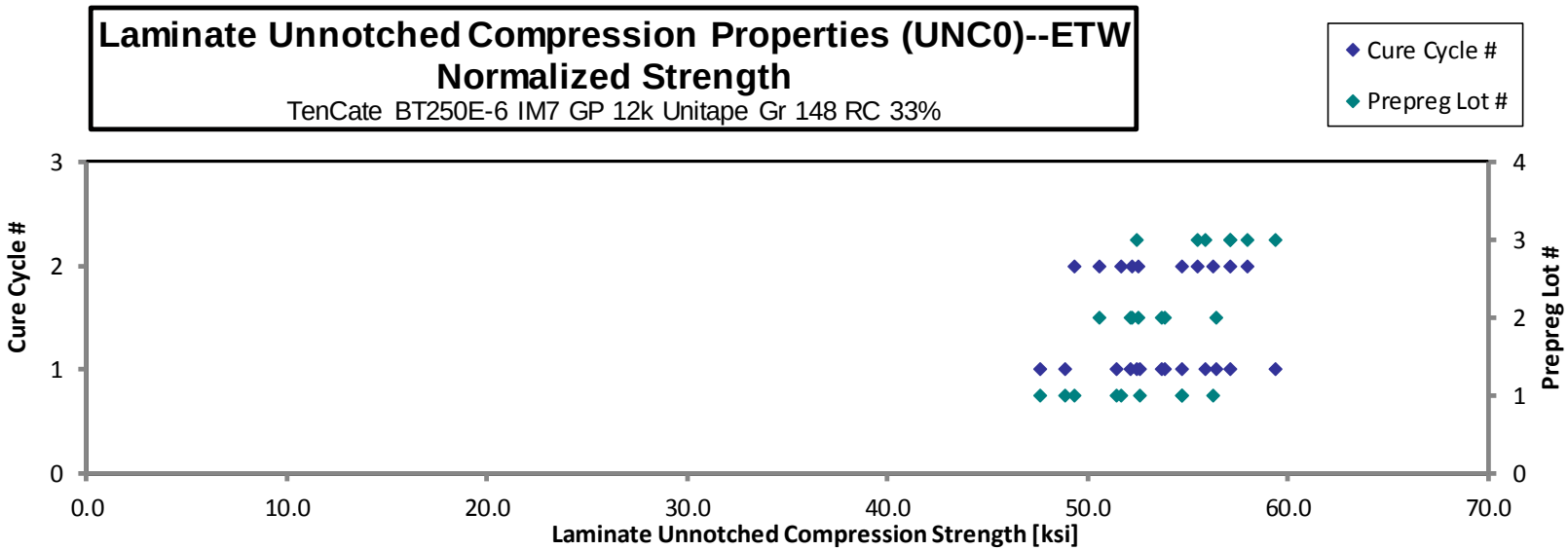
Laminate Unnotched Compression Properties (UNC0)--ETW
Strength & Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

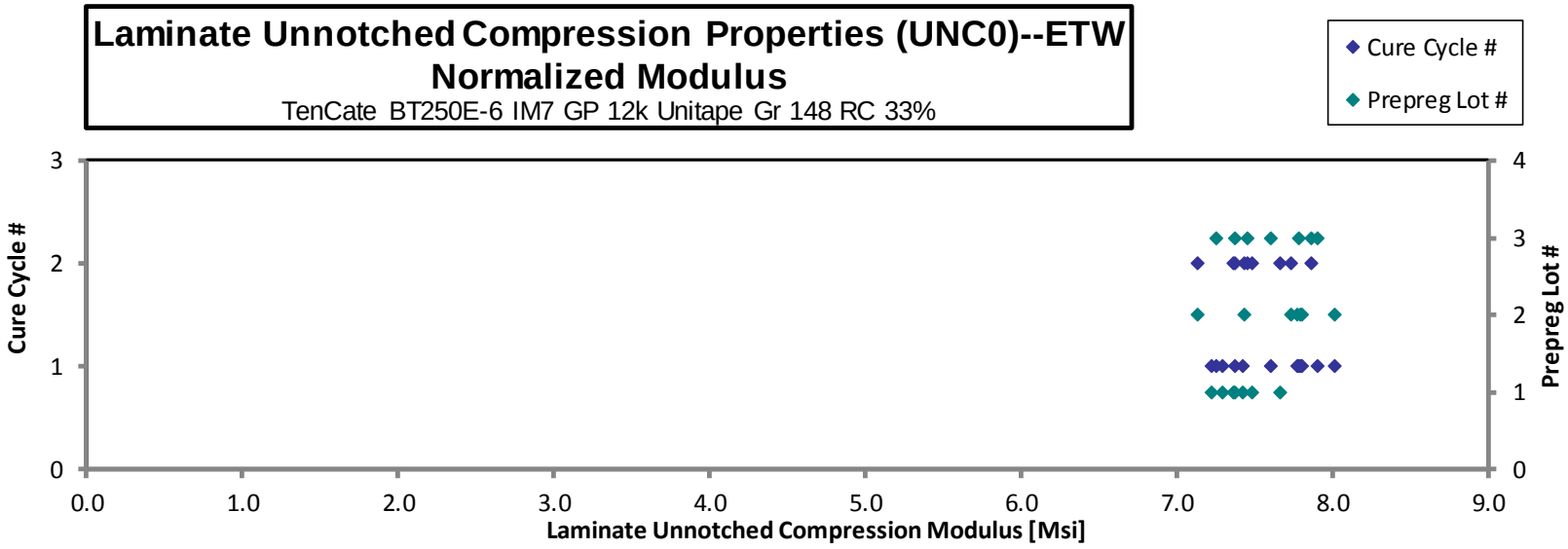
normalizing t_{ply} [in]
0.0058

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
EAARA11GD	A	C1	1	1		7.533	0.118	21	BAB	0.0056		7.296
EAARA11HD	A	C1	1	1		7.608	0.119	21	BAB	0.0057		7.417
EAARA11ID	A	C1	1	1	48.562		0.119	21	HAT / HIT	0.0057	47.575	
EAARA11JD	A	C1	1	1		7.338	0.120	21	BAB / HIB	0.0057		7.219
EAARA11KD	A	C1	1	1		7.485	0.120	21	HGM	0.0057		7.375
EAARA11MD	A	C1	1	1	53.468		0.120	21	BAB	0.0057	52.623	
EAARA11ND	A	C1	1	1	49.677		0.120	21	BAB	0.0057	48.861	
EAARA11PD	A	C1	1	1	55.595		0.120	21	BAT	0.0057	54.694	
EAARA11QD	A	C1	1	1	52.413		0.120	21	BAB / HIB	0.0057	51.450	
EAARA21DD	A	C2	1	2		7.881	0.118	21	HIT	0.0056		7.661
EAARA21ED	A	C2	1	2		7.620	0.120	21	HAT	0.0057		7.477
EAARA21FD	A	C2	1	2		7.480	0.120	21	HIB	0.0057		7.357
EAARA21HD	A	C2	1	2	50.301		0.119	21	BAT	0.0057	49.315	
EAARA21ID	A	C2	1	2	52.691		0.119	21	BIT/BAT	0.0057	51.658	
EAARA21JD	A	C2	1	2	55.780		0.119	21	BAT/BIT	0.0057	54.692	
EAARA21KD	A	C2	1	2	57.439		0.119	21	BAT	0.0057	56.236	
EAARB11BD	B	C1	2	1		7.976	0.119	21	BAT	0.0056		7.769
EAARB11CD	B	C1	2	1		8.097	0.120	21	BAB	0.0057		8.010
EAARB11DD	B	C1	2	1		7.787	0.122	21	HIT/BAB	0.0058		7.794
EAARB11ED	B	C1	2	1		7.727	0.123	21	BAB	0.0059		7.799
EAARB11FD	B	C1	2	1	53.263		0.123	21	BAT	0.0059	53.864	
EAARB11HD	B	C1	2	1	51.432		0.123	21	HAT	0.0059	52.144	
EAARB11ID	B	C1	2	1	55.769		0.123	21	BAB	0.0059	56.364	
EAARB11JD	B	C1	2	1	53.170		0.123	21	BAB	0.0059	53.661	
EAARB219D	B	C2	2	2		7.124	0.122	21	BAT	0.0058		7.129
EAARB21AD	B	C2	2	2		7.352	0.123	21	BAB	0.0059		7.434
EAARB21BD	B	C2	2	2		7.597	0.124	21	BAB	0.0059		7.732
EAARB21ED	B	C2	2	2	50.789		0.126	21	BAB	0.0060	52.514	
EAARB21FD	B	C2	2	2	48.846		0.126	21	BAB	0.0060	50.535	
EAARB21GD	B	C2	2	2	50.421		0.126	21	BAT	0.0060	52.160	
EAARC11BD	C	C1	3	1		7.382	0.120	21	HIT	0.0057		7.250
EAARC11CD	C	C1	3	1		7.645	0.121	21	HIT	0.0058		7.604
EAARC11DD	C	C1	3	1		7.779	0.122	21	HAT	0.0058		7.780
EAARC11ED	C	C1	3	1		7.866	0.122	21	HIT	0.0058		7.907
EAARC11FD	C	C1	3	1	58.842		0.123	21	BAB	0.0058	59.325	
EAARC11GD	C	C1	3	1	56.436		0.123	21	BAB/HIB	0.0059	57.085	
EAARC11HD	C	C1	3	1	55.369		0.123	21	BAB	0.0059	55.886	
EAARC11ID	C	C1	3	1	52.002		0.123	21	BAT	0.0058	52.397	
EAARC219D	C	C2	3	2		7.553	0.119	21	HIT/BAB	0.0057		7.370
EAARC21AD	C	C2	3	2		7.614	0.119	21	BAT	0.0057		7.456
EAARC21BD	C	C2	3	2		7.945	0.121	21	HGM	0.0057		7.860
EAARC21CD	C	C2	3	2	58.485		0.121	21	BAB	0.0057	57.975	
EAARC21ED	C	C2	3	2	55.581		0.122	21	BAB	0.0058	55.501	
EAARC21FD	C	C2	3	2	57.288		0.121	21	BAB	0.0058	57.117	

Average	**53.636**	**7.638**	
Standard Dev.	**3.091**	**0.240**	
Coeff. of Var. [%]	**5.764**	**3.141**	
Min.	**48.562**	**7.124**	
Max.	**58.842**	**8.097**	
Number of Spec.	**23**	**21**	

$Average_{norm}$	**0.0058**	**53.636**	**7.557**
Standard $Dev._{norm}$		**3.052**	**0.254**
Coeff. of Var. $[\%]_{norm}$		**5.691**	**3.362**
Min.	**0.0056**	**47.575**	**7.129**
Max.	**0.0060**	**59.325**	**8.010**
Number of Spec.	**44**	**23**	**21**


Laminate Unnotched Compression Properties (UNC0)--ETW
Normalized Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
Laminate Unnotched Compression Strength [ksi]

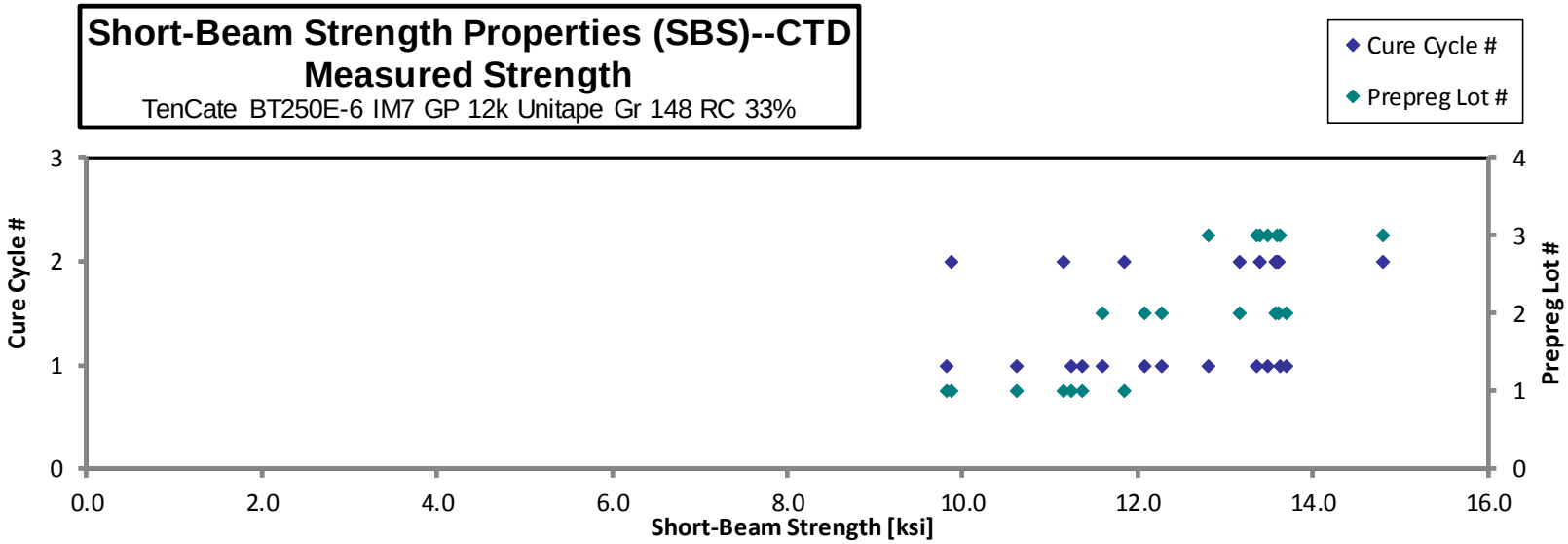

Laminate Unnotched Compression Properties (UNC0)--ETW
Normalized Modulus
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
Laminate Unnotched Compression Modulus [Msi]

4.7 Lamina Short-Beam Strength Properties (SBS)

Short-Beam Strength Properties (SBS)--CTD
Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode
EAAQA118B	A	C1	1	1	11.228	0.250	45	0.0056	ILS
EAAQA119B	A	C1	1	1	10.621	0.252	45	0.0056	ILS
EAAQA11AB	A	C1	1	1	11.357	0.255	45	0.0057	ILS
EAAQA11BB	A	C1	1	1	9.811	0.259	45	0.0058	ILS
EAAQA215B	A	C2	1	2	11.838	0.256	45	0.0057	ILS
EAAQA216B	A	C2	1	2	11.140	0.255	45	0.0057	ILS
EAAQA218B	A	C2	1	2	9.865	0.254	45	0.0056	ILS
EAAQB115B	B	C1	2	1	13.698	0.264	45	0.0059	ILS
EAAQB116B	B	C1	2	1	12.079	0.265	45	0.0059	ILS
EAAQB117B	B	C1	2	1	12.274	0.266	45	0.0059	ILS
EAAQB118B	B	C1	2	1	11.592	0.265	45	0.0059	ILS
EAAQB215B	B	C2	2	2	13.563	0.264	45	0.0059	ILS
EAAQB216B	B	C2	2	2	13.609	0.265	45	0.0059	ILS
EAAQB217B	B	C2	2	2	13.151	0.266	45	0.0059	ILS
EAAQC116B	C	C1	3	1	13.352	0.257	45	0.0057	ILS
EAAQC117B	C	C1	3	1	12.807	0.260	45	0.0058	ILS
EAAQC118B	C	C1	3	1	13.486	0.258	45	0.0057	ILS
EAAQC119B	C	C1	3	1	13.621	0.261	45	0.0058	ILS
EAAQC216B	C	C2	3	2	13.594	0.262	45	0.0058	ILS
EAAQC217B	C	C2	3	2	14.800	0.259	45	0.0058	ILS
EAAQC218B	C	C2	3	2	13.386	0.255	45	0.0057	ILS

Average	**12.422**	**Average**	**0.0058**
Standard Dev.	**1.385**	**Standard Dev.**	
Coeff. of Var. [%]	**11.151**	**Coeff. of Var. [%]**	
Min.	**9.811**	**Min.**	**0.0056**
Max.	**14.800**	**Max.**	**0.0059**
Number of Spec.	**21**	**Number of Spec.**	**21**

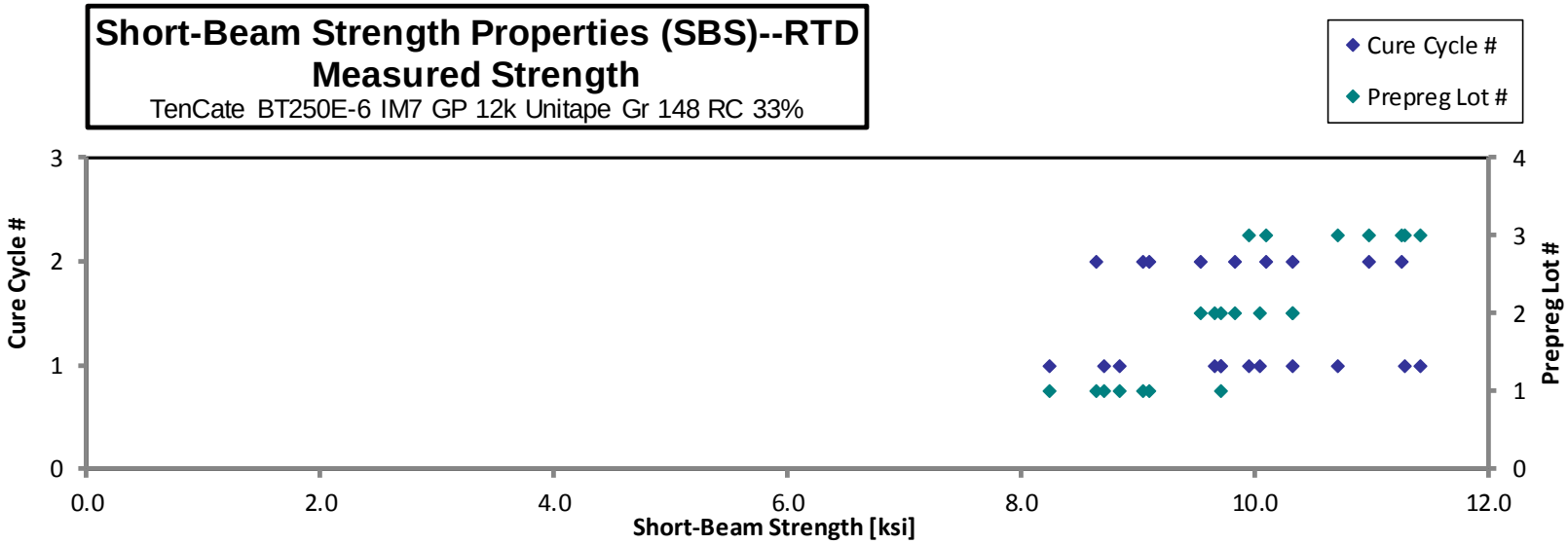

Short-Beam Strength Properties (SBS)--CTD
Measured Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
Short-Beam Strength [ksi]
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
0
1
2
3
4

Short-Beam Strength Properties (SBS)--RTD
Strength

TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode
EAAQA111A	A	C1	1	1	9.709	0.249	45	0.0055	ILS
EAAQA112A	A	C1	1	1	8.701	0.252	45	0.0056	ILS
EAAQA113A	A	C1	1	1	8.236	0.254	45	0.0056	ILS
EAAQA114A	A	C1	1	1	8.847	0.255	45	0.0057	ILS
EAAQA211A	A	C2	1	2	8.639	0.252	45	0.0056	ILS
EAAQA212A	A	C2	1	2	9.091	0.254	45	0.0056	ILS
EAAQA213A	A	C2	1	2	9.046	0.256	45	0.0057	ILS
EAAQB111A	B	C1	2	1	9.711	0.251	45	0.0056	ILS
EAAQB112A	B	C1	2	1	9.652	0.256	45	0.0057	ILS
EAAQB113A	B	C1	2	1	10.038	0.259	45	0.0058	ILS
EAAQB114A	B	C1	2	1	10.317	0.262	45	0.0058	ILS
EAAQB211A	B	C2	2	2	10.318	0.254	45	0.0056	ILS
EAAQB212A	B	C2	2	2	9.827	0.256	45	0.0057	ILS
EAAQB213A	B	C2	2	2	9.533	0.258	45	0.0057	ILS
EAAQC111A	C	C1	3	1	11.277	0.260	45	0.0058	ILS
EAAQC112A	C	C1	3	1	10.714	0.261	45	0.0058	ILS
EAAQC113A	C	C1	3	1	11.417	0.260	45	0.0058	ILS
EAAQC114A	C	C1	3	1	9.943	0.263	45	0.0058	ILS
EAAQC211A	C	C2	3	2	10.090	0.254	45	0.0056	ILS
EAAQC212A	C	C2	3	2	11.260	0.260	45	0.0058	ILS
EAAQC213A	C	C2	3	2	10.982	0.263	45	0.0058	ILS

Average	**9.874**	**Average**	**0.0057**
Standard Dev.	**0.917**	**Standard Dev.**	
Coeff. of Var. [%]	**9.291**	**Coeff. of Var. [%]**	
Min.	**8.236**	**Min.**	**0.0055**
Max.	**11.417**	**Max.**	**0.0058**
Number of Spec.	**21**	**Number of Spec.**	**21**

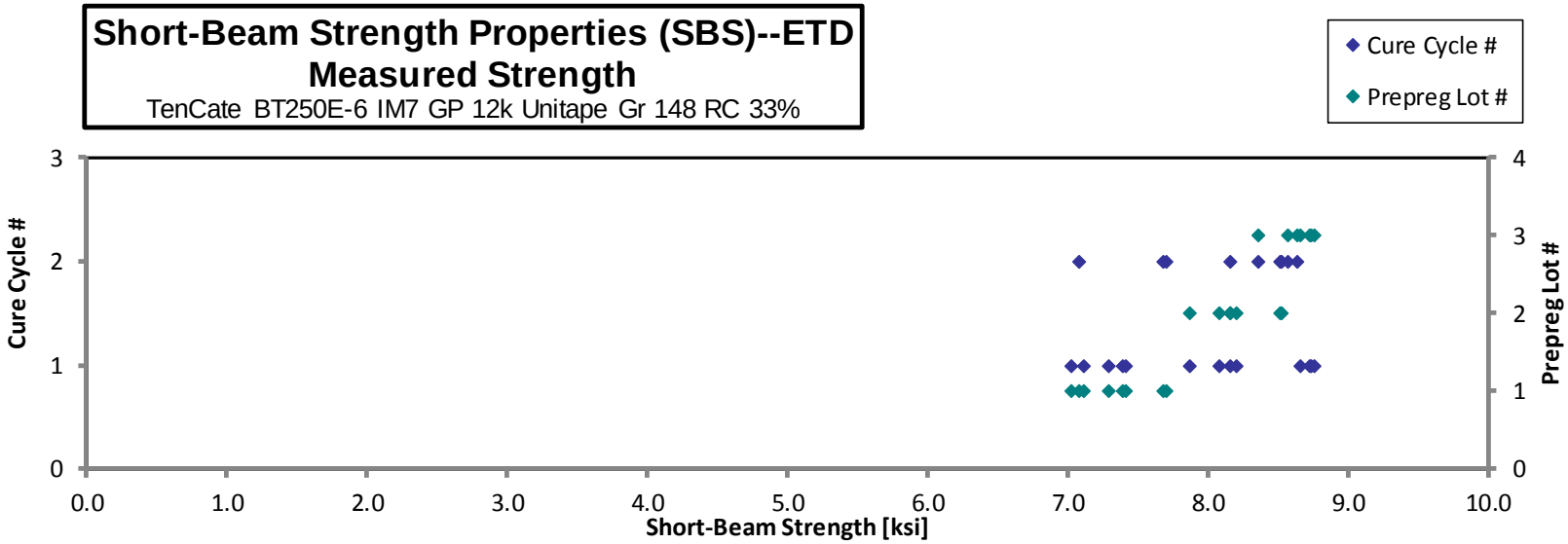

Short-Beam Strength Properties (SBS)--RTD
Measured Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
Short-Beam Strength [ksi]
0.0
2.0
4.0
6.0
8.0
10.0
12.0
0
1
2
3
4

Short-Beam Strength Properties (SBS)--ETD
Strength

TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode
EAAQA11DC	A	C1	1	1	7.114	0.260	45	0.0058	ILS
EAAQA11EC	A	C1	1	1	7.288	0.258	45	0.0057	ILS
EAAQA11FC	A	C1	1	1	7.408	0.256	45	0.0057	ILS
EAAQA11GC	A	C1	1	1	7.392	0.252	45	0.0056	ILS
EAAQA11HC	A	C1	1	1	7.026	0.253	45	0.0056	ILS
EAAQA21AC	A	C2	1	2	7.680	0.256	45	0.0057	ILS
EAAQA21BC	A	C2	1	2	7.077	0.258	45	0.0057	ILS
EAAQA21CC	A	C2	1	2	7.697	0.259	45	0.0057	ILS
EAAQB11AC	B	C1	2	1	8.200	0.264	45	0.0059	ILS
EAAQB11BC	B	C1	2	1	8.162	0.262	45	0.0058	ILS
EAAQB11CC	B	C1	2	1	7.868	0.261	45	0.0058	ILS
EAAQB11DC	B	C1	2	1	8.082	0.259	45	0.0058	ILS
EAAQB219C	B	C2	2	2	8.515	0.265	45	0.0059	ILS
EAAQB21AC	B	C2	2	2	8.157	0.265	45	0.0059	ILS
EAAQB21BC	B	C2	2	2	8.529	0.265	45	0.0059	ILS
EAAQC11BC	C	C1	3	1	8.762	0.258	45	0.0057	ILS
EAAQC11CC	C	C1	3	1	8.663	0.259	45	0.0058	ILS
EAAQC11DC	C	C1	3	1	8.725	0.261	45	0.0058	ILS
EAAQC11EC	C	C1	3	1	8.730	0.259	45	0.0057	ILS
EAAQC21BC	C	C2	3	2	8.640	0.261	45	0.0058	ILS
EAAQC21CC	C	C2	3	2	8.570	0.263	45	0.0058	ILS
EAAQC21DC	C	C2	3	2	8.361	0.263	45	0.0058	ILS

Average	**8.029**	**Average**	**0.0058**
Standard Dev.	**0.601**	**Standard Dev.**	
Coeff. of Var. [%]	**7.488**	**Coeff. of Var. [%]**	
Min.	**7.026**	**Min.**	**0.0056**
Max.	**8.762**	**Max.**	**0.0059**
Number of Spec.	**22**	**Number of Spec.**	**22**

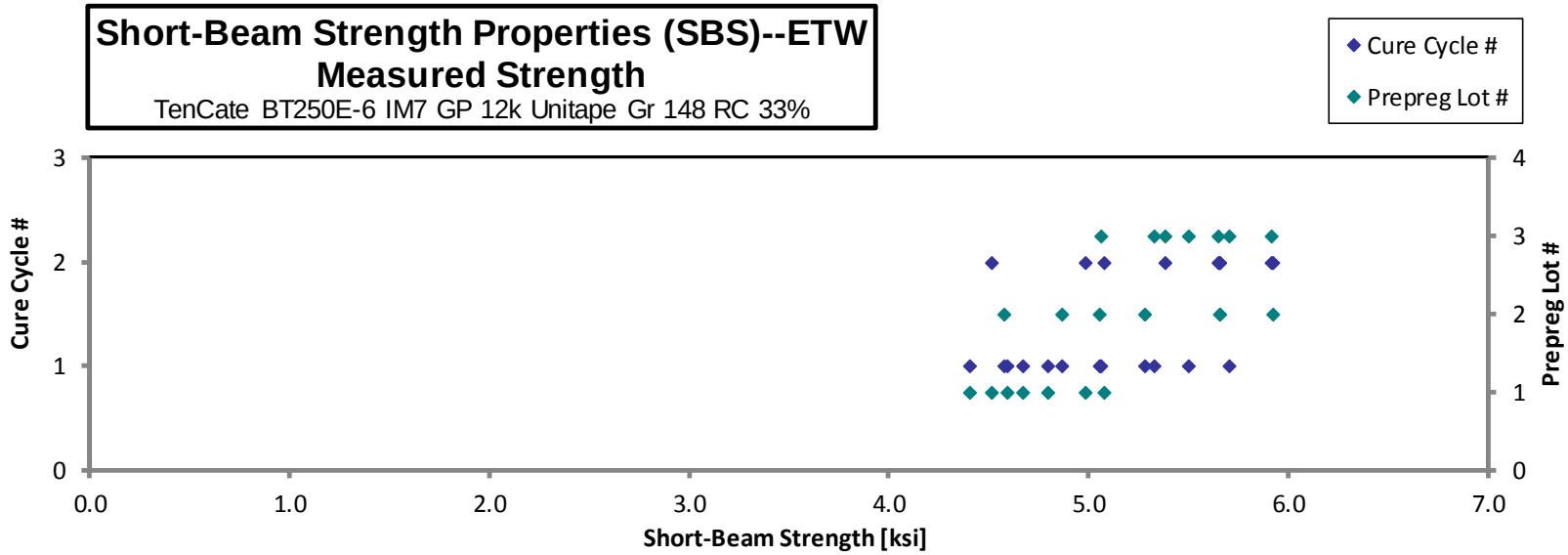

Short-Beam Strength Properties (SBS)--ETD
Measured Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
Short-Beam Strength [ksi]
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0
1
2
3
4

Short-Beam Strength Properties (SBS)--ETW
Strength

TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

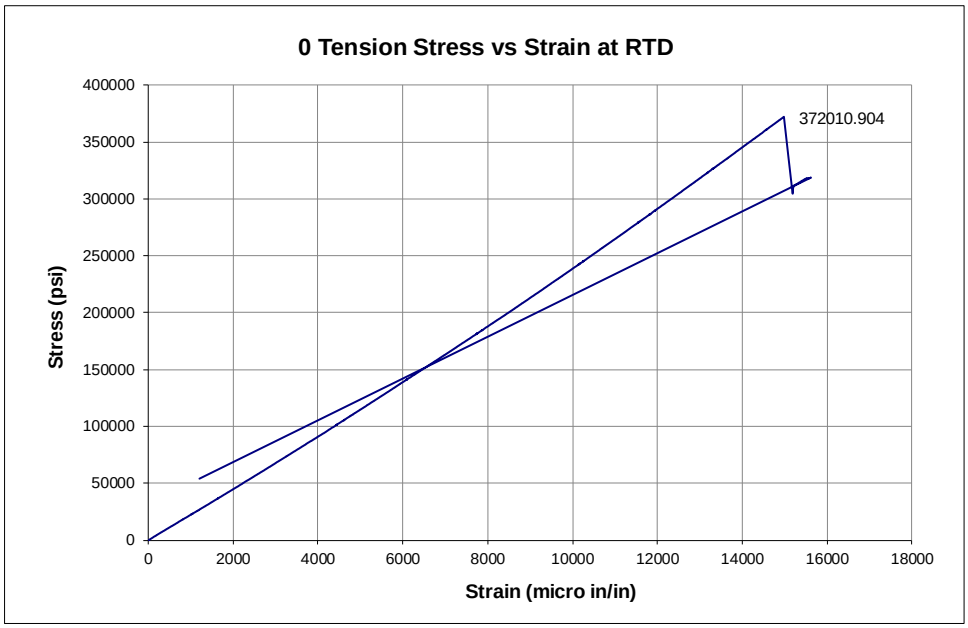
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode
EAAQA11JD	A	C1	1	1	4.671	0.259	45	0.0058	ILS
EAAQA11KD	A	C1	1	1	4.793	0.259	45	0.0058	ILS
EAAQA11LD	A	C1	1	1	4.590	0.260	45	0.0058	ILS
EAAQA11MD	A	C1	1	1	4.404	0.259	45	0.0058	ILS
EAAQA21GD	A	C2	1	2	4.516	0.255	45	0.0057	ILS
EAAQA21HD	A	C2	1	2	5.079	0.254	45	0.0057	ILS
EAAQA21ID	A	C2	1	2	4.982	0.254	45	0.0056	ILS
EAAQB11FD	B	C1	2	1	5.278	0.255	45	0.0057	ILS
EAAQB11GD	B	C1	2	1	5.051	0.253	45	0.0056	ILS
EAAQB11ID	B	C1	2	1	4.577	0.250	45	0.0056	ILS
EAAQB11JD	B	C1	2	1	4.863	0.255	45	0.0057	ILS
EAAQB21DD	B	C2	2	2	5.922	0.261	45	0.0058	ILS
EAAQB21ED	B	C2	2	2	5.659	0.258	45	0.0057	ILS
EAAQB21FD	B	C2	2	2	5.654	0.254	45	0.0056	ILS
EAAQC11GD	C	C1	3	1	5.496	0.263	45	0.0058	ILS
EAAQC11HD	C	C1	3	1	5.064	0.262	45	0.0058	ILS
EAAQC11ID	C	C1	3	1	5.330	0.264	45	0.0059	ILS
EAAQC11JD	C	C1	3	1	5.706	0.262	45	0.0058	ILS
EAAQC21HD	C	C2	3	2	5.385	0.250	45	0.0056	ILS
EAAQC21ID	C	C2	3	2	5.912	0.256	45	0.0057	ILS
EAAQC21JD	C	C2	3	2	5.651	0.259	45	0.0058	ILS

Average	**5.171**	**Average**	**0.0057**
Standard Dev.	**0.477**	**Standard Dev.**	
Coeff. of Var. [%]	**9.229**	**Coeff. of Var. [%]**	
Min.	**4.404**	**Min.**	**0.0056**
Max.	**5.922**	**Max.**	**0.0059**
Number of Spec.	**21**	**Number of Spec.**	**21**

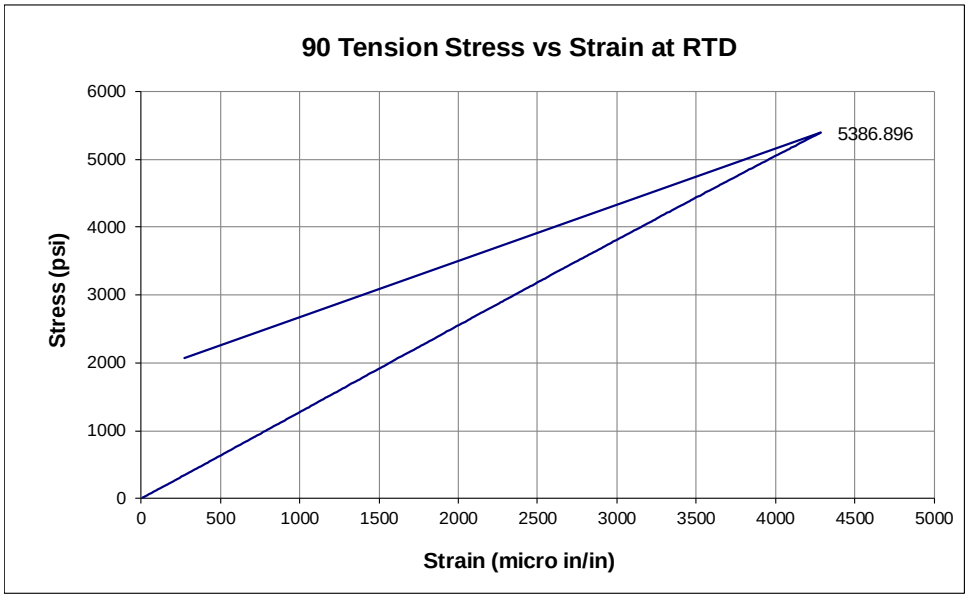

Short-Beam Strength Properties (SBS)--ETW
Measured Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
Short-Beam Strength [ksi]
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
0
1
2
3
4

5. Full Stress vs. Strain Curve

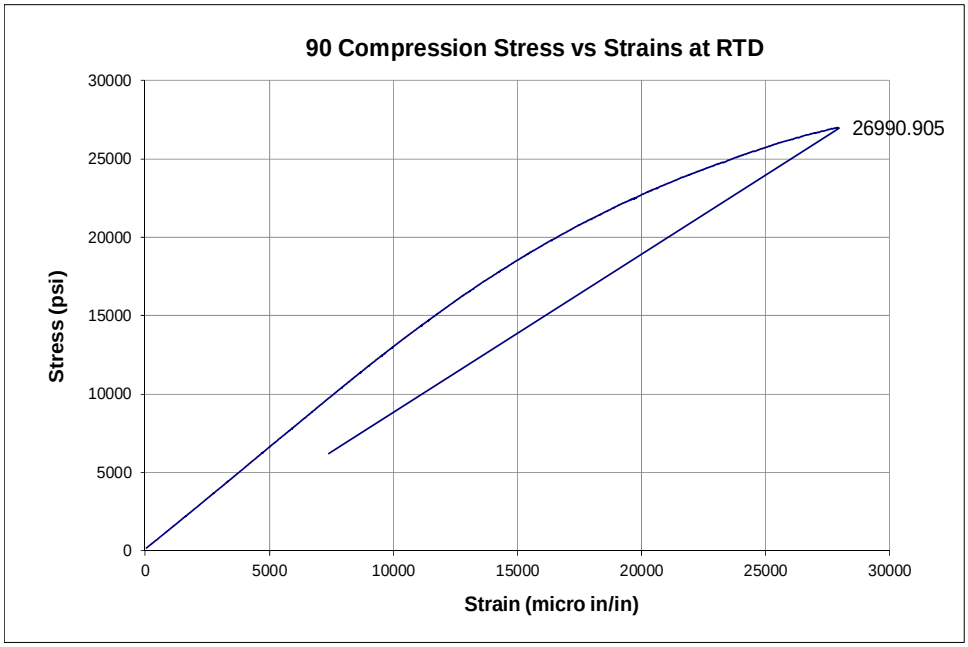
5.1 Longitudinal Tension



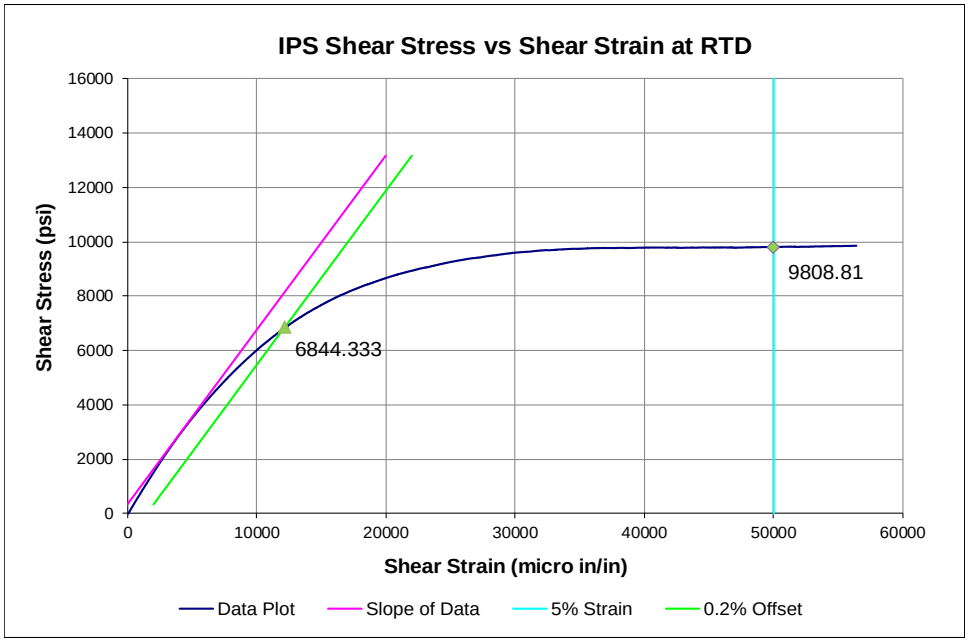
5.2 Transverse Tension



5.3 Transverse Compression



5.4 In-Plane Shear



6. Fluid Sensitivity Comparison

6.1 Room Temperature Test Data

	Fluid	Exposure
b	ASTM D1655 Jet A Fuel	90 days min @ 70°F ± 10F
c	Mil-H-5606 Hydraulic Oil	
d	Mil-H-83282 Hydraulic Oil	
f	Engine Lube Oil Mil-L-23699	
g	Sea Water (ASTM D1141 or equiv.)	
r	Distilled Water	
j	MEK washing fluid	90 mins @ 70°F ± 10F
k	Polypropylene Glycol Deicer	
q	Isopropyl Alcohol Deicing	48±4 hrs @ 70°F ± 10F
A	Dry	Per section 3.6 Test plan
t	85% Relative Humidity	

Fluid	Average Short-Beam Strength With Fluid (ksi)	Same Environment Short-Beam Strength Without Fluid (ksi) (RTD)	Worst Case Environment Short-Beam Strength (ksi) (RTW)	% Strength Reduction With Respect to RTD
b	10.443	9.914	8.778	-5.336
c	10.494	9.914	8.778	-5.849
d	9.966	9.914	8.778	-0.529
f	9.761	9.914	8.778	1.536
g	9.592	9.914	8.778	3.248
j	10.039	9.914	8.778	-1.259
k	10.290	9.914	8.778	-3.800
q	10.171	9.914	8.778	-2.590
r	9.754	9.914	8.778	1.613
A	9.914	9.914	8.778	0.000
t	8.778	9.914	8.778	11.458

Fluid Sensitivity Screening
Short-Beam Strength Properties (FSSBS)--RT Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Fluid	Strength [ksi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode	Average
EAAQB121b	B	C1	2	b	10.085	0.251	45	0.0056		
EAAQB122b	B	C1	2	b	10.426	0.256	45	0.0057		
EAAQB123b	B	C1	2	b	10.532	0.260	45	0.0058	Interlaminar Shear	10.443
EAAQB124b	B	C1	2	b	10.516	0.261	45	0.0058		
EAAQB125b	B	C1	2	b	10.313	0.262	45	0.0058		
EAAQB126b	B	C1	2	b	10.783	0.263	45	0.0058		
EAAQB128c	B	C1	2	c	10.001	0.263	45	0.0058		
EAAQB129c	B	C1	2	c	10.565	0.262	45	0.0058		
EAAQB12Ac	B	C1	2	c	10.820	0.261	45	0.0058	Interlaminar Shear	10.494
EAAQB12Bc	B	C1	2	c	10.503	0.259	45	0.0058		
EAAQB12Cc	B	C1	2	c	10.547	0.258	45	0.0057		
EAAQB12Dc	B	C1	2	c	10.526	0.256	45	0.0057		
EAAQB12Fd	B	C1	2	d	10.560	0.251	45	0.0056		
EAAQB12Gd	B	C1	2	d	11.014	0.249	45	0.0055		
EAAQB12Hd	B	C1	2	d	9.587	0.251	45	0.0056	Interlaminar Shear	9.966
EAAQB12Id	B	C1	2	d	9.412	0.256	45	0.0057		
EAAQB12Jd	B	C1	2	d	9.570	0.260	45	0.0058		
EAAQB12Kd	B	C1	2	d	9.653	0.263	45	0.0058		
EAAQB12Mf	B	C1	2	f	9.559	0.266	45	0.0059		
EAAQB12Nf	B	C1	2	f	10.133	0.266	45	0.0059		
EAAQB12Of	B	C1	2	f	9.023	0.267	45	0.0059	Interlaminar Shear	9.761
EAAQB12Pf	B	C1	2	f	10.009	0.266	45	0.0059		
EAAQB12Qf	B	C1	2	f	10.336	0.265	45	0.0059		
EAAQB12Rf	B	C1	2	f	9.509	0.264	45	0.0059		
EAAQB131g	B	C1	2	g	9.722	0.262	45	0.0058		
EAAQB132g	B	C1	2	g	10.033	0.264	45	0.0059		
EAAQB133g	B	C1	2	g	9.076	0.266	45	0.0059	Interlaminar Shear	9.592
EAAQB134g	B	C1	2	g	9.801	0.266	45	0.0059		
EAAQB135g	B	C1	2	g	8.998	0.267	45	0.0059		
EAAQB136g	B	C1	2	g	9.920	0.266	45	0.0059		
EAAQB138j	B	C1	2	j	10.317	0.263	45	0.0059		
EAAQB139j	B	C1	2	j	10.007	0.262	45	0.0058		
EAAQB13Aj	B	C1	2	j	9.422	0.261	45	0.0058	Interlaminar Shear	10.039
EAAQB13Bj	B	C1	2	j	10.147	0.258	45	0.0057		
EAAQB13Cj	B	C1	2	j	9.841	0.256	45	0.0057		
EAAQB13Dj	B	C1	2	j	10.497	0.254	45	0.0056		
EAAQB13Fk	B	C1	2	k	9.759	0.247	45	0.0055		
EAAQB13Gk	B	C1	2	k	10.010	0.253	45	0.0056		
EAAQB13Hk	B	C1	2	k	10.639	0.257	45	0.0057	Interlaminar Shear	10.290
EAAQB13Ik	B	C1	2	k	10.206	0.261	45	0.0058		
EAAQB13Jk	B	C1	2	k	10.524	0.264	45	0.0059		
EAAQB13Kk	B	C1	2	k	10.604	0.263	45	0.0059		
EAAQB141q	B	C1	2	q	9.697	0.250	45	0.0055		
EAAQB142q	B	C1	2	q	9.513	0.256	45	0.0057		
EAAQB143q	B	C1	2	q	10.685	0.259	45	0.0057	Interlaminar Shear	10.171
EAAQB144q	B	C1	2	q	9.888	0.262	45	0.0058		
EAAQB145q	B	C1	2	q	11.005	0.264	45	0.0059		
EAAQB146q	B	C1	2	q	10.235	0.265	45	0.0059		
EAAQB148r	B	C1	2	r	9.050	0.265	45	0.0059		
EAAQB149r	B	C1	2	r	9.754	0.265	45	0.0059		
EAAQB14Ar	B	C1	2	r	10.055	0.264	45	0.0059	Interlaminar Shear	9.754
EAAQB14Br	B	C1	2	r	10.180	0.263	45	0.0058		
EAAQB14Cr	B	C1	2	r	9.713	0.261	45	0.0058		
EAAQB14Dr	B	C1	2	r	9.770	0.259	45	0.0057		
EAAQB111A	B	C1	2	A	9.711	0.251	45	0.0056		
EAAQB112A	B	C1	2	A	9.652	0.256	45	0.0057		
EAAQB113A	B	C1	2	A	10.038	0.259	45	0.0058	Interlaminar Shear	9.914
EAAQB114A	B	C1	2	A	10.317	0.262	45	0.0058		
EAAQB211A	B	C2	2	A	10.318	0.254	45	0.0056		
EAAQB212A	B	C2	2	A	9.827	0.256	45	0.0057		
EAAQB213A	B	C2	2	A	9.533	0.258	45	0.0057		
EAAQB14Ft	B	C1	2	t	8.794	0.255	45	0.0057		
EAAQB14Gt	B	C1	2	t	9.098	0.253	45	0.0056		
EAAQB14Ht	B	C1	2	t	8.995	0.253	45	0.0056	Interlaminar Shear	8.778
EAAQB14It	B	C1	2	t	8.341	0.260	45	0.0058		
EAAQB14Jt	B	C1	2	t	8.631	0.257	45	0.0057		
EAAQB14Kt	B	C1	2	t	8.808	0.256	45	0.0057		

Average	**9.927**
Standard Dev.	**0.596**
Coeff. of Var. [%]	**6.005**
Min.	**8.341**
Max.	**11.014**
Number of Spec.	**67**

6.2 Elevated Temperature Test Data

	Fluid	Exposure
2 3 4 6 7 s	Jet A Fuel Mil-H-5606 Hydraulic Oil Mil-H-83282 Hydraulic Oil Engine Lube Oil Mil-L-23699 Sea Water (ASTM D1141 or equiv.) Distilled Water	90 days min @ 70°F ± 10F
m n	MEK washing fluid Polypropylene Glycol Deicer	90 mins @ 70°F ± 10F
p	Isopropyl Alcohol Deicing	48±4 hrs @ 70°F ± 10F
C D	Dry 85% Relative Humidity	Per section 3.6 Test plan

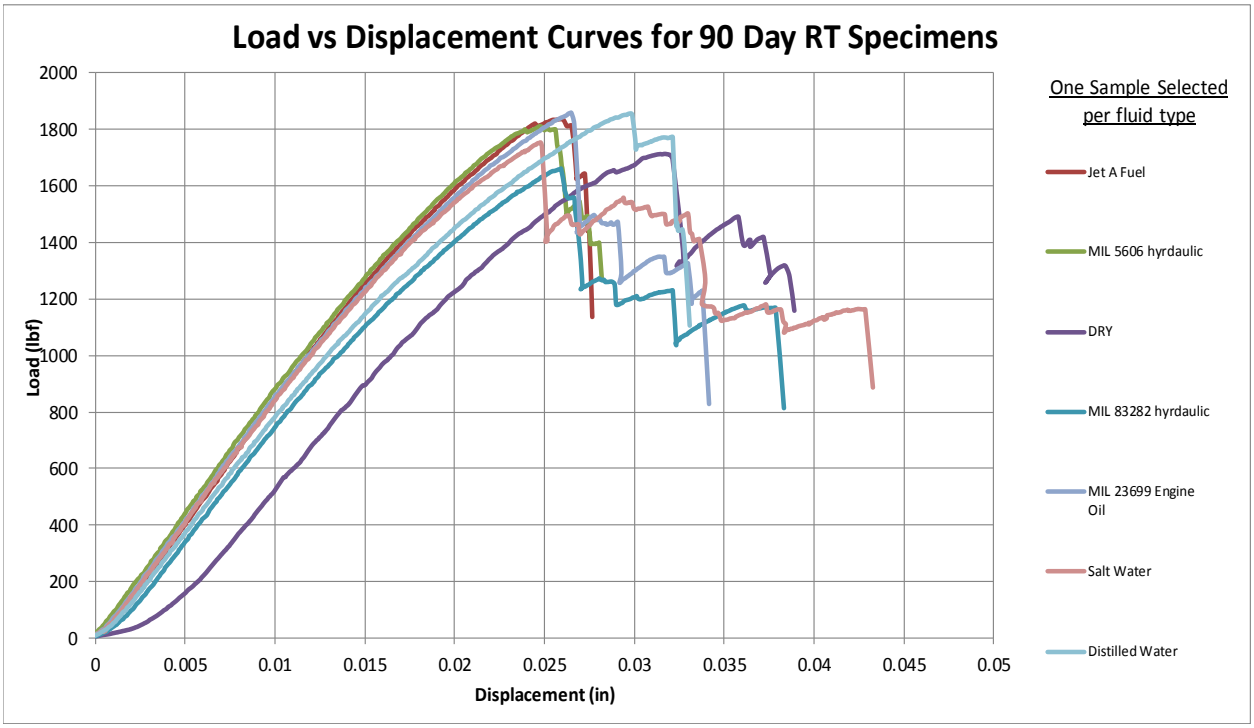
Fluid	Average Short-Beam Strength With Fluid (ksi)	Same Environment Short-Beam Strength Without Fluid (ksi) (ETD)	Worst Case Environment Short-Beam Strength (ksi) (ETW)	% Strength Reduction With Respect to ETD
2	8.093	8.216	5.286	1.494
3	8.000	8.216	5.286	2.633
4	8.145	8.216	5.286	0.864
6	7.808	8.216	5.286	4.967
7	7.426	8.216	5.286	9.614
m	7.888	8.216	5.286	3.999
n	8.153	8.216	5.286	0.764
p	8.275	8.216	5.286	-0.721
s	7.580	8.216	5.286	7.742
C	8.216	8.216	5.286	0.000
D	5.286	8.216	5.286	35.658

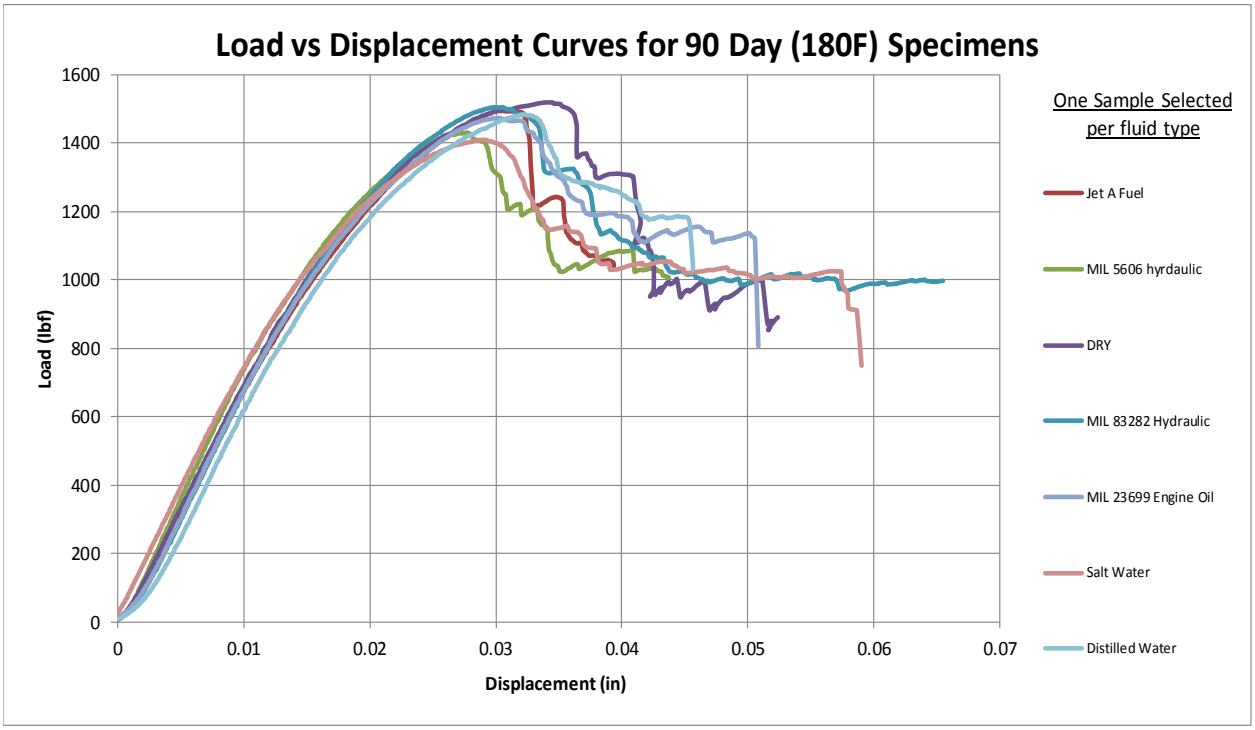
Fluid Sensitivity Screening
Short-Beam Strength Properties (FSSBS)--ET Strength
TenCate BT250E-6 IM7 GP 12k Unitape Gr 148 RC 33%

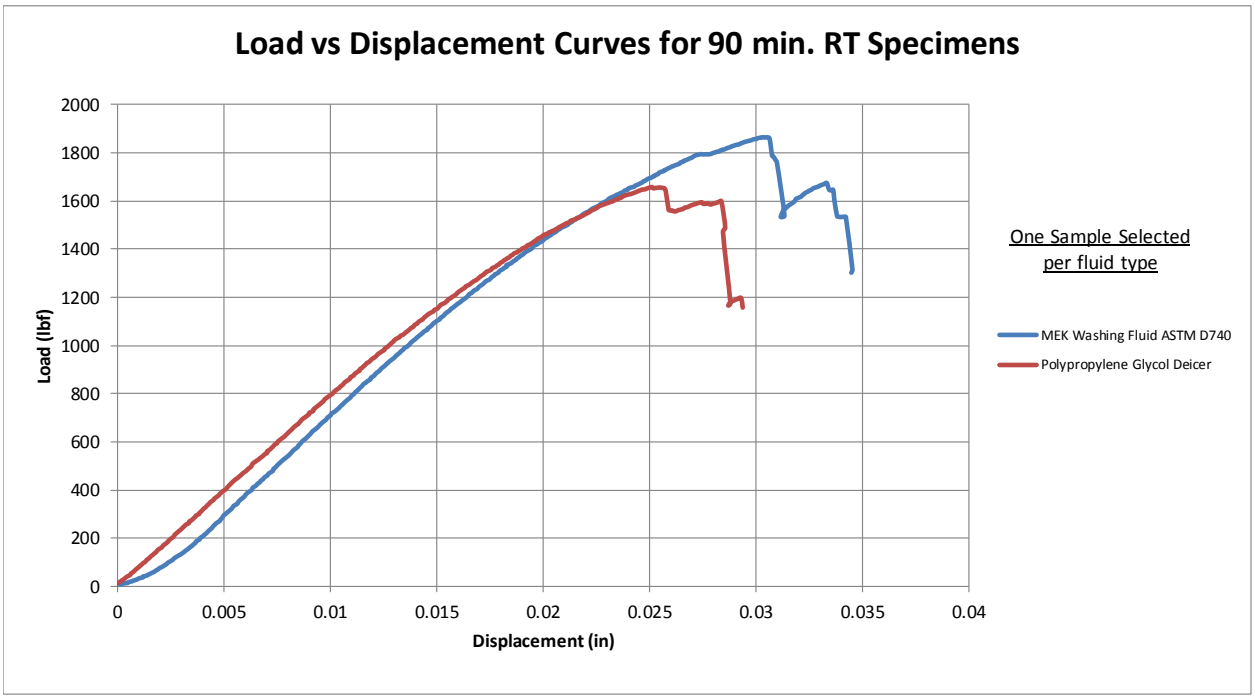
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Fluid	Strength [ksi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode	Average
EAAQB2212	B	C2	2	2	8.104	0.268	45	0.0060		
EAAQB2222	B	C2	2	2	7.908	0.267	45	0.0059		
EAAQB2232	B	C2	2	2	8.252	0.264	45	0.0059	Interlaminar Shear	8.093
EAAQB2242	B	C2	2	2	8.082	0.260	45	0.0058		
EAAQB2252	B	C2	2	2	8.096	0.256	45	0.0057		
EAAQB2262	B	C2	2	2	8.118	0.250	45	0.0056		
EAAQB2283	B	C2	2	3	7.784	0.256	45	0.0057		
EAAQB2293	B	C2	2	3	8.130	0.259	45	0.0058		
EAAQB22A3	B	C2	2	3	7.950	0.261	45	0.0058	Interlaminar Shear	8.000
EAAQB22B3	B	C2	2	3	8.289	0.265	45	0.0059		
EAAQB22C3	B	C2	2	3	7.821	0.267	45	0.0059		
EAAQB22D3	B	C2	2	3	8.024	0.269	45	0.0060		
EAAQB22F4	B	C2	2	4	7.732	0.270	45	0.0060		
EAAQB22G4	B	C2	2	4	8.135	0.269	45	0.0060		
EAAQB22H4	B	C2	2	4	7.695	0.269	45	0.0060	Interlaminar Shear	8.145
EAAQB22I4	B	C2	2	4	8.318	0.267	45	0.0059		
EAAQB22J4	B	C2	2	4	8.476	0.265	45	0.0059		
EAAQB22K4	B	C2	2	4	8.514	0.263	45	0.0058		
EAAQB2316	B	C2	2	6	7.989	0.268	45	0.0060		
EAAQB2326	B	C2	2	6	7.707	0.269	45	0.0060		
EAAQB2336	B	C2	2	6	7.174	0.269	45	0.0060	Interlaminar Shear	7.808
EAAQB2346	B	C2	2	6	8.041	0.269	45	0.0060		
EAAQB2356	B	C2	2	6	7.922	0.269	45	0.0060		
EAAQB2366	B	C2	2	6	8.016	0.255	45	0.0057		
EAAQB2387	B	C2	2	7	7.758	0.264	45	0.0059		
EAAQB2397	B	C2	2	7	7.410	0.260	45	0.0058		
EAAQB23A7	B	C2	2	7	7.351	0.255	45	0.0057	Interlaminar Shear	7.426
EAAQB23B7	B	C2	2	7	7.652	0.249	45	0.0055		
EAAQB23C7	B	C2	2	7	7.233	0.265	45	0.0059		
EAAQB23D7	B	C2	2	7	7.153	0.257	45	0.0057		
EAAQB23Fm	B	C2	2	m	8.050	0.262	45	0.0058		
EAAQB23Gm	B	C2	2	m	8.179	0.269	45	0.0060		
EAAQB23Hm	B	C2	2	m	7.963	0.267	45	0.0059	Interlaminar Shear	7.888
EAAQB23Im	B	C2	2	m	7.949	0.269	45	0.0060		
EAAQB23Jm	B	C2	2	m	7.458	0.271	45	0.0060		
EAAQB23Km	B	C2	2	m	7.725	0.270	45	0.0060		
EAAQB241n	B	C2	2	n	8.075	0.252	45	0.0056		
EAAQB242n	B	C2	2	n	7.855	0.255	45	0.0057		
EAAQB243n	B	C2	2	n	8.143	0.258	45	0.0057	Interlaminar Shear	8.153
EAAQB244n	B	C2	2	n	8.163	0.261	45	0.0058		
EAAQB245n	B	C2	2	n	8.343	0.263	45	0.0058		
EAAQB246n	B	C2	2	n	8.340	0.265	45	0.0059		
EAAQB248p	B	C2	2	p	8.456	0.266	45	0.0059		
EAAQB249p	B	C2	2	p	8.158	0.267	45	0.0059		
EAAQB24Ap	B	C2	2	p	8.409	0.268	45	0.0060	Interlaminar Shear	8.275
EAAQB24Bp	B	C2	2	p	7.843	0.268	45	0.0059		
EAAQB24Cp	B	C2	2	p	8.511	0.267	45	0.0059		
EAAQB24Dp	B	C2	2	p	8.275	0.267	45	0.0059		
EAAQB24Fs	B	C2	2	s	8.206	0.258	45	0.0057		
EAAQB24Gs	B	C2	2	s	7.953	0.253	45	0.0056		
EAAQB24Hs	B	C2	2	s	6.990	0.255	45	0.0057	Interlaminar Shear	7.580
EAAQB24Is	B	C2	2	s	7.301	0.256	45	0.0057		
EAAQB24Js	B	C2	2	s	7.355	0.260	45	0.0058		
EAAQB24Ks	B	C2	2	s	7.674	0.261	45	0.0058		
EAAQB11AC	B	C1	2	C	8.200	0.264	45	0.0059		
EAAQB11BC	B	C1	2	C	8.162	0.262	45	0.0058		
EAAQB11CC	B	C1	2	C	7.868	0.261	45	0.0058	Interlaminar Shear	8.216
EAAQB11DC	B	C1	2	C	8.082	0.259	45	0.0058		
EAAQB219C	B	C2	2	C	8.515	0.265	45	0.0059		
EAAQB21AC	B	C2	2	C	8.157	0.265	45	0.0059		
EAAQB21BC	B	C2	2	C	8.529	0.265	45	0.0059		
EAAQB11FD	B	C1	2	D	5.278	0.255	45	0.0057		
EAAQB11GD	B	C1	2	D	5.051	0.253	45	0.0056		
EAAQB11ID	B	C1	2	D	4.577	0.250	45	0.0056	Interlaminar Shear	5.286
EAAQB11JD	B	C1	2	D	4.863	0.255	45	0.0057		
EAAQB21DD	B	C2	2	D	5.922	0.261	45	0.0058		
EAAQB21ED	B	C2	2	D	5.659	0.258	45	0.0057		
EAAQB21FD	B	C2	2	D	5.654	0.254	45	0.0056		

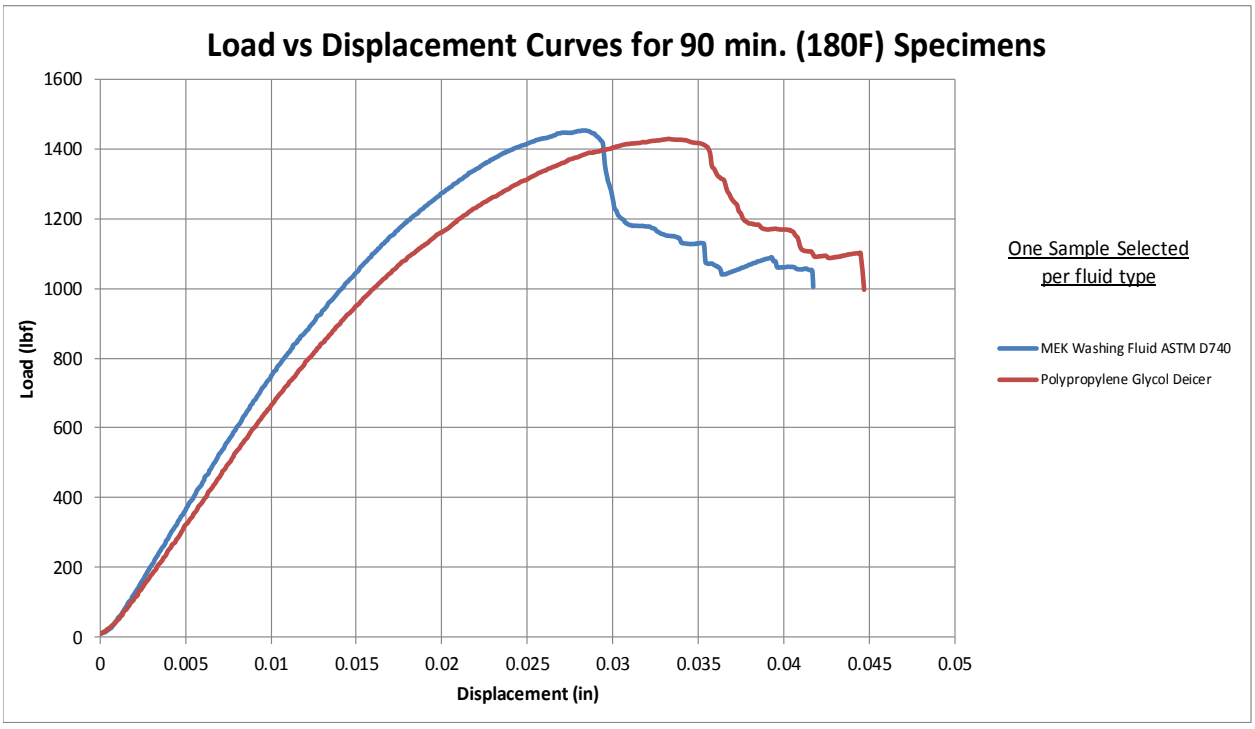
Average	**7.687**
Standard Dev.	**0.903**
Coeff. of Var. [%]	**11.745**
Min.	**4.577**
Max.	**8.529**
Number of Spec.	**68**

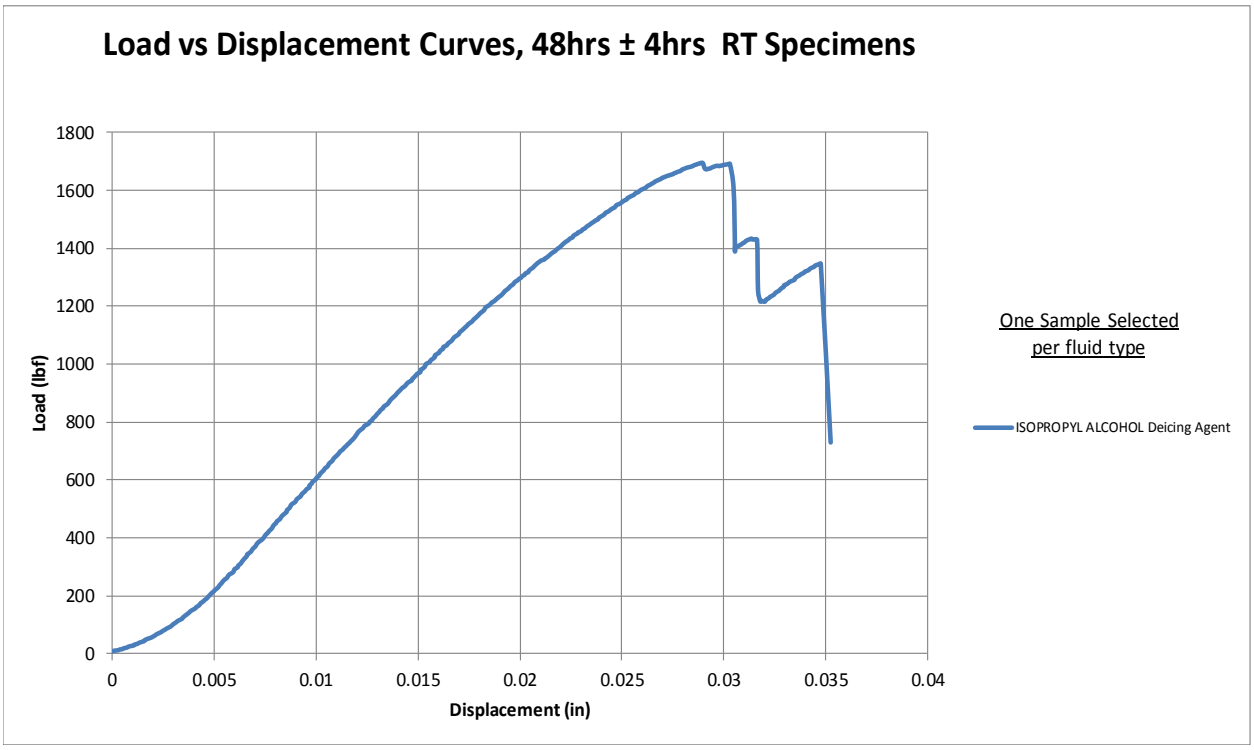
6.3 Load Displacement Curves

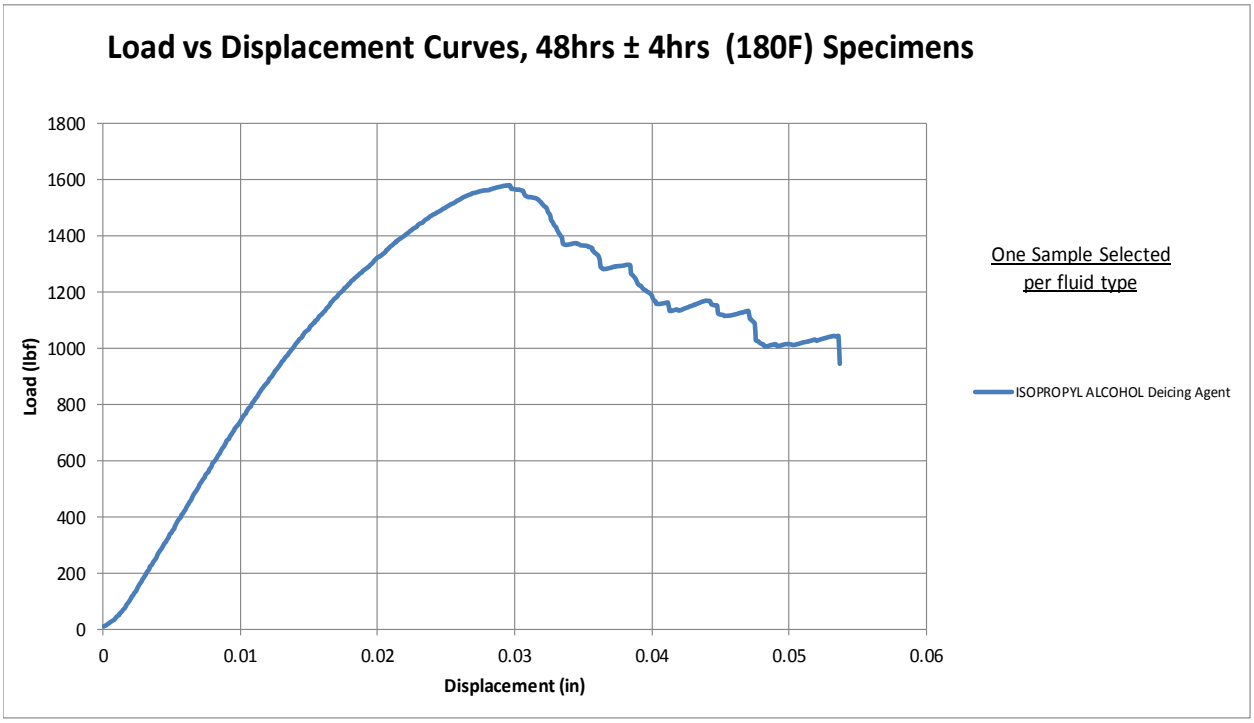


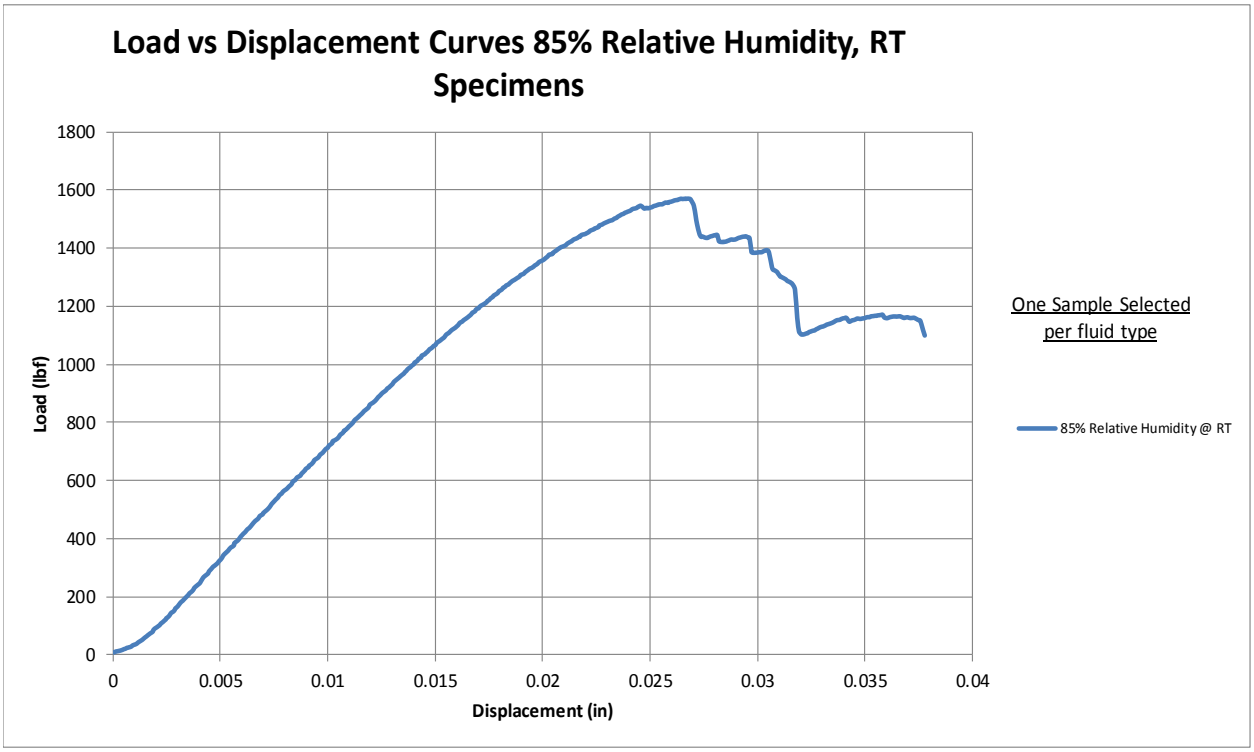


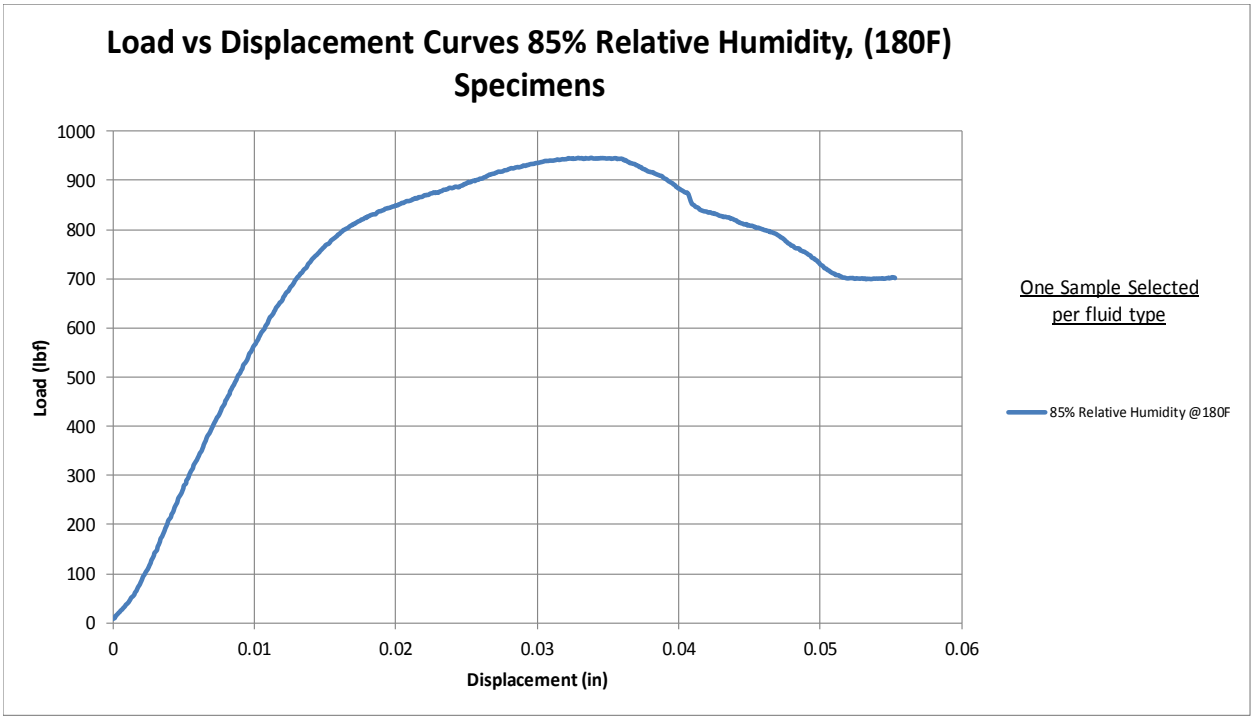

Load vs Displacement Curves for 90 min. RT Specimens
Load (lbf)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
Displacement (in)
One Sample Selected per fluid type
MEK Washing Fluid ASTM D740
Polypropylene Glycol Deicer


Load vs Displacement Curves for 90 min. (180F) Specimens
Load (lbf)
1600
1400
1200
1000
800
600
400
200
0
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045
0.05
Displacement (in)
One Sample Selected per fluid type
MEK Washing Fluid ASTM D740
Polypropylene Glycol Deicer


Load vs Displacement Curves, 48hrs ± 4hrs RT Specimens
Load (lbf)
1800
1600
1400
1200
1000
800
600
400
200
0
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
Displacement (in)
One Sample Selected per fluid type
ISOPROPYL ALCOHOL Deicing Agent

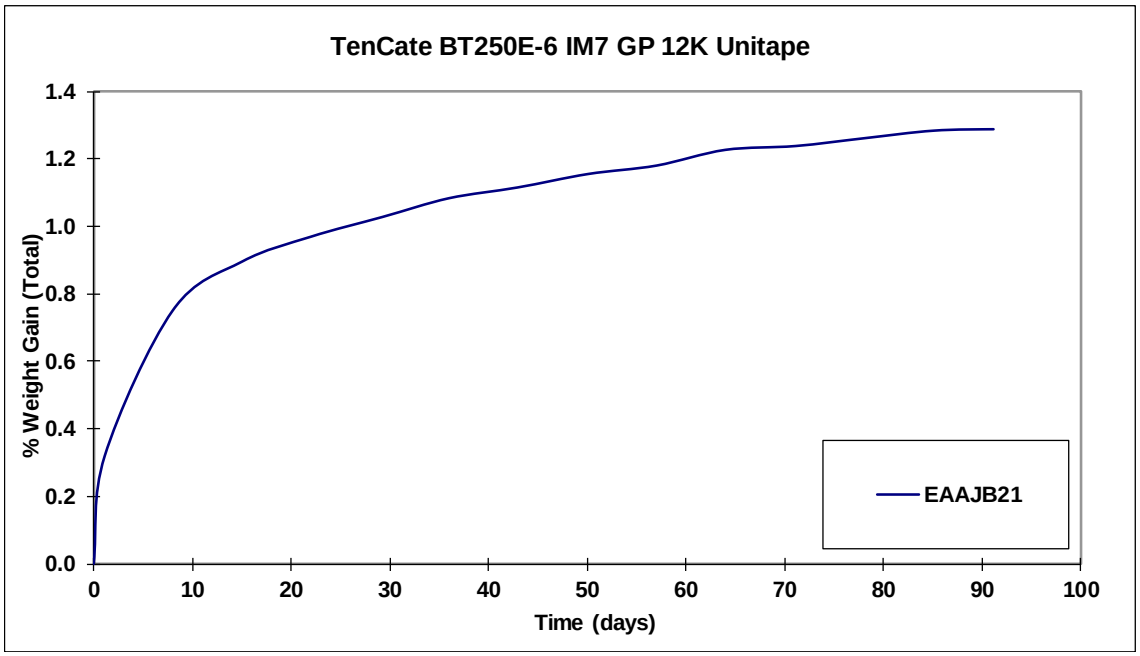

Load vs Displacement Curves, 48hrs ± 4hrs (180F) Specimens
Load (lbf)
1800
1600
1400
1200
1000
800
600
400
200
0
0
0.01
0.02
0.03
0.04
0.05
0.06
Displacement (in)
One Sample Selected per fluid type
ISOPROPYL ALCOHOL Deicing Agent


Load vs Displacement Curves 85% Relative Humidity, RT Specimens
Load (lbf)
1800
1600
1400
1200
1000
800
600
400
200
0
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
Displacement (in)
One Sample Selected per fluid type
85% Relative Humidity @ RT

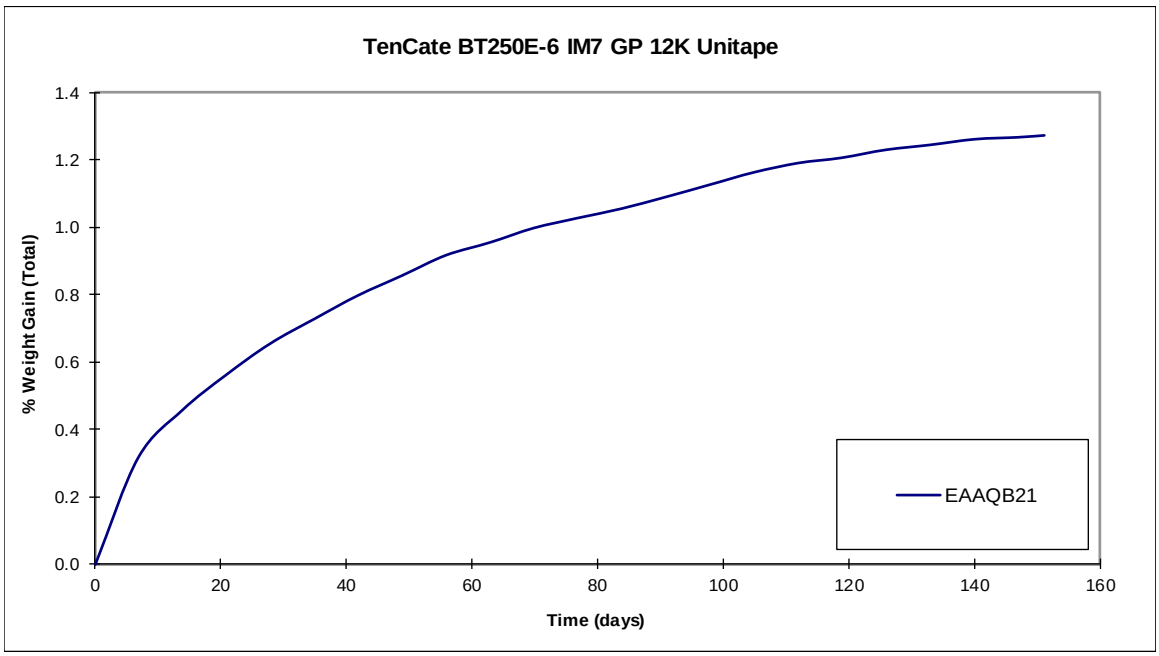

Load vs Displacement Curves 85% Relative Humidity, (180F) Specimens
Load (lbf)
1000
900
800
700
600
500
400
300
200
100
0
0
0.01
0.02
0.03
0.04
0.05
0.06
Displacement (in)
One Sample Selected per fluid type
85% Relative Humidity @180F

7. Moisture Conditioning Charts

7.1 Longitudinal Tension – Thinnest Panel



7.2 Short Beam Shear – Thickest Panel



For “wet” mechanical test specimens, the drying procedures may not have completely dried the specimens prior to moisture conditioning, so the total amount of moisture absorbed by the specimens may be higher than those recorded in the moisture gain charts.

8. DMA Results

DMA Results Summary

TenCate BT250E-6 IM7 GP 12K Unitape DRY

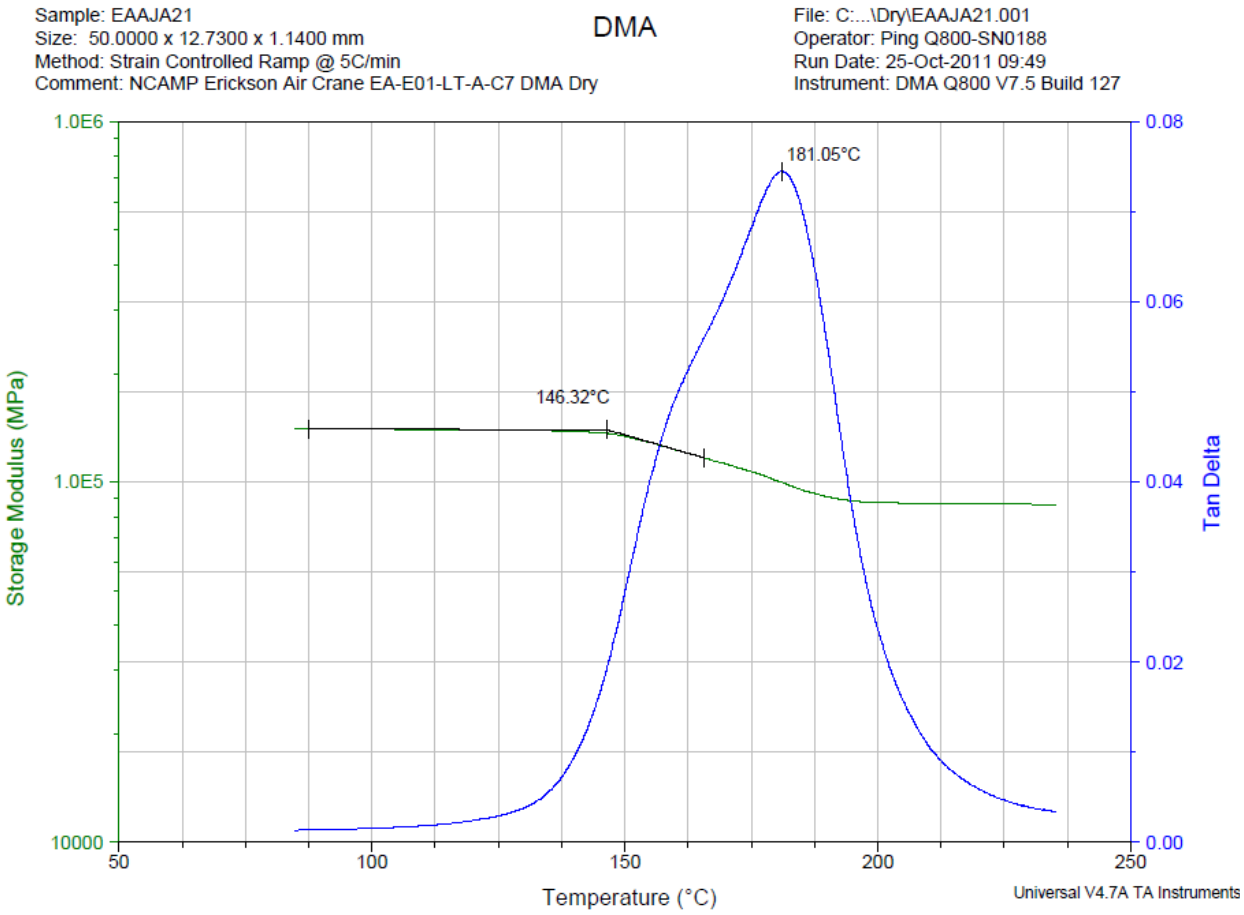
Sample #	Onset Storage Modulus		Peak of Tangent Delta	
	Tg [°C]	Tg [°F]	Tg [°C]	Tg [°F]
EAAJA11 (EA-E01-LT-A-C6)	143.16	289.69	182.98	361.36
EAAJA21 (EA-E01-LT-A-C7)	146.32	295.38	181.05	357.89
EAAJB11 (EA-E01-LT-B-C6)	145.17	293.31	182.30	360.14
EAAJB21 (EA-E01-LT-B-C7)	143.78	290.80	183.36	362.05
EAAJC11 (EA-E01-LT-C-C6)	139.50	283.10	183.83	362.89
EAAJC21 (EA-E01-LT-C-C8)	143.41	290.14	184.46	364.03
EAALA11 (EA-E01-LC-A-C4)	139.97	283.95	179.18	354.52
EAALA21 (EA-E01-LC-A-C5)	138.88	281.98	178.47	353.25
EAALB11 (EA-E01-LC-B-C4)	137.44	279.39	179.64	355.35
EAALB21 (EA-E01-LC-B-C5)	139.02	282.24	180.71	357.28
EAAUA11 (EA-E01-TT-A-C8)	136.42	277.56	176.89	350.40
EAAUA21 (EA-E01-TT-A-C9)	137.34	279.21	177.75	351.95
EAAUB11 (EA-E01-TT-B-C8)	136.86	278.35	179.01	354.22
EAAUB21 (EA-E01-TT-B-C11)	138.09	280.56	180.35	356.63
EAAUC11 (EA-E01-TT-C-C10)	137.93	280.27	181.68	359.02
EAAUC21 (EA-E01-TT-C-C11)	135.02	275.04	181.55	358.79
EAAZC21 - 1 (EA-E01-TC-C-C13)	136.29	277.32	181.29	358.32
EAAZC21 - 2 (EA-E01-TC-C-C13)	135.45	275.81	181.08	357.94
EAARB21 - 1 (EA-E01-UNC0-B-C9)	136.56	277.81	180.77	357.39
EAARB21 - 2 (EA-E01-UNC0-B-C9)	136.67	278.01	181.37	358.47
EAARC11 - 1 (EA-E01-UNC0-C-C7)	133.96	273.13	181.53	358.75
EAARC11 - 2 (EA-E01-UNC0-C-C7)	134.20	273.56	181.35	358.43
EAARC21 - 1 (EA-E01-UNC0-C-C9)	135.82	276.48	181.74	359.13
EAARC21 - 2 (EA-E01-UNC0-C-C9)	135.96	276.73	182.70	360.86
Average	138.47	281.24	181.04	357.88
Standard Deviation	3.48	6.27	1.86	3.35

DMA Results Summary

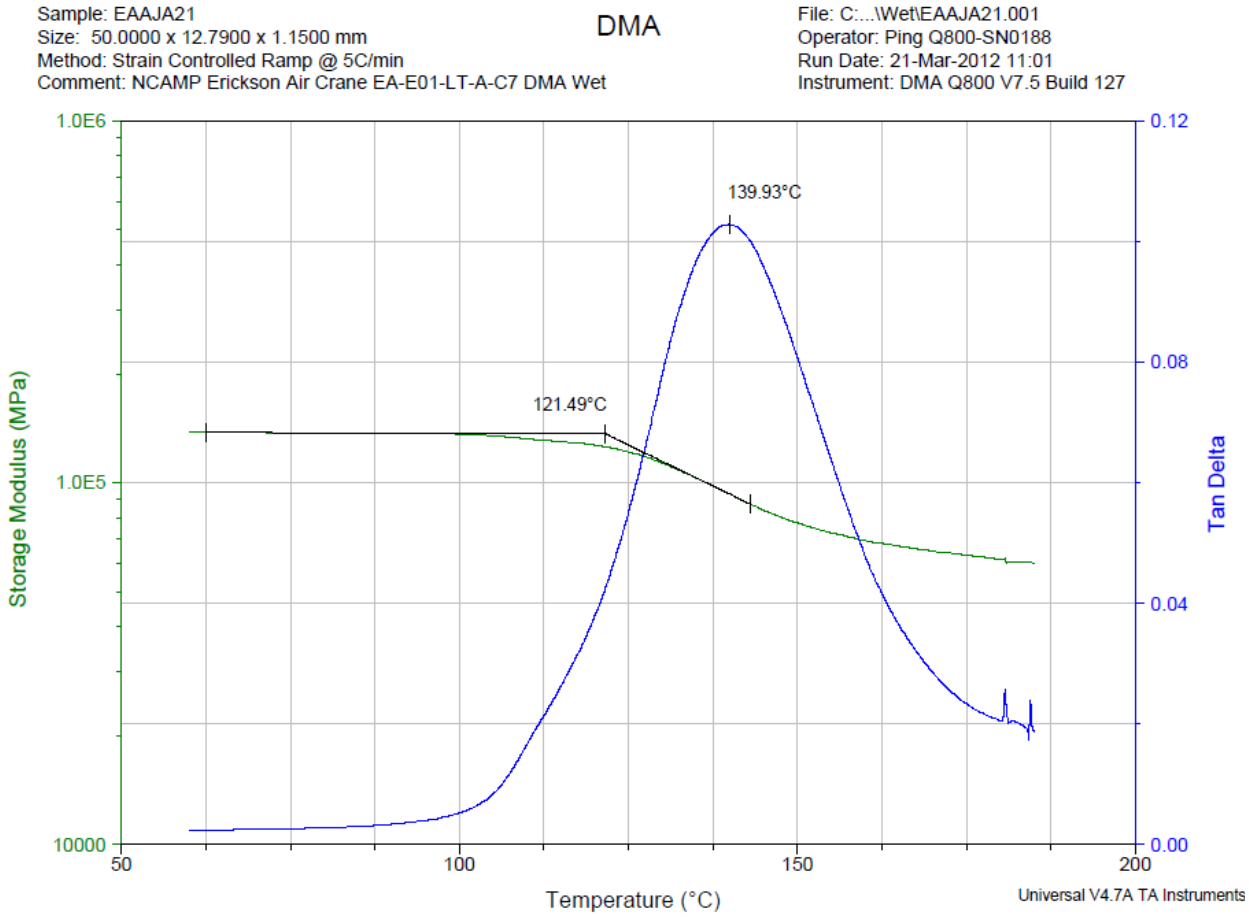
TenCATE BT250E-6 IM7 GP 12K Unitape WET

Sample #	Onset Storage Modulus		Peak of Tangent Delta	
	Tg [°C]	Tg [°F]	Tg [°C]	Tg [°F]
EAAJA11 (EA-E01-LT-A-C6)	121.93	251.47	139.37	282.87
EAAJA21 (EA-E01-LT-A-C7)	121.49	250.68	139.93	283.87
EAAJB11 (EA-E01-LT-B-C6)	119.71	247.48	139.71	283.48
EAAJB21 (EA-E01-LT-B-C7)	122.30	252.14	139.50	283.10
EAAJC11 (EA-E01-LT-C-C6)	121.89	251.40	139.39	282.90
EAAJC21 (EA-E01-LT-C-C8)	118.35	245.03	137.93	280.27
EAALA11 (EA-E01-LC-A-C4)	110.63	231.13	131.05	267.89
EAALA21 (EA-E01-LC-A-C5)	111.52	232.74	131.84	269.31
EAALB11 (EA-E01-LC-B-C4)	112.77	234.99	133.20	271.76
EAALB21 (EA-E01-LC-B-C5)	115.56	240.01	132.96	271.33
EAAUA11 (EA-E01-TT-A-C8)	115.56	240.01	132.88	271.18
EAAUA21 (EA-E01-TT-A-C9)	113.54	236.37	131.75	269.15
EAAUB11 (EA-E01-TT-B-C8)	117.80	244.04	135.69	276.24
EAAUB21 (EA-E01-TT-B-C11)	117.26	243.07	135.82	276.48
EAAUC11 (EA-E01-TT-C-C10)	117.38	243.28	136.24	277.23
EAAUC21 (EA-E01-TT-C-C11)	118.67	245.61	135.98	276.76
EAAZC21 - 1 (EA-E01-TC-C-C13)	114.60	238.28	132.55	270.59
EAAZC21 - 2 (EA-E01-TC-C-C13)	116.89	242.40	135.77	276.39
EAARB21 - 1 (EA-E01-UNC0-B-C9)	114.27	237.69	135.14	275.25
EAARB21 - 2 (EA-E01-UNC0-B-C9)	113.52	236.34	134.91	274.84
EAARC11 - 1 (EA-E01-UNC0-C-C7)	114.42	237.96	136.21	277.18
EAARC11 - 2 (EA-E01-UNC0-C-C7)	113.32	235.98	135.24	275.43
EAARC21 - 1 (EA-E01-UNC0-C-C9)	117.92	244.26	138.36	281.05
EAARC21 - 2 (EA-E01-UNC0-C-C9)	117.68	243.82	139.17	282.51
Average	116.62	241.92	135.86	276.54
Standard Deviation	3.34	6.02	2.83	5.10

8.1 DMA Dry Batch A



8.2 DMA Wet Batch A



9. Deviations

N/A