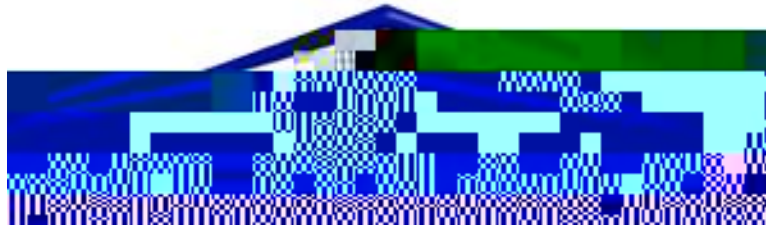




Report No: CAM-RP-2015-039 Rev N/C
Report Date: October 24, 2017



TenCate BT250E-6 AS4C 3k-PW Fabric Gr 195 gsm 40% RC Qualification Material Property Data Report

FAA Special Project Number: TD03019RC-R

NCAMP Test Report Number: CAM-RP-2015-039 N/C

Report Date: October 24, 2017

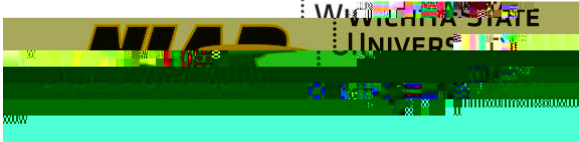
Testing Facility:

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

Distribution Statement A. Approved for public release; distribution is unlimited.



Report No: CAM-RP-2015-039 Rev N/C
Report Date: October 24, 2017

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REVISIONS:

Rev	By	Date	Pages Revised or Added
N/C	Vinsensius Tanoto	10/24/2017	Document Initial Release

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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 NSP100; 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 does 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 a 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 AS4C 3k-PW Fabric with BT250E-6 Resin Material Allowables Statistical Analysis Report, NCP-RP-2015-020 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 250/2 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

db

October 24, 2017

CAM-RP-2015-039 N/C

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

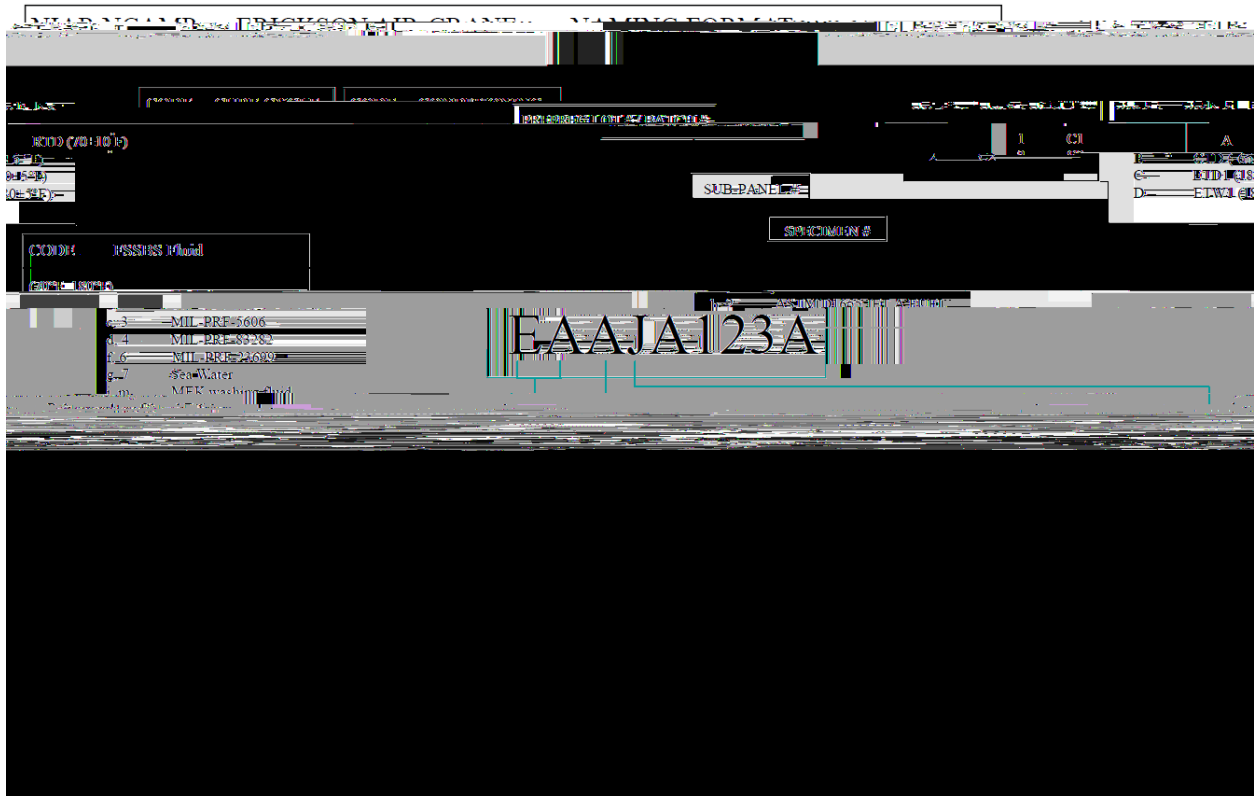


Figure 1-1: Naming Format

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 $\pm 45^\circ$ 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.

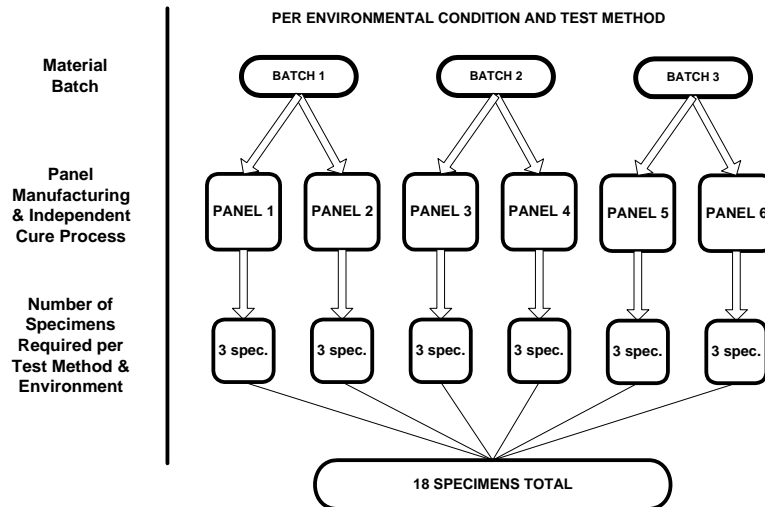


Figure 1-2: Specimen Selection Methodology

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.

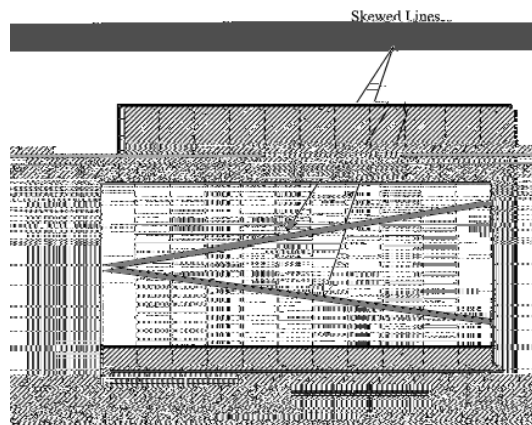


Figure 1-3: Specimen Traceability Line

1.5.2 Specimen & Testing Details

1.5.2.1 Tabbings

No tabs were used for this program.

1.5.2.2 Specimen Dimensions & Test Configuration

For SBS specimens, a span of 4.5T and 4T were used for CTD, RTD and ETD conditions and a span of 4T was used for ETW condition, 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 $\pm 5^{\circ}\text{F}$ applied to all temperature conditions specified in this document.

1.5.2.3

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] ₁₅	ASTM D3039 0° Tension	Strength, Modulus and Poisson's Ratio	3x2x3	3x2x3		3x2x3
[0] ₁₅	ASTM D6641 0° Compression	Strength and Modulus	3x2x3	3x2x3 (1)		3x2x3
[90] ₁₅	ASTM D3039 90° Tension	Strength and Modulus	3x2x3	3x2x3		3x2x3
[90] ₁₅	ASTM D6641 90° Compression	Strength and Modulus	3x2x3	3x2x3 (1)	1x2x3	3x2x3 (3)
[45/-45] _{3S}	ASTM D3518 In- Plane Shear (2)	Strength and Modulus	3x2x3	3x2x3		3x2x3
[0] ₃₂	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 of each environment. 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: Gripped (tab) length is 1.5±0.5" on each end of the 10" long specimen. Once the samples have reached the 5% 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:

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 spec

1.5.7 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 90° tensile strength and modulus (unidirectional only), 90° 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.

The theoretically calculated cured ply thickness was 0.0075 inches. The experimentally Out-of-Autoclave measured cured ply thickness of 0.0085 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:

$$\text{Normalized Value} = \text{Measured Value} \times \text{Measured CPT} / \text{Nominal CPT}.$$

1.5.8 Inspection Verification

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

1.5.9 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 AS4C 3k-PW Fabric 195gsm 40% RC

Material Specification: NMS 250/2

Process Specification: NPS 81250

Fiber: AS4C 3k-PW

Resin: TenCate BT250E-6

Tg(dry): 275.46 °F

Tg(wet): 249.55 °F

Tg METHOD:

2.2 Individual Test Summaries

2.2.1 Warp Tension Properties (WT)



2.2.2 Fill Tension Properties (FT)

Material:	TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%				Tension, 2-axis	
Resin content:	38.25 % wt		Comp. density:	1.489 g/cc		TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%
Fiber volume:	51.64 % vol					[90]15
Ply count:	15					
Test method:	ASTM D 3039-08		Modulus calculation: 1000 to 3000 microstrain			
Normalized by:	0.0085		in. CPT			
Test Temperature [°F]			CTD	RTD	ETW	
Moisture Conditioning			-65	70	180	
Equilibrium at T, RH			Dry	Dry	Equilibrium	
Source code			EABUX XXXB		EABUX XXXA	
			EABUX XXXD			
			Normalized	Measured	Normalized	Measured
	Mean	120.271	120.324	124.751	125.323	110.388
	Minimum	111.238	109.120	114.261	114.351	99.509
	Maximum	132.730	133.218	133.012	132.998	121.328
	C.V.(%)	4.488	5.194	3.967	4.373	5.533
F₂^{tu} [ksi]						
	No. Specimens	21		21		21
	No. Prepreg Lots	3		3		3
	Mean	8.641	8.615	8.530	8.569	8.604
	Minimum	8.482	8.404	8.215	8.195	8.421
	Maximum	8.783	8.746	8.737	9.003	8.790
	C.V.(%)	1.021	0.978	1.385	1.983	1.286
E₂^t [Msi]						
	No. Specimens	18		21		21
	No. Prepreg Lots	3		3		3

2.2.3 Warp Compression Properties (WC)

Material:

Resin content:	39.64 % wt	Comp. density:	1.484 g/cc
Fiber volume:	50.33 % vol		
Ply count:	15		
Test method:	ASTM D 6641-09		
Normalized by:	0.0085	in. CPT	



2.2.4 Fill Compression Properties (FC)

Material: TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%		Compression, 2-axis TenCate BT250E-6 AS4C-PW 3k fabric with RC 40% [90]15							
Resin content: 39.10 % wt	Comp. density: 1.486 g/cc								
Fiber volume: 50.83 % vol									
Ply count: 15									
Test method: ASTM D 6641-09	Modulus calculation: 1000 to 3000 microstrain								
Normalized by: 0.0085	in. CPT								
	CTD	RTD		ETD		ETW			
Test Temperature [°F]	-65	70		180		180			
Moisture Conditioning	Dry	Dry		Dry		Equilibrium			
Equilibrium at T, RH						160 F,85%			
Source code	EABZX XXXB	EABZX XXXA		EABZX XXXC		EABZX XXXD			
	Normalized	Measured	Normalized	Measured	Normalized	Measured	Normalized	Measured	
F₂^{cu} [ksij]	Mean	93.260	93.152	85.122	85.240	73.543	72.056	50.327	49.864
	Minimum	82.771	82.690	78.582	79.502	64.866	64.293	44.995	45.571
	Maximum	103.399	104.268	93.019	92.628	81.002	78.115	57.347	55.730
	C.V.(%)	6.828	7.194	5.207	4.832	9.239	8.143	7.059	6.029
	No. Specimens	21		21		7		22	
No. Prepreg Lots	3		3		1		3		
E₂^c [Msi]	Mean	8.111	8.109	7.862	7.882	7.896	7.724	7.906	7.886
	Minimum	7.688	7.691	7.576	7.661	7.629	7.555	7.737	7.682
	Maximum	8.439	8.526	8.450	8.596	8.157	7.868	8.101	8.065
	C.V.(%)	2.181	2.873	2.269	2.676	3.329	1.751	1.222	1.521
	No. Specimens	18		18		6		21	
No. Prepreg Lots	3		3		1		3		

2.2.5 In-Plane Shear Properties (IPS)

Material:

Resin content: 38.29 % wt
Fiber volume: 50.73 % vol
Ply count: 12

Comp. density: 1.465 g/cc



2.2.6 Lamina Short-Beam Strength Properties (SBS)

Material:

Resin content: 39.04 % wt
Fiber volume: 51.87 % vol
Ply count: 32
Test method: ASTM D 2344-06
Normalized by: NA

Comp. density: 1.520 g/cc

CTD

-65

Dry

Dry

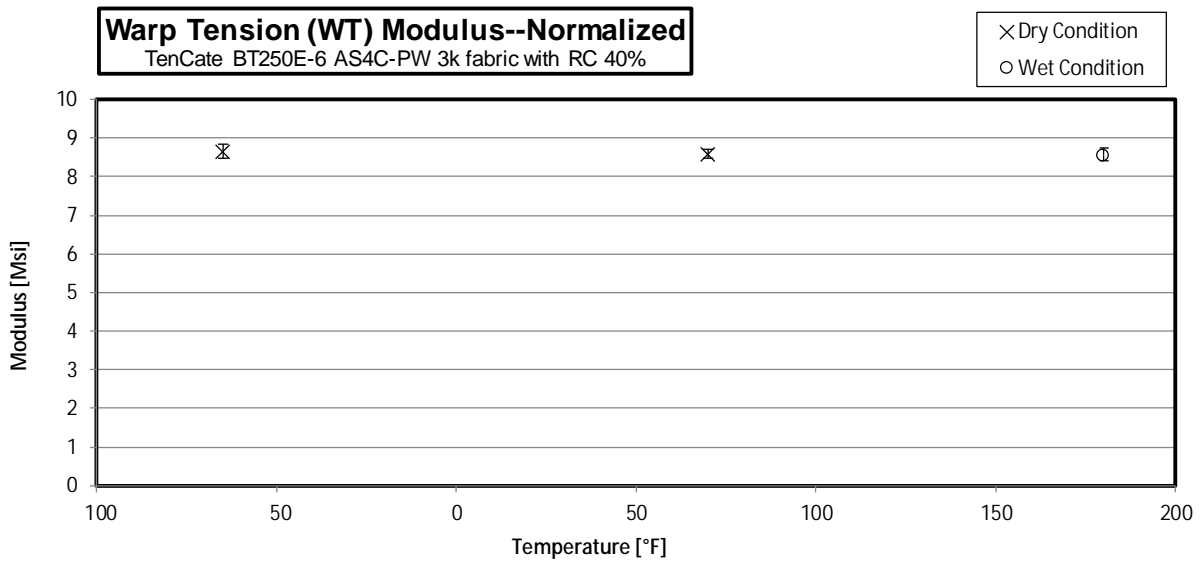
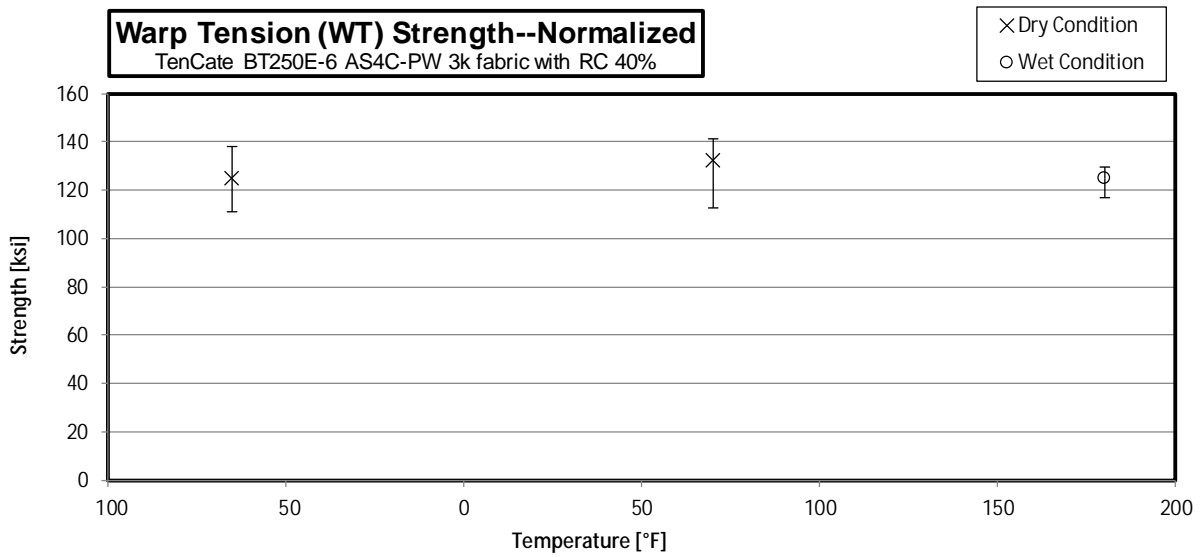
Source code

	EABQX XXXB		EABQX XXXA		EABQX XXXC		EABQX XXXD	
	Normalized	Measured	Normalized	Measured	Normalized	Measured	Normalized	Measured
Mean		8.466		8.157		7.109		5.044
Minimum		7.885		7.745		6.443		4.597
Maximum		8.948		8.896		7.554		5.630
SBS [ksij]		3.323		3.458		4.617		4.444
C.V.(%)								
No. Specimens		22		23		21		22
No. Prepreg Lots		3		3		3		3

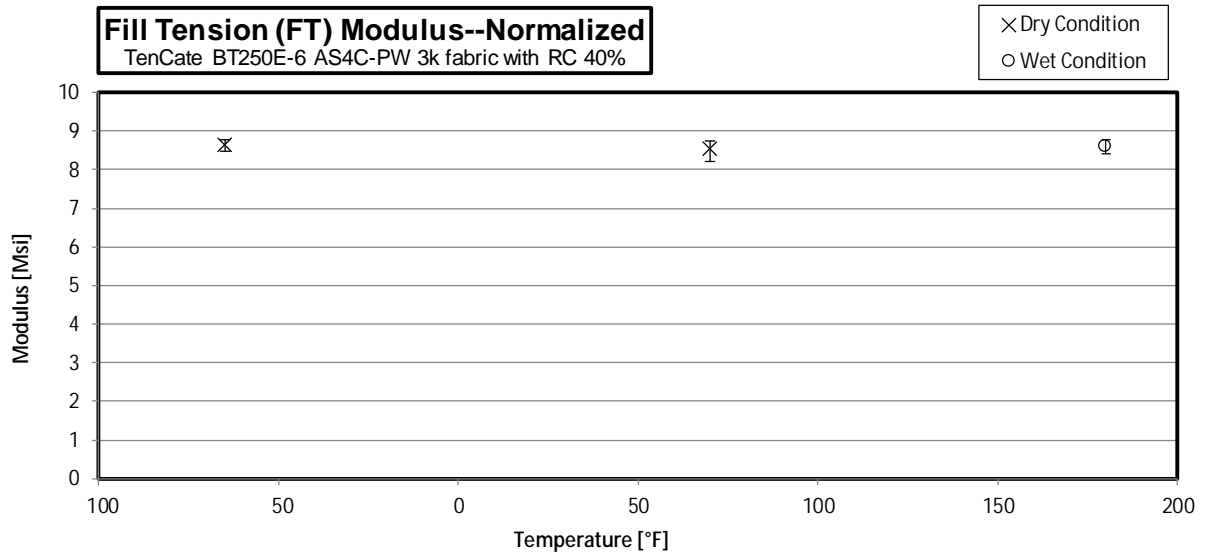
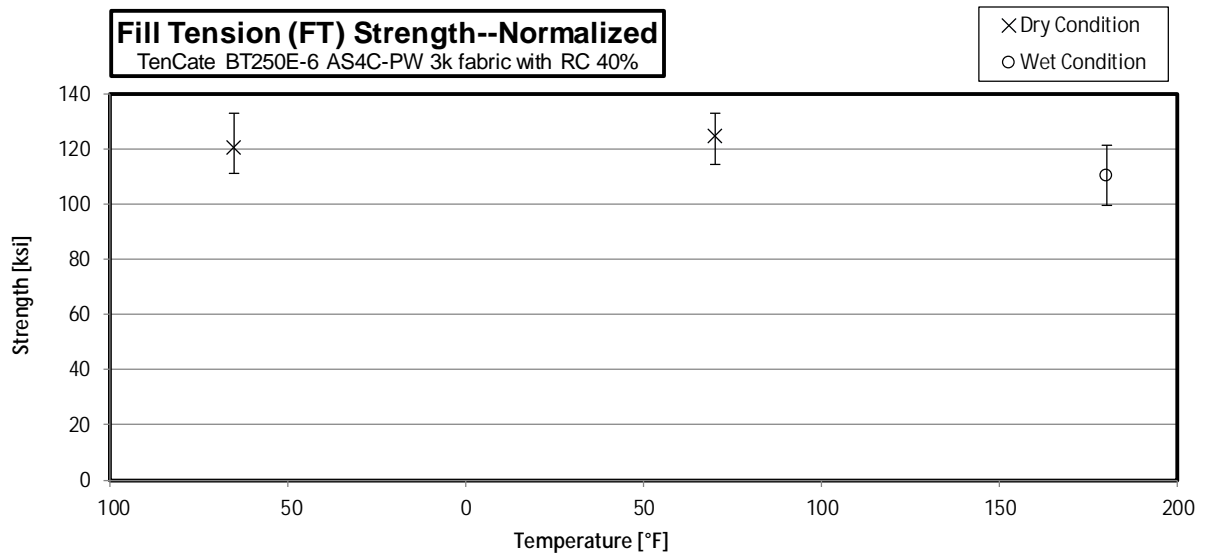
3. Individual Test Charts

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

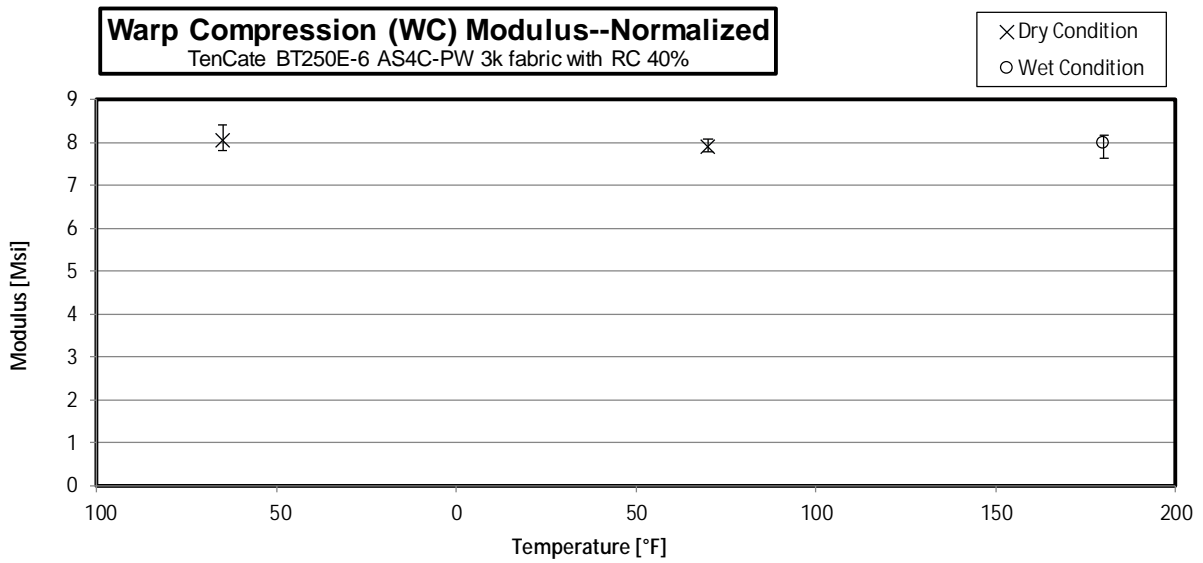
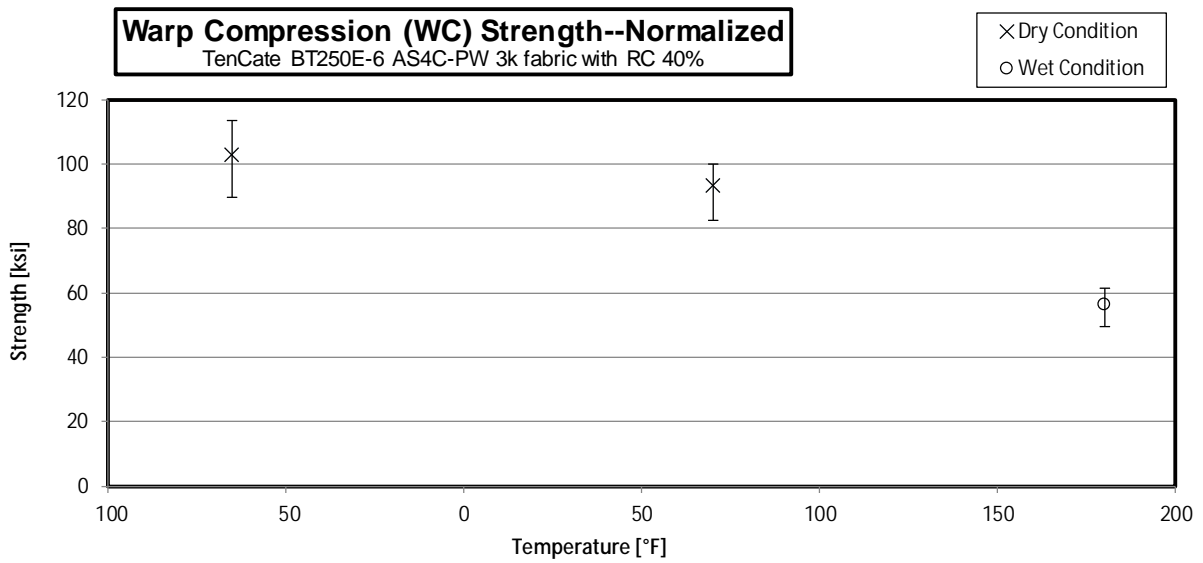
3.1 Warp Tension Properties (WT)



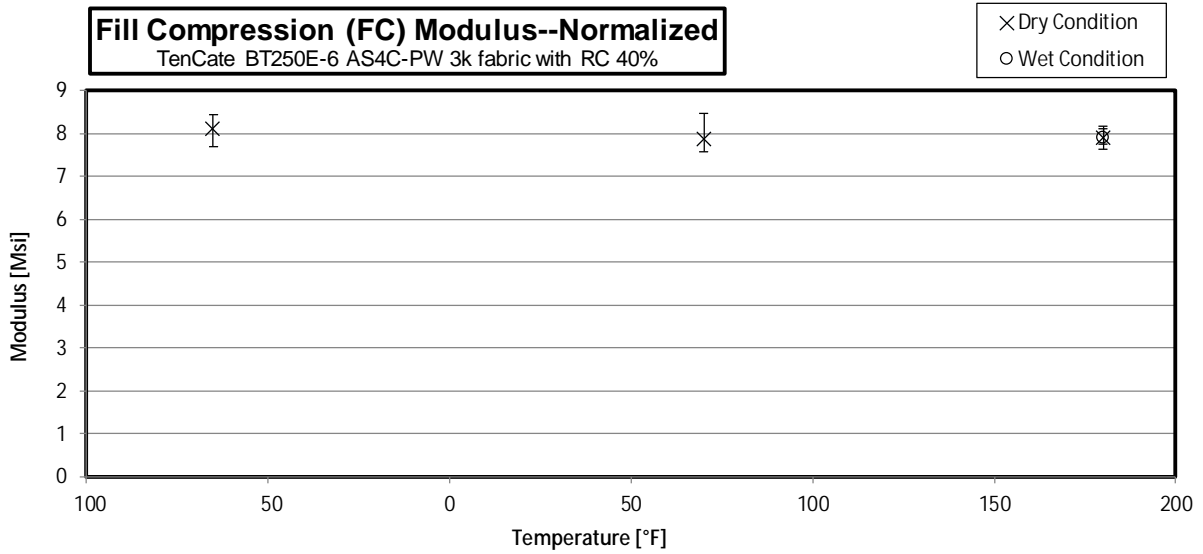
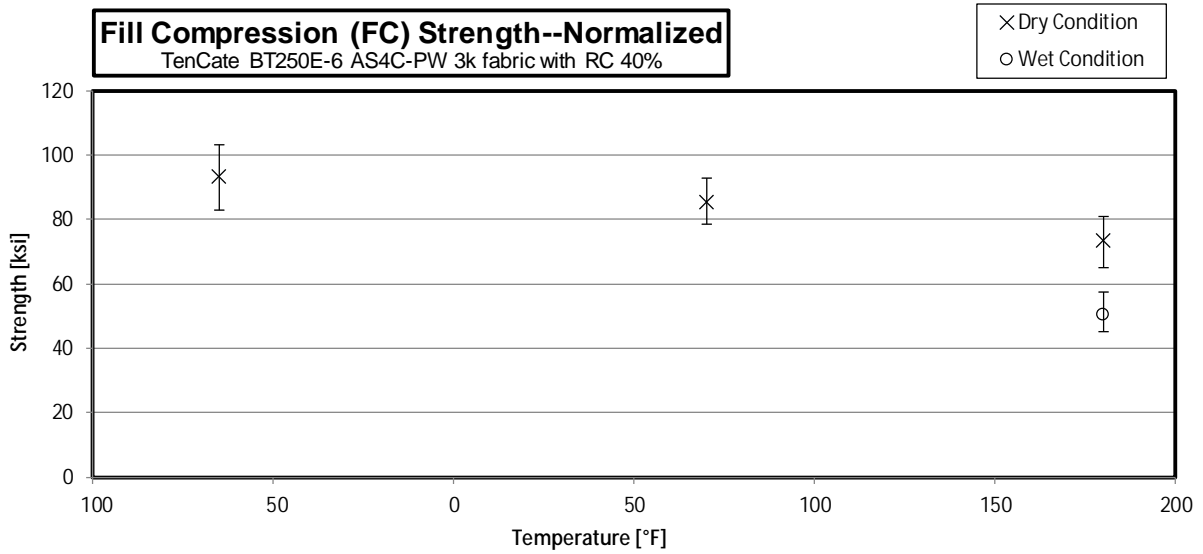
3.2 Fill Tension Properties (FT)



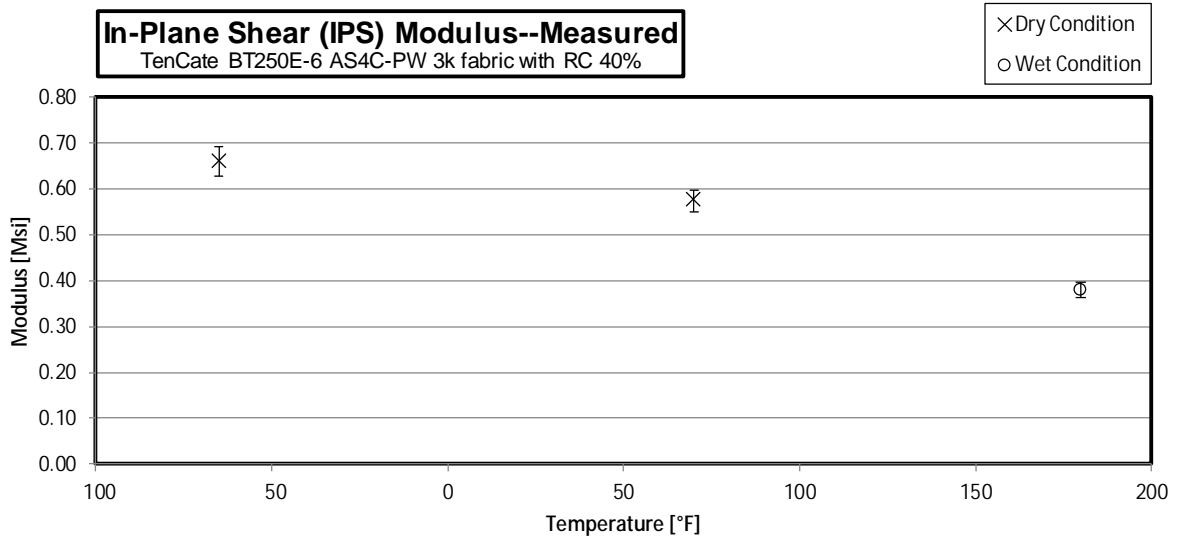
3.3 Warp Compression Properties (WC)



3.4 Fill Compression Properties (FC)



3.5 In-Plane Shear Properties (IPS)



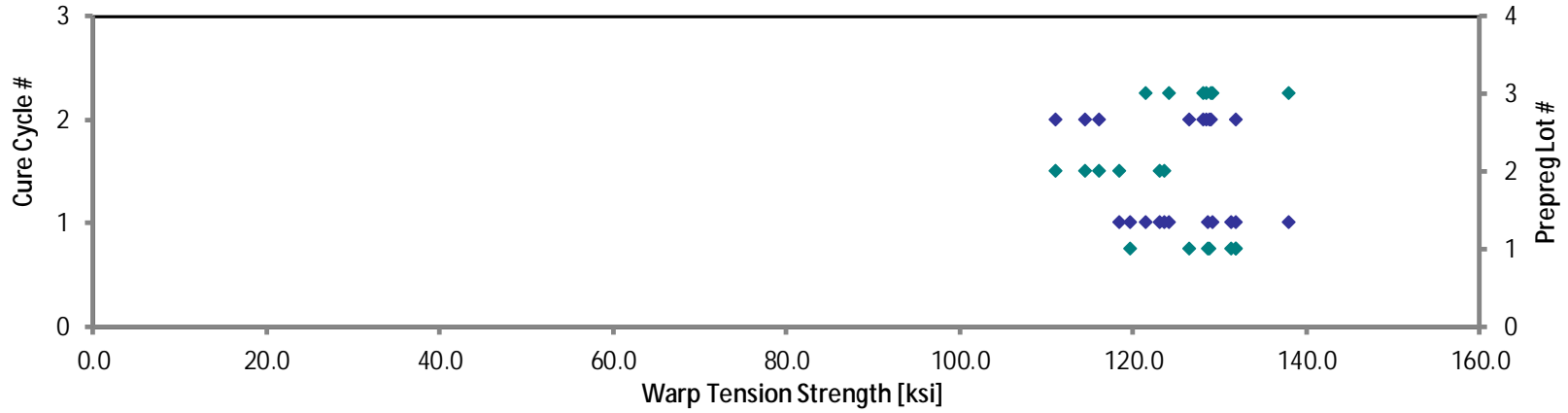
4. Individual Test Data

4.1 Warp Tension Properties (WT)

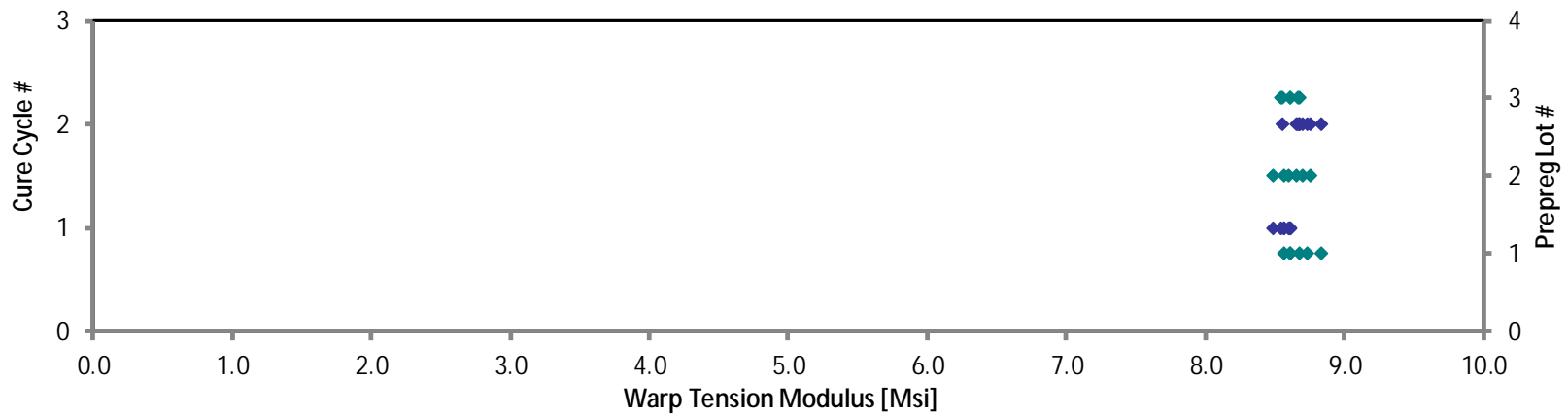
normalizing
 t_{ply} [in]
 0.0085

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]
EABJA116B	A	C1	1	1	129.990	8.695	0.060	0.126	15	LGM/ LWB	0.0084	128.614	8.603
EABJA117B	A	C1	1	1	134.359	8.760	***	0.125	15	LGM	0.0083	131.267	8.558
EABJA118B	A	C1	1	1	122.974	8.843	***	0.124	15	LGM	0.0083	119.630	8.603
EABJA119B*	A	C1	1	1	133.790			0.126	15	LGM/ LWB	0.0084	131.762	
EABJA215B	A	C2	1	2	126.493	8.684	***	0.127	15	LGM / LWT	0.0085	126.394	8.677
EABJA216B	A	C2	1	2	132.440	8.764	0.066	0.127	15	LWT / LGM	0.0085	131.869	8.726
EABJA217B	A	C2	1	2	131.243	9.004	0.066	0.125	15	LAB	0.0083	128.687	8.829
EABJB116B	B	C1	2	1	120.123	8.364	0.059	0.131	15	LAT	0.0087	122.965	8.562
EABJB117B	B	C1	2	1	115.311	8.268	***	0.131	15	LGM	0.0087	118.340	8.485
EABJB118B	B	C1	2	1	**	8.402	0.062	0.130	15	LIT	0.0087		8.595
EABJB119B*	B	C1	2	1	124.227			0.127	15	LGM	0.0085	123.610	
EABJB215B	B	C2	2	2	110.386	8.714	0.055	0.128	15	LAB	0.0085	110.920	8.756
EABJB216B	B	C2	2	2	113.891	8.612	0.051	0.128	15	LAB	0.0085	114.412	8.651
EABJB217B	B	C2	2	2	117.330	8.787	0.056	0.126	15	LAT / LWB	0.0084	116.073	8.693
EABJC116B	C	C1	3	1	124.808	8.257	0.055	0.132	15	LWB / LAT	0.0088	129.132	8.543
EABJC117B	C	C1	3	1	120.132	8.332	0.049	0.132	15	LGM / LWT	0.0088	124.058	8.605
EABJC118B	C	C1	3	1	118.502	8.405	0.060	0.131	15	LWT/LWB	0.0087	121.322	8.605

Warp Tension Properties (WT)--CTD
Normalized Strength
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%



Warp Tension Properties (WT)--CTD
Normalized Modulus
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%

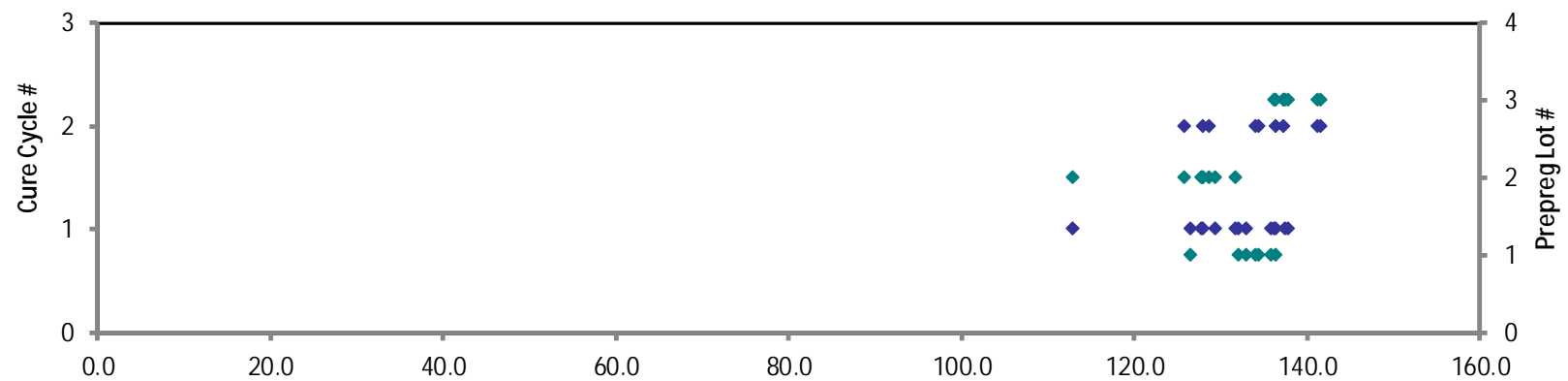


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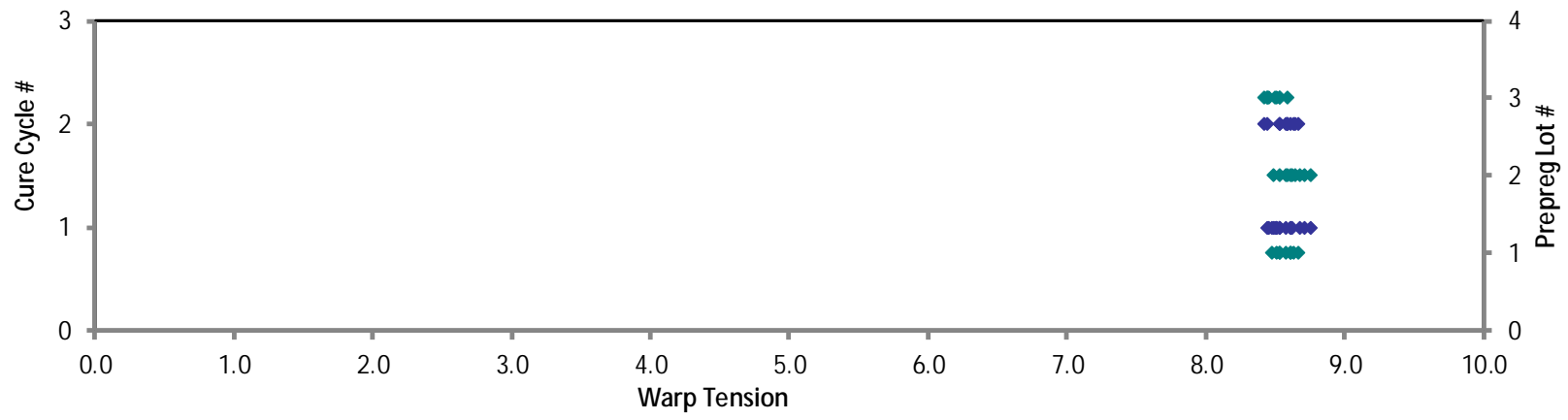
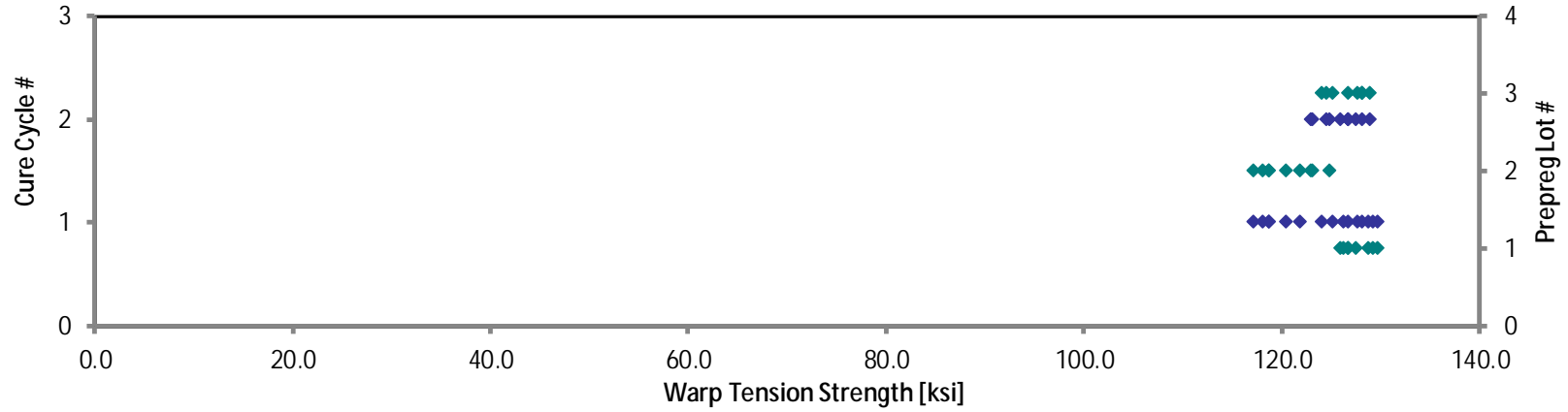
normalizing
t_{ply} [in]
0.0085

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksj]	Modulus [Msj]	Poisson's Ratio	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t _{ply} [in]	Strength _{norm} [ksj]	Modulus _{norm} [Msj]
EABJA111A	A	C1	1	1	136.161	8.911	0.051	0.124	15	LWB/LWT	0.0083	132.904	8.698
EABJA112A	A	C1	1	1	134.214	8.742	**	0.125	15	LWB/LWT	0.0084	131.951	8.594
EABJA113A	A	C1	1	1	128.471	8.710	0.053	0.125	15	LWB/LWT	0.0084	126.439	8.572
EABJA114A	A	C1	1	1	137.605	8.714	0.057	0.126	15	LWB/LWT	0.0084	135.716	8.595



Warp Tension Properties (WT)--ETW
Normalized Strength
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%

- ◆ Cure Cycle #
- ◆ Prepreg Lot #



4.2 Fill Tension Properties (FT)

**Fill Tension Properties (FT)--CTD
Strength & Modulus**
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%

normalizing
t_{ply} [in]
0.0085

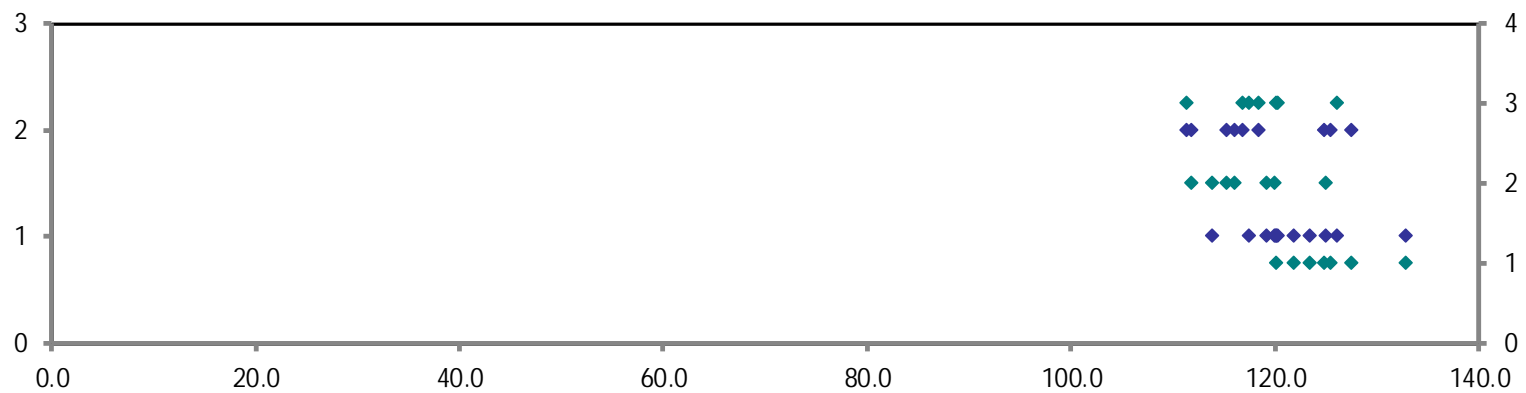
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode
EABUA116B	A	C1	1	1	133.218	8.664	0.127	15	LGM
EABUA117B	A	C1	1	1	122.223	8.596	0.127	15	LWT
EABUA118B	A	C1	1	1	124.625	8.636	0.126	15	LWT
EABUA119B*	A	C1	1	1	122.935		0.124	15	LWB
EABUA215B	A	C2	1	2	123.536	8.404	0.129	15	LWB
EABUA216B	A	C2	1	2	126.473	8.498	0.128	15	LWB
EABUA217B	A	C2	1	2	125.745	8.639	0.127	15	LAB
EABUB116B	B	C1	2	1	117.783	8.571	0.130	15	LAT/ LWB
EABUB117B	B	C1	2	1	112.145	8.597	0.129	15	LGM
EABUB118B	B	C1	2	1	117.070	8.637	0.130	15	LGM
EABUB119B*	B	C1	2	1	124.853		0.127	15	LGM
EABUB215B	B	C2	2	2	109.120	8.566	0.131	15	LAB
EABUB216B	B	C2	2	2	113.526	8.536	0.130	15	LAB
EABUB217B	B	C2	2	2	115.424	8.659	0.127	15	LAB
EABUC116B	C	C1	3	1	121.165	8.681	0.127	15	LAB
EABUC117B	C	C1	3	1	121.228	8.746	0.126	15	LGM
EABUC118B	C	C1	3	1	118.259	8.609	0.127	15	LAT / LWB
EABUC119B*	C	C1	3	1	130.128		0.123	15	LGM / LWB
EABUC216B	C	C2	3	2	116.288	8.719	0.128	15	LGM
EABUC217B	C	C2	3	2	120.237	8.726	0.126	15	LWT/ LWB
EABUC218B	C	C2	3	2	110.832	8.587	0.128	15	LAB

Avg. t _{ply} [in]	Strength _{norm} [ksi]	Modulus _{norm} [Msi]
0.0085	132.730	8.632
0.0085	121.695	8.559
0.0084	123.403	8.551
0.0083	119.978	
0.0086	124.682	8.482
0.0086	127.366	8.558
0.0085	125.383	8.614
0.0086	119.815	8.719
0.0086	113.787	8.722
0.0086	119.044	8.783
0.0085	124.837	
0.0087	111.773	8.774
0.0087	116.034	8.725
0.0085	115.213	8.643
0.0084	120.215	8.613
0.0084	120.102	8.664
0.0084	117.332	8.541
0.0082	125.995	
0.0085	116.728	8.752
0.0084	118.351	8.589
0.0085	111.238	8.619

* Specimen was not gaged and tested for strength only.

Average	120.324	8.615
Standard Dev.	6.250	0.084
Coeff. of Var. [%]	5.194	0.978
Min.	109.120	8.404
Max.	133.218	8.746
Number of Spec.	21	18

Average_{norm}	0.0085	120.271	8.641
Standard Dev._{norm}		5.398	0.088
Coeff. of Var. [%]_{norm}		4.488	1.021
Min.	0.0082	111.238	8.482
Max.	0.0087	132.730	8.783
Number of Spec.	21	21	18

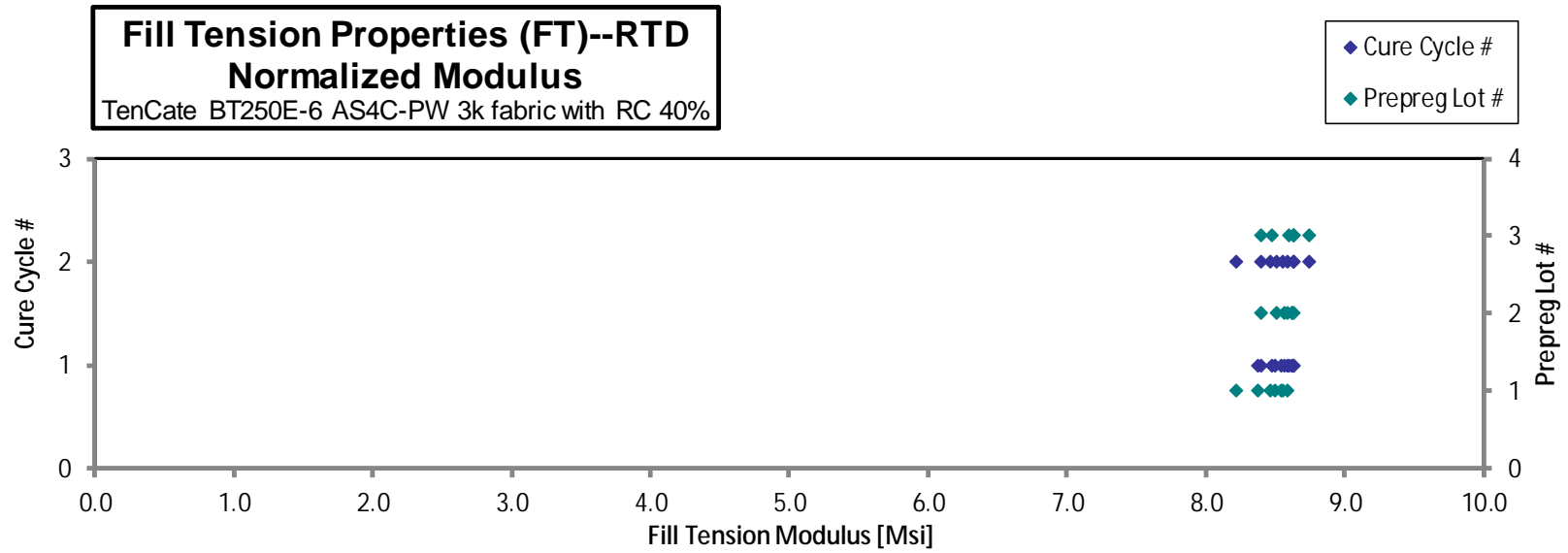
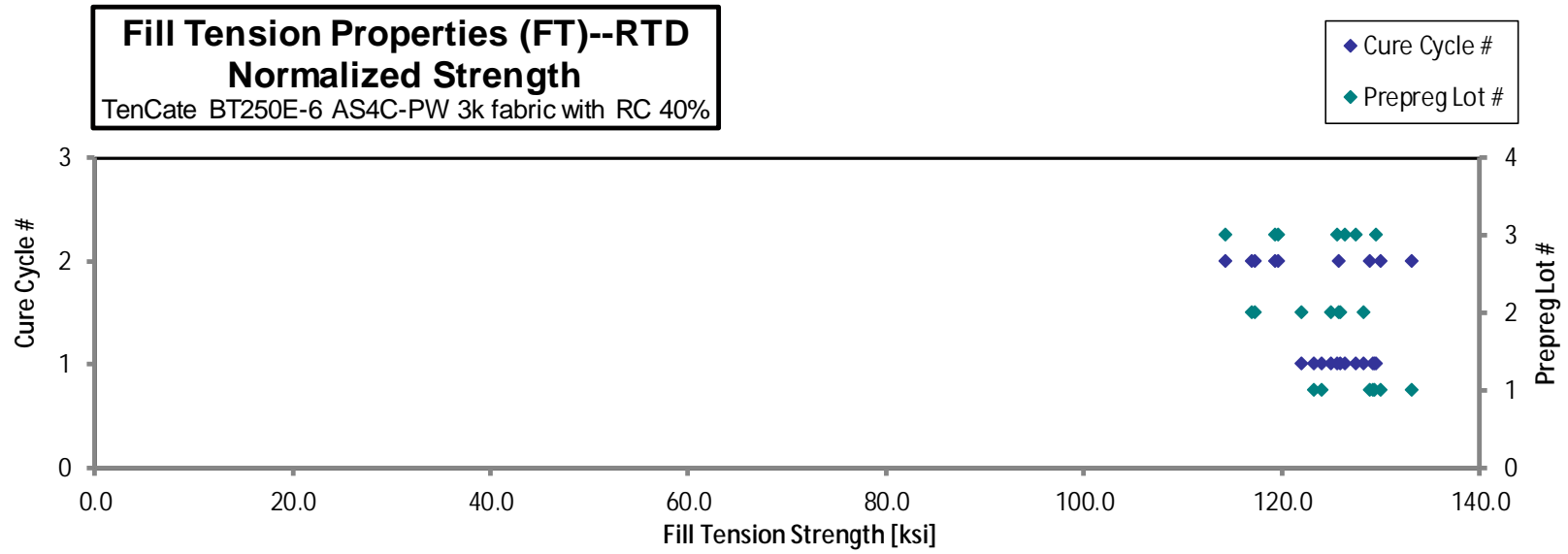


October 24, 2017

CAM-RP-2015-039 N/C

normalizing
t_{ply} [in]
0.0085

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]
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Fill Tension Properties (FT)--ETW
Strength & Modulus
 TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%

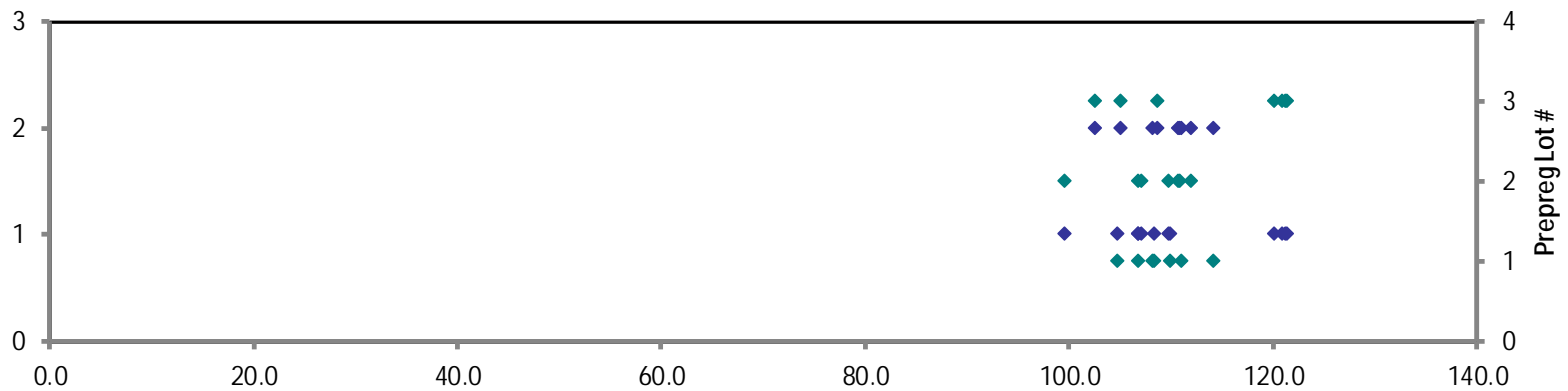
normalizing
 t_{ply} [in]
 0.0085

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksj]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode
EABUA11BD	A	C1	1	1	105.781	8.653	0.126	15	LGM
EABUA11CD	A	C1	1	1	109.023	8.635	0.127	15	LGM
EABUA11DD	A	C1	1	1	106.818	8.469	0.127	15	LWB
EABUA11ED	A	C1	1	1	110.082	8.501	0.127	15	LGM/LWB
EABUA219D	A	C2	1	2	107.596	8.459	0.128	15	LGM
EABUA21AD	A	C2	1	2	110.091	8.399	0.129	15	LWT/LWB/DGM
EABUA21BD	A	C2	1	2	113.251	8.363	0.128	15	LGM
EABUB11BD	B	C1	2	1	109.038	8.552	0.128	15	LGM
EABUB11CD	B	C1	2	1	106.289	8.614	0.128	15	LGM
EABUB11DD	B	C1	2	1	105.986	8.564	0.128	15	LWB/DGM
EABUB11ED	B	C1	2	1	98.594	8.592	0.129	15	LGM
EABUB219D	B	C2	2	2	110.058	8.428	0.128	15	LGM
EABUB21AD	B	C2	2	2	109.443	8.694	0.129	15	LWT
EABUB21BD	B	C2	2	2	109.874	8.551	0.130	15	LGM
EABUC11BD	C	C1	3	1	121.105	8.871	0.126	15	LGM/DGM
EABUC11CD	C	C1	3	1	122.067	8.713	0.126	15	LGM/DGM
EABUC11DD	C	C1	3	1	122.561	8.832	0.126	15	LGM/DGM
EABUC11ED	C	C1	3	1	122.182	8.790	0.126	15	LGM/DGM
EABUC219D	C	C2	3	2	101.223	8.569	0.129	15	LGM
EABUC21AD	C	C2	3	2	103.909	8.456	0.129	15	LWB
EABUC21BD	C	C2	3	2	108.479	8.571	0.128	15	LGM

Avg. t_{ply} [in]	Strength _{norm} [ksj]	Modulus _{norm} [Msi]
0.0084	104.689	8.564
0.0084	108.324	8.580
0.0085	106.622	8.453
0.0085	109.909	8.488
0.0085	108.172	8.505
0.0086	110.955	8.465
0.0086	114.035	8.421
0.0085	109.637	8.599
0.0086	106.984	8.671
0.0086	106.707	8.622
0.0086	99.509	8.671
0.0086	110.806	8.485
0.0086	110.573	8.784
0.0087	111.943	8.712
0.0084	119.997	8.790
0.0084	120.823	8.624
0.0084	121.328	8.743
0.0084	121.080	8.711
0.0086	102.533	8.680
0.0086	104.955	8.541
0.0085	108.564	8.578

Average 110.164 8.585
 Standard Dev. 6.699 0.139
 Coeff. of Var. [%] 6.081 1.618
 Min. 98.594 8.363
 Max. 122.561 8.871
 Number of Spec. 21 21

Average_{norm} 0.0085 110.388 8.604
 Standard Dev_{norm} 6.108 0.111
 Coeff. of Var. [%]_{norm} 5.533 1.286
 Min. 0.0084 99.509 8.421
 Max. 0.0087 121.328 8.790
 Number of Spec. 21 21 21




October 24, 2017

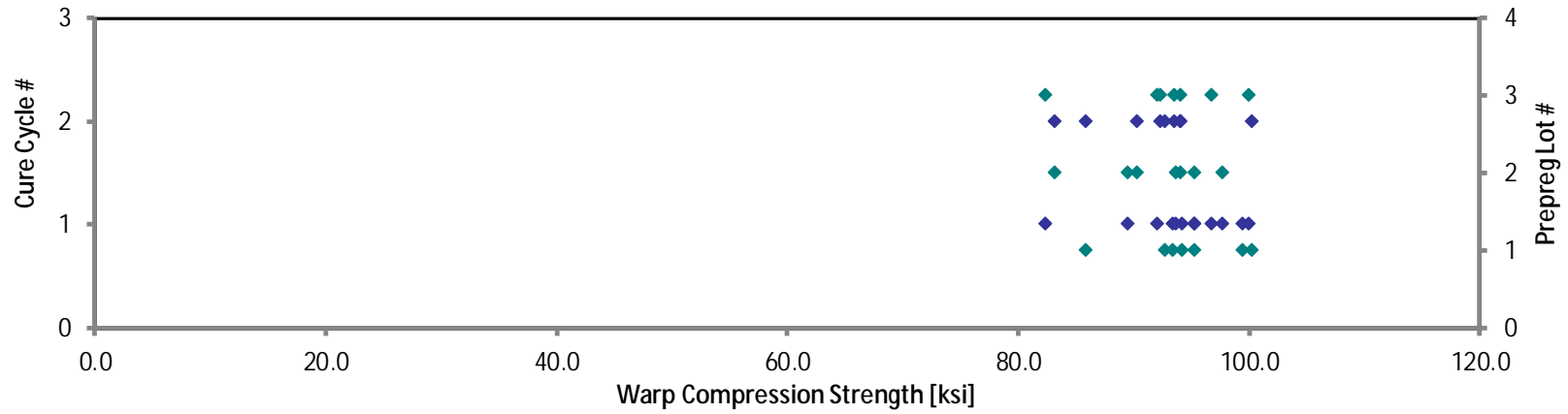
CAM-RP-2015-039 N/C

4.3 Warp Compression Properties (WC)

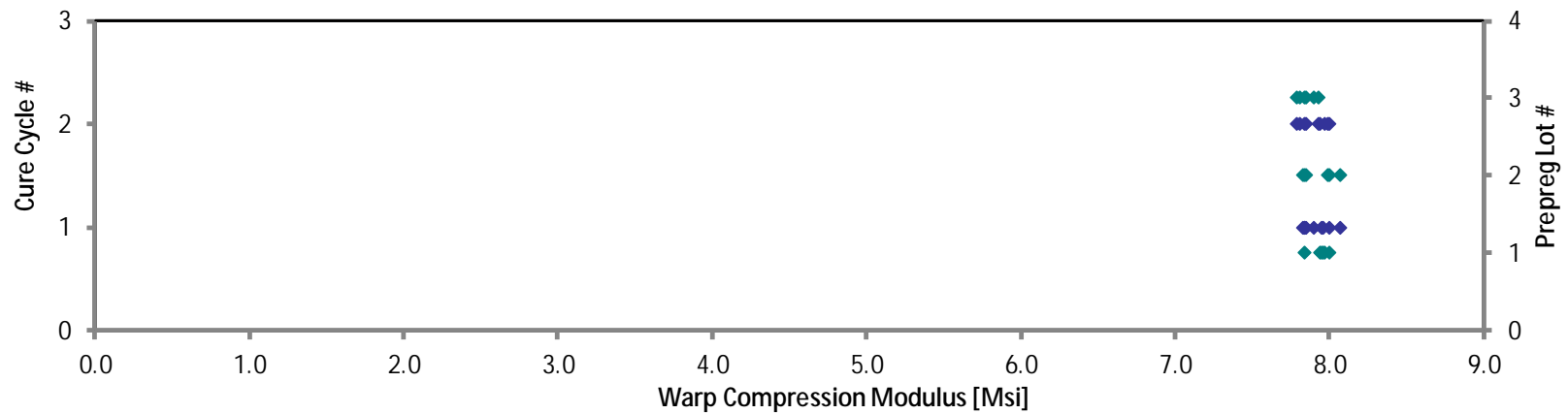
normalizing
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Warp Compression Properties (WC)--RTD
Normalized Strength
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%



Warp Compression Properties (WC)--RTD
Normalized Modulus
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%



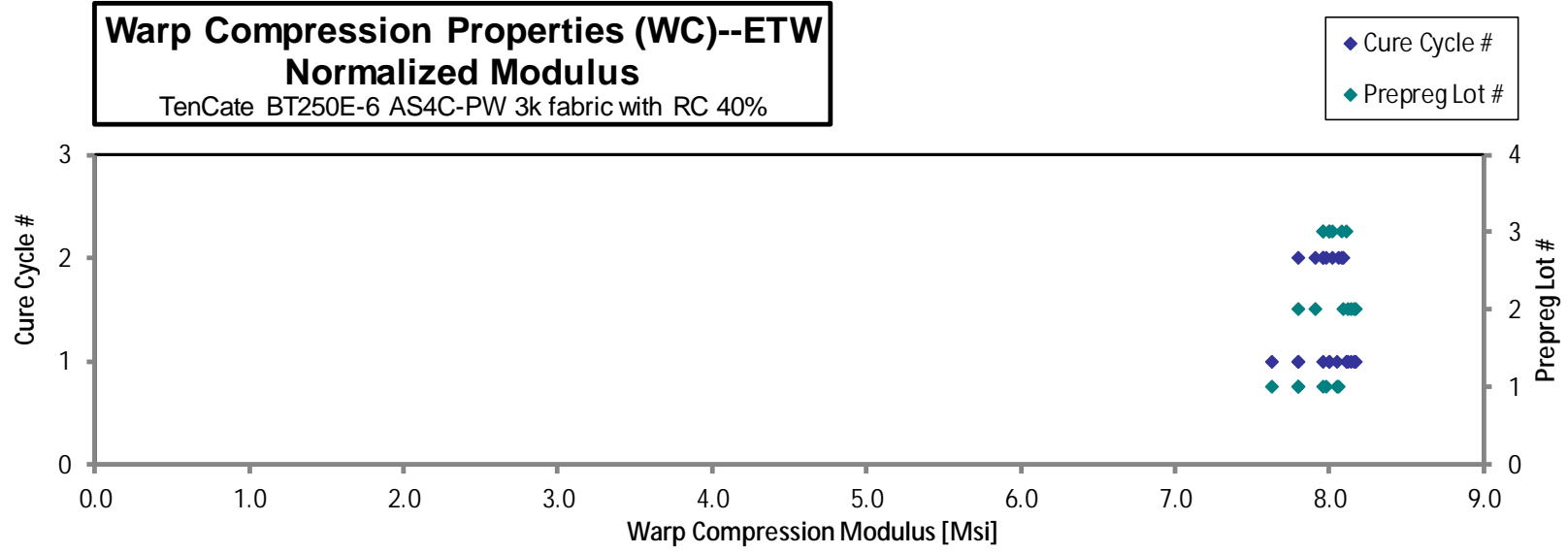
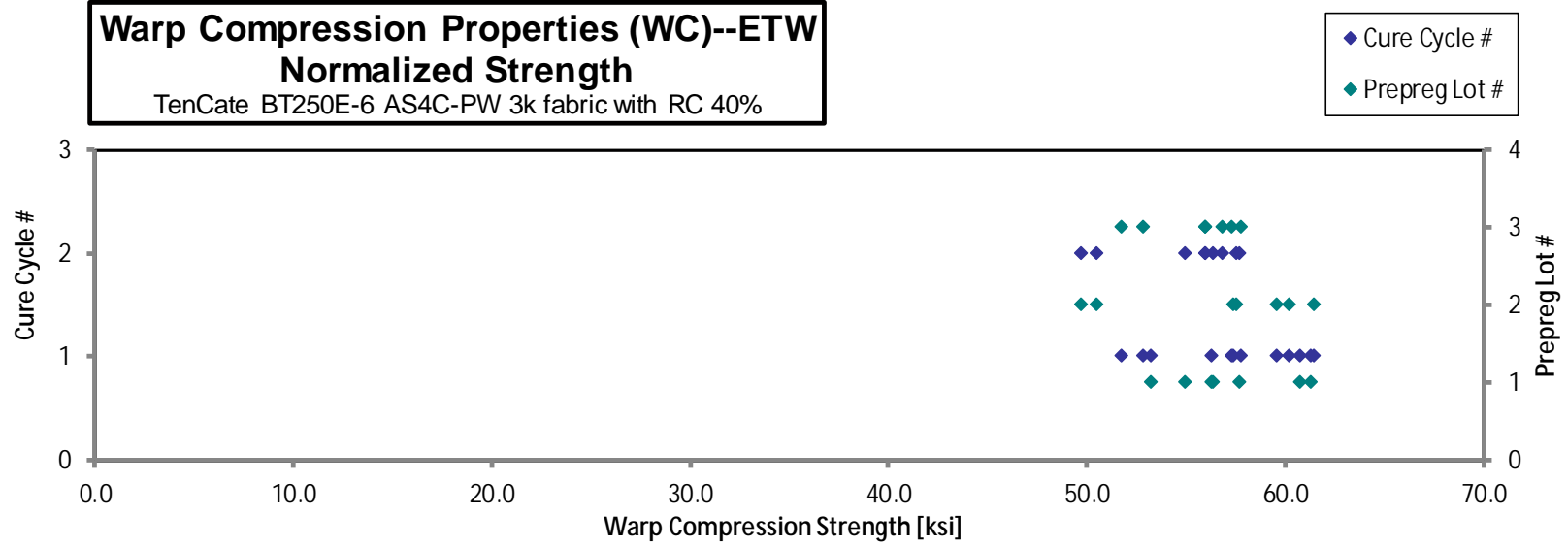
Warp Compression Properties (WC)--ETW
Strength & Modulus
 TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%

normalizing
 t_{ply} [in]
 0.0085

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]
EABLA11BD	A	C1	1	1		8.179	0.125	15	HGM	0.0084		8.049
EABLA11CD	A	C1	1	1		7.835	0.127	15	BGM	0.0085		7.790
EABLA11DD	A	C1	1	1		7.787	0.128	15	BGM	0.0085		7.800
EABLA11ED	A	C1	1	1		7.550	0.129	15	HGM	0.0086		7.622
EABLA11FD	A	C1	1	1	60.544		0.129	15	BGM	0.0086	61.238	
EABLA11GD	A	C1	1	1	60.161		0.129	15	BGM	0.0086	60.692	
EABLA11HD	A	C1	1	1	55.968		0.128	15	HGM	0.0085	56.226	
EABLA11ID	A	C1	1	1	53.306		0.127	15	HAT	0.0085	53.196	
EABLA219D	A	C2	1	2		7.890	0.129	15	BGM	0.0086		7.955
EABLA21AD	A	C2	1	2		7.978	0.129	15	HGM	0.0086		8.058
EABLA21BD	A	C2	1	2		7.850	0.130	15	HGM	0.0086		7.977
EABLA21CD	A	C2	1	2	53.958		0.130	15	HGM	0.0086	54.904	
EABLA21DD	A	C2	1	2	55.325		0.130	15	HAT	0.0087	56.307	
EABLA21ED	A	C2	1	2	56.636		0.130	15	HGM	0.0086	57.624	
EABLB11BD	B	C1	2	1		8.282	0.126	15	BGM	0.0084		8.158
EABLB11CD	B	C1	2	1		8.212	0.126	15	BGM	0.0084		8.113
EABLB11DD	B	C1	2	1		8.191	0.127	15	HGM	0.0085		8.172
EABLB11ED	B	C1	2	1		8.091	0.128	15	HGM	0.0085		8.137
EABLB11FD	B	C1	2	1	59.720		0.128	15	BGM	0.0086	60.153	
EABLB11GD	B	C1	2	1	60.572		0.129	15	HAB	0.0086	61.373	
EABLB11HD	B	C1	2	1	56.181		0.130	15	BAT	0.0087	57.376	
EABLB11ID	B	C1	2	1	58.058		0.131	15	HGM	0.0087	59.498	
EABLB219D	B	C2	2	2		8.186	0.126	15	HAB	0.0084		8.084
EABLB21AD	B	C2	2	2		7.812	0.127	15	BGM	0.0085		7.800
EABLB21BD	B	C2	2	2		7.750	0.130	15	BGM	0.0087		7.901
EABLB21CD	B	C2	2	2	49.155		0.131	15	HGM	0.0087	50.470	
EABLB21DD	B	C2	2	2	47.952		0.132	15	HGM	0.0088	49.677	
EABLB21FD	B	C2	2	2	55.569		0.132	15	BGM	0.0088	57.498	
EABLC11BD	C	C1	3	1		7.996	0.127	15	HGM	0.0085		7.993
EABLC11CD	C	C1	3	1		7.944	0.128	15	BGM	0.0086		7.993
EABLC11DD	C	C1	3	1		8.063	0.128	15	BAB	0.0085		8.105
EABLC11ED	C	C1	3	1		7.844	0.129	15	HGM	0.0086		7.958
EABLC11FD	C	C1	3	1	51.031		0.129	15	HGM	0.0086	51.691	
EABLC11GD	C	C1	3	1	51.945		0.130	15	HGM	0.0086	52.842	
EABLC11HD	C	C1	3	1	56.451		0.130	15	HGM	0.0087	57.702	
EABLC11JD	C	C1	3	1	56.301		0.130	15	HGM	0.0086	57.251	
EABLC219D	C	C2	3	2		8.061	0.127	15	HGM	0.0085		8.020
EABLC21AD	C	C2	3	2		7.926	0.128	15	BGM	0.0085		7.958
EABLC21BD	C	C2	3	2		7.998	0.129	15	HGM	0.0086		8.077
EABLC21CD	C	C2	3	2	55.923		0.129	15	BGM/HGM	0.0086	56.778	
EABLC21DD	C	C2	3	2	54.879		0.130	15	BGM/HGM	0.0087	55.928	
EABLC21ED	C	C2	3	2	54.641		0.131	15	HGM	0.0087	55.938	

Average 55.442 7.973
 Standard Dev. 3.457 0.183
 Coeff. of Var. [%] 6.236 2.294
 Min. 47.952 7.550
 Max. 60.572 8.282
 Number of Spec. 21 21

Average_{norm} 0.0086 56.398 7.987
 Standard Dev._{norm} 3.351 0.141
 Coeff. of Var. [%]_{norm} 5.942 1.760
 Min. 0.0084 49.677 7.622
 Max. 0.0088 61.373 8.172
 Number of Spec. 42 21 21



October 24, 2017

CAM-RP-2015-039 N/C

4.4 Fill Compression Properties (FC)

normalizing
t_{ply} [in]
0.0085

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]
EABZA116B	A	C1	1	1	91.100	7.691	0.131	15	BGM	0.0087	93.386	7.884
EABZA117B	A	C1	1	1	87.790	7.771	0.131	15	BGM	0.0087	90.337	7.997
EABZA118B	A	C1	1	1	89.410	7.850	0.132	15	BGM	0.0088	92.417	8.114
EABZA119B*	A	C1	1	1	90.841		0.132	15	BGM	0.0088	93.994	
EABZA215B	A	C2	1	2	96.903	8.394	0.127	15	BGM	0.0084	96.171	8.330
EABZA216B	A	C2	1	2	102.989	8.054	0.127	15	BGM	0.0085	102.565	8.021
EABZA217B	A	C2	1	2	84.579	8.143	0.127	15	BGM	0.0085	84.165	8.104
EABZB116B*	B	C1	2	1	92.839		0.127	15	BGM	0.0085	92.757	
EABZB117B	B	C1	2	1	92.286	8.268	0.127	15	BGM	0.0085	91.960	8.239
EABZB118B	B	C1	2	1	102.512	8.094	0.127	15	BGM	0.0085	102.110	8.062
EABZB119B	B	C1	2	1	98.392	7.736	0.127	15	BGM	0.0084	97.775	7.688
EABZB215B	B	C2	2	2	**	8.303	0.127	15	HIT/BGM	0.0085		8.281
EABZB216B	B	C2	2	2	84.317	8.061	0.127	15	BGM	0.0085	84.078	8.038
EABZB217B	B	C2	2	2	88.592	8.128	0.127	15	BGM	0.0085	88.366	8.108
EABZB218B*	B	C2	2	2	82.690		0.128	15	BGM	0.0085	82.771	
EABZC116B	C	C1	3	1	104.268	8.360	0.126	15	BGM	0.0084	103.399	8.291
EABZC117B	C	C1	3	1	91.625	8.245	0.127	15	BGM	0.0084	90.933	8.183
EABZC118B	C	C1	3	1	101.843	8.526	0.126	15	BGM	0.0084	100.805	8.439
EABZC119B*	C	C1	3	1	91.089		0.126	15	BGM	0.0084	89.696	
EABZC215B	C	C2	3	2	86.781	8.070	0.127	15	BGM	0.0085	86.270	8.022
EABZC216B	C	C2	3	2	102.676	8.036	0.127	15	BGM	0.0084	102.042	7.986
EABZC217B	C	C2	3	2	92.664	8.230	0.127	15	BGM	0.0085	92.473	8.214

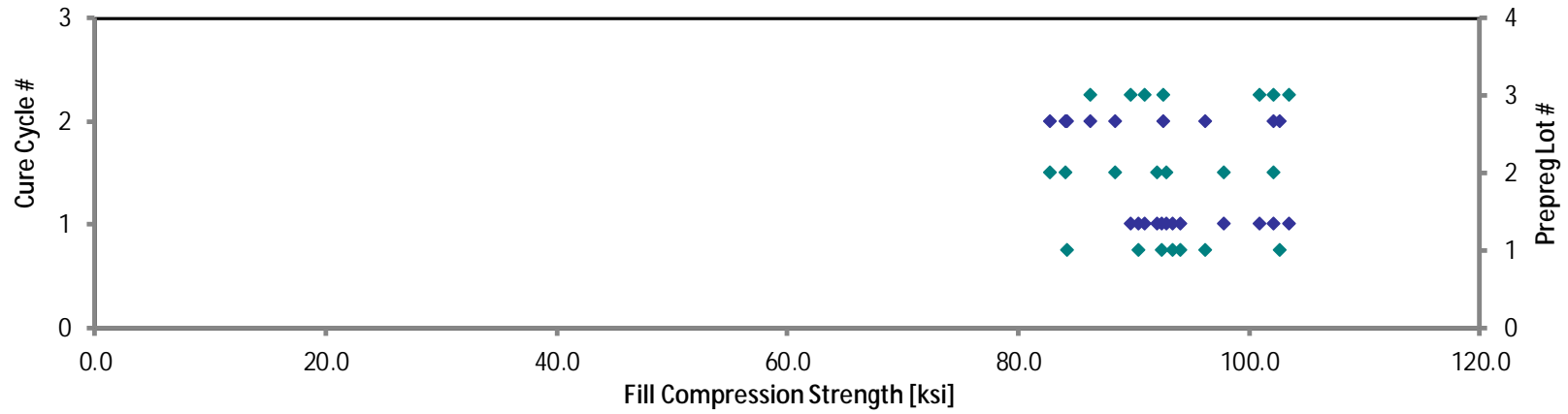
* Specimen was not gaged and tested for strength only.

** Strength not reported due to dominant bad failure mode.

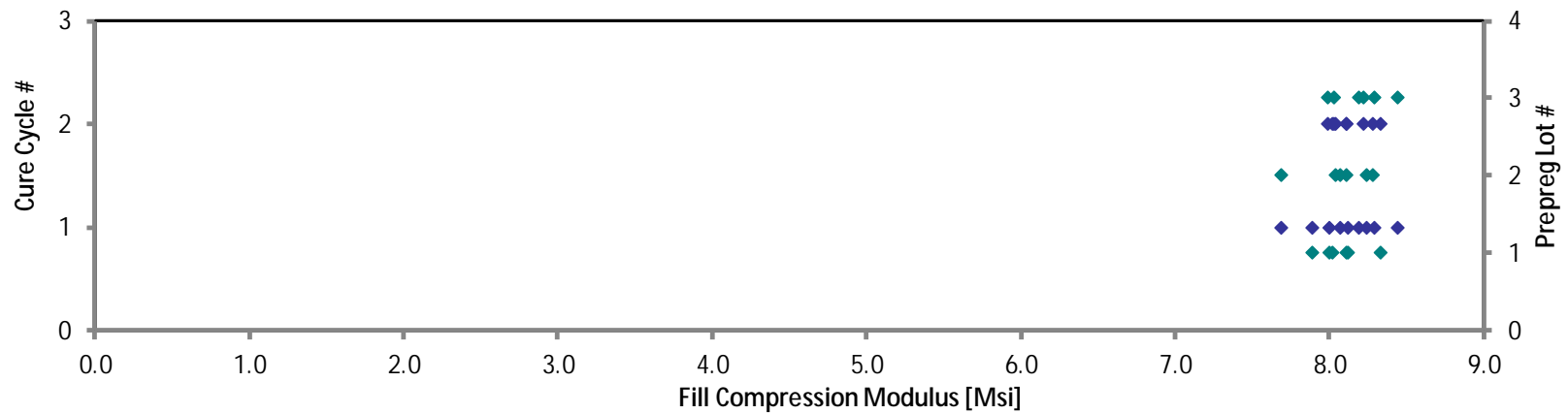
Average 93.152 8.109

Average

Fill Compression Properties (FC)--CTD
Normalized Strength
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%



Fill Compression Properties (FC)--CTD
Normalized Modulus
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%



October 24, 2017

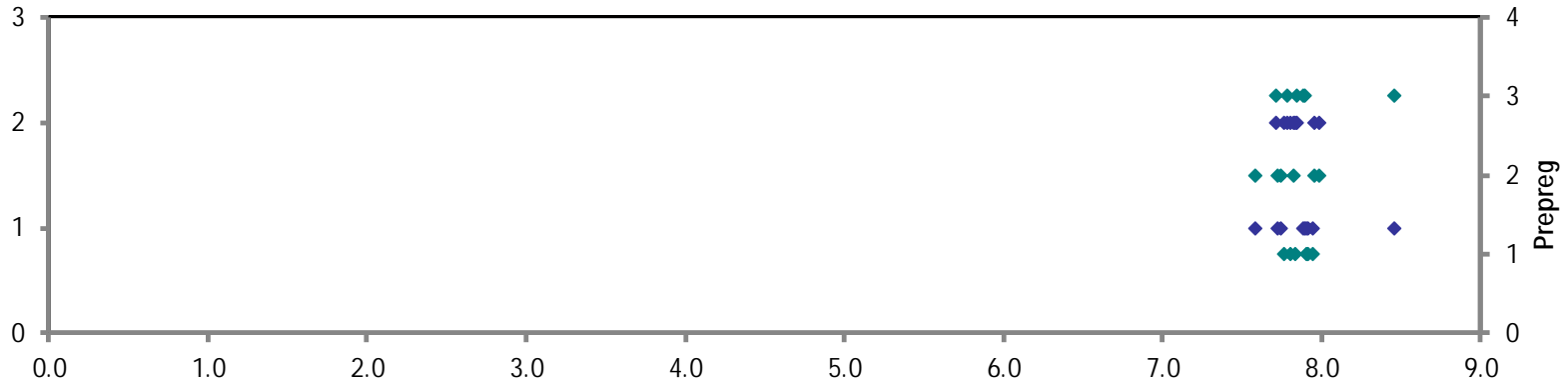
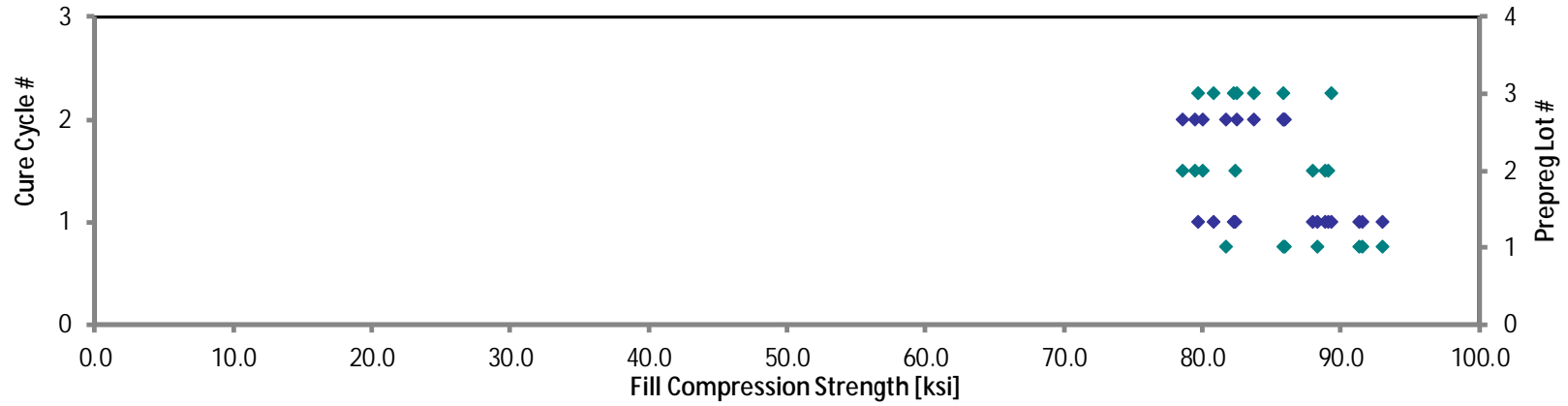
CAM-RP-2015-039 N/C

normalizing
t_{ply} [in]
0.0085

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]
EABZA111A	A	C1	1	1	92.628	7.875	0.128	15	BGM	0.0085	93.019	7.909
EABZA112A	A	C1	1	1	87.261	7.851	0.129	15	BGM/HIB	0.0086	88.322	7.946
EABZA113A	A	C1	1	1	89.835	7.780	0.130	15	BGM	0.0086	91.253	7.903
EABZA114A*	A	C1	1	1	89.504		0.130	15	BGM	0.0087	91.469	

Fill Compression Properties (FC)--RTD
Normalized Strength
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%

◆ Cure Cycle #
◆ Prepreg Lot #



Fill Compression Properties (FC)--ETD
Strength & Modulus
 TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%

normalizing
 t_{ply} [in]
 0.0085

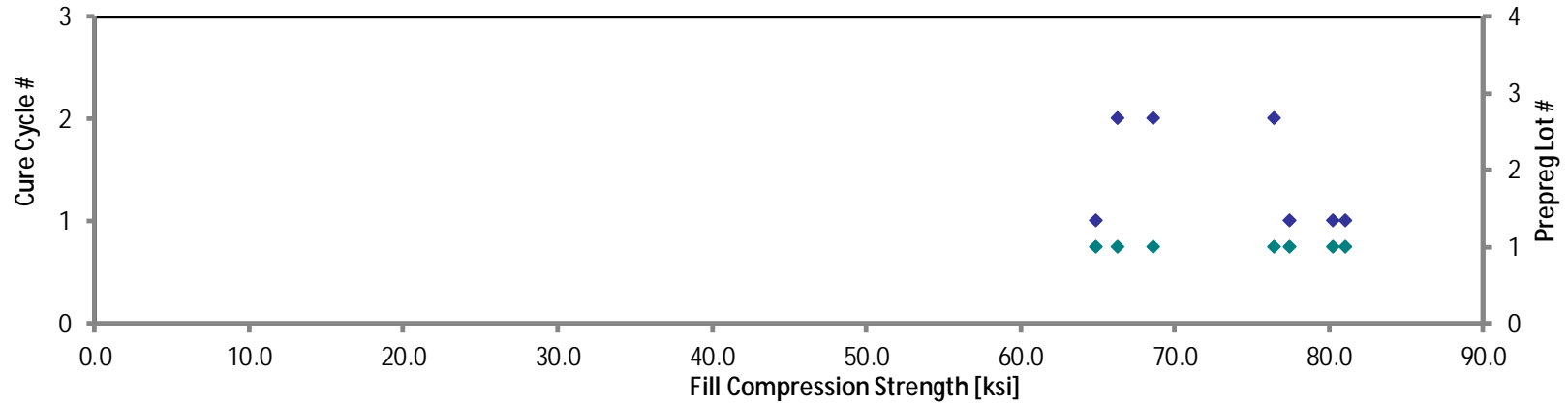
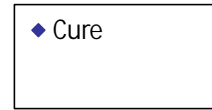
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode
EABZA11BC	A	C1	1	1	77.377	7.868	0.132	15	BGM
EABZA11CC	A	C1	1	1	78.115	7.840	0.132	15	BGM/CIT
EABZA11DC	A	C1	1	1	74.576	7.819	0.132	15	BGM/HIB
EABZA11EC*	A	C1	1	1	64.293		0.129	15	BGM
EABZA219C	A	C2	1	2	65.575	7.555	0.129	15	BGM
EABZA21AC	A	C2	1	2	68.173	7.597	0.128	15	BGM
EABZA21BC	A	C2	1	2	**	7.663	0.128	15	HIT/BGM
EABZA21CC*	A	C2	1	2	76.281		0.128	15	BAB

Avg. t_{ply} [in]	Strength _{norm} [ksi]	Modulus _{norm} [Msi]
0.0088	80.222	8.157
0.0088	81.002	8.130
0.0088	77.427	8.118
0.0086	64.866	
0.0086	66.218	7.629
0.0086	68.614	7.646
0.0085		7.696
0.0085	76.453	

* Specimen was not gaged and tested for strength only.
 ** Strength not reported due to dominant bad failure mode.

Average	72.056	7.724	Average_{norm}	0.0087	73.543	7.896
Standard Dev.	5.868	0.135	Standard Dev._{norm}		6.795	0.263
Coeff. of Var. [%]	8.143	1.751	Coeff. of Var. [%]_{norm}		9.239	3.329
Min.	64.293	7.555	Min.	0.0085	64.866	7.629
Max.	78.115	7.868	Max.	0.0088	81.002	8.157
Number of Spec.	7	6	Number of Spec.	8	7	6

Fill Compression Properties (FC)--ETD
Normalized Strength
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%



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normalizing
t_{ply} [in]
0.0085

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]
EABZA11GD	A	C1	1	1		7.735	0.130	15	HGM	0.0087		7.898
EABZA11HD	A	C1	1	1		7.682	0.131	15	HGM	0.0087		7.872
EABZA11ID	A	C1	1	1		7.731	0.131	15	HGM	0.0087		7.918
EABZA11JD	A	C1	1	1		7.737	0.131	15	HGM	0.0087		7.941
EABZA11KD	A	C1	1	1	51.567		0.131	15	HGM	0.0088	53.164	

4.5 In-Plane Shear Properties (IPS)

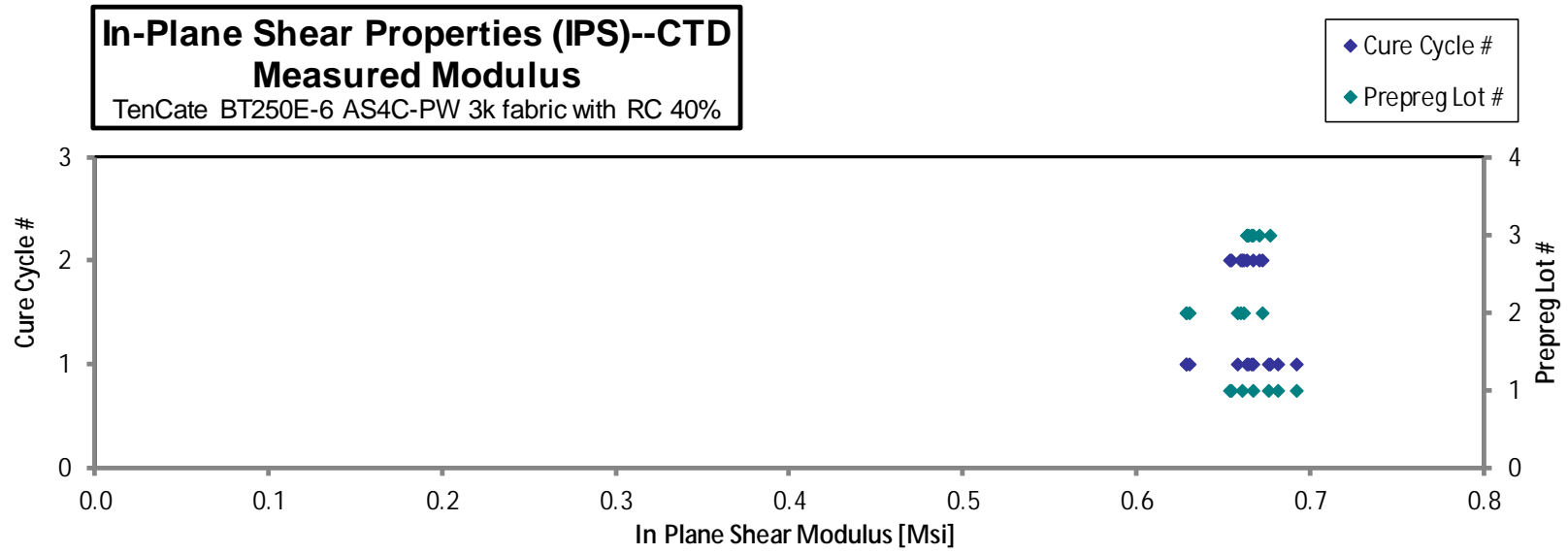
**In-Plane Shear Properties (IPS)--CTD
Strength & Modulus**
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	0.2% Offset Strength [ksj]	Strength at 5% Strain [ksj]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]
EABNA116B	A	C1	1	1	8.538	13.444	0.676	0.102	12	0.0085
EABNA117B	A	C1	1	1	8.636	13.465	0.667	0.102	12	0.0085
EABNA118B	A	C1	1	1	8.646	13.472	0.681	0.102	12	0.0085
EABNA119B	A	C1	1	1	8.724	13.316	0.692	0.099	12	0.0082
EABNA215B	A	C2	1	2	8.285	12.717	0.660	0.105	12	0.0087
EABNA216B	A	C2	1	2	8.254	12.799	0.654	0.105	12	0.0087
EABNA217B	A	C2	1	2	8.237	12.517	0.655	0.103	12	0.0085
EABNB116B	B	C1	2	1	8.101	13.163	0.630	0.108	12	0.0090
EABNB117B	B	C1	2	1	8.129	13.133	0.629	0.107	12	0.0089
EABNB118B	B	C1	2	1	7.957	12.890	0.629	0.106	12	0.0088
EABNB119B	B	C1	2	1	8.245	13.497	0.658	0.105	12	0.0088
EABNB215B	B	C2	2	2	8.424	13.973	0.662	0.103	12	0.0085
EABNB216B	B	C2	2	2	8.274	13.786	0.659	0.103	12	0.0086
EABNB217B	B	C2	2	2	8.490	13.742	0.672	0.102	12	0.0085
EABNC116B	C	C1	3	1	8.506	13.010	0.666	0.102	12	0.0085
EABNC117B	C	C1	3	1	8.564	13.406	0.677	0.102	12	0.0085
EABNC118B	C	C1	3	1	8.494	13.137	0.664	0.102	12	0.0085
EABNC119B	C	C1	3	1	8.426	13.271	0.664	0.103	12	0.0085
EABNC215B	C	C2	3	2	8.373	12.955	0.670	0.103	12	0.0086
EABNC216B	C	C2	3	2	8.487	13.074	0.663	0.103	12	0.0086
EABNC217B	C	C2	3	2	8.515	13.392	0.667	0.103	12	0.0085

Average	8.396	13.246	0.662	Average	0.0086
Standard Dev.	0.197	0.365	0.016	Standard Dev.	
Coeff. of Var. [%]	2.348	2.753	2.460	Coeff. of Var. [%]	
Min.	7.957	12.517	0.629	Min.	0.0082
Max.	8.724	13.973	0.692	Max.	0.0090
Number of Spec.	21	21	21	Number of Spec.	21

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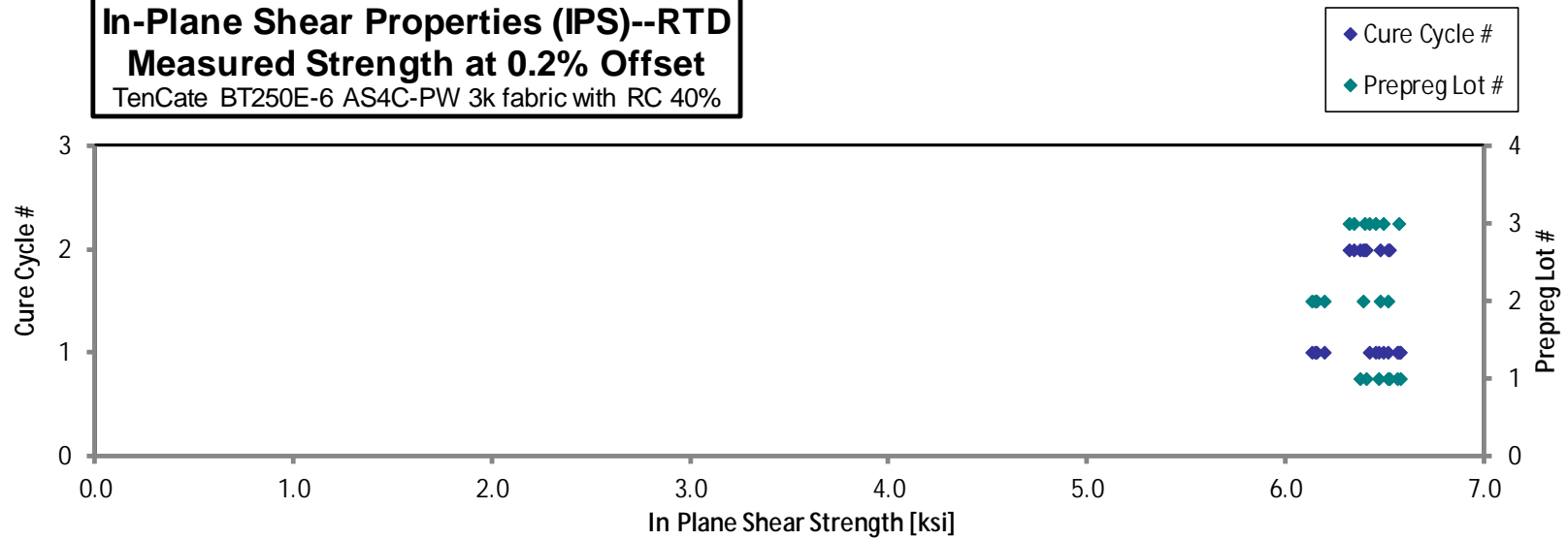


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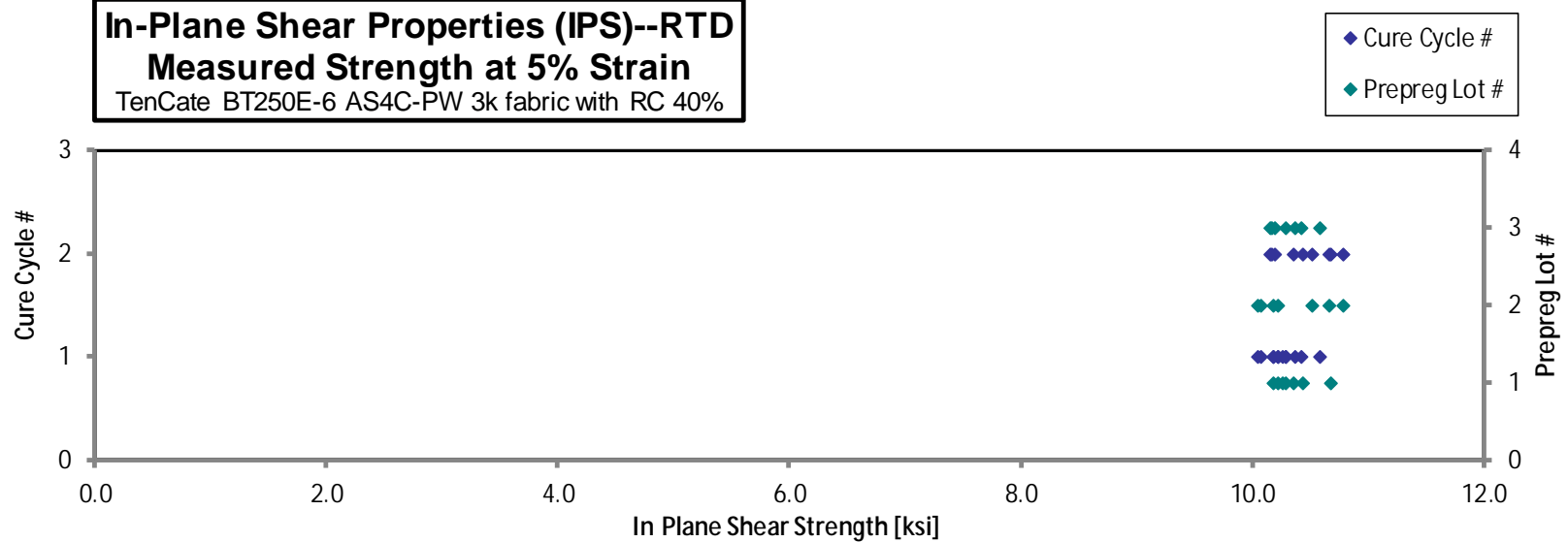
CAM-RP-2015-039 N/C

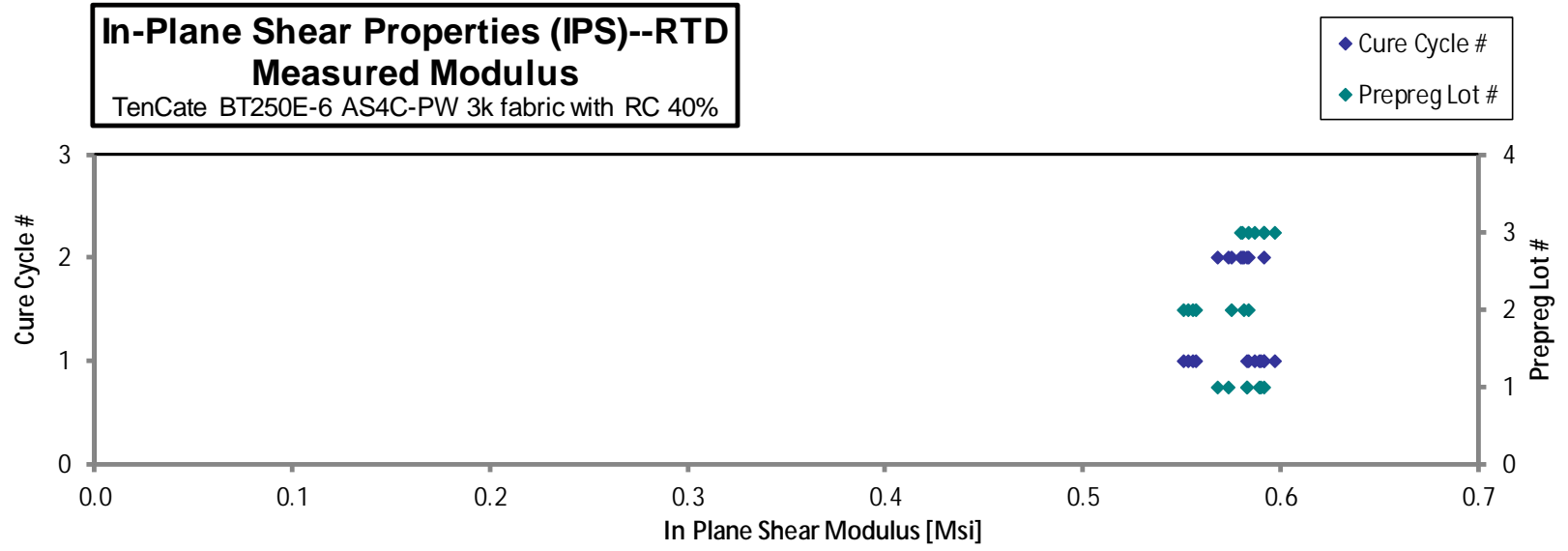
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	0.2% Offset Strength [ksi]	Strength at 5% Strain [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]
EABNA111A	A	C1	1	1	6.583	10.217	0.590	0.100	12	0.0083
EABNA112A	A	C1	1	1	6.472	10.185	0.583	0.101	12	0.0084
EABNA113A	A	C1	1	1	6.562	10.291	0.589	0.101	12	0.0084
EABNA114A	A	C1	1	1	6.515	10.260	0.591	0.101	12	0.0085
EABNA211A	A	C2	1	2	6.527	10.668	0.583	0.102	12	0.0085
EABNA212A	A	C2	1	2	6.373	10.430	0.568	0.105	12	0.0087
EABNA213A	A	C2	1	2	6.404	10.353	0.573	0.104	12	0.0087
EABNB111A	B	C1	2	1	6.159	10.050	0.553	0.105	12	0.0088
EABNB112A	B	C1	2	1	6.134	10.072	0.556	0.106	12	0.0088
EABNB113A	B	C1	2	1	6.198	10.218	0.557	0.107	12	0.0089
EABNB114A	B	C1	2	1	6.145	10.176	0.550	0.107	12	0.0089
EABNB211A	B	C2	2	2	6.393	10.520	0.575	0.102	12	0.0085
EABNB212A	B	C2	2	2	6.479	10.660	0.582	0.102	12	0.0085
EABNB213A	B	C2	2	2	6.516	10.779	0.584	0.102	12	0.0085
EABNC111A	C	C1	3	1	6.421	10.288	0.584	0.102	12	0.0085
EABNC112A	C	C1	3	1	6.489	10.418	0.591	0.101	12	0.0084
EABNC113A	C	C1	3	1	6.572	10.587	0.597	0.101	12	0.0084
EABNC114A	C	C1	3	1	6.453	10.360	0.586	0.102	12	0.0085
EABNC211A	C	C2	3	2	6.403	10.149	0.591	0.101	12	0.0084
EABNC212A	C	C2	3	2	6.342	10.170	0.580	0.103	12	0.0086

In-Plane Shear Properties (IPS)--RTD
Measured Strength at 0.2% Offset
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%



In-Plane Shear Properties (IPS)--RTD
Measured Strength at 5% Strain
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%



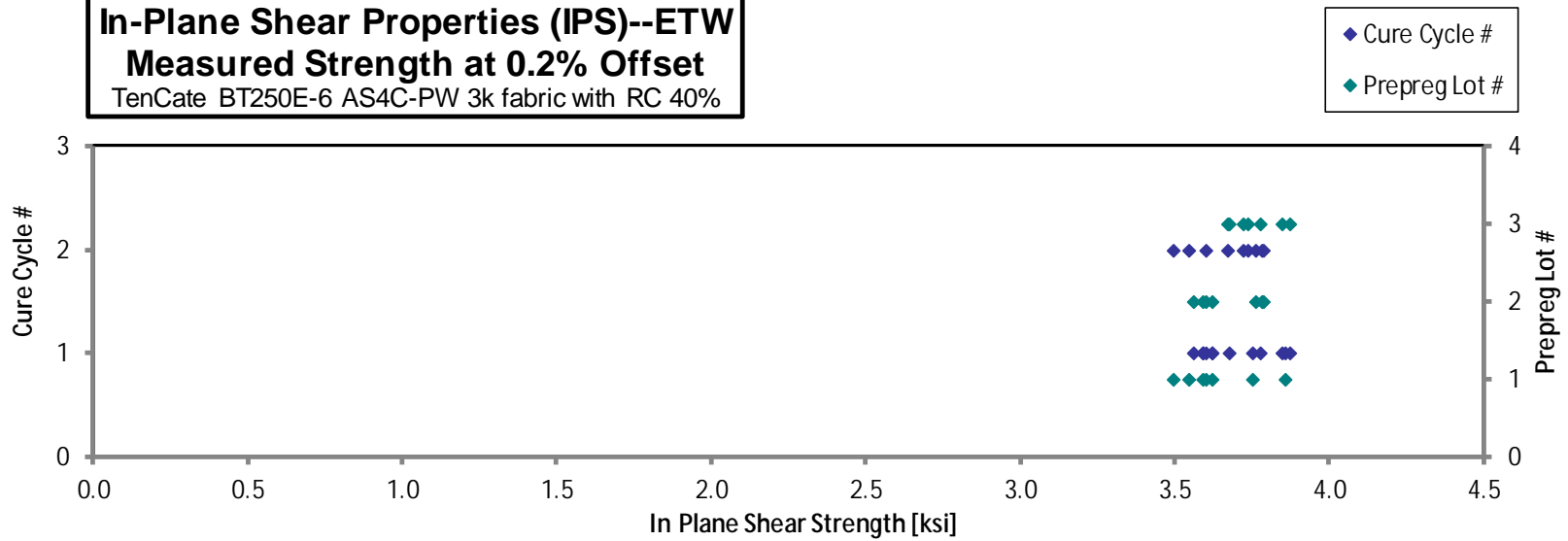


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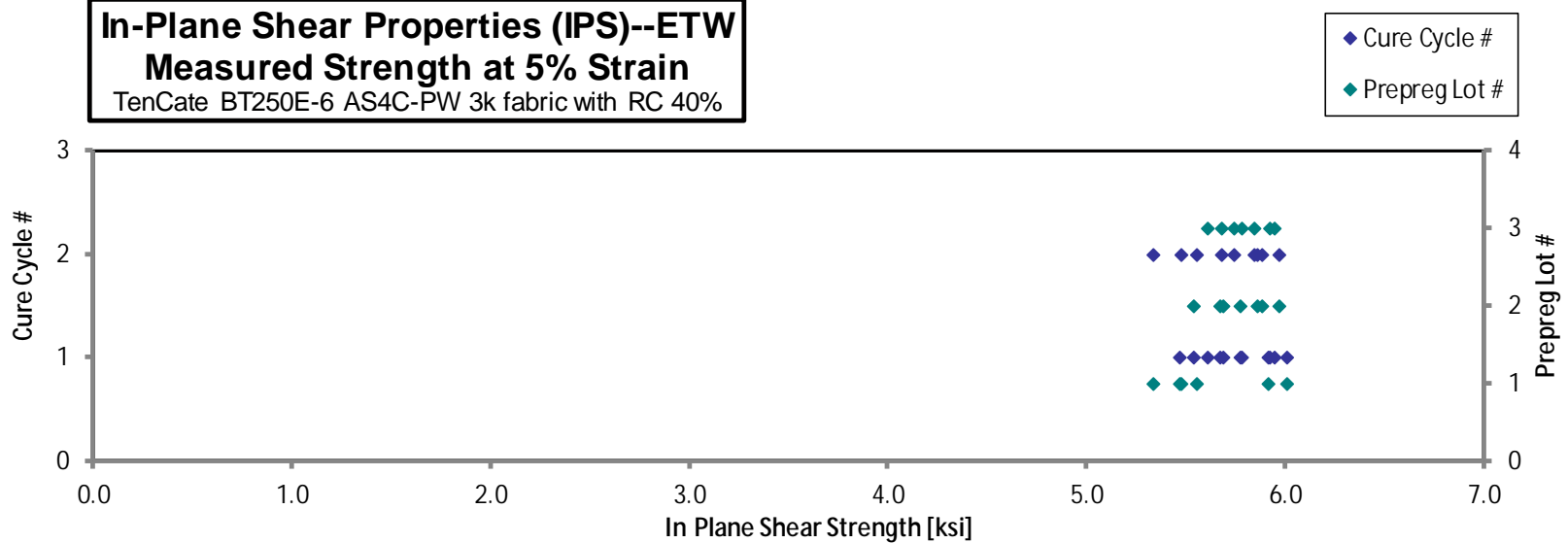
CAM-RP-2015-039 N/C

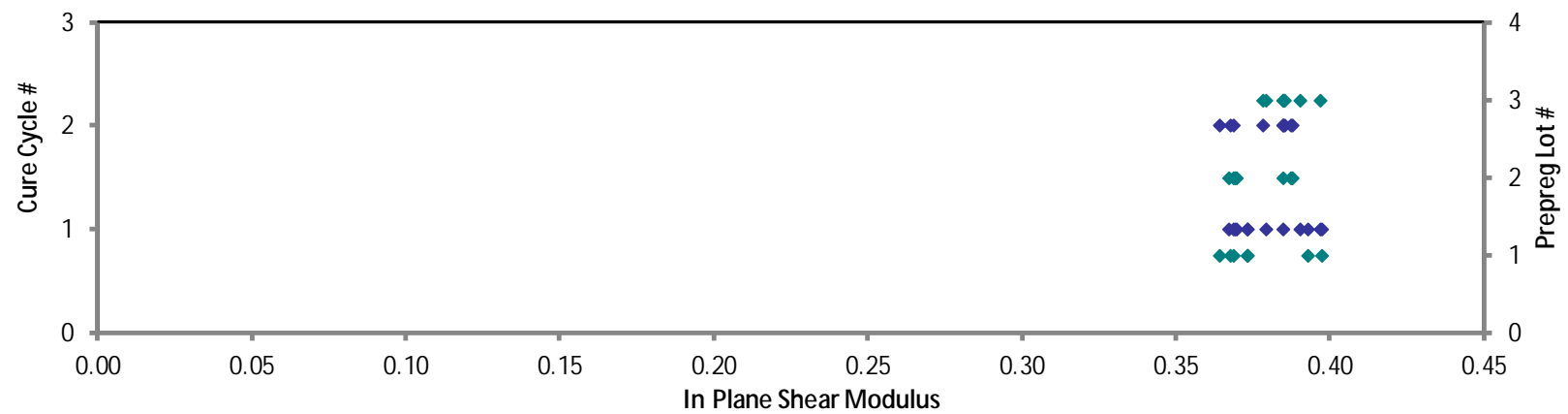
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	0.2% Offset Strength [ksi]	Strength at 5% Strain [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply}
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In-Plane Shear Properties (IPS)--ETW
Measured Strength at 0.2% Offset
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%



In-Plane Shear Properties (IPS)--ETW
Measured Strength at 5% Strain
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%





4.6 Lamina Short-Beam Strength Properties (SBS)

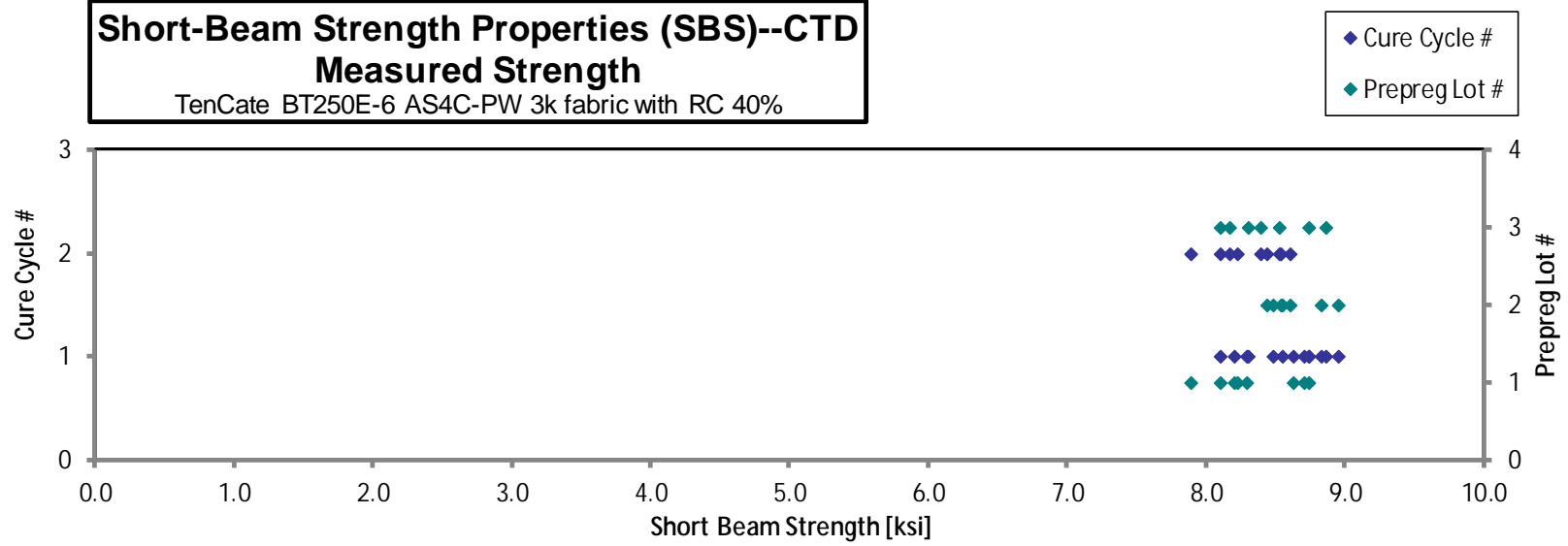
**Short-Beam Strength Properties (SBS)--CTD
Strength**
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%

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
EABQA116B*	A	C1	1	1	8.631	0.268	32	0.0084	COMPRESSION
EABQA117B	A	C1	1	1	8.207	0.270	32	0.0084	ILS
EABQA118B	A	C1	1	1	8.292	0.272	32	0.0085	ILS
EABQA119B	A	C1	1	1	8.702	0.273	32	0.0085	ILS
EABQA11AB	A	C1	1	1	8.736	0.273	32	0.0085	ILS
EABQA215B	A	C2	1	2	7.885	0.268	32	0.0084	1st: COMPRESSION/ 2nd: ILS
EABQA216B	A	C2	1	2	8.107	0.271	32	0.0085	ILS
EABQA217B	A	C2	1	2	8.230	0.273	32	0.0085	ILS
EABQB116B	B	C1	2	1	8.482	0.264	32	0.0083	1st: ILS/ 2nd: COMPRESSION
EABQB117B	B	C1	2	1	8.550	0.267	32	0.0083	ILS
EABQB119B	B	C1	2	1	8.948	0.269	32	0.0084	ILS
EABQB11AB	B	C1	2	1	8.833	0.269	32	0.0084	ILS
EABQB214B	B	C2	2	2	8.605	0.261	32	0.0081	ILS
EABQB215B	B	C2	2	2	8.534	0.261	32	0.0082	ILS
EABQB216B	B	C2	2	2	8.433	0.262	32	0.0082	1st: ILS/ 2nd: COMPRESSION
EABQC115B	C	C1	3	1	8.738	0.267	32	0.0084	ILS
EABQC116B	C	C1	3	1	8.098	0.264	32	0.0082	ILS
EABQC117B	C	C1	3	1	8.304	0.267	32	0.0083	ILS
EABQC118B	C	C1	3	1	8.857	0.266	32	0.0083	ILS
EABQC215B	C	C2	3	2	8.167	0.258	32	0.0081	ILS
EABQC216B	C	C2	3	2	8.389	0.259	32	0.0081	ILS
EABQC217B	C	C2	3	2	8.524	0.261	32	0.0082	ILS

*4T span was used.

Span of 4.5T was used for all specimens except EABQA116B.

Average	8.466	Average	0.0083
Standard Dev.	0.281	Standard Dev.	
Coeff. of Var. [%]	3.323	Coeff. of Var. [%]	
Min.	7.885	Min.	0.0081
Max.	8.948	Max.	0.0085
Number of Spec.	22	Number of Spec.	22



Short-Beam Strength Properties (SBS)--RTD Strength TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%

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
EABQA111A*	A	C1	1	1	8.130	0.264	32	0.0082	COMPRESSION
EABQA112A*	A	C1	1	1	8.309	0.266	32	0.0083	COMPRESSION
EABQA113A*	A	C1	1	1	8.417	0.267	32	0.0084	COMPRESSION
EABQA114A	A	C1	1	1	8.437	0.269	32	0.0084	ILS
EABQA115A	A	C1	1	1	8.275	0.269	32	0.0084	1st: COMPRESSION/ 2nd: ILS
EABQA211A	A	C2	1	2	7.746	0.262	32	0.0082	1st: ILS / 2nd: COMPRESSION
EABQA212A	A	C2	1	2	7.933	0.266	32	0.0083	ILS
EABQA213A	A	C2	1	2	7.978	0.268	32	0.0084	1st: ILS / 2nd: COMPRESSION
EABQA214A	A	C2	1	2	7.745	0.270	32	0.0084	1st: COMPRESSION/ 2nd: ILS
EABQB111A	B	C1	2	1	8.063	0.263	32	0.0082	COMPRESSION
EABQB112A	B	C1	2	1	8.454	0.264	32	0.0082	1st: ILS / 2nd: COMPRESSION
EABQB113A	B	C1	2	1	8.447	0.266	32	0.0083	1st: ILS / 2nd: COMPRESSION
EABQB114A	B	C1	2	1	8.896	0.267	32	0.0083	COMPRESSION
EABQB211A	B	C2	2	2	7.922	0.258	32	0.0081	1st:COMPRESSION / 2nd: ILS
EABQB212A	B	C2	2	2	7.990	0.260	32	0.0081	ILS
EABQB213A	B	C2	2	2	8.108	0.261	32	0.0082	1st: ILS / 2nd: COMPRESSION
EABQC111A	C	C1	3	1	7.966	0.262	32	0.0082	ILS
EABQC112A	C	C1	3	1	8.386	0.264	32	0.0082	COMPRESSION
EABQC113A	C	C1	3	1	8.296	0.265	32	0.0083	ILS
EABQC114A	C	C1	3	1	8.320	0.266	32	0.0083	COMPRESSION
EABQC211A	C	C2	3	2	7.766	0.257	32	0.0080	1st: ILS/ 2nd: COMPRESSION
EABQC212A	C	C2	3	2	7.994	0.259	32	0.0081	1st: ILS/ 2nd: COMPRESSION
EABQC213A	C	C2	3	2	8.025	0.260	32	0.0081	ILS

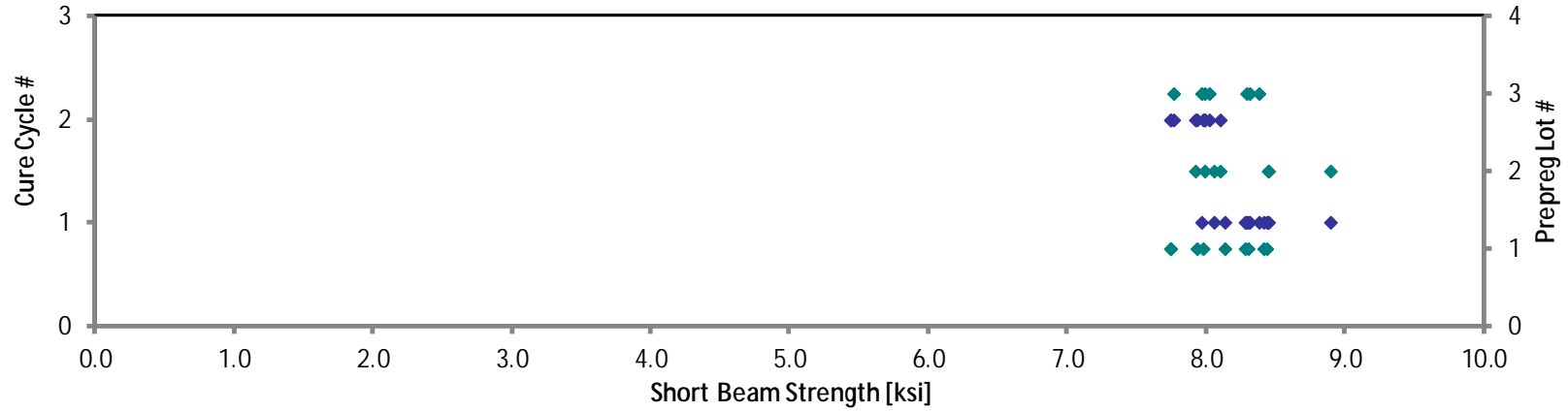
*4T span was used.

Span of 4.5T was used for all specimens except EABQA111A, EABQA112A, EABQA113A.

Average	8.157	Average	0.0082
Standard Dev.	0.282	Standard Dev.	
Coeff. of Var. [%]	3.458	Coeff. of Var. [%]	
Min.	7.745	Min.	0.0080
Max.	8.896	Max.	0.0084
Number of Spec.	23	Number of Spec.	23

Short-Beam Strength Properties (SBS)--RTD
Measured Strength
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%

◆ Cure Cycle #
◆ Prepreg Lot #



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
EABQA11BC*	A	C1	1	1	7.554	0.269	32	0.0084	COMPRESSION/ ILS
EABQA11CC	A	C1	1	1	7.398	0.270	32	0.0085	ILS
EABQA11FC	A	C1	1	1	7.483	0.275	32	0.0086	ILS/ COMPRESSION
EABQA219C	A	C2	1	2	7.055	0.270	32	0.0084	COMPRESSION/ ILS
EABQA21AC	A	C2	1	2	7.087	0.273	32	0.0085	COMPRESSION/ ILS
EABQA21BC	A	C2	1	2	7.164	0.275	32	0.0086	ILS
EABQA21CC	A	C2	1	2	7.349	0.277	32	0.0087	ILS
EABQB11BC	B	C1	2	1	7.370	0.267	32	0.0083	COMPRESSION/ ILS
EABQB11CC	B	C1	2	1	7.456	0.269	32	0.0084	ILS
EABQB11DC	B	C1	2	1	7.315	0.268	32	0.0084	COMPRESSION/ ILS
EABQB11EC	B	C1	2	1	7.276	0.269	32	0.0084	ILS/ COMPRESSION
EABQB218C	B	C2	2	2	7.228	0.263	32	0.0082	COMPRESSION/ ILS
EABQB219C	B	C2	2	2	6.443	0.264	32	0.0082	COMPRESSION/ ILS
EABQB21AC	B	C2	2	2	6.709	0.265	32	0.0083	COMPRESSION/ ILS
EABQC11AC	C	C1	3	1	6.799	0.269	32	0.0084	ILS/ COMPRESSION
EABQC11BC	C	C1	3	1	6.659	0.262	32	0.0082	ILS/ COMPRESSION
EABQC11CC	C	C1	3	1	7.322	0.263	32	0.0082	ILS/ COMPRESSION
EABQC11DC	C	C1	3	1	7.291	0.265	32	0.0083	ILS/ COMPRESSION
EABQC21AC	C	C2	3	2	6.558	0.262	32	0.0082	ILS/ COMPRESSION
EABQC21BC	C	C2	3	2	6.818	0.261	32	0.0081	ILS/ COMPRESSION
EABQC21CC	C	C2	3	2	6.945	0.262	32	0.0082	ILS/ COMPRESSION

*4T span was used.

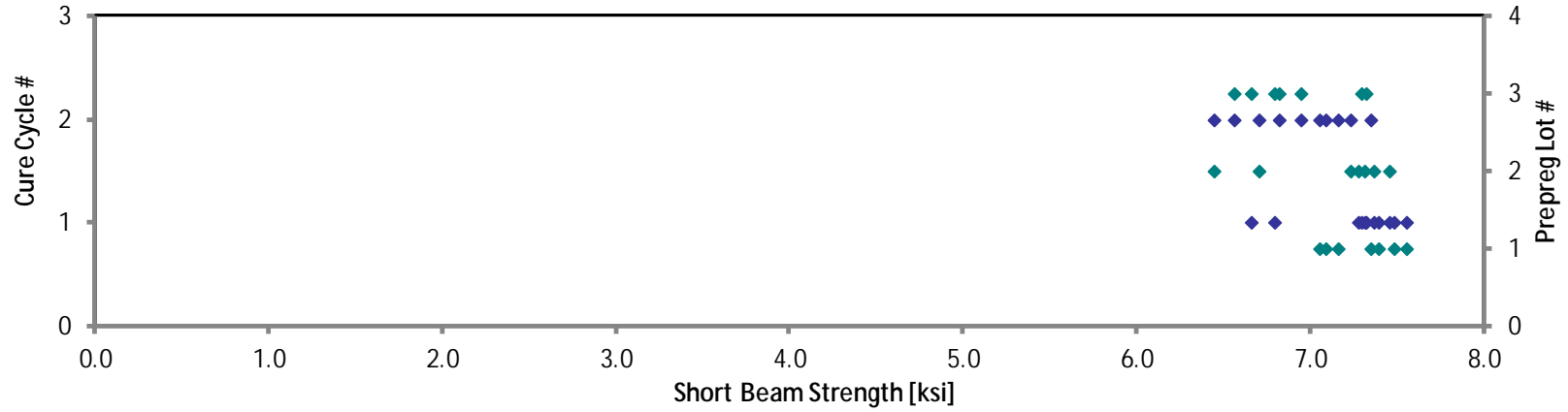
Span of 4.5T was used for all specimens except EABQA11BC.

Average 7.109
Standard Dev. 0.328

Average 0.0084
Standard Dev.

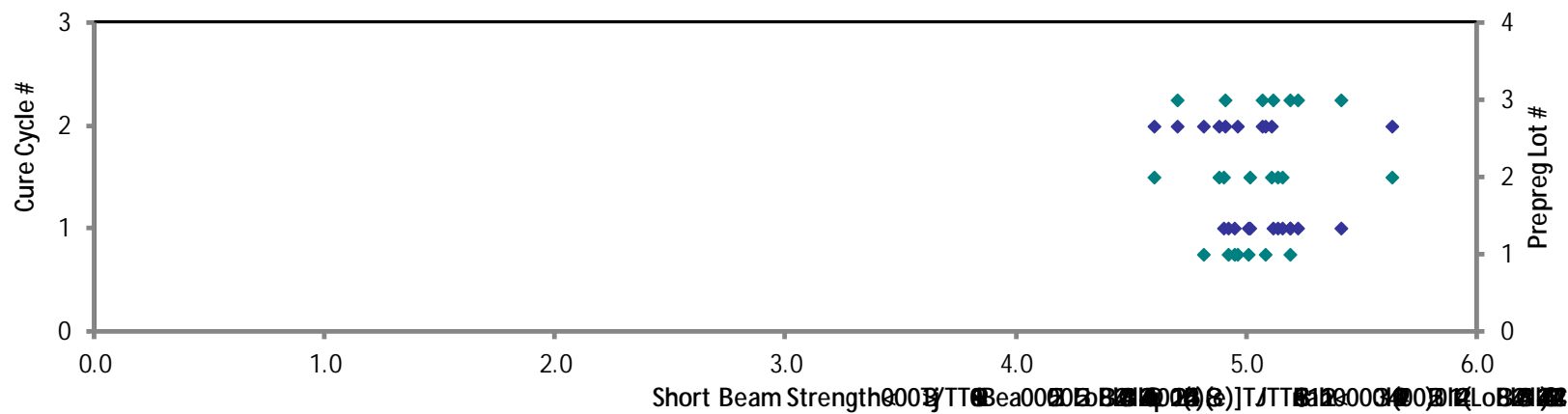
Short-Beam Strength Properties (SBS)--ETD
Measured Strength
TenCate BT250E-6 AS4C-PW 3k fabric with RC 40%

◆ Cure Cycle #
◆ Prepreg Lot #



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5. Full Stress vs. Strain Curve

5.1 Warp Tension

5.3 Fill Tension

5.5 In-Plane Shear

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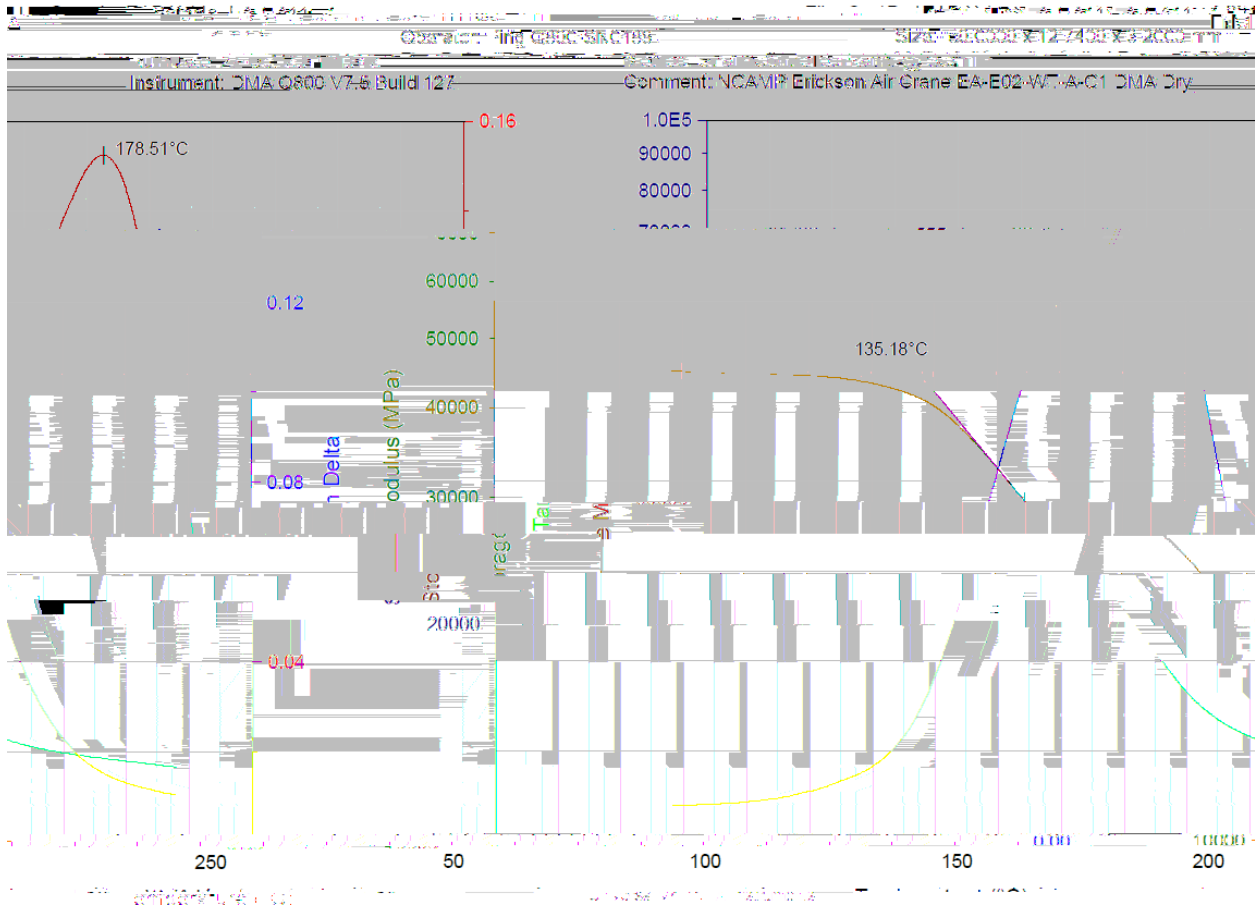
For “wet” mechanical test specimens, the drying procedures may not have completely dried the specimens prior to moisture conditioning, so the total amount of moisture absorbed by the specimens may be higher than those recorded in the moisture gain charts.

7. DMA Results

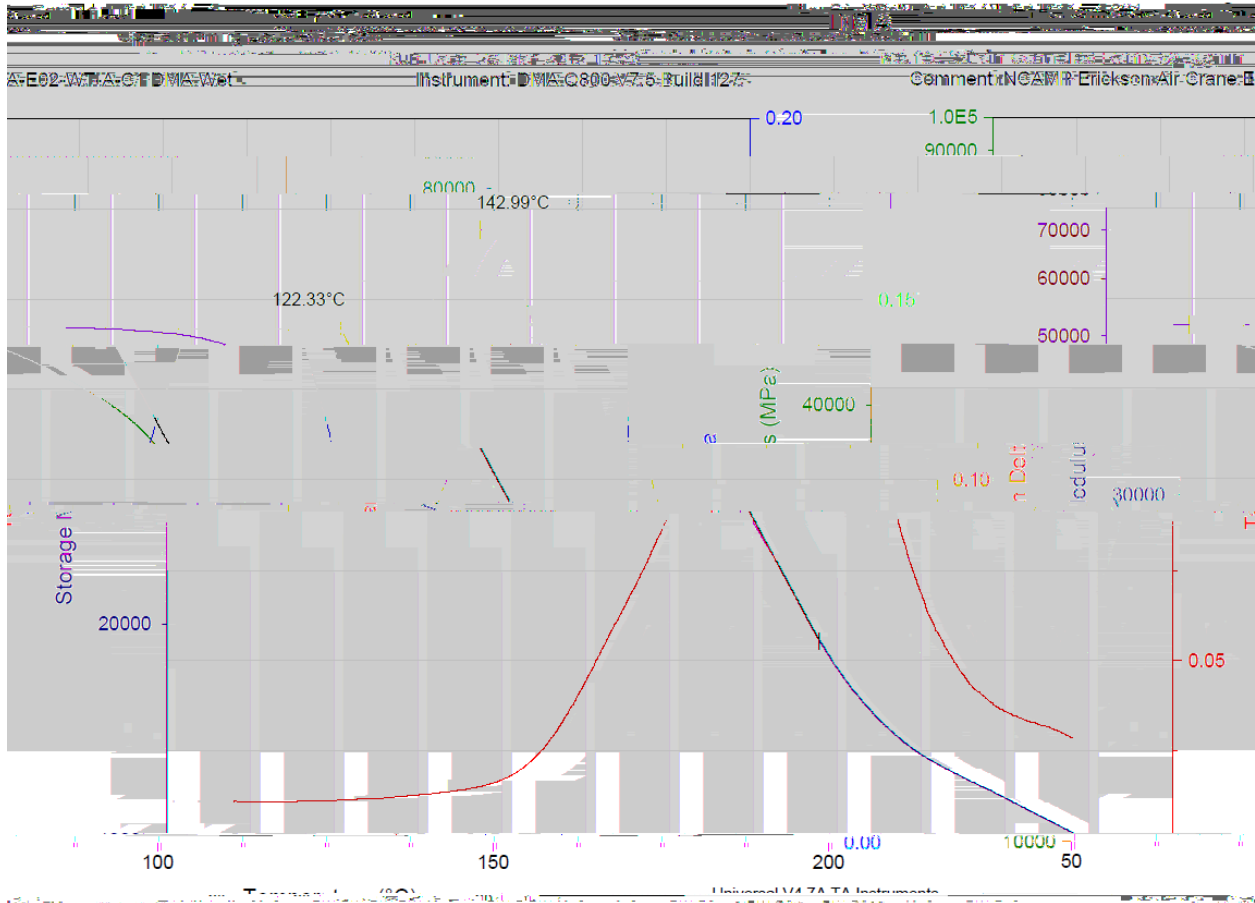
DMA Results Summary				
TenCate BT250E-6 AS4C-PW 3k Fabric DRY				
Sample #	Onset Storage Modulus		Peak of Tangent Delta	
	Average		Average	
	Tg [°C]	Tg [°F]	Tg [°C]	Tg [°F]
EABJA11 - 1 (EA-E02-WT-A-C1)	135.18	275.32	178.51	353.32
EABJA11 - 2 (EA-E02-WT-A-C1)	135.79	276.42	177.73	351.91
EABJA21 - 1 (EA-E02-WT-A-C2)	137.81	280.06	178.25	352.85
EABJA21 - 2 (EA-E02-WT-A-C2)	138.03	280.45	177.79	352.02
EABJB11 - 1 (EA-E02-WT-B-C1)	134.57	274.23	174.81	346.66
EABJB11 - 2 (EA-E02-WT-B-C1)	133.84	272.91	174.30	345.74
EABJB21 - 1 (EA-E02-WT-B-C2)	136.15	277.07	180.06	356.11
EABJB21 - 2 (EA-E02-WT-B-C2)	136.16	277.09	178.93	354.07
EABJC11 - 1 (EA-E02-WT-C-C1)	130.53	266.95	176.41	349.54
EABJC11 - 2 (EA-E02-WT-C-C1)	130.15	266.27	178.42	353.16
EABJC21 - 1 (EA-E02-WT-C-C2)	132.73	270.91	180.43	356.77
EABJC21 - 2 (EA-E02-WT-C-C2)	132.27	270.09	180.17	356.31
EABLB21 - 1 (EA-E02-WC-B-C3)	136.56	277.81	179.49	355.08
EABLB21 - 2 (EA-E02-WC-B-C3)	137.28	279.10	180.20	356.36
EABUA11 - 1 (EA-E02-FT-A-C3)	136.84	278.31	178.49	353.28
EABUA11 - 2 (EA-E02-FT-A-C3)	137.19	278.94	178.57	353.43
EABUA21 - 1 (EA-E02-FT-A-C4)	137.43	279.37	178.63	353.53
EABUA21 - 2 (EA-E02-FT-A-C4)	136.52	277.74	179.17	354.51
EABUB11 - 1 (EA-E02-FT-B-C4)	135.75	276.35	178.78	353.80
EABUB11 - 2 (EA-E02-FT-B-C4)	135.81	276.46	178.96	354.13
EABUB21 - 1 (EA-E02-FT-B-C5)	137.23	279.01	182.06	359.71
EABUB21 - 2 (EA-E02-FT-B-C5)	136.22	277.20	182.05	359.69
EABUC11 - 1 (EA-E02-FT-C-C4)	134.35	273.83	182.32	360.18
EABUC11 - 2 (EA-E02-FT-C-C4)	134.84	274.71	181.97	359.55
EABUC21 - 1 (EA-E02-FT-C-C5)	136.09	276.96	182.35	360.23
EABUC21 - 2 (EA-E02-FT-C-C5)	137.01	278.62	182.50	360.50
EABNB21 - 1 (EA-E02-IPS-B-C11)	132.93	271.27	157.71	315.88
EABNB21 - 2 (EA-E02-IPS-B-C11)	131.97	269.55	158.08	316.54
Average	135.26	275.46	177.76	351.96
Standard Deviation	2.17	3.90	5.98	10.77

DMA Results Summary				
TenCate BT250E-6 AS4C-PW 3k Fabric WET				
Sample #	Onset Storage Modulus		Peak of Tangent Delta	
	Average		Average	
	Tg [°C]	Tg [°F]	Tg [°C]	Tg [°F]
EABJA11 - 1 (EA-E02-WT-A-C1)	122.33	252.19	142.99	289.38
EABJA11 - 2 (EA-E02-WT-A-C1)	121.36	250.45	143.35	290.03
EABJA21 - 1 (EA-E02-WT-A-C2)	120.03	248.05	140.26	284.47
EABJA21 - 2 (EA-E02-WT-A-C2)	121.23	250.21	142.62	288.72
EABJB11 - 1 (EA-E02-WT-B-C1)	125.51	257.92	147.24	297.03
EABJB11 - 2 (EA-E02-WT-B-C1)	125.52	257.94	147.22	297.00
EABJB21 - 1 (EA-E02-WT-B-C2)	121.48	250.66	142.08	287.74
EABJB21 - 2 (EA-E02-WT-B-C2)	120.21	248.38	143.33	289.99
EABJC11 - 1 (EA-E02-WT-C-C1)	122.48	252.46	146.24	295.23
EABJC11 - 2 (EA-E02-WT-C-C1)	121.23	250.21	145.59	294.06
EABJC21 - 1 (EA-E02-WT-C-C2)	120.46	248.83	143.27	289.89
EABJC21 - 2 (EA-E02-WT-C-C2)	122.41	252.34	143.22	289.80
EABLB21 - 1 (EA-E02-WC-B-C3)	121.42	250.56	141.32	286.38
EABLB21 - 2 (EA-E02-WC-B-C3)	122.05	251.69	142.16	287.89
EABUA11 - 1 (EA-E02-FT-A-C3)	117.46	243.43	139.11	282.40
EABUA11 - 2 (EA-E02-FT-A-C3)	118.03	244.45	138.75	281.75
EABUA21 - 1 (EA-E02-FT-A-C4)	120.66	249.19	141.65	286.97
EABUA21 - 2 (EA-E02-FT-A-C4)	119.41	246.94	140.86	285.55
EABUB11 - 1 (EA-E02-FT-B-C4)	121.74	251.13	144.23	291.61
EABUB11 - 2 (EA-E02-FT-B-C4)	123.53	254.35	143.69	290.64
EABUB21 - 1 (EA-E02-FT-B-C5)	120.52	248.94	141.13	286.03
EABUB21 - 2 (EA-E02-FT-B-C5)	118.51	245.32	140.42	284.76
EABUC11 - 1 (EA-E02-FT-C-C4)	121.17	250.11	143.59	290.46
EABUC11 - 2 (EA-E02-FT-C-C4)	121.70	251.06	142.71	288.88
EABUC21 - 1 (EA-E02-FT-C-C5)	122.09	251.76	142.20	287.96
EABUC21 - 2 (EA-E02-FT-C-C5)	121.16	250.09	142.41	288.34
EABNB21 - 1 (EA-E02-IPS-B-C11)	114.41	237.94	145.63	294.13
EABNB21 - 2 (EA-E02-IPS-B-C11)	116.06	240.91	146.15	295.07
Average	120.86	249.55	142.98	289.36
Standard Deviation	2.41	4.34	2.24	4.03

7.1 DMA Dry Batch A



7.2 DMA Wet Batch A



8. Deviations

- D2344 SBS for CTD, RTD and ETD conditions were tested with a mixture of 4T and 4.5T span length. The SBS for ETW condition was tested with 4T span length.