Advanced General Aviation Transport Experiments

B – Basis Design Allowables for Epoxy – Based Prepreg

Fiberite Plain Weave Graphite Fabric T650 3K-70-PW / 7740

AGATE-WP3.3-033051-100

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TABLE OF CONTENTS

1.0 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. These properties are considered to provide the initial base of the “building block” approach. Additional coupon level tests and subelement tests may be required to fully substantiate the full-scale design.

The test methods and results contained in this document are consistent with MIL-HDBK-17-1E,2D,3E - Military Handbook for Polymer Matrix Composites. All material, specimens, fixtures and test results contained within this document were traceable and conformed by the Federal Aviation Administration (FAA). It should be noted that before application of the basis values presented in this document to design, demonstration of the ability to consistently produce equivalent material properties as that evaluated during this program should be substantiated through an acceptable test program.

1.2 Symbols Used

ν_{12}^{tu}	major Poisson's ratio, tension
$\mu\varepsilon$	micro-strain
E_1^c	compressive modulus, longitudinal
E_1^t	tensile modulus, longitudinal
E_2^c	compressive modulus, transverse
E_2^t	tensile modulus, transverse
F_{12}^{su}	in – plane shear strength
F_{13}^{su}	apparent interlaminar shear strength
F_1^{cu}	compressive strength, longitudinal
F_1^{tu}	tensile strength, longitudinal
F_2^{cu}	compressive strength, transverse
F_2^{tu}	tensile strength, transverse
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	1 – axis; longitudinal (parallel to warp direction of reinforcement)
2	2 – axis; transverse (parallel to fill direction of reinforcement)
12	in – plane shear
13	interlaminar shear (apparent)

1.3 Acronyms and Definitions

A – Basis	95% lower confidence limit on the first population percentile
AGATE	Advanced General Aviation Transport Experiments
ASTM	American Society for Testing and Materials
B – Basis	95% lower confidence limit on the tenth population percentile
C. V.	coefficient of variation
CTD	cold temperature dry
CPT	cured ply thickness
DMA	dynamic mechanical analysis
dry	specimen tested with an “as fabricated” moisture content
ETD	elevated temperature dry
ETW	elevated temperature wet
FAR	Federal Aviation Regulations
FAW	fiber areal weight
Gr/Ep	Graphite/Epoxy
NASA	National Aeronautics and Space Administration
RTD	room temperature dry
SACMA	Suppliers of Advanced Composite Materials Association
SRM	SACMA Recommended Method
T_g	glass transition temperature
t_{ply}	cured ply thickness
wet	specimen tested with an equilibrium moisture content per section 1.5.2

1.4 References

ASTM Standards

D3039-95	Tensile Properties of Polymer Matrix Composite Materials
D5379-93	Shear Properties of Composite Materials by the V-Notched Beam Method
D2344-89	Apparent Interlaminar Shear Strength of Parallel Fiber Composites by Short – Beam Method
D792-91	Density and Specific Gravity (Relative Density) of Plastics by Displacement
D2734-94	Void Content of Reinforced Plastics
D3171-90	Fiber Content of Resin – Matrix Composites by Matrix Digestion
D695-91	Compressive Properties of Rigid Plastics

SACMA Standards

SRM 1-94	Compressive Properties of Oriented Fiber-Resin Composites
SRM 8-94	Short Beam Shear Strength of Oriented Fiber-Resin Composites
SRM 18-94	Glass Transition Temperature (T_g) Determination by DMA of Oriented Fiber-Resin Composites

Other Documents

FAA Document DOT/FAA/AR-00/47: Material Qualification and Equivalency for Polymer Matrix Composite Material Systems, J.S. Tomblin, Y.C. Ng and K.S. Raju, 2001.

MIL-HDBK-17 1E, 2D, 3E – Military Handbook for Polymer Matrix Composites

Cessna Aircraft Company, Document # 98-87-005: B-Basis Design Allowables Test Plan for Preimpregnated Carbon/Epoxy Broadgoods, Revision B, January 1999.

1.5 Methodology

1.5.1 Test Matrix

Testing was performed according to the test methods delineated in the test matrix, with modifications as referenced in the AGATE report, *Material Qualification and Equivalency for Polymer Matrix Composite Material Systems*. The test matrix for properties included in this document is listed on the next page, with the following notation cited in each column:

 # x #

where the first # represents the required number of prepreg batches, defined as: Prepreg containing T650 3K-70-PW graphite fabric from one mill roll, impregnated with one batch of resin in one continuous manufacturing operation with traceability to all components. The second # represents the required number of replicates per prepreg batch. For example, “3 x 6” refers to three prepreg batches of material and six specimens per prepreg batch for a total requirement of 18 test specimens.

Table 1.5.1: Test Matrix and Standards Used

TEST	METHOD	NO. OF REPLICATES PER TEST CONDITION			
		CTD[1,5]	RTD[2,5]	ETW[3]	ETD[4,5]
0^o (warp) Tension Strength	ASTM D3039-95	1x4	3x4	3x4	3x4
0^o (warp) Tension Modulus, Strength and Poisson's Ratio	ASTM D3039-95	1x2	3x2	3x2	3x2
90^o (fill) Tension Strength	ASTM D3039-95	1x4	3x4	3x4	3x4
90^o (fill) Tension Modulus and Strength	ASTM D3039-95	1x2	3x2	3x2	3x2
0^o (warp) Compression Strength	SACMA SRM 1-94	1x6	3x6	3x6	3x6
0^o (warp) Compression Modulus	SACMA SRM 1-94	1x2	3x2	3x2	3x2
90^o (fill) Compression Strength	SACMA SRM 1-94	1x6	3x6	3x6	3x6
90^o (fill) Compression Modulus	SACMA SRM 1-94	1x2	3x2	3x2	3x2
In-Plane Shear Strength	ASTM D5379-93	1x4	3x4	3x4	3x4
In-Plane Shear Modulus and Strength	ASTM D5379-93	1x2	3x2	3x2	3x2
Short Beam Shear	ASTM D2344-89	--	3x6	--	--
Fiber Volume	ASTM D3171-90	One sample per panel			
Resin Volume	ASTM D3171-90	One sample per panel			
Void Content	ASTM D2734-94	One sample per panel			
Cured Neat Resin Density	---	Supplied by manufacturer for material			
Glass Transition Temperature	SACMA SRM 18-94	3 dry, 3 wet per prepreg lot			

Notes :

1 CTD: One prepreg lot of material tested (test temperature = -65 $\pm$ 5^o F, moisture content = as fabricated, soak time at –65 was 3 min.)

2 RTD: Three prepreg lots of material tested (test temperature = 70 $\pm$ 10^o F, moisture content = as fabricated)

3 ETW: Three prepreg lots of material tested (test temperature = 180 $\pm$ 5^o F, moisture content = equilibrium per section 1.5.2, soak time at 180 was 60 sec.)

4 ETD: Three prepreg lots of material tested (test temperature = 180 $\pm$ 5^o F, moisture content = as fabricated, soak time at 180 was 60 sec.)

5 Dry specimens are "as fabricated" specimens that have been maintained at ambient conditions in an environmentally controlled laboratory.

1.5.2 Environmental Conditioning

All 'wet' conditioned samples were exposed to elevated temperature and humidity conditions to establish moisture saturation of the material. Specimens were exposed to 85 ± 5 % relative humidity and 145 ± 5 °F until an equilibrium moisture weight gain of traveler, or witness coupons (1" x 1" x specimen thickness) was achieved. ASTM D5229 and SACMA SRM 11 were used as guidelines for environmental conditioning and moisture absorption.

Effective moisture equilibrium was achieved when the average moisture content of the traveler specimen changed by less than 0.05% for two consecutive readings within a span of 7 ± 0.5 days and was expressed by:

$$\frac{W_i - W_{i-1}}{W_b} < 0.0005$$

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

It is common to see small fluctuations in an unfitted plot of the weight gain vs. time curve. There were no fluctuations that made significant errors in results or caused rejection in the moisture equilibrium criteria. Once the traveler coupons passed the criteria for two consecutive readings, the samples were removed from the environmental chamber and placed in a sealed bag with a moist paper or cotton towel for a maximum of 14 days until mechanical testing. Strain gauged specimens were removed from the controlled environment for a maximum of 2 hours for application of gages in ambient laboratory conditions.

1.5.3 Fluid Sensitivity Screening

All 'wet' conditioned samples were exposed to elevated temperature and humidity conditions to establish moisture saturation of the material. Specimens were exposed to 85 ± 5 % relative humidity and 145 ± 5 °F until an equilibrium moisture weight gain of traveler, or witness coupons (1" x 1" x specimen thickness) was achieved. ASTM D5229 and SACMA SRM 11 were used as guidelines for environmental conditioning and moisture absorption.

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$$\frac{W_i - W_{i-1}}{W_b} < 0.0005$$

where W_i = weight at current time
W_{i-1} = weight at previous time
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It is common to see small fluctuations in an unfitted plot of the weight gain vs. time curve. There were no fluctuations that made significant errors in results or caused rejection in the moisture equilibrium criteria. Once the traveler coupons passed the criteria for two consecutive readings, the samples were removed from the environmental chamber and placed in a sealed bag with a moist paper or cotton towel for a maximum of 14 days until mechanical testing. Strain gauged specimens were removed from the controlled environment for a maximum of 2 hours for application of gages in ambient laboratory conditions.

1.5.4 Normalization Procedures

The normalization procedure attempts to reduce variability in fiber-dominated material properties by adjusting raw test values to a specified fiber volume content. Only the following properties were normalized:

- 0° (warp) Tensile Strength and Modulus
- 90° (fill) Tensile Strength and Modulus
- 0° (warp) Compressive Strength and Modulus
- 90° (fill) Compressive Strength and Modulus

The normalization procedure was adopted from MIL-HDBK-17-1E, section 2.4.3.3. The procedure which was used to normalize the data is based on two primary assumptions:

- The relationship between fiber volume fraction and ultimate laminate strength is linear over the entire range of fiber/resin ratios. (It neglects the effects of resin starvation at high fiber contents.)

- Fiber volume is not commonly measured for each test sample, so this method accounts for the fiber volume variation between individual test specimens by utilizing a relationship between fiber volume fraction and laminate cured ply thickness. This relationship is virtually linear in the 0.45 to 0.65 fiber volume fraction range.

Additional information is detailed in FAA Document DOT/FAA/AR-00/47: Material Qualification and Equivalency for Polymer Matrix Composite Material Systems. For all

normalized data contained in this document, the test values are normalized by cured ply thickness according to:

$$Normalized\ \ Value = Test\ Value \times \frac{CPT_{specimen}}{CPT_{normalizing}}$$

where:

$$CPT_{specimen} = \frac{Average\ \ Sample\ Thickness}{\#\ of\ \ plies}$$

1.5.5 Statistical Analysis

When compared to metallic materials, fiber reinforced composite materials exhibit a high degree of material property variability. This variability is due to many factors, including but not limited to: raw material and prepreg manufacture, material handling, part fabrication techniques, ply stacking sequence, environmental conditions, and testing techniques. This inherent variability drives up the cost of composite testing and tends to render smaller data sets than those produced for metallic materials. This necessitates the usage of statistical techniques for determining reasonable design allowables for composites.

The analyses and design allowable generation for both A and B basis values were performed using the procedure detailed in section 5.3 of FAA Document DOT/FAA/AR-00/47: Material Qualification and Equivalency for Polymer Matrix Composite Material Systems.

1.5.6 Material Performance Envelope and Interpolation

Using the B-basis numbers, a material performance envelope may be generated for the material system by plotting these values as a function of temperature. Figure 1.5.1 shows an example material performance envelope using B-basis values.

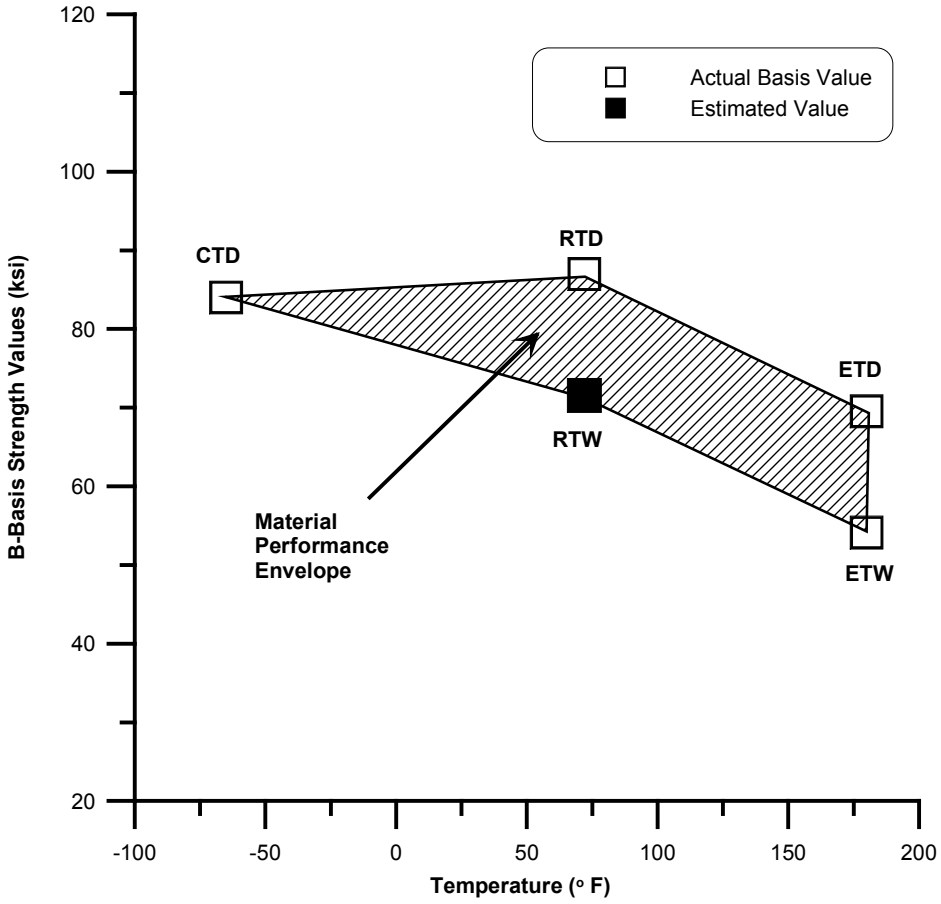


Figure 1.5.1 Material performance envelope.

Since each specific aircraft application of the qualified material may have different Material Operational Limits (MOL) than those tested in the material qualification (which is usually the upper limit), some applications may require a reduced MOL. In this case, simple linear interpolation may be used to obtain the corresponding basis values at the new application MOL.

This interpolation may be accomplished using the following simple relationships assuming $T_{RTD} < T_{MOL} < T_{ETD}$:

For the corresponding MOL "dry" basis value, the "interpolated" basis value using the qualification data is

$$B_{MOL} = B_{RTD} - \frac{(B_{RTD} - B_{ETD})(T_{RTD} - T_{MOL})}{(T_{RTD} - T_{ETD})}$$

where B_{MOL} = new application basis value interpolated to T_{MOL}

B_{RTD} = basis RTD strength value
B_{ETD} = basis ETD strength value
T_{RTD} = RTD test temperature
T_{ETD} = ETD test temperature
T_{MOL} = new application MOL temperature

For the corresponding MOL "wet" basis value, an estimated Room Temperature Wet (RTW) value must be calculated. This may be accomplished by the simple relation

$$B_{RTW} = B_{RTD} - (B_{ETD} - B_{ETW})$$

The "interpolated" wet basis value using the qualification data may then be obtained by

$$B_{MOL} = B_{RTW} - \frac{(B_{RTW} - B_{ETW})(T_{RTW} - T_{MOL})}{(T_{RTW} - T_{ETW})}$$

where:
B_{MOL} = new application basis value interpolated to T_{MOL}
B_{RTW} = estimated basis RTW strength value
B_{ETW} = basis ETW strength value
T_{RTW} = RTW (i.e., RTD) test temperature
T_{ETW} = ETW test temperature
T_{MOL} = new application MOL temperature

These equations may also be used for interpolated mean strengths as well as A-basis values with the appropriate substitutions. It should be noted that because unforeseen material property drop-offs with respect to temperature and environment can occur, *extrapolation* to a higher MOL should not be attempted without additional testing and verification. In addition, the interpolation equations shown above are practical for materials obeying *typical* mechanical behavior. In most cases, some minimal amount of testing may also be required to verify the interpolated values.

1.5.6.1 Interpolation Example

This section provides an example of linear interpolations to a specific application environment less than the tested upper material limit used in qualification. Assuming a specific application environment of 150° F, Figure 1.5.2 depicts the linear interpolation of the B-basis design allowable to this environment. Using the above equations along with the nominal testing temperatures (see Table 1.5.1), the interpolated basis values at 150° F become

ETD : B_{MOL} = 75.106 ksi

ETW : B_{MOL} = 59.746 ksi

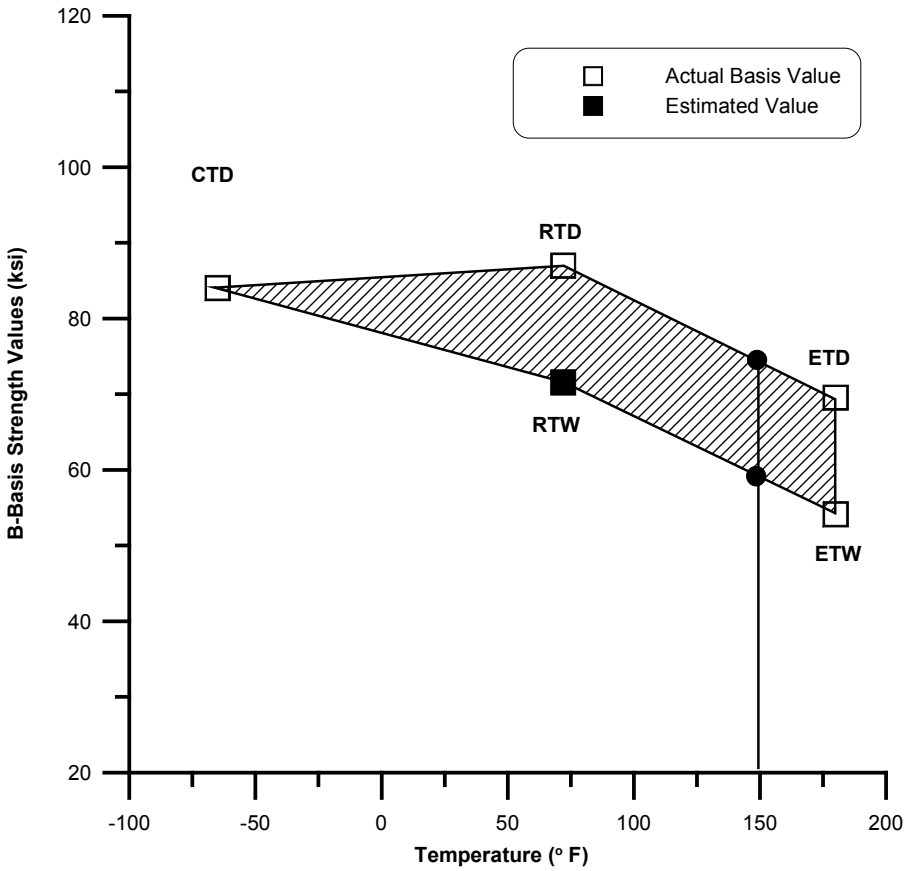


Figure 1.5.2 Example of 150° F interpolation for B-basis values.

2.0 FIBERITE T650 3K-70-PW / 7740 PREPREG PROPERTIES

2.1 Prepreg Documentation by Prepreg Lot

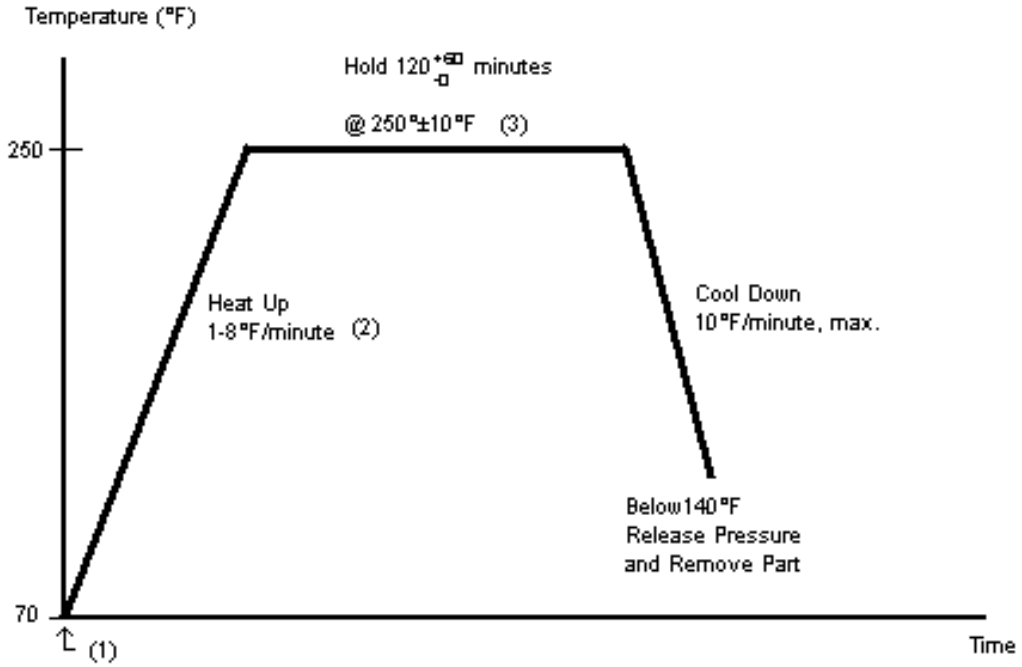
Prepreg Documentation	**Prepreg Manufacturer & Product ID:** **HMF 7740/T650-35-3K-PW-195-42"** **Impregnation Method: SOLVENT**		
Prepreg Batch or Lot #	**310604**	**310605**	**310606**
Batch (Lot) ID as labeled on samples	**1**	**2**	**3**
Date of Manufacture	**11-13-97**	**11-13-97**	**11-13-97**
Expiration Date	**11-13-98**	**11-13-98**	**11-13-98**
Resin Content [%]	**39%**	**38 %**	**38 %**
Reinforcement Areal Weight & Test Method	**194 g/sq m**	**195 g/sq m**	**192 g/sq m**
Resin Flow & Test Conditions	**20% @ 100 psi**	**19% @ 100 psi**	**20% @ 100 psi**
Gel Time & Test Conditions	**3 min @ 177 C**	**3 min @ 177 C**	**3 min @ 177 C**
Volatile Content	**0.5**	**0.6**	**0.9**
Reinforcement Documentation	**Fiber/Fabric Manufacturer & Product ID: T650/35 3K 309NT** **Precursor Type: PAN** **Nominal Filament Count: 3K** **Finish/Sizing Type and %: UC309, .93—.97%** **Nominal tow or yarn count/inch:** **Twist: not available**		
Fabric Batch or Lot #	**B3S0803**	**B3S0803**	**B3S0602**
Sizing weight, %	**.97 %**	**.97 %**	**.93%**
Date of Manufacture	**8-27-97**	**8-27-97**	**8-27-97**
Average Fiber Density per Lot & Test Method	**1.778 g/cc**	**1.778 g/cc**	**1.772 g/cc**

Matrix Documentation	**Resin Manufacturer & Product ID:**		
Matrix Batch or Lot #	**310604**	**310605**	**310606**
Date of Manufacture	**11-5-97**	**11-5-97**	**11-5-97**
Average Neat Resin Density by Lot & Test Method	**1.27 g/ccm**	**1.27 g/ccm**	**1.27 g/ccm**

2.2 Process Specification

This specification does not address issues relating to safety, quality control, bagging material selection, bagging procedure, tool preparation, or equipment selection. Although these may affect overall part quality, it is the responsibility of the end user to develop procedures related to these issues in a manner that produces parts with high quality and consistency.

The following autoclave cure procedures are excerpts from Cessna process specification CSAC005. The exception to this specification is the cure cycle and ply orientation tolerance. The cure cycle for panel fabrication is 250°F, ±10°: for 120 minutes, +60, -0; 45 psi, ±5. Individual ply orientation is ±2° with respect to the tooled reference edge. The detailed cure cycle procedure is given below. All test specimens were cured per this specification by Cessna Aircraft Company. However, the effects of the upper and lower limits of vacuum, temperature, cure time, heat-up rate and hold temperature on the mechanical and thermal properties have not been investigated.



(1) Apply 22 in-Hg of vacuum minimum to vacuum bag. Initiate autoclave pressure 3 psi/minute minimum, vent bag at 20±10 psig. Final vessel pressure 45±5 psi.
(2) From 230°F to 240°F, a minimum heat up rate of 0.3°F/minute is acceptable.
(3) All thermocouples shall be at temperature

3.0 FIBERITE T650 3K-70-PW / 7740 LAMINATE PROPERTIES

3.1 Test Results

3.1.1 Summary

MATERIAL:	Fiberite 7740/T650 3K-70-PW Graphite	**7740/T650 3K-70-PW Summary**
PREPREG:	Fiberite HMF 7740/T650-35-3K-PW-195-42"	
FIBER:	Amoco T650/35 3K 309NT	**RESIN:** Fiberite HMF 7740
T_g (dry): 244.44 °F	**T_g (wet):** 205.69 °F	**T_g METHOD:** DMA (SRM 18-94)
PROCESSING:	Autoclave cure: 250±10°F for 120+60,–0 min. @ 45±5 psi	

Date of fiber manufacture	8/27/97	**Date of testing**	1/26/99 - 4/14/99
Date of resin manufacture	11/5/97	**Date of data submittal**	8/99
Date of prepreg manufacture	11/13/97	**Date of analysis**	1/27/99 - 4/14/99
Date of composite manufacture	3/19/98 – 4/16/98		

LAMINA MECHANICAL PROPERTY SUMMARY
Data Reported as: Measured
(Normalized by CPT=0.0079 in)

	CTD		RTD		ETD		ETW	
	B-Basis	**Mean**	**B-Basis**	**Mean**	**B-Basis**	**Mean**	**B-Basis**	**Mean**
F_1^{tu} (ksi)	117.30 (116.20)	126.79 (126.33)	117.77 (117.04)	125.88 (125.71)	120.99 (120.07)	129.37 (129.01)	116.72 (116.44)	124.41 (124.69)
E_1^t (Msi)	---	9.49 (9.42)	---	9.75 (9.69)	---	8.92 (8.91)	---	9.96 (9.87)
ν_{12}^{tu}	---	0.034	---	0.045	---	0.033	---	0.039
F_2^{tu} (ksi)	105.10 (106.73)	117.64 (119.44)	108.15 (108.42)	119.13 (119.41)	104.22 (104.96)	114.81 (115.60)	102.70 (103.23)	112.62 (113.17)
E_2^t (Msi)	---	10.31 (10.49)	---	9.84 (9.77)	---	8.69 (8.77)	---	9.67 (9.66)
F_1^{cu} (ksi)	95.02 (91.59)	111.17 (108.52)	91.72 (90.19)	104.90 (104.27)	73.22 (71.91)	83.75 (83.13)	52.25 (51.62)	59.38 (59.26)
E_1^c (Msi)	---	8.72 (8.80)	---	9.29 (9.14)	---	9.59 (9.46)	---	9.64 (9.47)
F_2^{cu} (ksi)	94.16 (92.76)	108.41 (107.87)	85.85 (84.66)	96.87 (96.33)	69.29 (67.65)	78.18 (76.98)	52.47 (51.82)	58.90 (58.65)
E_2^c (Msi)	---	9.27 (9.31)	---	8.94 (8.85)	---	9.20 (9.14)	---	9.58 (9.44)
F_{12}^{su} (ksi)	22.38	24.08	17.72	18.82	13.32	14.14	10.22	10.86
G_{12}^s (Msi)	---	0.71	---	0.67	---	0.46	---	0.43
F_{13}^{su**} (ksi)	---	---	9.99	10.68	---	---	---	---

** *Apparent* interlaminar shear strength

3.1.2 Individual Test Summaries

3.1.2.1 Tension, 1-axis

Tension, 1-axis
G/Ep
Fiberite 7740/T650 3K-70-PW Graphite
$[0]_{14}$

Material:	Fiberite 7740/T650 3K-70-PW Graphite		
Resin content:	33 - 39 wt%	**Comp. density:**	1.51 - 1.54 g/cc
Fiber volume:	52 - 58 vol%	**Void content:**	1.8 to 2.4 %
Ply thickness:	0.0073 - 0.0082 in.		
Ply range:	14 plies		
Test method:	D3039-95	**Modulus calculation:**	linear fit from 1000 - 3000 με
Normalized by:	0.0079 in. ply thickness		

		CTD (B)		RTD (A)		ETD (G)		ETW (F)			
Test Temperature [°F]		-65		75		180		180			
Moisture Conditioning		dry		dry		dry		62 days, .64-.71% wt gain			
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		145 F, 85 %			
Source code		BCJXXXXB		BCJXXXXA		BCJXXXXG		BCJXXXXF			
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
F_1^{tu} (ksi)	**Mean**	126.33	126.79	125.71	125.88	129.01	129.37	124.69	124.41		
	Minimum	113.70	117.87	116.03	119.01	123.15	121.96	113.04	112.64		
	Maximum	136.35	136.76	135.59	133.91	134.55	135.62	132.14	132.16		
	C.V.(%)	6.52	5.23	3.92	3.18	2.49	2.77	4.34	4.34		
	B-value	116.20	117.30	117.04	117.77	120.07	120.99	116.44	116.72		
	A-value	110.58	112.03	111.30	112.40	114.18	115.48	110.68	111.36		
	No. Specimens	6		19		18		30			
	No. Prepreg Lots	1		3		3		3			
E_1^t (Msi)	**Mean**	9.42	9.49	9.69	9.75	8.91	8.92	9.87	9.96		
	Minimum	9.14	8.94	9.36	9.28	8.19	8.17	9.33	9.34		
	Maximum	9.70	10.04	10.01	10.62	9.56	9.82	10.41	10.56		
	C.V.(%)	4.22	8.19	2.43	5.08	5.29	6.34	4.07	4.66		
	No. Specimens	2		6		6		6			
	No. Prepreg Lots	1		3		3		3			
ν_{12}^t	**Mean**	0.034		0.045		0.033		0.039			
	No. Specimens	2		6		6		6			
	No. Prepreg Lots	1		3		3		3			

3.1.2.2 Tension, 2-axis

Tension, 2-axis
G/Ep
Fiberite 7740/T650 3K-70-PW Graphite
$[0]_{14}$

Material:	Fiberite 7740/T650 3K-70-PW Graphite		
Resin content:	32 - 40 wt%	**Comp. density:**	1.50 - 1.55 g/cc
Fiber volume:	52 - 58 vol%	**Void content:**	0.2 to 3.9 %
Ply thickness:	0.0073 - 0.0083 in.		
Ply range:	14 plies		
Test method:	D3039-95	**Modulus calculation:**	linear fit from 1000 - 3000 με
Normalized by:	0.0079 in. ply thickness		

		CTD (B)		RTD (A)		ETD (G)		ETW (F)			
Test Temperature [°F]		-65		75		180		180			
Moisture Conditioning		dry		dry		dry		62 days, .63-.74% wt gain			
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		145 F, 85 %			
Source code		BCUXXXXB		BCUXXXXA		BCUXXXXG		BCUXXXXF			
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
F_2^{tu} (ksi)	**Mean**	119.44	117.64	119.41	119.13	115.60	114.81	113.17	112.62		
	Minimum	112.37	112.68	107.28	107.81	104.80	104.41	99.84	100.85		
	Maximum	125.85	122.25	128.86	133.86	127.80	122.54	125.45	125.19		
	C.V.(%)	4.49	3.27	5.51	6.01	5.51	4.69	5.40	5.70		
	B-value	106.73	105.10	108.42	108.15	104.96	104.22	103.23	102.70		
	A-value	99.67	98.13	101.19	100.91	97.96	97.25	96.29	95.78		
	No. Specimens	6		18		18		30			
	No. Prepreg Lots	1		3		3		3			
E_2^t (Msi)	**Mean**	10.49	10.31	9.77	9.84	8.77	8.69	9.66	9.67		
	Minimum	10.47	10.23	9.31	9.36	8.58	8.23	9.45	9.37		
	Maximum	10.50	10.40	10.13	10.59	8.95	9.00	9.97	10.45		
	C.V.(%)	0.19	1.17	2.88	4.29	1.69	3.04	1.83	4.24		
	No. Specimens	2		6		6		6			
	No. Prepreg Lots	1		3		3		3			

3.1.2.3 Compression, 1-axis

Compression, 1-axis
G/Ep
Fiberite 7740/T650 3K-70-PW Graphite
$[0]_{16}$

Material:	Fiberite 7740/T650 3K-70-PW Graphite		
Resin content:	32 - 35 wt%	**Comp. density:**	1.51 - 1.54 g/cc
Fiber volume:	55 - 58 vol%	**Void content:**	1.9 to 4.1 %
Ply thickness:	0.0071 - 0.0083 in.		
Ply range:	16 plies		
Test method:	SRM 1-94, D695-91 (mod)	**Modulus calculation:**	linear fit from 1000 - 3000 με
Normalized by:	0.0079 in. ply thickness		

		CTD (B)		RTD (A)		ETD (G)		ETW (F)			
Test Temperature [°F]		-65		75		180		180			
Moisture Conditioning		dry		dry		dry		69 days, .62-.72% wt gain			
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		145 F, 85 %			
Source code		BCKXXXXB		BCKXXXXA		BCKXXXXG		BCKXXXXF			
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
F_1^{cu} (ksi)	**Mean**	108.52	111.17	104.27	104.90	83.13	83.75	59.26	59.38		
	Minimum	101.94	102.78	92.07	98.21	75.24	76.99	46.41	45.89		
	Maximum	114.67	119.34	112.61	112.03	91.06	94.65	68.55	69.14		
	C.V.(%)	4.02	4.84	5.67	3.86	5.59	5.72	10.33	9.77		
	B-value	91.59	95.02	90.19	91.72	71.91	73.22	51.62	52.25		
	A-value	82.18	86.04	80.93	83.04	64.52	66.29	46.29	47.28		
	No. Specimens	6		18		18		30			
	No. Prepreg Lots	1		3		3		3			
E_1^c (Msi)	**Mean**	8.80	8.72	9.14	9.29	9.46	9.59	9.47	9.64		
	Minimum	8.78	8.62	8.33	8.69	9.29	9.12	8.05	8.90		
	Maximum	8.83	8.83	9.84	9.76	9.70	10.02	10.06	9.99		
	C.V.(%)	0.40	1.75	5.46	5.32	1.83	3.78	8.15	4.38		
	No. Specimens	2		6		6		6			
	No. Prepreg Lots	1		3		3		3			

3.1.2.4 Compression, 2-axis

Compression, 2-axis
G/Ep
Fiberite 7740/T650 3K-70-PW Graphite
$[0]_{16}$

Material:	Fiberite 7740/T650 3K-70-PW Graphite		
Resin content:	29 - 39 wt%	**Comp. density:**	1.50 - 1.53 g/cc
Fiber volume:	52 - 61 vol%	**Void content:**	0.7 to 5.3 %
Ply thickness:	0.0073 - 0.0081 in.		
Ply range:	16 plies		
Test method:	SRM 1-94, D695-91 (mod)	**Modulus calculation:**	linear fit from 1000 - 3000 με
Normalized by:	0.0079 in. ply thickness		

		CTD (B)		RTD (A)		ETD (G)		ETW (F)			
Test Temperature [°F]		-65		75		180		180			
Moisture Conditioning		dry		dry		dry		52-67 days, .56-.73% wt gain			
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		145 F, 85 %			
Source code		BCWXXXXB		BCWXXXXA		BCWXXXXG		BCWXXXXF			
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean	107.87	108.41	96.33	96.87	76.98	78.18	58.65	58.90		
	Minimum	101.99	99.99	85.26	86.25	60.34	61.89	50.51	50.06		
	Maximum	114.02	114.78	104.75	108.39	89.41	86.82	69.23	69.12		
	C.V.(%)	4.37	4.99	5.87	6.25	8.50	7.42	7.25	6.68		
F_2^{cu} (ksi)	**B-value**	92.76	94.16	84.66	85.85	67.65	69.29	51.82	52.47		
	A-value	84.35	86.24	76.96	78.59	61.50	63.43	47.09	48.01		
	No. Specimens	6		18		18		28			
	No. Prepreg Lots	1		3		3		3			
	Mean	9.31	9.27	8.85	8.94	9.14	9.20	9.44	9.58		
	Minimum	9.09	9.27	8.17	7.95	7.29	7.19	8.35	8.36		
	Maximum	9.54	9.28	9.40	10.11	11.30	11.54	9.98	10.80		
E_2^c (Msi)	**C.V.(%)**	3.40	0.07	5.50	8.83	16.63	17.63	6.93	9.48		
	No. Specimens	2		6		6		6			
	No. Prepreg Lots	1		3		3		3			

3.1.2.5 Shear, 12 axis

Shear, 12-axis
G/Ep
Fiberite 7740/T650 3K-70-PW Graphite
$[(0/90)_4/0]_S$

Material:	Fiberite 7740/T650 3K-70-PW Graphite		
Resin content:	35 - 38 wt%	**Comp. density:**	1.50 - 1.54 g/cc
Fiber volume:	53 - 55 vol%	**Void content:**	0.8 to 3.5 %
Ply thickness:	0.0075 - 0.0083 in.		
Ply range:	18 plies		
Test method:	D5379-93	**Modulus calculation:**	linear fit from 1000 - 6000 με
Normalized by:	N/A		

		CTD (B)		RTD (A)		ETD (G)		ETW (F)			
Test Temperature [°F]		-65		75		180		180			
Moisture Conditioning		dry		dry		dry		70 days, .63-.70% wt gain			
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		145 F, 85 %			
Source code		BCNXXXXB		BCNXXXXA		BCNXXXXG		BCNXXXXF			
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean		24.08		18.82		14.14		10.86		
	Minimum		23.19		17.71		13.49		10.04		
	Maximum		24.54		19.53		15.46		11.87		
	C.V.(%)		2.23		2.18		3.35		5.07		
F_{12}^{su} (ksi)	**B-value**		22.38		17.72		13.32		10.22		
	A-value		21.44		16.96		12.75		9.78		
	No. Specimens	6		28		27		24			
	No. Prepreg Lots	1		3		3		3			
	Mean		0.71		0.67		0.46		0.43		
	Minimum		0.63		0.62		0.37		0.41		
	Maximum		0.80		0.71		0.60		0.46		
G_{12}^{s} (Msi)	**C.V.(%)**		16.79		6.05		18.08		4.96		
	No. Specimens	2		6		7		6			
	No. Prepreg Lots	1		3		3		3			

3.1.2.6 Shear, 13 axis

Shear, 13-axis
G/Ep
Fiberite 7740/T650 3K-70-PW Graphite
$[0]_{14}$

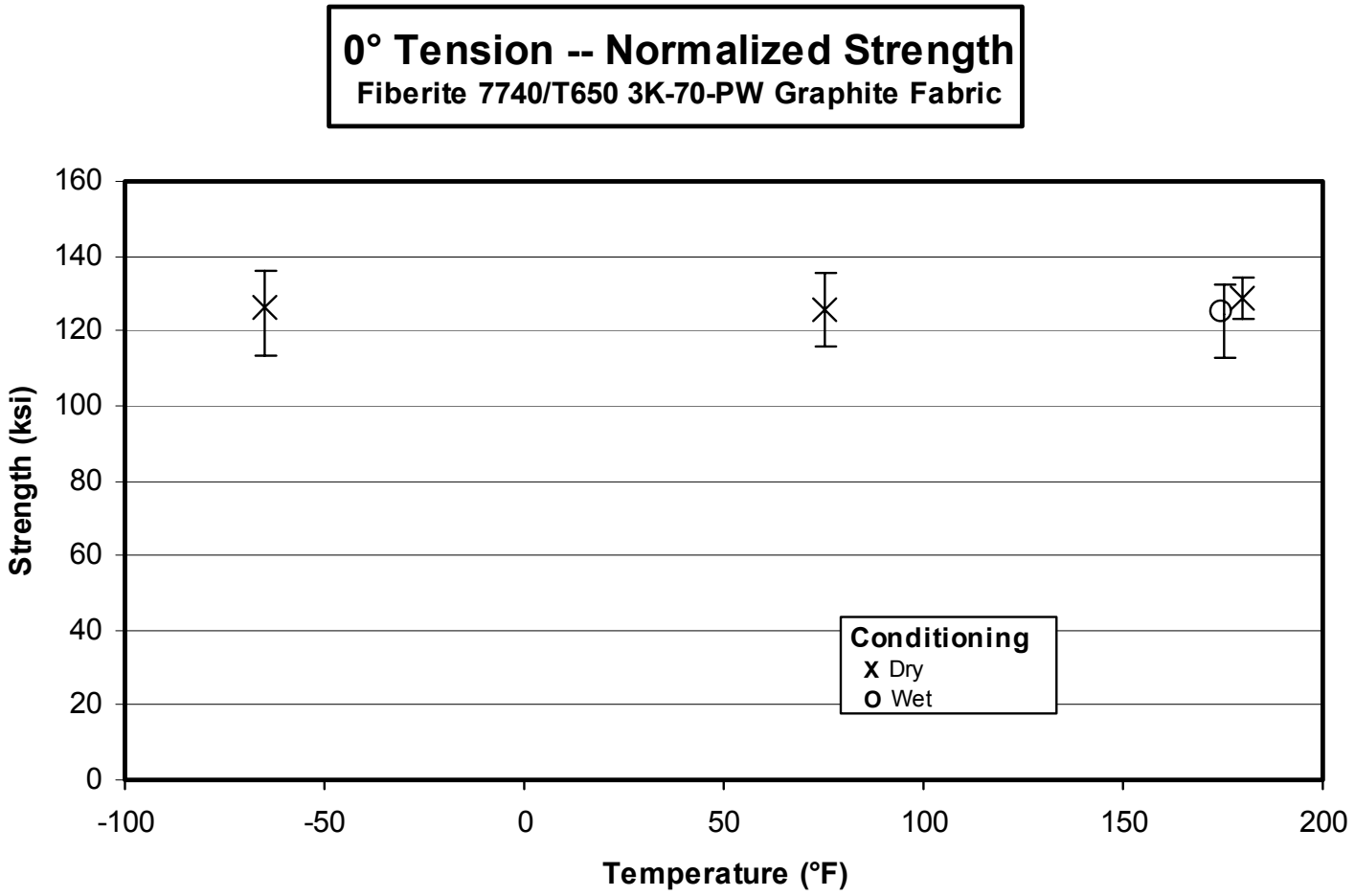
Material:	Fiberite 7740/T650 3K-70-PW Graphite		
Resin content:	32 - 39 wt%	**Comp. density:**	1.51 - 1.55 g/cc
Fiber volume:	52 - 59 vol%	**Void content:**	1.6 to 3.1 %
Ply thickness:	0.0072 - 0.0081 in.		
Ply range:	14 plies		
Test method:	D2344-89	**Modulus calculation:**	N/A
Normalized by:	N/A		

		CTD (B)		RTD (A)		ETD (G)		ETW (F)			
Test Temperature [°F]				75							
Moisture Conditioning				dry							
Equilibrium at T, RH				as fabricated							
Source code				BCQXXXXA							
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean				10.68						
	Minimum				10.16						
	Maximum				11.24						
	C.V.(%)				3.24						
F_{13}^{su} (ksi)	**B-value**				9.99						
	A-value				9.50						
	No. Specimens			18							
	No. Prepreg Lots			3							

NOTES: These values represent the apparent interlaminar shear properties and are to be used for quality control purposes only. Do not use these values for interlaminar shear strength design values.

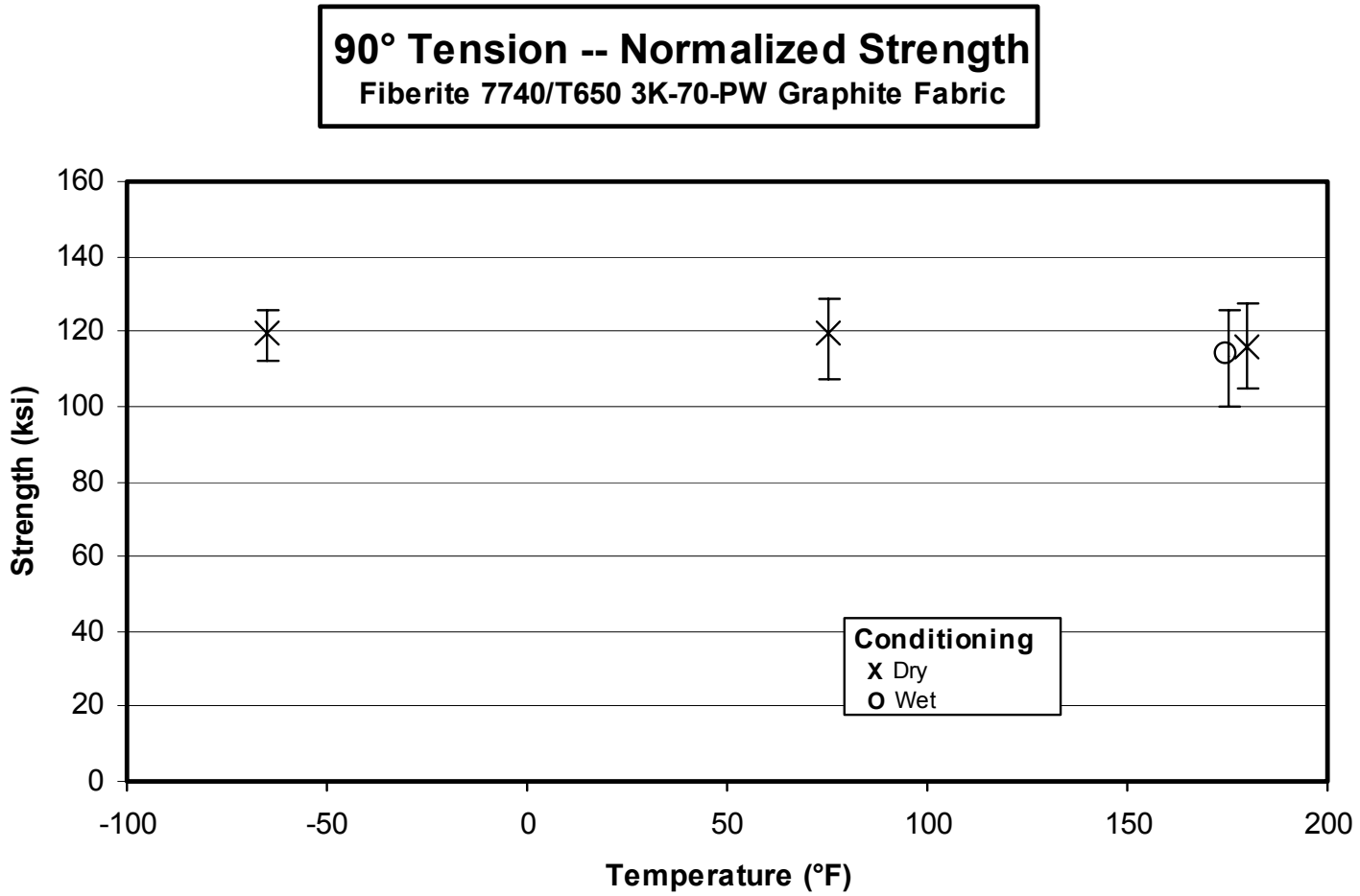
3.1.3 Individual Test Charts

3.1.3.1 Tension, 1-axis



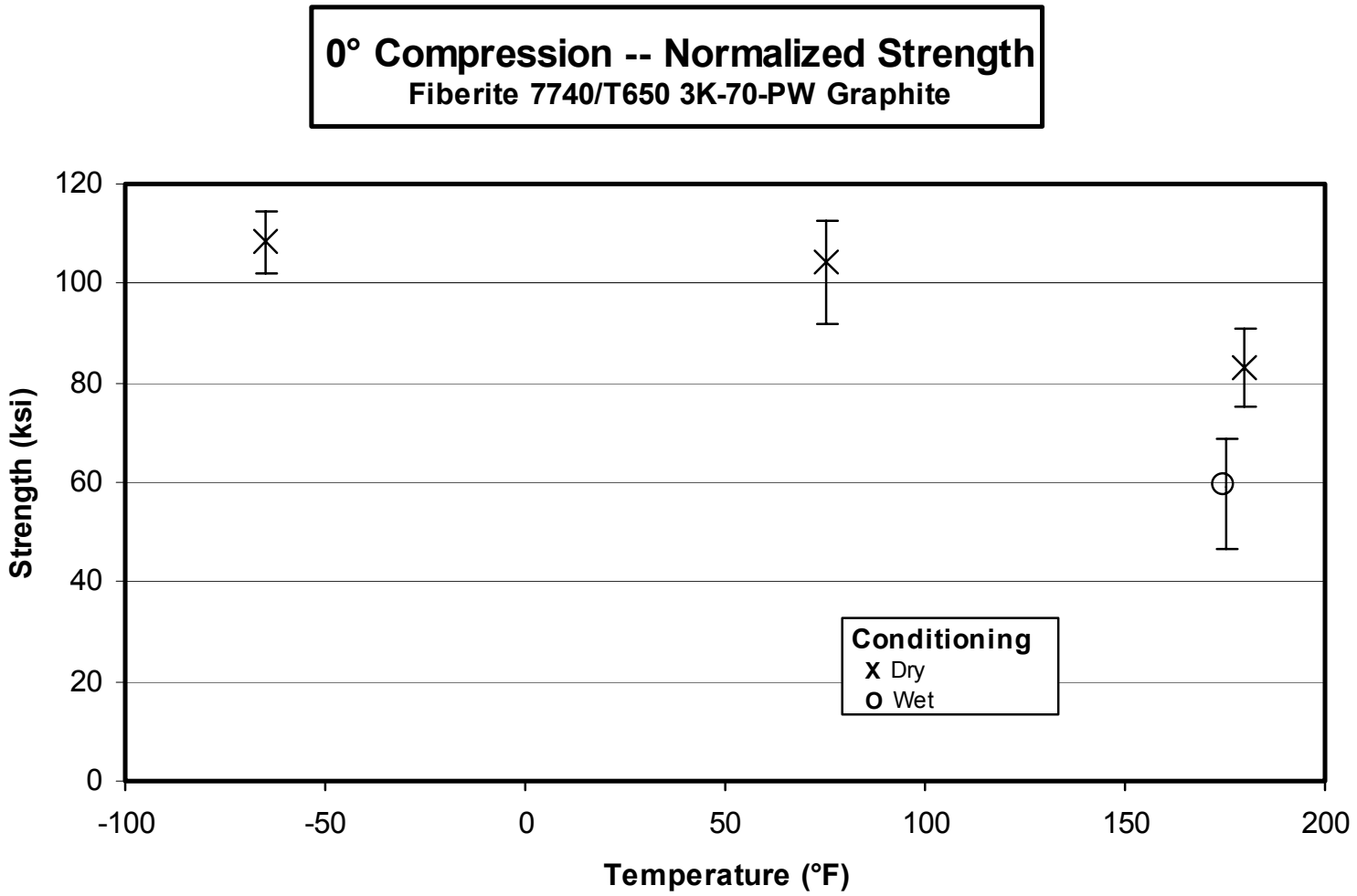
NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limit of the data. The 180° dry and wet data have been staggered for clarity.

3.1.3.2 Tension, 2-axis



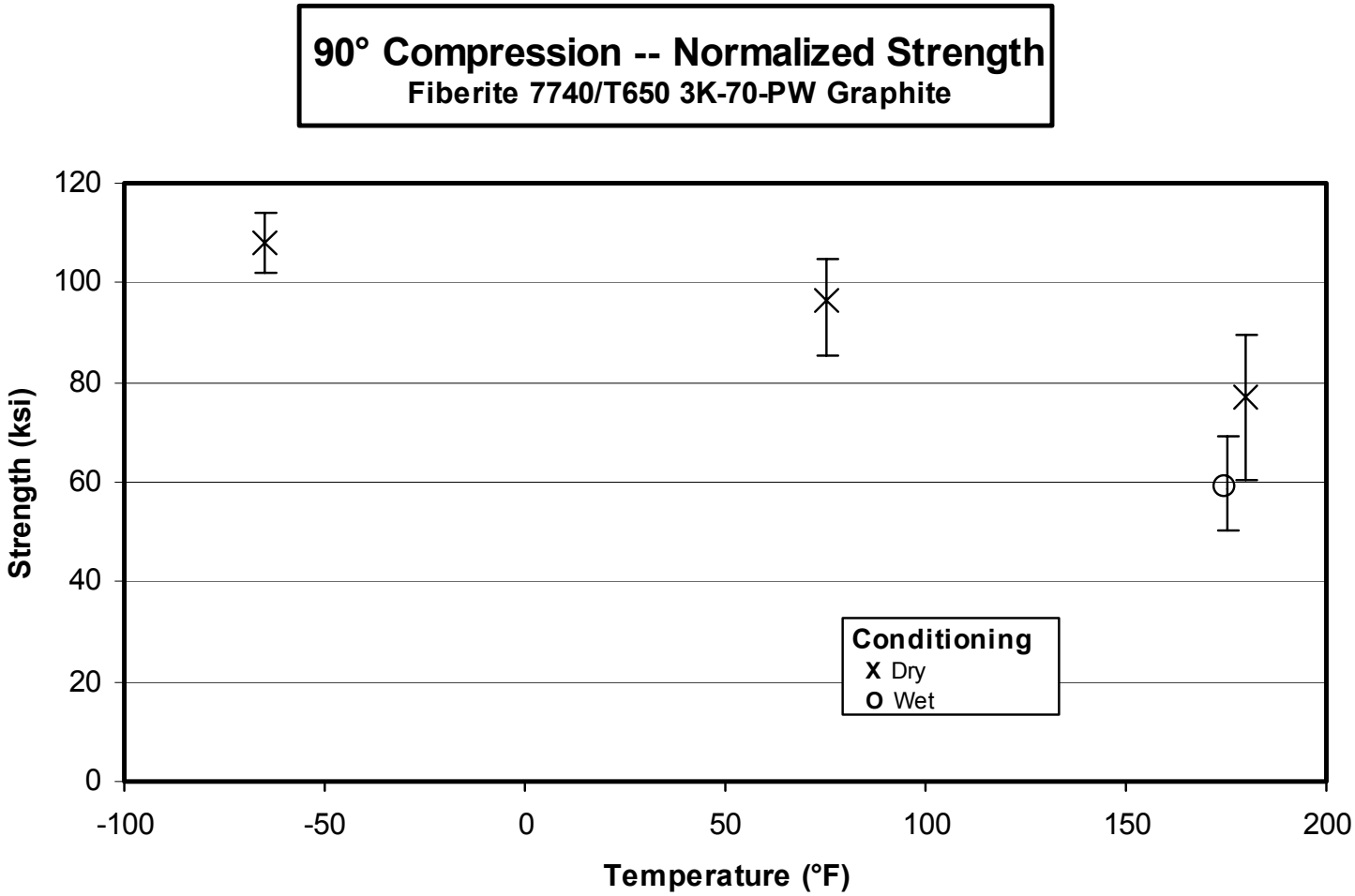
NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limit of the data. The 180° dry and wet data have been staggered for clarity.

3.1.3.3 Compression, 1-axis



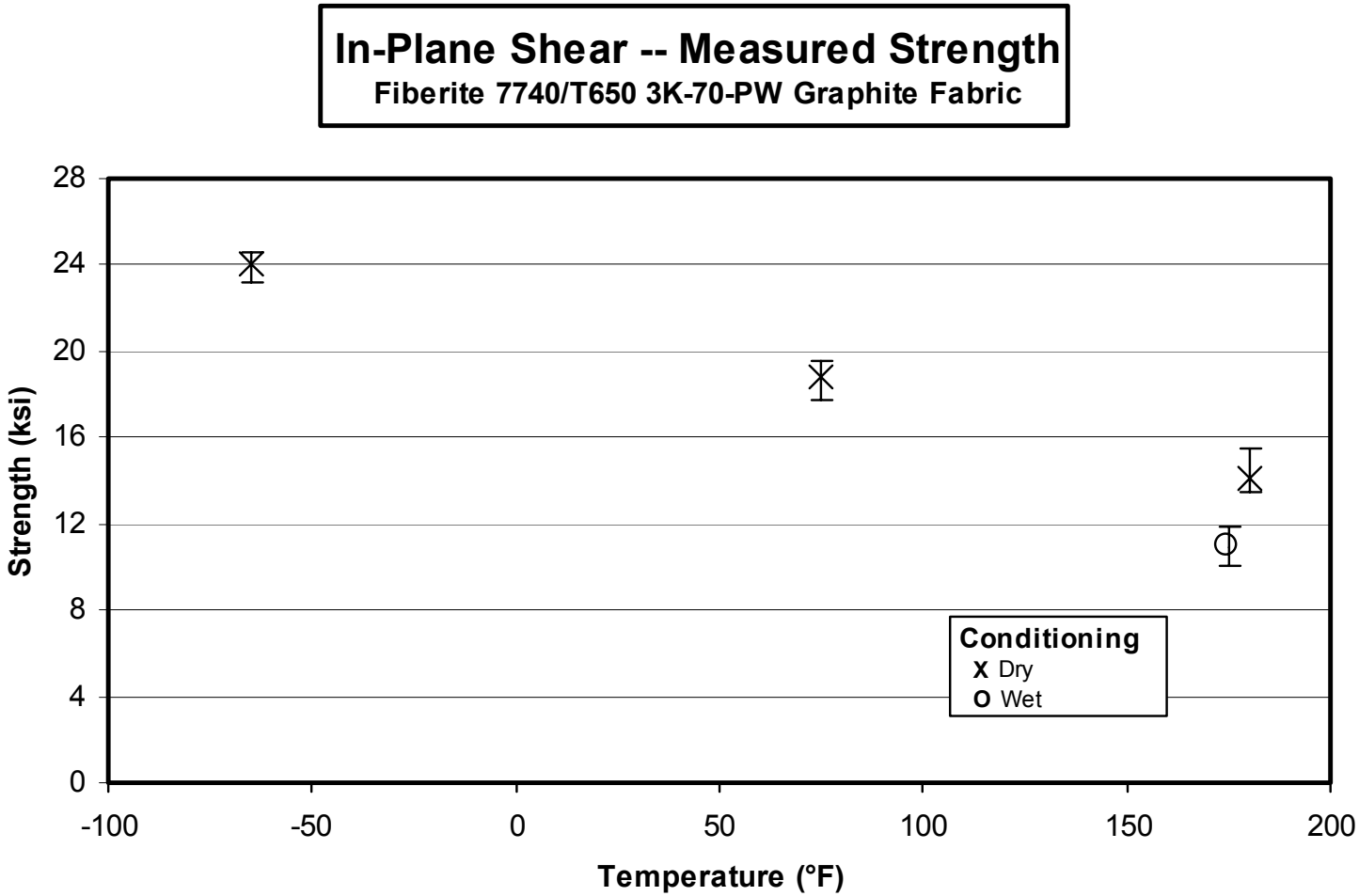
NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limit of the data. The 180° dry and wet data have been staggered for clarity.

3.1.3.4 Compression, 2-axis



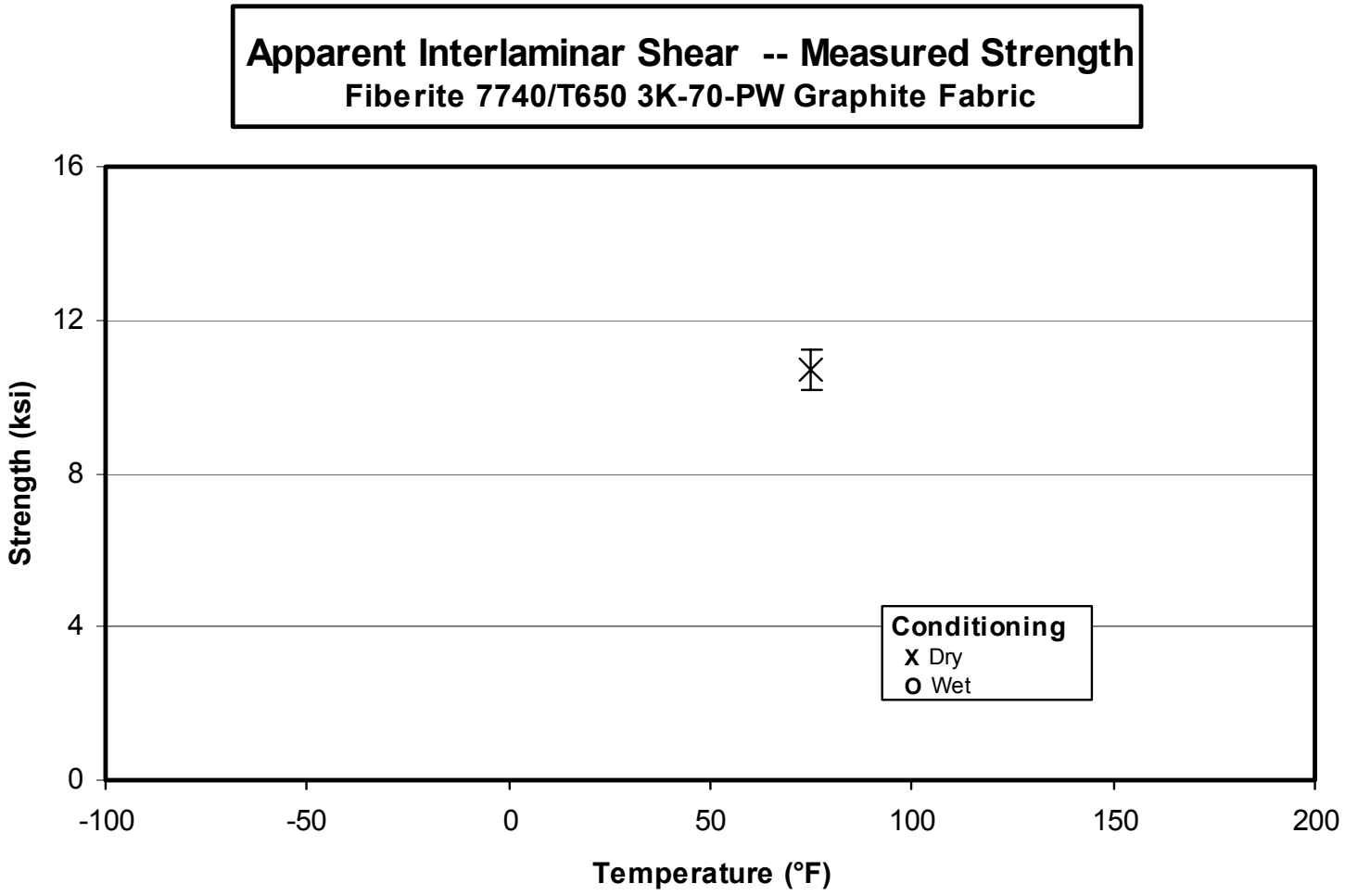
NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limit of the data. The 180° dry and wet data have been staggered for clarity.

3.1.3.5 Shear, 12 axis



NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limit of the data. The 180° dry and wet data have been staggered for clarity.

3.1.3.6 Shear, 13 axis



NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limit of the data.

3.2 Raw Data

Specimen Naming Convention

Test coupons were identified using an eight-digit specimen code, with the significance of each digit delineated below. A representative sample ID is shown for reference purposes.

B C J 2 1 2 5 F

1st Character: Fabricator
'B' designates Cessna

2nd Character: Material System
'C' designates T650 3K-70-PW / 7740

3rd Character: Test Type
'J' designates 0° Tension Strength and Modulus, other test types will be clearly labeled at the top of each sheet

4th Character: Prepreg Batch ID
See Table 2.1 for Fiberite Batch ID / Sample Batch ID correlation.

5th Character: Panel Number
The panel(s) fabricated for a specific test method.

6th Character: Subpanel Number
The sub-panel(s) cut from each panel, with subpanel numbers labeled increasing from reference edge.

7th Character: Sample Number
The sample(s) cut from each subpanel, with sample numbers labeled increasing from reference edge.

8th Character: Test Condition
'A' --- RTD
'B' --- CTD
'F' --- ETW
'G' --- ETD
See Table 1.5.1 for condition parameters.

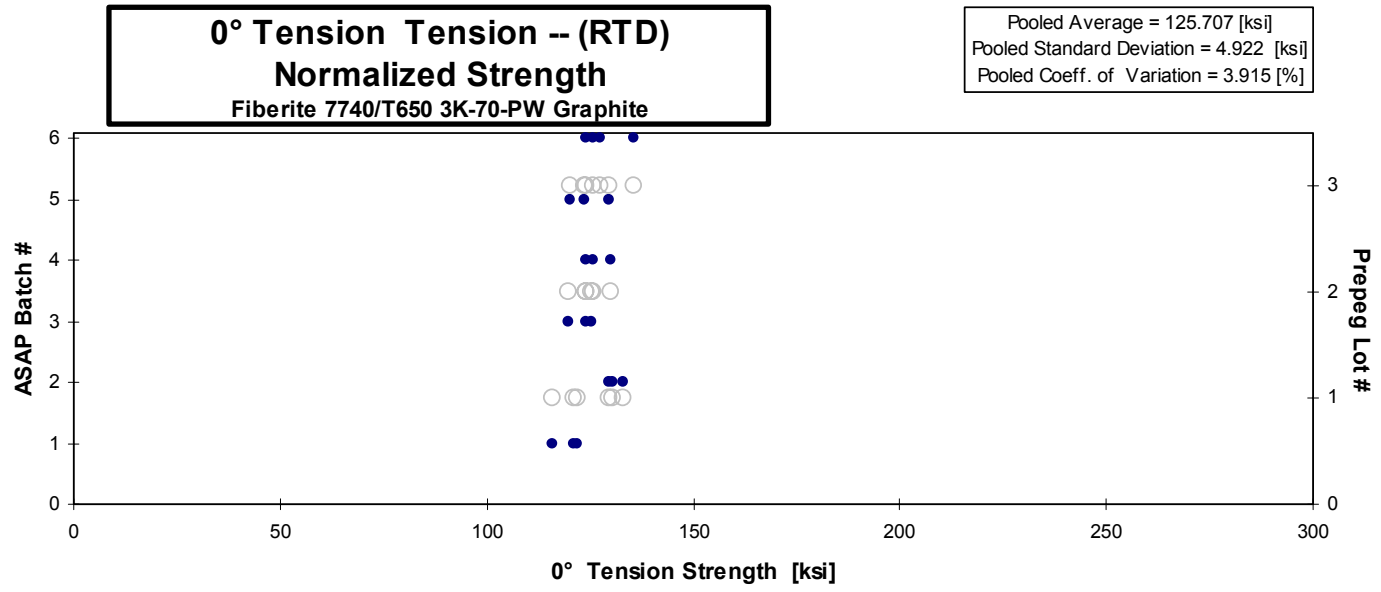
3.2.1 Raw Data Spreadsheets and Scatter Charts

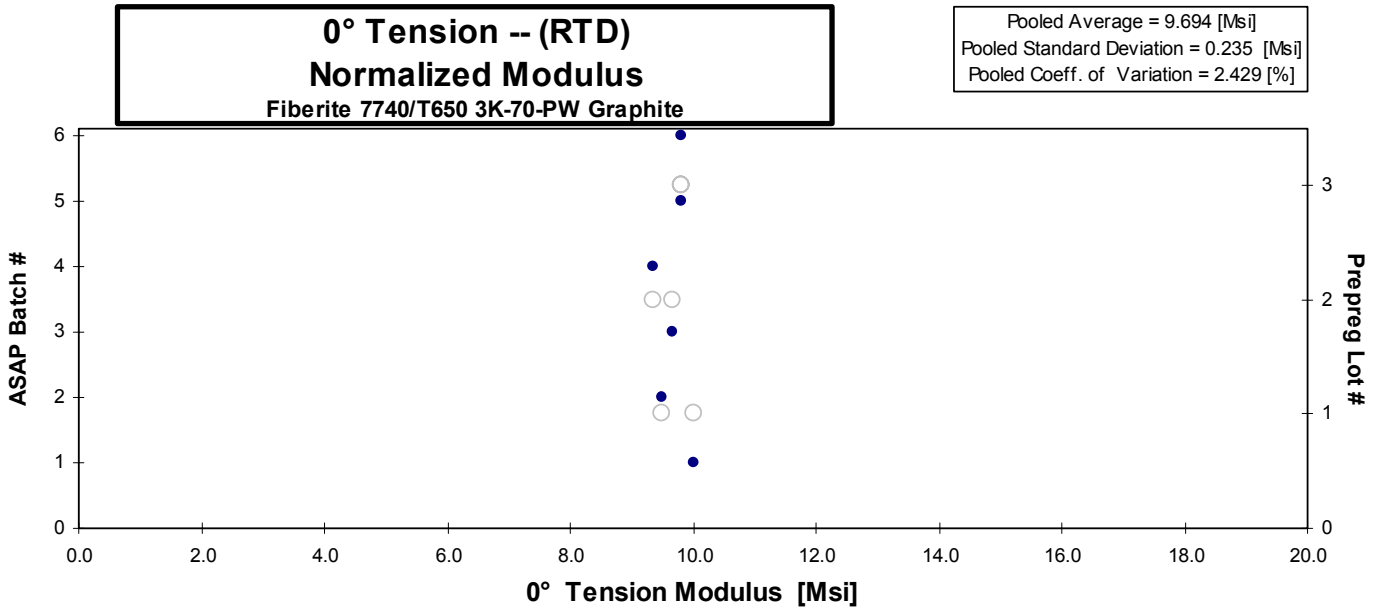
0° Tension-- (RTD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCJ12X1A	1	1	1	129.543	10.618	0.044	0.104	14	0.00745	122.164	10.013
BCJ12X2A	1	1	1	125.589			0.107	14	0.00761	120.952	
BCJ12X3A	1	1	1	120.994			0.106	14	0.00758	116.035	
BCJ14X1A	2	1	2	126.619	9.295	0.046	0.113	14	0.00808	129.539	9.509
BCJ14X2A	2	1	2	127.762			0.113	14	0.00807	130.458	
BCJ14X3A	2	1	2	129.576			0.114	14	0.00812	133.208	
BCJ21X1A	1	2	3	128.994	9.918	0.049	0.108	14	0.00769	125.592	9.657
BCJ21X2A	1	2	3	123.772			0.111	14	0.00791	123.922	
BCJ21X3A	1	2	3	119.768			0.111	14	0.00790	119.750	
BCJ23X6A	2	2	4	123.002	9.282	0.042	0.112	14	0.00797	124.040	9.361
BCJ23X7A	2	2	4	130.173			0.111	14	0.00790	130.134	
BCJ23X8A	2	2	4	127.717			0.109	14	0.00777	125.619	
BCJ31X6A	1	3	5	129.053	9.769	0.051	0.111	14	0.00795	129.811	9.827
BCJ31X7A	1	3	5	123.179			0.111	14	0.00794	123.791	
BCJ31X8A	1	3	5	119.007			0.112	14	0.00799	120.406	
BCJ33X2A	2	3	6	126.983			0.111	14	0.00794	127.557	
BCJ33X3A	2	3	6	124.450			0.112	14	0.00799	125.912	
BCJ33X4A	2	3	6	133.913			0.112	14	0.00800	135.588	
BCJ33X6A	2	3	6	121.541	9.608	0.037	0.113	14	0.00806	123.959	9.799

Average	**125.876**	**9.748**	**0.045**	**$Average_{norm}$**	**0.00789**	**125.707**	**9.694**
Standard Dev.	**3.999**	**0.496**	**0.005**	**Standard $Dev._{norm}$**		**4.922**	**0.235**
Coeff. of Var. [%]	**3.177**	**5.084**	**11.320**	**Coeff. of Var. $[\%]_{norm}$**		**3.915**	**2.429**
Min.	**119.007**	**9.282**	**0.037**	**Min.**	**0.0075**	**116.035**	**9.361**
Max.	**133.913**	**10.618**	**0.051**	**Max.**	**0.0081**	**135.588**	**10.013**
Number of Spec.	**19**	**6**	**6**	**Number of Spec.**		**19**	**6**



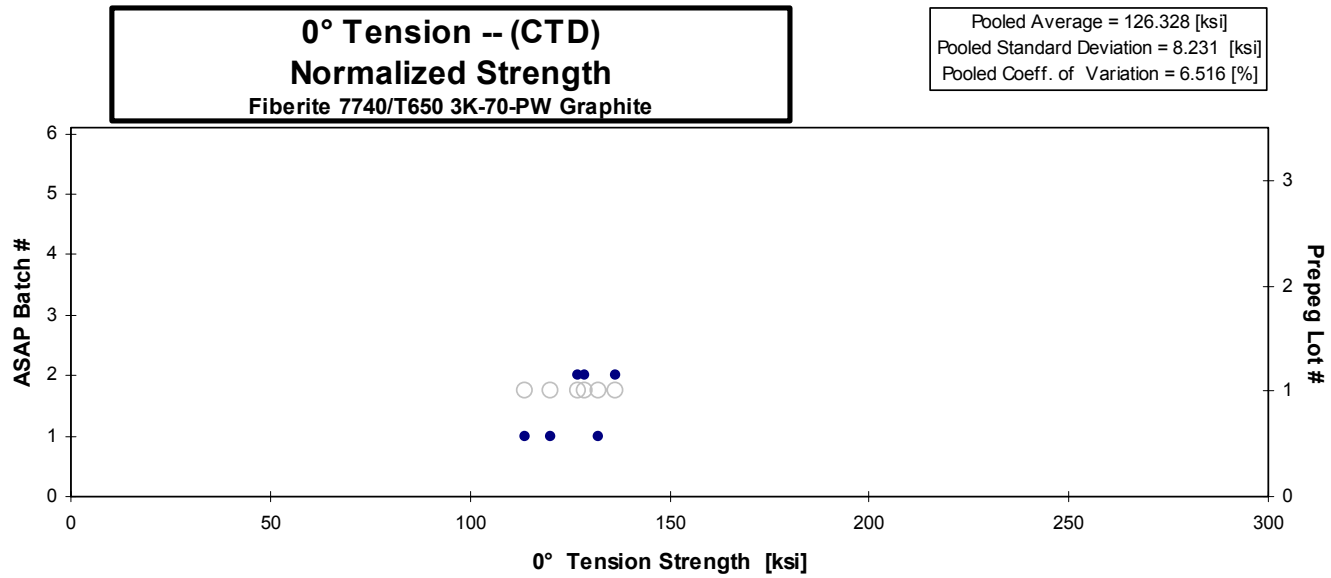


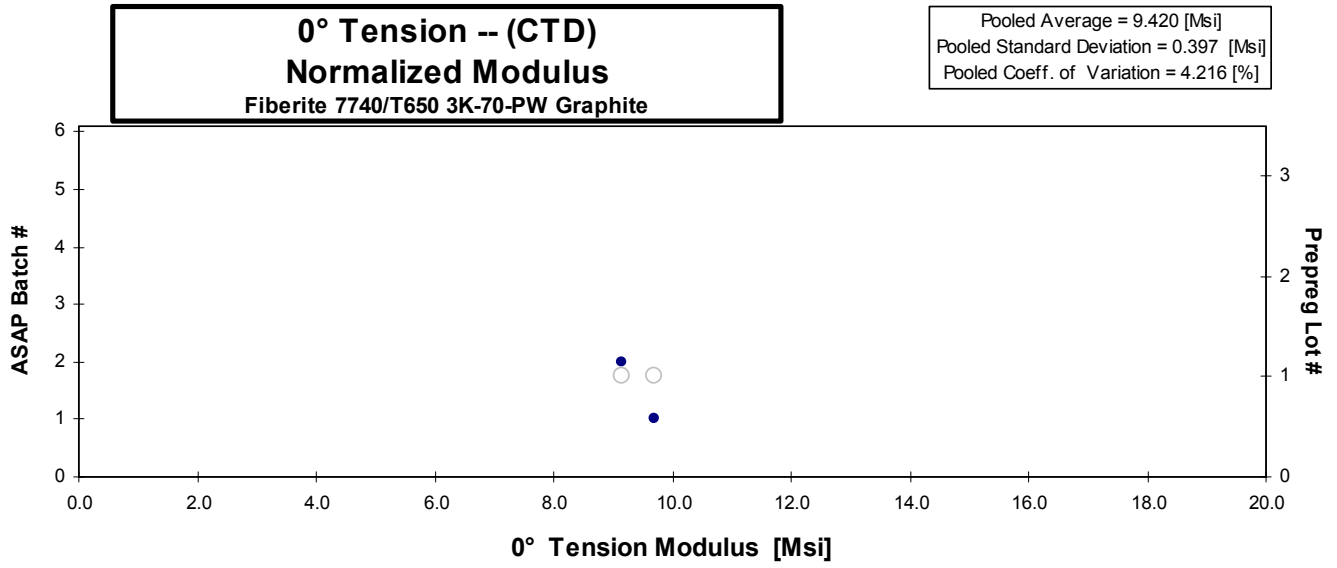
0° Tension -- (CTD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCJ12X5B	1	1	1	117.869			0.107	14	0.00762	113.695	
BCJ12X6B	1	1	1	124.511			0.107	14	0.00762	120.102	
BCJ12X7B	1	1	1	136.763	10.040	0.036	0.107	14	0.00763	132.146	9.701
BCJ14X5B	2	1	2	131.973			0.114	14	0.00816	136.348	
BCJ14X6B	2	1	2	125.435			0.114	14	0.00811	128.724	
BCJ14X7B	2	1	2	124.202	8.941	0.032	0.113	14	0.00808	126.953	9.139

Average	**126.792**	**9.491**	**0.034**	**$Average_{norm}$**	**0.00787**	**126.328**	**9.420**
Standard Dev.	**6.628**	**0.777**	**0.003**	**$Standard\ Dev._{norm}$**		**8.231**	**0.397**
Coeff. of Var. [%]	**5.227**	**8.185**	**7.661**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**6.516**	**4.216**
Min.	**117.869**	**8.941**	**0.032**	**Min.**	**0.0076**	**113.695**	**9.139**
Max.	**136.763**	**10.040**	**0.036**	**Max.**	**0.0082**	**136.348**	**9.701**
Number of Spec.	**6**	**2**	**2**	**Number of Spec.**		**6**	**2**



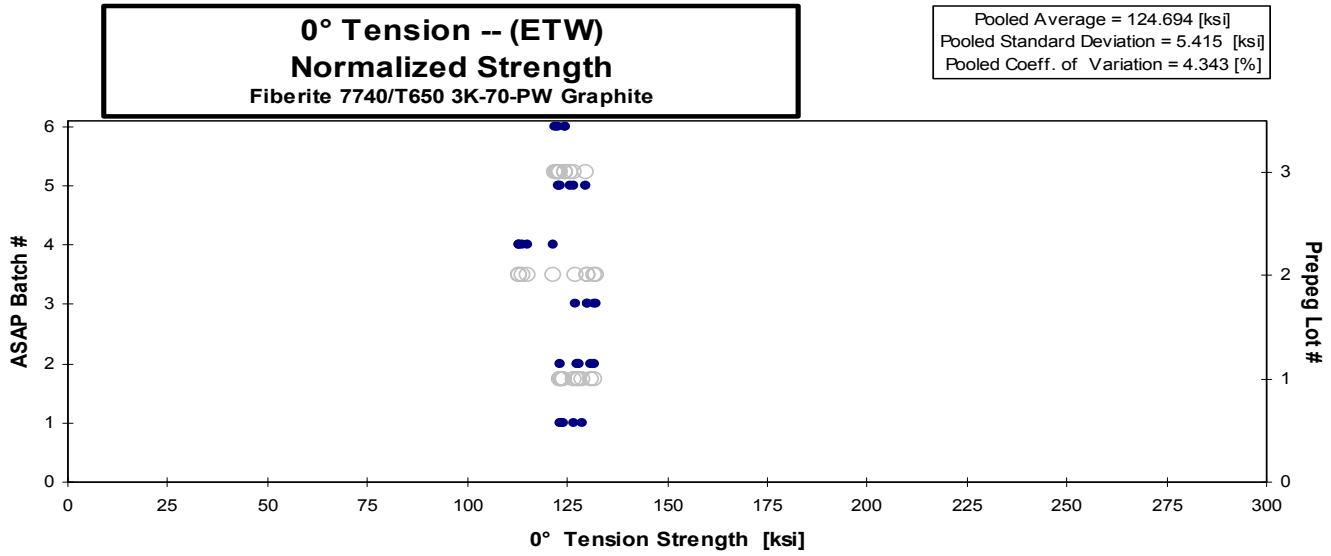


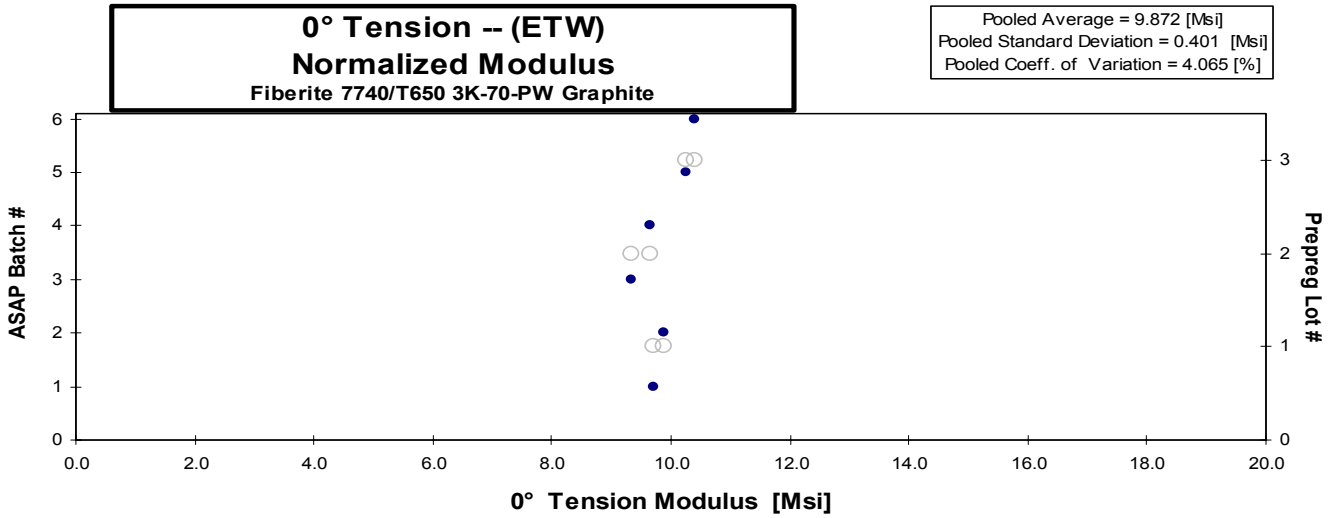
0° Tension -- (ETW)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCJ11X1F	1	1	1	130.479	10.277	0.043	0.105	14	0.00747	123.381	9.718
BCJ11X2F	1	1	1	126.941			0.108	14	0.00769	123.574	
BCJ11X3F	1	1	1	127.160			0.108	14	0.00771	124.133	
BCJ11X4F	1	1	1	131.651			0.108	14	0.00773	128.735	
BCJ11X5F	1	1	1	128.188			0.109	14	0.00780	126.507	
BCJ13X1F	2	1	2	127.007	9.577	0.035	0.114	14	0.00815	131.026	9.880
BCJ13X2F	2	1	2	126.307			0.115	14	0.00825	131.865	
BCJ13X3F	2	1	2	123.586			0.115	14	0.00818	127.963	
BCJ13X4F	2	1	2	119.666			0.114	14	0.00813	123.147	
BCJ13X5F	2	1	2	124.519			0.113	14	0.00808	127.390	
BCJ22X1F	1	2	3	132.159	9.336	0.029	0.110	14	0.00789	132.019	9.327
BCJ22X2F	1	2	3	128.420			0.112	14	0.00801	130.239	
BCJ22X3F	1	2	3	125.005			0.112	14	0.00802	126.945	
BCJ22X4F	1	2	3	131.685			0.111	14	0.00793	132.141	
BCJ22X5F	1	2	3	130.874			0.110	14	0.00786	130.184	
BCJ23X1F	2	2	4	123.651	9.818	0.042	0.109	14	0.00776	121.489	9.646
BCJ23X2F	2	2	4	115.418			0.110	14	0.00787	114.948	
BCJ23X3F	2	2	4	112.638			0.111	14	0.00794	113.164	
BCJ23X4F	2	2	4	113.372			0.111	14	0.00795	114.021	
BCJ23X5F	2	2	4	113.500			0.110	14	0.00787	113.038	
BCJ31X1F	1	3	5	129.183	10.198	0.044	0.111	14	0.00794	129.865	10.252
BCJ31X2F	1	3	5	126.325			0.111	14	0.00793	126.820	
BCJ31X3F	1	3	5	120.629			0.113	14	0.00805	122.865	
BCJ31X4F	1	3	5	122.650			0.111	14	0.00795	123.390	
BCJ31X5F	1	3	5	125.375			0.111	14	0.00792	125.753	
BCJ34X1F	2	3	6	124.301	10.562	0.039	0.109	14	0.00779	122.502	10.410
BCJ34X2F	2	3	6	124.216			0.111	14	0.00791	124.404	
BCJ34X3F	2	3	6	122.778			0.112	14	0.00800	124.351	
BCJ34X4F	2	3	6	120.685			0.112	14	0.00799	122.012	
BCJ34X5F	2	3	6	124.011			0.110	14	0.00783	122.964	

Average	**124.413**	**9.961**	**0.039**	**$Average_{norm}$**	**0.00792**	**124.694**	**9.872**
Standard Dev.	**5.397**	**0.464**	**0.006**	**Standard $Dev._{norm}$**		**5.415**	**0.401**
Coeff. of Var. [%]	**4.338**	**4.657**	**15.100**	**Coeff. of Var. $[\%]_{norm}$**		**4.343**	**4.065**
Min.	**112.638**	**9.336**	**0.029**	**Min.**	**0.0075**	**113.038**	**9.327**
Max.	**132.159**	**10.562**	**0.044**	**Max.**	**0.0082**	**132.141**	**10.410**
Number of Spec.	**30**	**6**	**6**	**Number of Spec.**		**30**	**6**



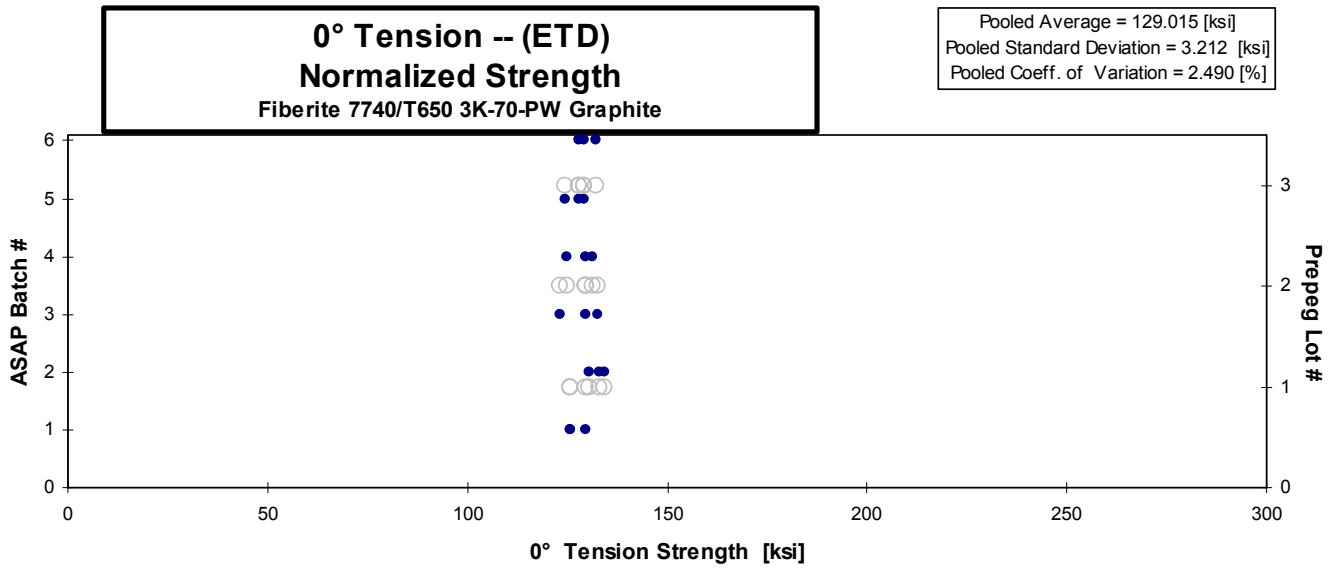


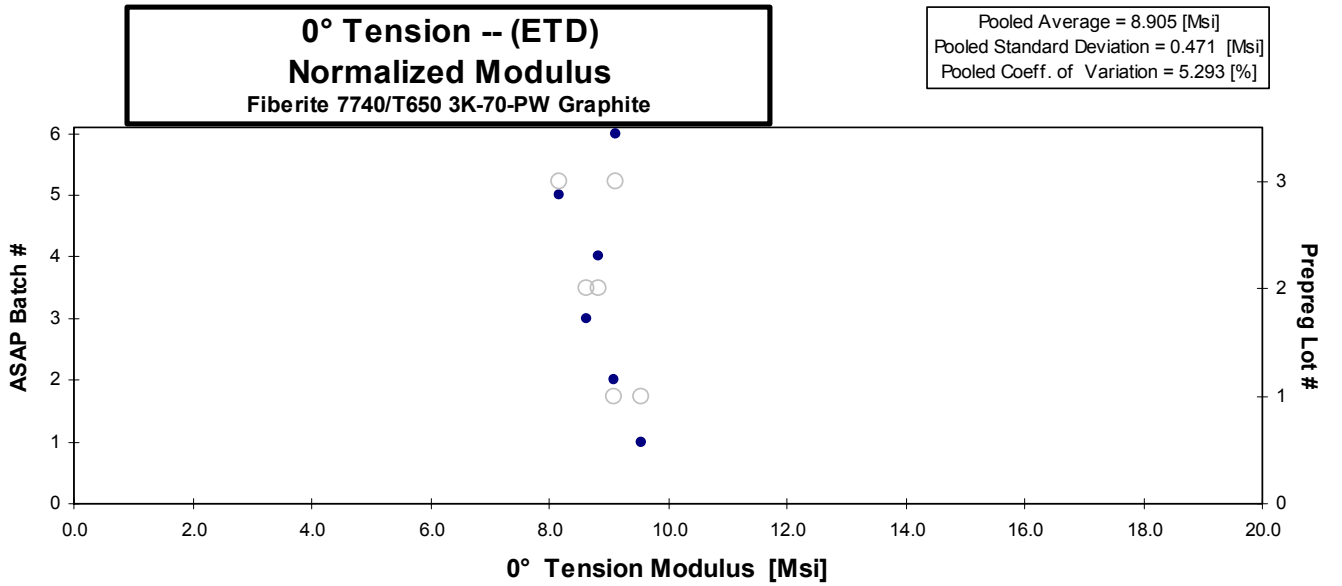
0° Tension-- (ETD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCJ11X6G	1	1	1	133.078	9.825	0.033	0.108	14	0.00769	129.469	9.558
BCJ11X7G	1	1	1	131.437			0.106	14	0.00756	125.851	
BCJ11X8G	1	1	1	135.622			0.103	14	0.00733	125.833	
BCJ13X6G	2	1	2	126.832	8.824	0.037	0.114	14	0.00813	130.540	9.082
BCJ13X7G	2	1	2	128.336			0.115	14	0.00819	133.113	
BCJ13X8G	2	1	2	130.214			0.114	14	0.00816	134.551	
BCJ21X5G	1	2	3	121.958	8.540	0.040	0.112	14	0.00798	123.153	8.624
BCJ21X6G	1	2	3	130.800			0.110	14	0.00784	129.775	
BCJ21X7G	1	2	3	133.928			0.109	14	0.00782	132.495	
BCJ24X1G	2	2	4	127.438	9.026	0.031	0.108	14	0.00774	124.903	8.847
BCJ24X2G	2	2	4	132.843			0.110	14	0.00782	131.542	
BCJ24X3G	2	2	4	130.805			0.110	14	0.00782	129.504	
BCJ32X1G	1	3	5	129.015	8.165	0.026	0.111	14	0.00792	129.346	8.186
BCJ32X2G	1	3	5	122.709			0.112	14	0.00801	124.373	
BCJ32X3G	1	3	5	127.189			0.111	14	0.00796	128.166	
BCJ34X6G	2	3	6	129.344	9.139	0.030	0.111	14	0.00790	129.305	9.136
BCJ34X7G	2	3	6	126.671			0.112	14	0.00798	127.988	
BCJ34X8G	2	3	6	130.392			0.112	14	0.00802	132.357	

Average	**129.367**	**8.920**	**0.033**	**$Average_{norm}$**	**0.00788**	**129.015**	**8.905**
Standard Dev.	**3.585**	**0.566**	**0.005**	**$Standard\ Dev._{norm}$**		**3.212**	**0.471**
Coeff. of Var. [%]	**2.771**	**6.344**	**16.186**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**2.490**	**5.293**
Min.	**121.958**	**8.165**	**0.026**	**Min.**	**0.0073**	**123.153**	**8.186**
Max.	**135.622**	**9.825**	**0.040**	**Max.**	**0.0082**	**134.551**	**9.558**
Number of Spec.	**18**	**6**	**6**	**Number of Spec.**		**18**	**6**



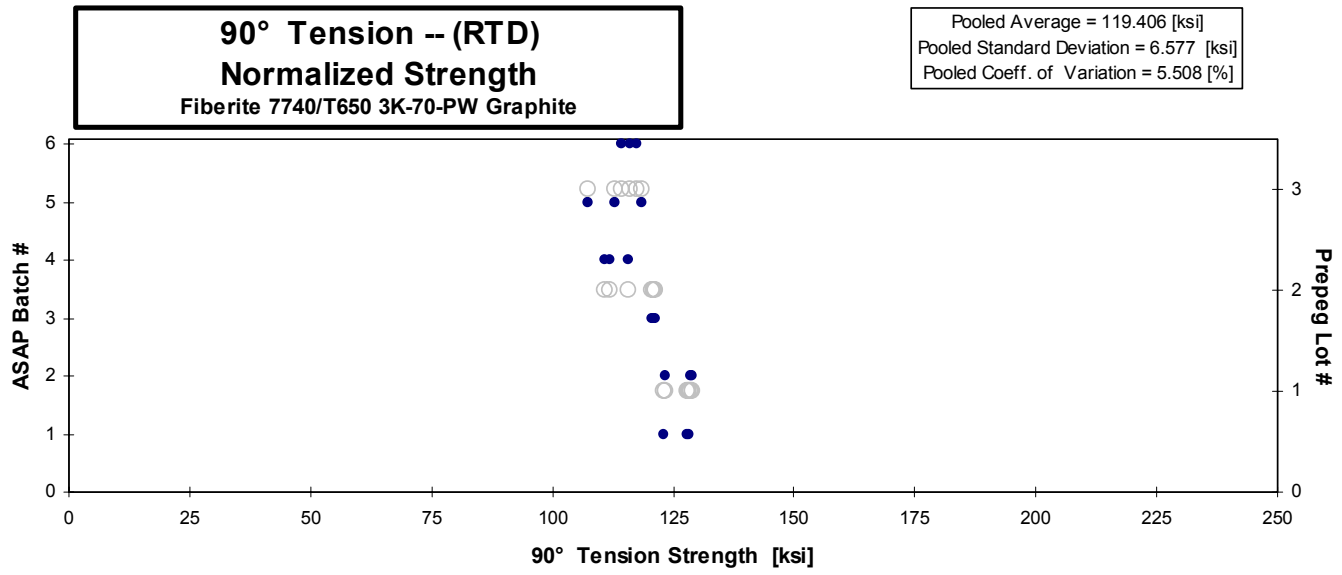


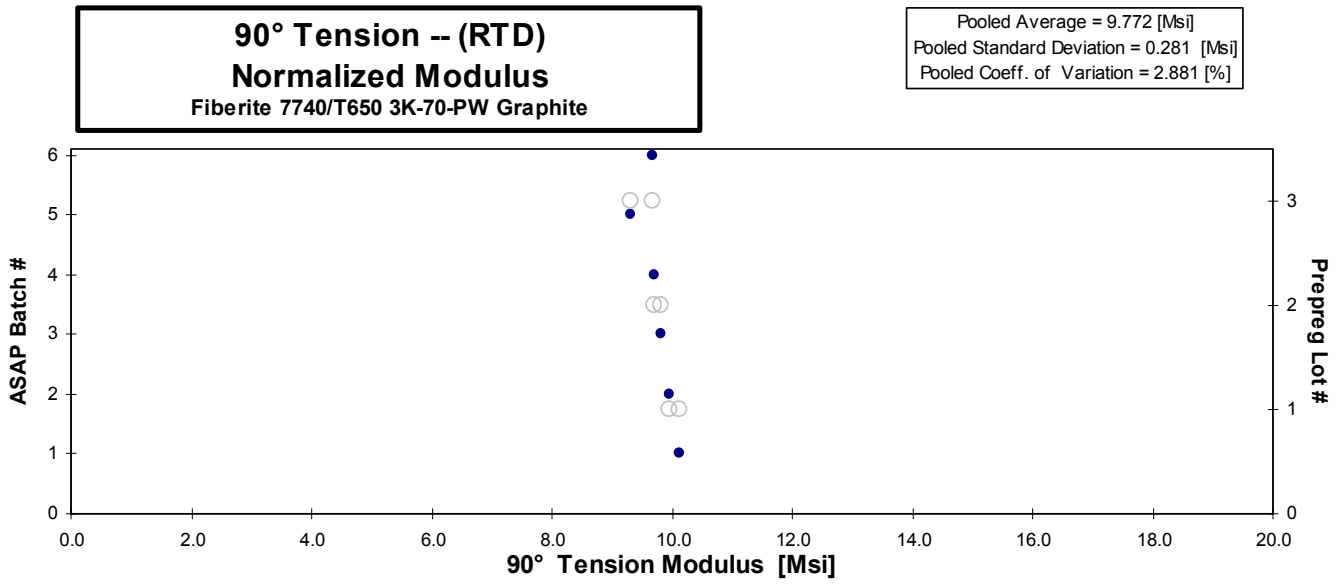
90° Tension-- (RTD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCU12X1A	1	1	1	133.860	10.588	0.106	14	0.00756	128.111	10.133
BCU12X2A	1	1	1	130.075		0.109	14	0.00778	128.173	
BCU12X3A	1	1	1	122.686		0.111	14	0.00794	123.241	
BCU14X1A	2	1	2	125.368		0.114	14	0.00812	128.863	
BCU14X2A	2	1	2	129.237	10.011	0.110	14	0.00787	128.711	9.970
BCU14X3A	2	1	2	120.787		0.113	14	0.00807	123.335	
BCU21X6A	1	2	3	120.883	9.772	0.111	14	0.00794	121.484	9.821
BCU21X7A	1	2	3	118.463		0.113	14	0.00806	120.908	
BCU21X8A	1	2	3	121.023		0.110	14	0.00788	120.713	
BCU23X3A	2	2	4	111.765	9.703	0.111	14	0.00790	111.815	9.707
BCU23X4A	2	2	4	115.079		0.111	14	0.00794	115.669	
BCU23X6A	2	2	4	111.230		0.110	14	0.00788	110.962	
BCU31X1A	1	3	5	107.814	9.357	0.110	14	0.00786	107.278	9.311
BCU31X2A	1	3	5	119.068		0.110	14	0.00788	118.709	
BCU31X3A	1	3	5	111.131		0.113	14	0.00804	113.158	
BCU33X6A	2	3	6	116.457		0.112	14	0.00797	117.510	
BCU33X7A	2	3	6	115.493	9.621	0.111	14	0.00795	116.294	9.688
BCU33X8A	2	3	6	113.937		0.111	14	0.00793	114.366	

Average	**119.131**	**9.842**		**$Average_{norm}$**	**0.00792**	**119.406**	**9.772**
Standard Dev.	**7.165**	**0.423**		**$Standard\ Dev._{norm}$**		**6.577**	**0.281**
Coeff. of Var. [%]	**6.014**	**4.294**		**Coeff. of Var. [%]$_{norm}$**		**5.508**	**2.881**
Min.	**107.814**	**9.357**		**Min.**	**0.0076**	**107.278**	**9.311**
Max.	**133.860**	**10.588**		**Max.**	**0.0081**	**128.863**	**10.133**
Number of Spec.	**18**	**6**		**Number of Spec.**		**18**	**6**



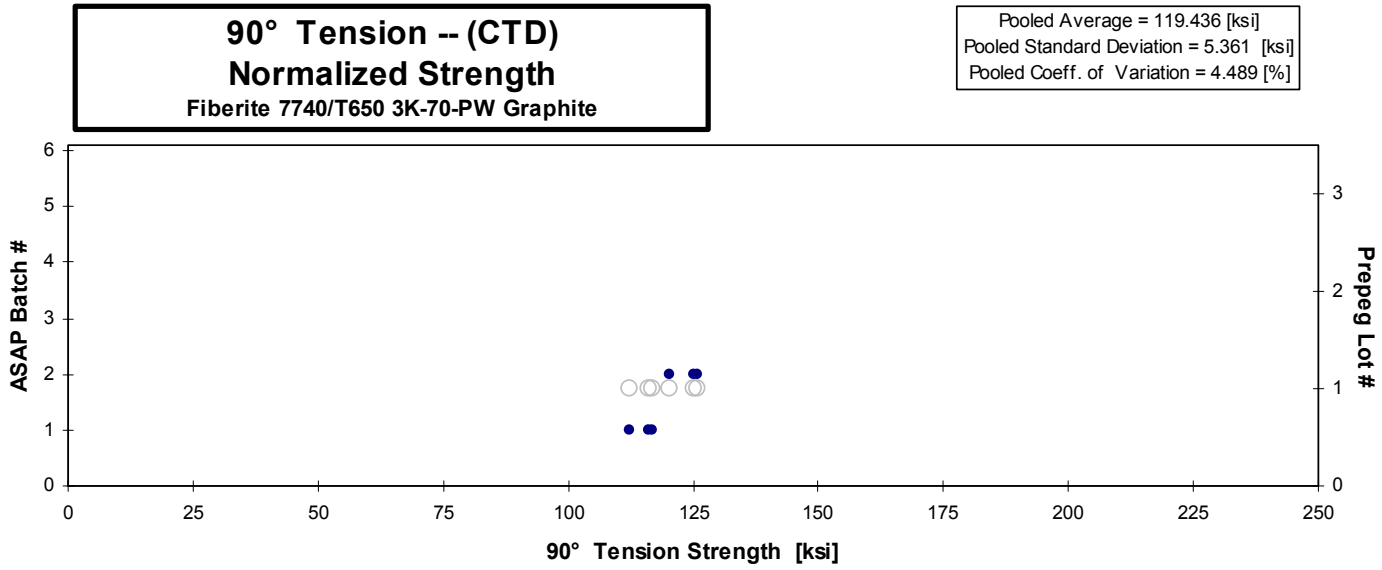


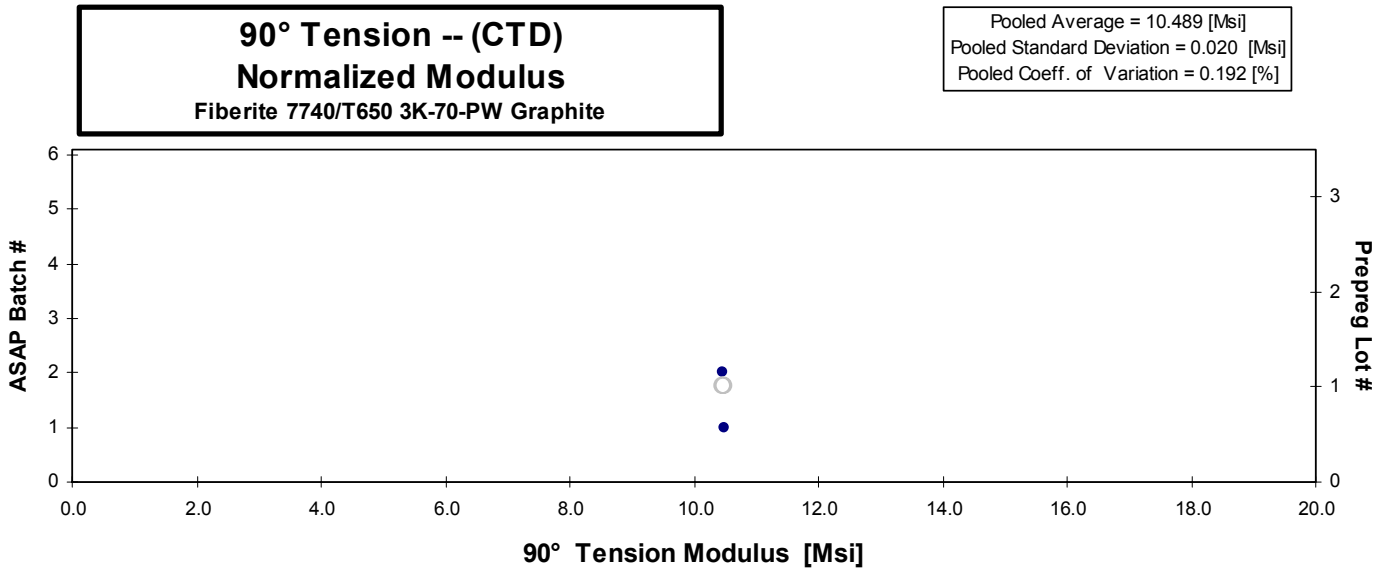
90° Tension-- (CTD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCU12X5B	1	1	1	115.550	10.398	0.112	14	0.00798	116.716	10.503
BCU12X6B	1	1	1	116.192		0.110	14	0.00789	116.069	
BCU12X7B	1	1	1	112.681		0.110	14	0.00788	112.375	
BCU14X5B	2	1	2	122.237	10.228	0.113	14	0.00809	125.185	10.475
BCU14X7B	2	1	2	116.905		0.114	14	0.00814	120.428	
BCU14X8B	2	1	2	122.253		0.114	14	0.00813	125.846	

Average	**117.636**	**10.313**	**$Average_{norm}$**	**0.00802**	**119.436**	**10.489**
Standard Dev.	**3.848**	**0.120**	**Standard $Dev._{norm}$**		**5.361**	**0.020**
Coeff. of Var. [%]	**3.271**	**1.167**	**Coeff. of Var. $[\%]_{norm}$**		**4.489**	**0.192**
Min.	**112.681**	**10.228**	**Min.**	**0.0079**	**112.375**	**10.475**
Max.	**122.253**	**10.398**	**Max.**	**0.0081**	**125.846**	**10.503**
Number of Spec.	**6**	**2**	**Number of Spec.**		**6**	**2**



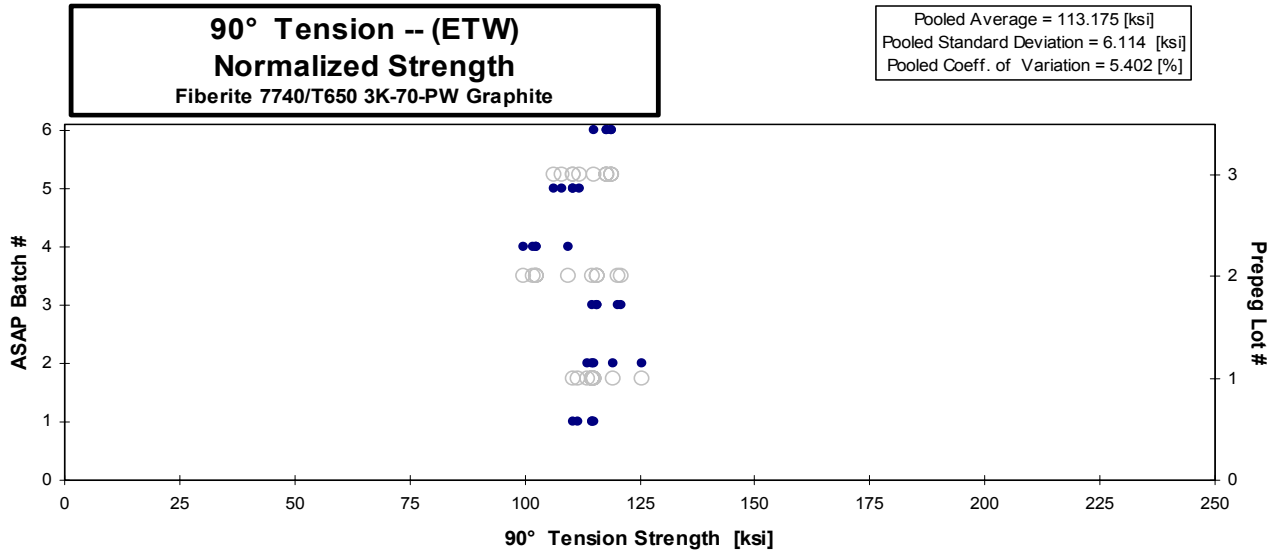


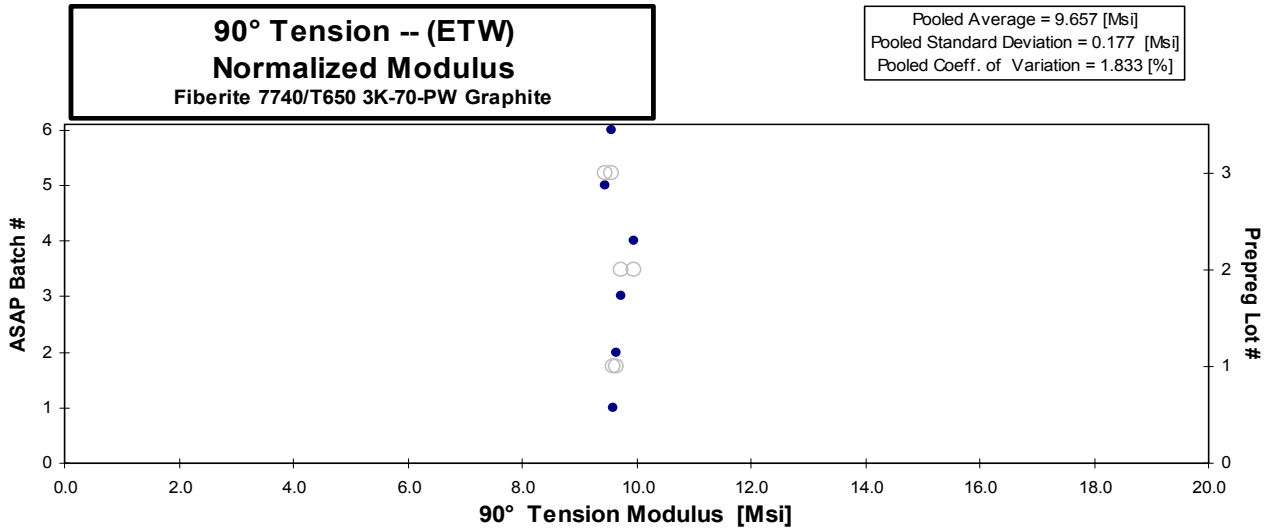
90° Tension-- (ETW)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCU11X1F	1	1	1	125.193	10.448	0.102	14	0.00726	115.100	9.605
BCU11X2F	1	1	1	121.044		0.105	14	0.00749	114.824	
BCU11X3F	1	1	1	114.712		0.108	14	0.00769	111.600	
BCU11X4F	1	1	1	116.413		0.109	14	0.00778	114.588	
BCU11X5F	1	1	1	112.449		0.109	14	0.00778	110.670	
BCU13X1F	2	1	2	112.171	9.434	0.113	14	0.00808	114.757	9.651
BCU13X2F	2	1	2	108.522		0.116	14	0.00828	113.738	
BCU13X3F	2	1	2	114.131		0.111	14	0.00796	114.939	
BCU13X4F	2	1	2	119.923		0.116	14	0.00826	125.453	
BCU13X5F	2	1	2	114.375		0.115	14	0.00823	119.149	
BCU21X1F	1	2	3	113.870	9.572	0.112	14	0.00802	115.638	9.721
BCU21X2F	1	2	3	119.731		0.112	14	0.00800	121.174	
BCU21X3F	1	2	3	112.204		0.113	14	0.00808	114.690	
BCU21X4F	1	2	3	118.891		0.112	14	0.00800	120.396	
BCU21X5F	1	2	3	117.557		0.109	14	0.00777	115.679	
BCU24X5F	2	2	4	100.880	9.794	0.113	14	0.00804	102.644	9.965
BCU24X6F	2	2	4	100.993		0.112	14	0.00797	101.861	
BCU24X7F	2	2	4	101.650		0.112	14	0.00798	102.630	
BCU24X8F	2	2	4	109.600		0.111	14	0.00790	109.584	
BCU24X9F	2	2	4	100.855		0.109	14	0.00782	99.836	
BCU32X1F	1	3	5	109.610	9.375	0.111	14	0.00796	110.452	9.447
BCU32X2F	1	3	5	110.641		0.112	14	0.00800	112.108	
BCU32X3F	1	3	5	107.353		0.111	14	0.00795	108.098	
BCU32X4F	1	3	5	108.961		0.112	14	0.00801	110.423	
BCU32X5F	1	3	5	104.144		0.113	14	0.00807	106.435	
BCU33X1F	2	3	6	113.291	9.407	0.112	14	0.00802	115.049	9.553
BCU33X2F	2	3	6	116.424		0.112	14	0.00801	118.003	
BCU33X3F	2	3	6	117.440		0.112	14	0.00800	118.997	
BCU33X4F	2	3	6	118.135		0.110	14	0.00787	117.708	
BCU33X5F	2	3	6	117.299		0.112	14	0.00802	119.014	

Average	**112.615**	**9.672**	**$Average_{norm}$**	**0.00794**	**113.175**	**9.657**
Standard Dev.	**6.424**	**0.410**	**$Standard\ Dev._{norm}$**		**6.114**	**0.177**
Coeff. of Var. [%]	**5.704**	**4.243**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**5.402**	**1.833**
Min.	**100.855**	**9.375**	**Min.**	**0.0073**	**99.836**	**9.447**
Max.	**125.193**	**10.448**	**Max.**	**0.0083**	**125.453**	**9.965**
Number of Spec.	**30**	**6**	**Number of Spec.**		**30**	**6**



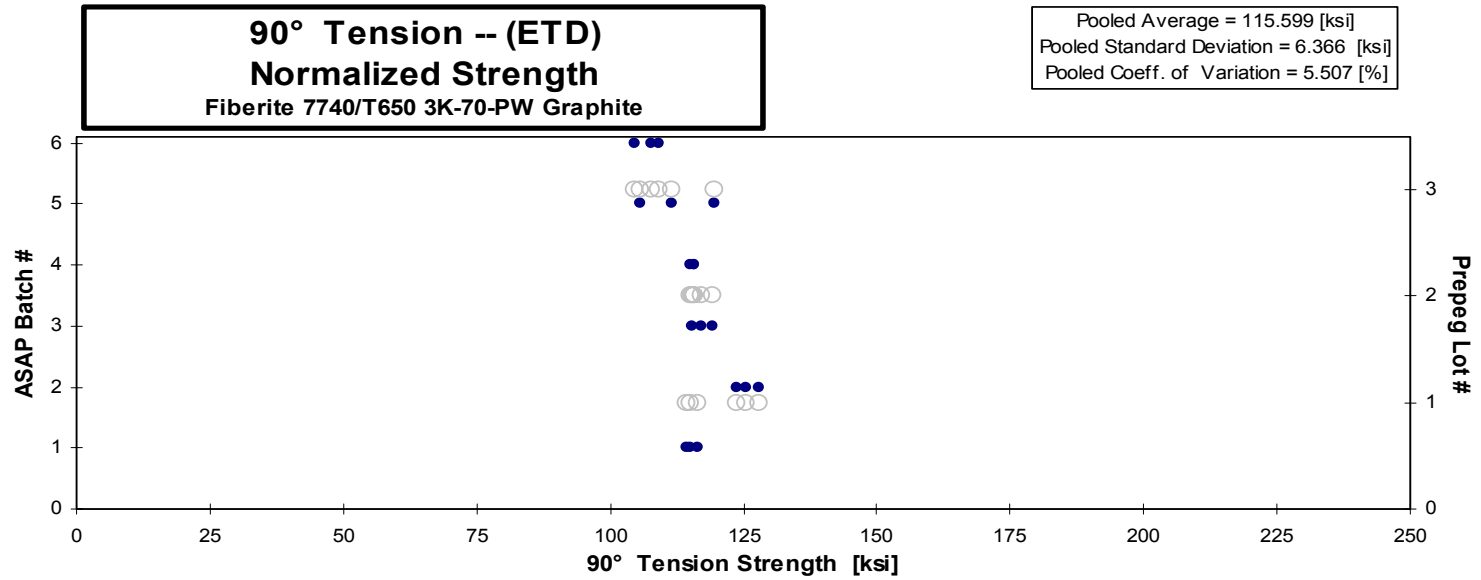


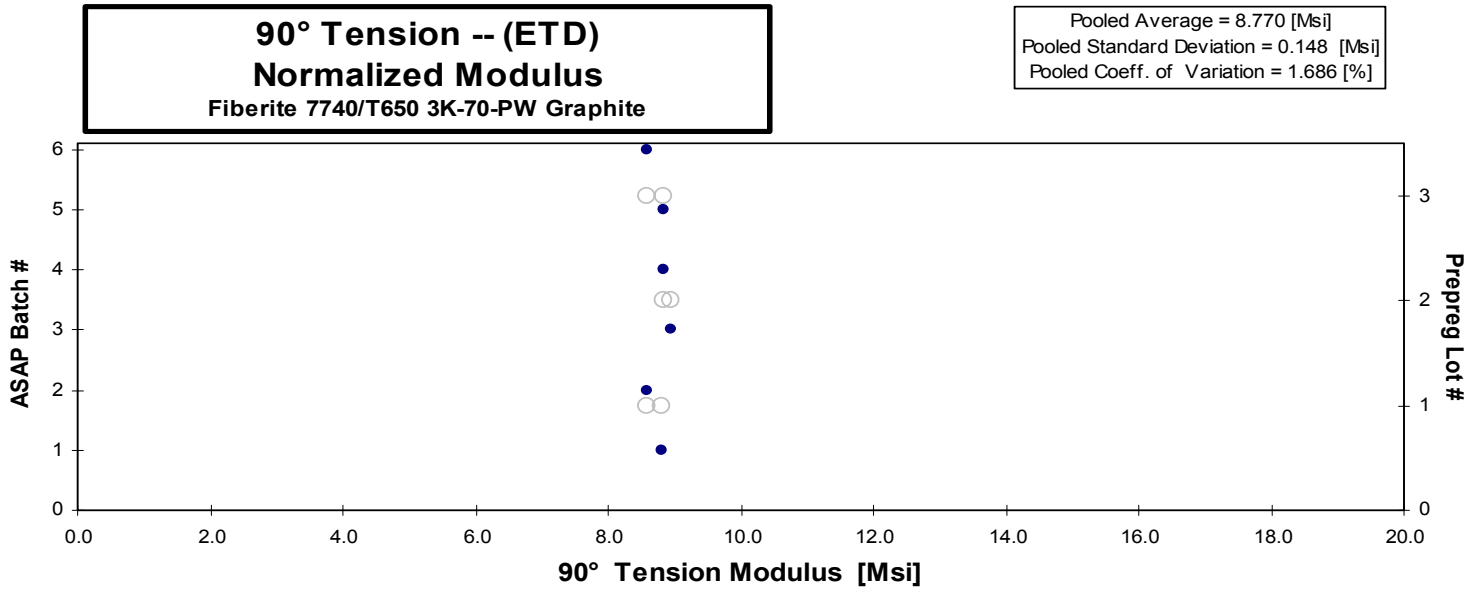
90° Tension-- (ETD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCU11X6G	1	1	1	117.359	9.001	0.108	14	0.00774	115.042	8.823
BCU11X7G	1	1	1	116.891		0.108	14	0.00773	114.390	
BCU11X8G	1	1	1	120.082		0.107	14	0.00767	116.626	
BCU13X6G	2	1	2	120.335	8.228	0.116	14	0.00825	125.684	8.594
BCU13X7G	2	1	2	118.583		0.115	14	0.00825	123.783	
BCU13X8G	2	1	2	122.540		0.115	14	0.00824	127.802	
BCU22X1G	1	2	3	115.388	8.800	0.112	14	0.00803	117.336	8.949
BCU22X2G	1	2	3	119.836		0.110	14	0.00787	119.403	
BCU22X3G	1	2	3	117.759		0.109	14	0.00775	115.523	
BCU24X1G	2	2	4	115.275	8.791	0.111	14	0.00795	115.953	8.843
BCU24X2G	2	2	4	114.618		0.112	14	0.00798	115.810	
BCU24X3G	2	2	4	113.416		0.112	14	0.00801	114.954	
BCU31X5G	1	3	5	104.409	8.724	0.112	14	0.00800	105.668	8.829
BCU31X6G	1	3	5	117.816		0.112	14	0.00802	119.538	
BCU31X7G	1	3	5	110.107		0.112	14	0.00800	111.534	
BCU34X1G	2	3	6	107.455	8.568	0.111	14	0.00791	107.649	8.584
BCU34X2G	2	3	6	105.293		0.110	14	0.00786	104.801	
BCU34X3G	2	3	6	109.331		0.111	14	0.00790	109.282	

Average	**114.805**	**8.685**	**$Average_{norm}$**	**0.00795**	**115.599**	**8.770**
Standard Dev.	**5.389**	**0.264**	**$Standard\ Dev._{norm}$**		**6.366**	**0.148**
Coeff. of Var. [%]	**4.694**	**3.039**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**5.507**	**1.686**
Min.	**104.409**	**8.228**	**Min.**	**0.0077**	**104.801**	**8.584**
Max.	**122.540**	**9.001**	**Max.**	**0.0083**	**127.802**	**8.949**
Number of Spec.	**18**	**6**	**Number of Spec.**		**18**	**6**



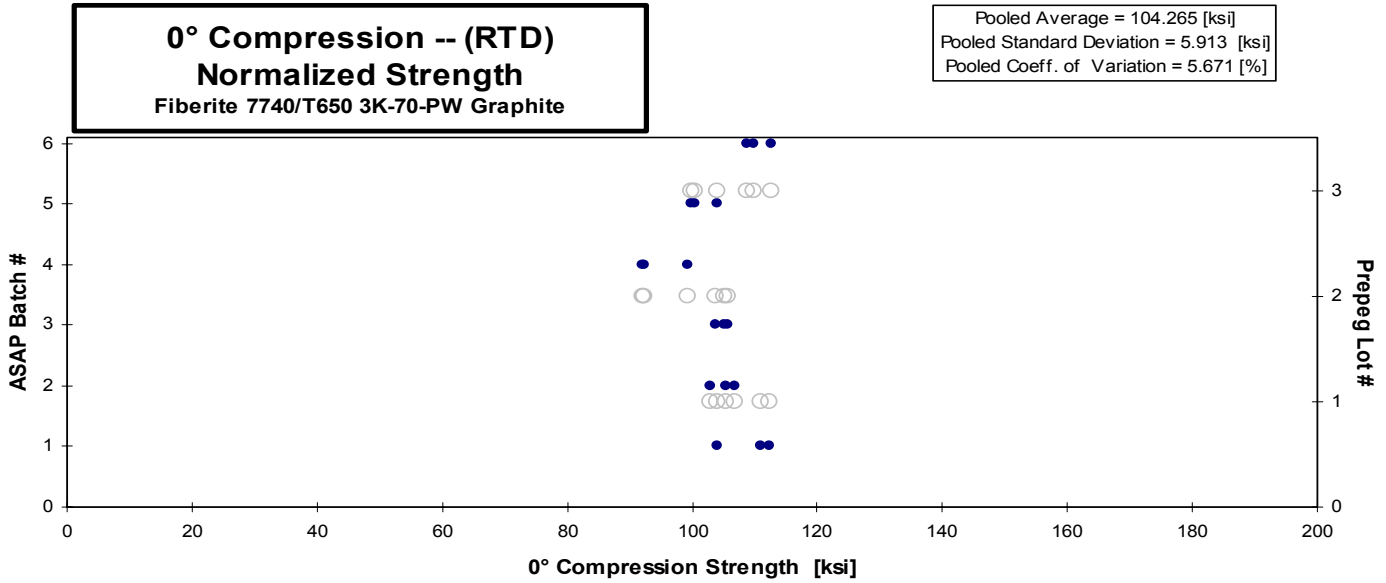


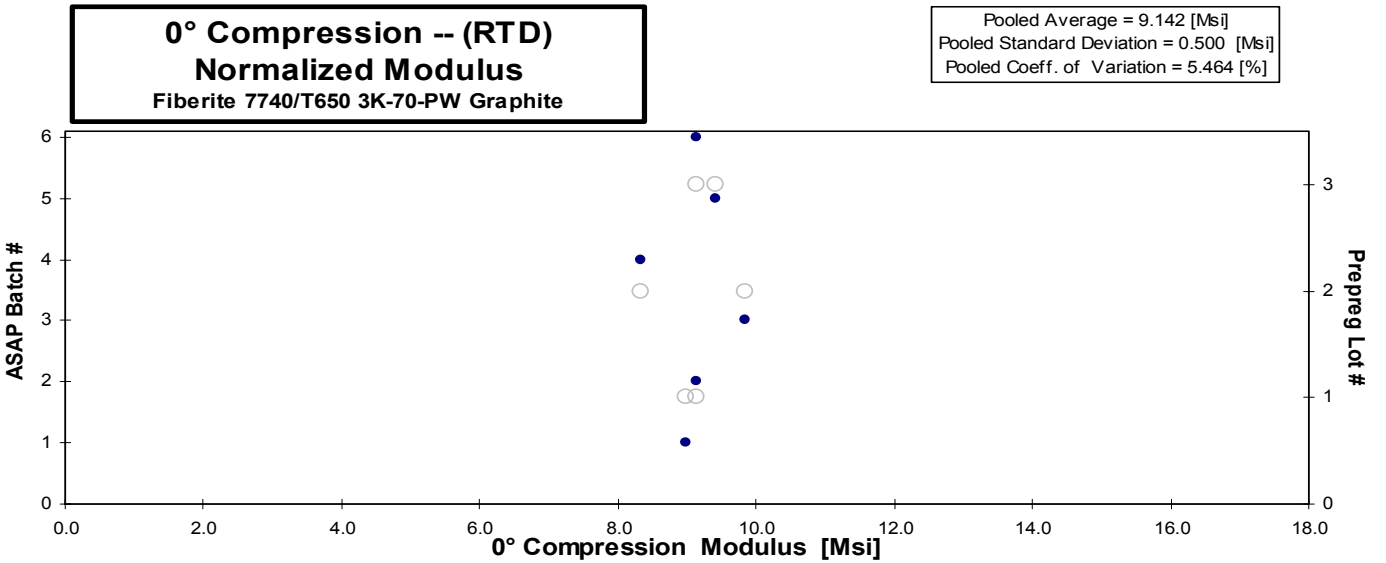
0° Compression -- (RTD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCK1116A	1	1	1	108.101		0.131	16	0.00822	112.420	
BCK1117A	1	1	1	99.603		0.132	16	0.00824	103.937	
BCK1118A	1	1	1	107.730		0.130	16	0.00815	111.118	
BCL11X6A	1	1	1		8.691	0.131	16	0.00818		8.996
BCK1218A	3	1	2	106.278		0.127	16	0.00794	106.845	
BCK1219A	3	1	2	109.619		0.122	16	0.00761	105.543	
BCK121BA	3	1	2	100.652		0.129	16	0.00808	102.921	
BCL12X6A	3	1	2		9.258	0.125	16	0.00779		9.133
BCK2116A	2	2	3	103.515		0.128	16	0.00803	105.214	
BCK2117A	2	2	3	101.821		0.129	16	0.00804	103.674	
BCK2118A	2	2	3	105.109		0.127	16	0.00794	105.650	
BCL21X6A	2	2	3		9.735	0.128	16	0.00799		9.843
BCK2216A	3	2	4	99.529		0.117	16	0.00734	92.482	
BCK2218A	3	2	4	98.212		0.119	16	0.00741	92.074	
BCK2219A	3	2	4	106.311		0.118	16	0.00738	99.309	
BCL22X6A	3	2	4		8.706	0.121	16	0.00756		8.329
BCK3117A	3	3	5	104.604		0.126	16	0.00785	103.963	
BCK3118A	3	3	5	102.512		0.124	16	0.00774	100.424	
BCK311AA	3	3	5	103.422		0.122	16	0.00763	99.903	
BCL31X6A	3	3	5		9.765	0.122	16	0.00761		9.412
BCK3227A	4	3	6	112.031		0.127	16	0.00794	112.607	
BCK3228A	4	3	6	110.001		0.126	16	0.00789	109.805	
BCK3229A	4	3	6	109.214		0.126	16	0.00788	108.890	
BCL32X6A	4	3	6		9.599	0.120	16	0.00752		9.142

Average	**104.904**	**9.292**	**$Average_{norm}$**	**0.00783**	**104.265**	**9.142**
Standard Dev.	**4.051**	**0.494**	**$Standard\ Dev._{norm}$**		**5.913**	**0.500**
Coeff. of Var. [%]	**3.862**	**5.317**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**5.671**	**5.464**
Min.	**98.212**	**8.691**	**Min.**	**0.0073**	**92.074**	**8.329**
Max.	**112.031**	**9.765**	**Max.**	**0.0082**	**112.607**	**9.843**
Number of Spec.	**18**	**6**	**Number of Spec.**		**18**	**6**



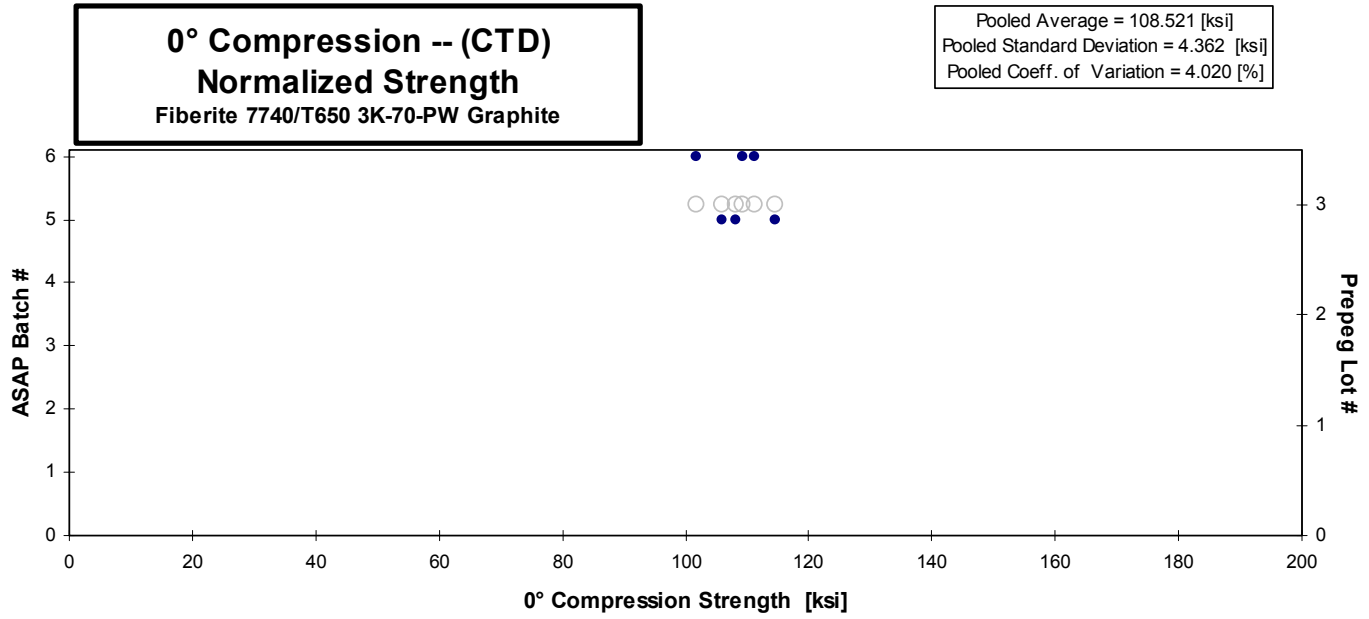


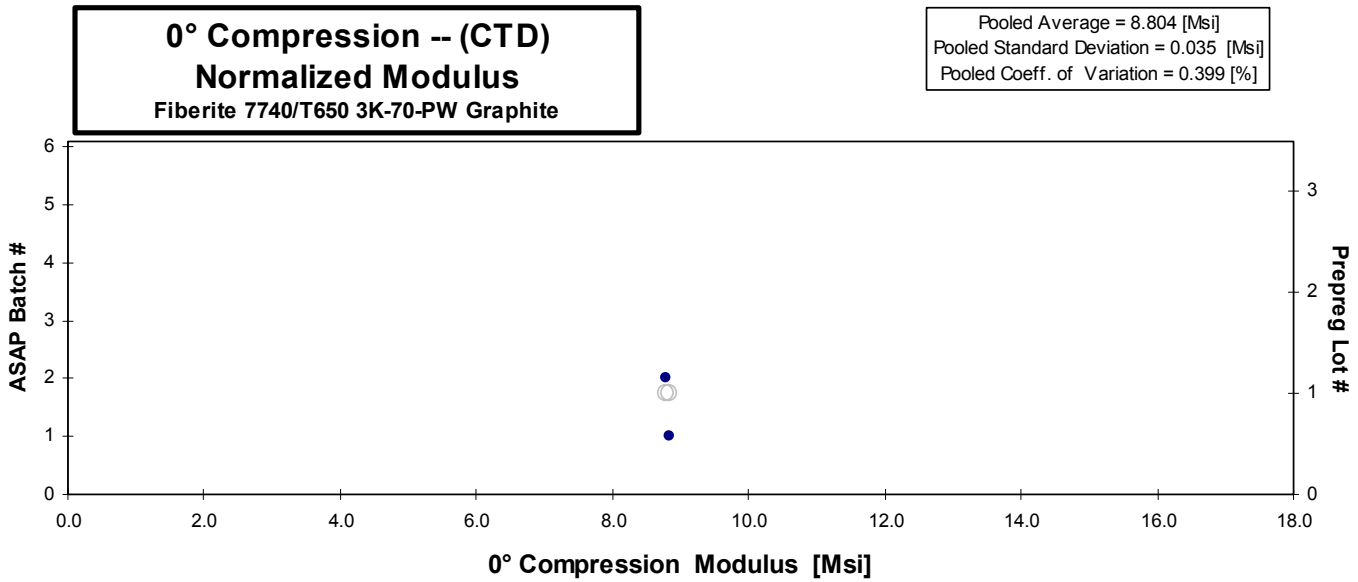
0° Compression -- (CTD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCL11X9B	1	1	1		8.616	0.130	16	0.00810		8.829
BCL12X9B	3	1	2		8.832	0.126	16	0.00785		8.779
BCK3122B	3	3	5	109.489		0.122	16	0.00765	105.959	
BCK3123B	3	3	5	113.297		0.121	16	0.00754	108.188	
BCK3124B	3	3	5	119.342		0.121	16	0.00759	114.668	
BCK3216B	4	3	6	111.421		0.126	16	0.00788	111.156	
BCK3217B	4	3	6	102.777		0.125	16	0.00784	101.943	
BCK3218B	4	3	6	110.699		0.125	16	0.00779	109.210	

Average	**111.171**	**8.724**	**$Average_{norm}$**	**0.00778**	**108.521**	**8.804**
Standard Dev.	**5.383**	**0.153**	**$Standard\ Dev._{norm}$**		**4.362**	**0.035**
Coeff. of Var. [%]	**4.842**	**1.749**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**4.020**	**0.399**
Min.	**102.777**	**8.616**	**Min.**	**0.0075**	**101.943**	**8.779**
Max.	**119.342**	**8.832**	**Max.**	**0.0081**	**114.668**	**8.829**
Number of Spec.	**6**	**2**	**Number of Spec.**		**6**	**2**



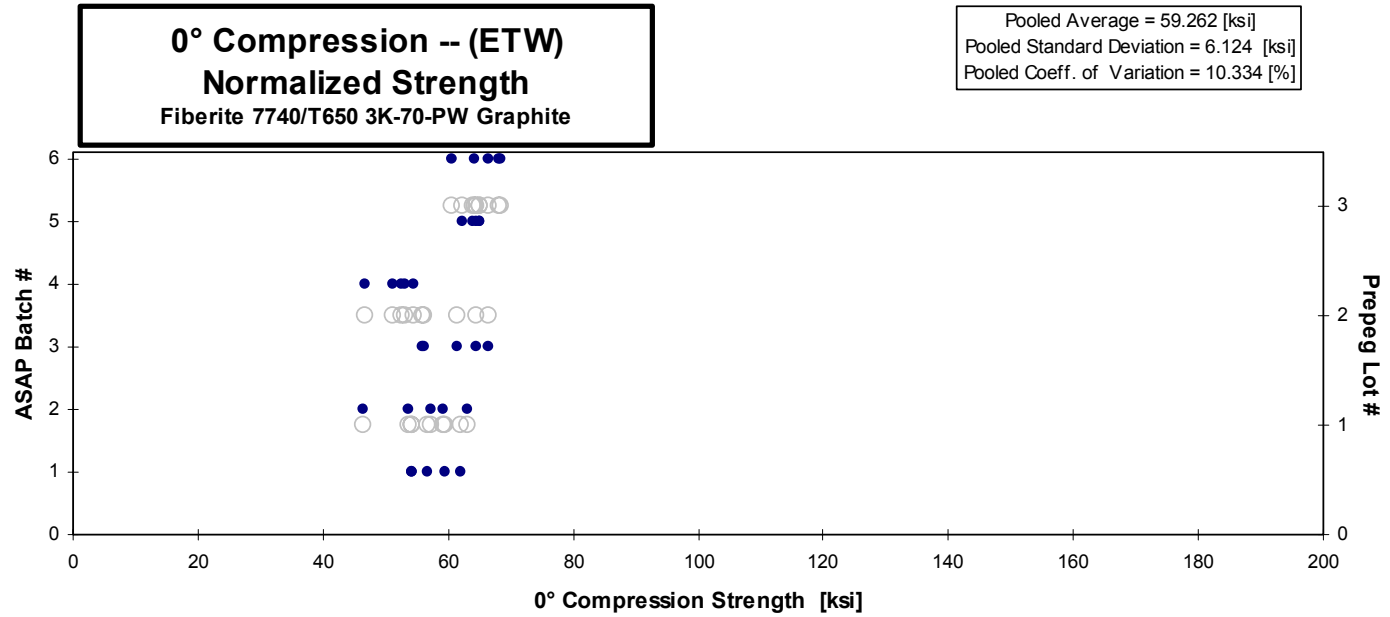


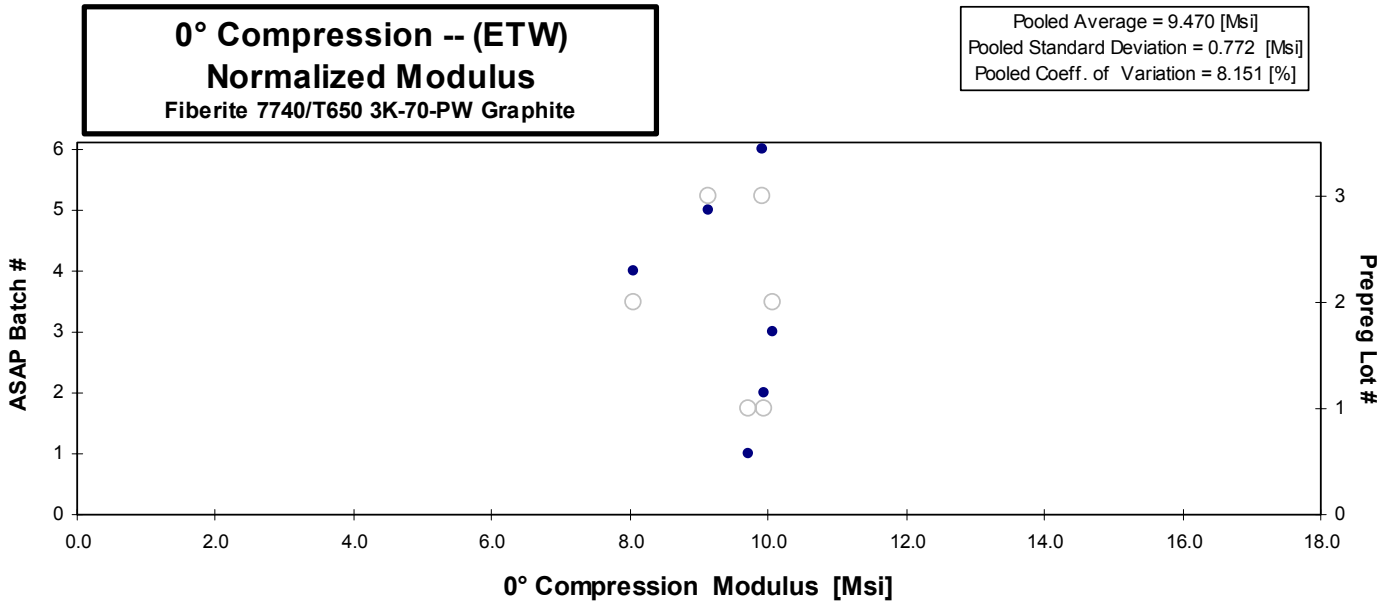
0° Compression -- (ETW)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCK1111F	1	1	1	51.781		0.132	16	0.00826	54.157	
BCK1112F	1	1	1	51.621		0.133	16	0.00829	54.153	
BCK1113F	1	1	1	57.288		0.131	16	0.00821	59.532	
BCK1114F	1	1	1	59.901		0.131	16	0.00818	61.998	
BCK1115F	1	1	1	55.347		0.129	16	0.00809	56.694	
BCL11X1F	1	1	1		9.472	0.130	16	0.00810		9.709
BCK1213F	3	1	2	45.891		0.128	16	0.00799	46.408	
BCK1214F	3	1	2	58.324		0.129	16	0.00804	59.351	
BCK1215F	3	1	2	61.471		0.130	16	0.00810	63.015	
BCK1216F	3	1	2	52.188		0.130	16	0.00811	53.582	
BCK1217F	3	1	2	56.796		0.127	16	0.00797	57.267	
BCL12X1F	3	1	2		9.989	0.126	16	0.00787		9.946
BCK2111F	2	2	3	55.081		0.128	16	0.00800	55.779	
BCK2112F	2	2	3	63.774		0.128	16	0.00801	64.644	
BCK2113F	2	2	3	57.197		0.124	16	0.00777	56.258	
BCK2114F	2	2	3	61.295		0.127	16	0.00791	61.392	
BCK2115F	2	2	3	65.984		0.127	16	0.00795	66.389	
BCL21X1F	2	2	3		9.977	0.127	16	0.00797		10.060
BCK2211F	3	2	4	51.044		0.116	16	0.00725	46.854	
BCK2212F	3	2	4	54.068		0.119	16	0.00746	51.063	
BCK2213F	3	2	4	57.748		0.119	16	0.00744	54.413	
BCK2214F	3	2	4	56.710		0.118	16	0.00739	53.043	
BCK2215F	3	2	4	56.018		0.119	16	0.00742	52.606	
BCL22X1F	3	2	4		8.902	0.114	16	0.00714		8.046
BCK3111F	3	3	5	65.936		0.125	16	0.00781	65.205	
BCK3113F	3	3	5	64.310		0.126	16	0.00787	64.081	
BCK3114F	3	3	5	64.653		0.126	16	0.00788	64.474	
BCK3115F	3	3	5	63.033		0.125	16	0.00782	62.360	
BCK3116F	3	3	5	65.208		0.126	16	0.00787	64.963	
BCL31X1F	3	3	5		9.576	0.121	16	0.00753		9.133
BCK3221F	4	3	6	66.159		0.127	16	0.00794	66.473	
BCK3222F	4	3	6	69.139		0.125	16	0.00783	68.551	
BCK3223F	4	3	6	68.081		0.127	16	0.00792	68.229	
BCK3224F	4	3	6	61.731		0.124	16	0.00778	60.779	
BCK3225F	4	3	6	63.496		0.128	16	0.00798	64.136	
BCL32X1F	4	3	6		9.921	0.126	16	0.00790		9.927

Average	**59.376**	**9.640**	**$Average_{norm}$**	**0.00786**	**59.262**	**9.470**
Standard Dev.	**5.799**	**0.422**	**$Standard\ Dev._{norm}$**		**6.124**	**0.772**
Coeff. of Var. [%]	**9.766**	**4.379**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**10.334**	**8.151**
Min.	**45.891**	**8.902**	**Min.**	**0.0071**	**46.408**	**8.046**
Max.	**69.139**	**9.989**	**Max.**	**0.0083**	**68.551**	**10.060**
Number of Spec.	**30**	**6**	**Number of Spec.**		**30**	**6**



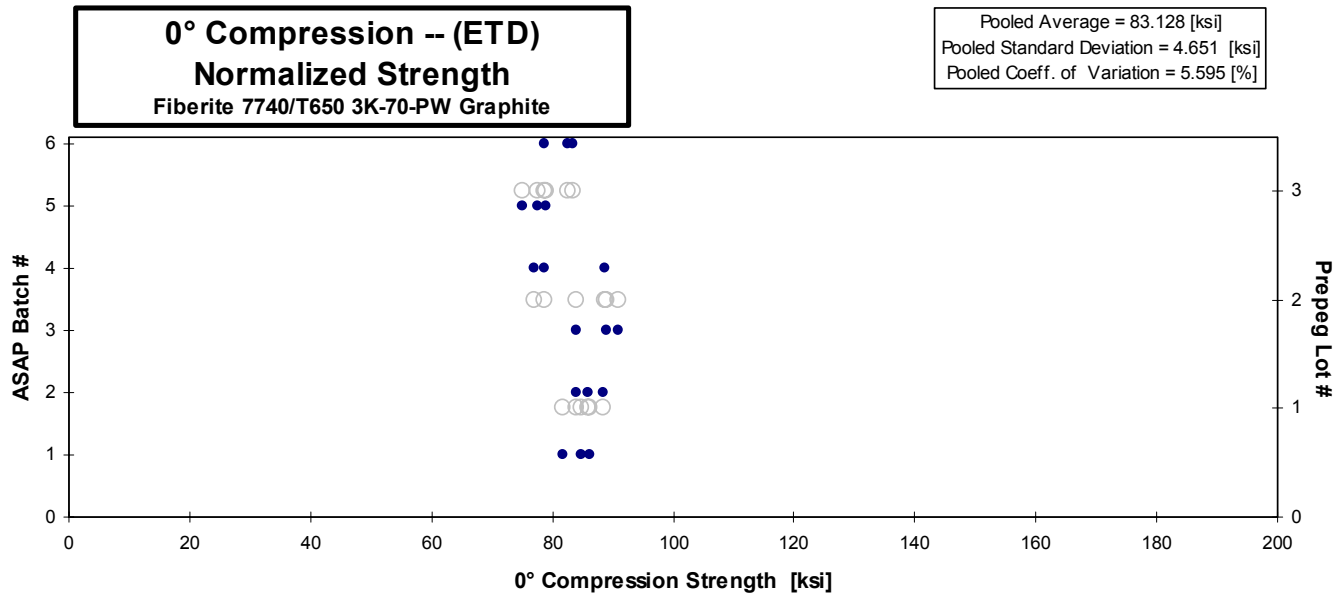


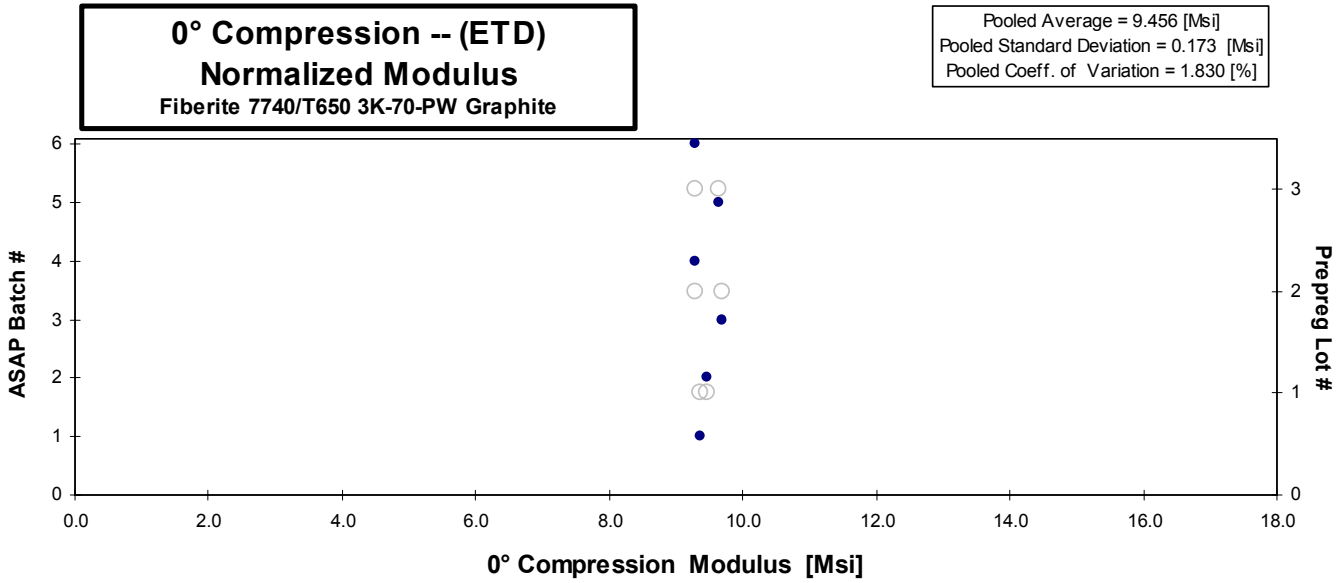
0° Compression -- (ETD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCK1119G	1	1	1	82.974		0.131	16	0.00822	86.306	
BCK111AG	1	1	1	78.843		0.131	16	0.00819	81.775	
BCK111BG	1	1	1	81.549		0.132	16	0.00822	84.839	
BCL11XCG	1	1	1		9.116	0.130	16	0.00811		9.363
BCK1227G	3	1	2	87.041		0.125	16	0.00780	85.905	
BCK1228G	3	1	2	89.490		0.125	16	0.00782	88.588	
BCK122AG	3	1	2	84.785		0.125	16	0.00782	83.930	
BCL12XCG	3	1	2		9.382	0.127	16	0.00796		9.457
BCK2129G	2	2	3	90.323		0.124	16	0.00778	88.948	
BCK211AG	2	2	3	89.746		0.128	16	0.00802	91.060	
BCK211BG	2	2	3	83.047		0.128	16	0.00799	84.000	
BCL21X9G	2	2	3		9.676	0.127	16	0.00792		9.698
BCK2221G	3	2	4	94.650		0.118	16	0.00740	88.604	
BCK2222G	3	2	4	81.595		0.122	16	0.00761	78.609	
BCK2223G	3	2	4	80.583		0.121	16	0.00756	77.140	
BCL22X9G	3	2	4		10.021	0.117	16	0.00733		9.295
BCK3126G	3	3	5	80.437		0.124	16	0.00776	79.037	
BCK3128G	3	3	5	76.987		0.124	16	0.00772	75.236	
BCK3129G	3	3	5	79.425		0.123	16	0.00771	77.540	
BCL31X9G	3	3	5		9.977	0.122	16	0.00763		9.630
BCK3211G	4	3	6	84.302		0.125	16	0.00782	83.468	
BCK3212G	4	3	6	78.680		0.126	16	0.00789	78.618	
BCK3213G	4	3	6	82.983		0.126	16	0.00787	82.704	
BCL32X9G	4	3	6		9.371	0.125	16	0.00783		9.293

Average	**83.747**	**9.591**	**$Average_{norm}$**	**0.00783**	**83.128**	**9.456**
Standard Dev.	**4.787**	**0.363**	**$Standard\ Dev._{norm}$**		**4.651**	**0.173**
Coeff. of Var. [%]	**5.716**	**3.785**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**5.595**	**1.830**
Min.	**76.987**	**9.116**	**Min.**	**0.0073**	**75.236**	**9.293**
Max.	**94.650**	**10.021**	**Max.**	**0.0082**	**91.060**	**9.698**
Number of Spec.	**18**	**6**	**Number of Spec.**		**18**	**6**



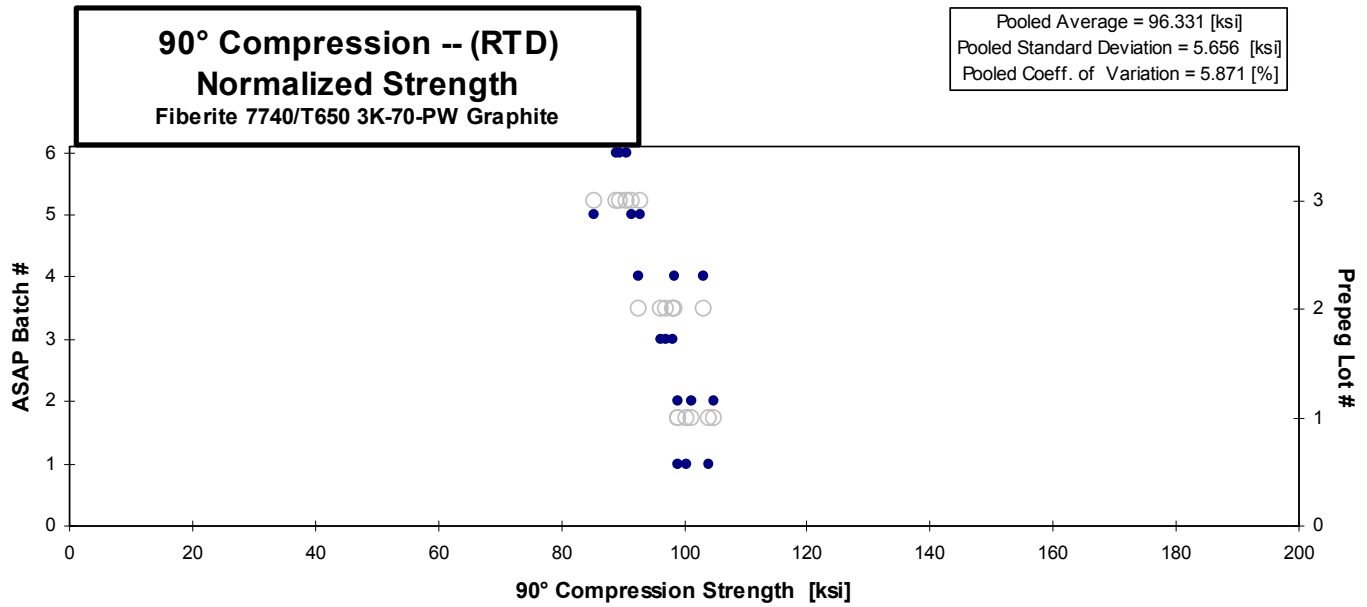


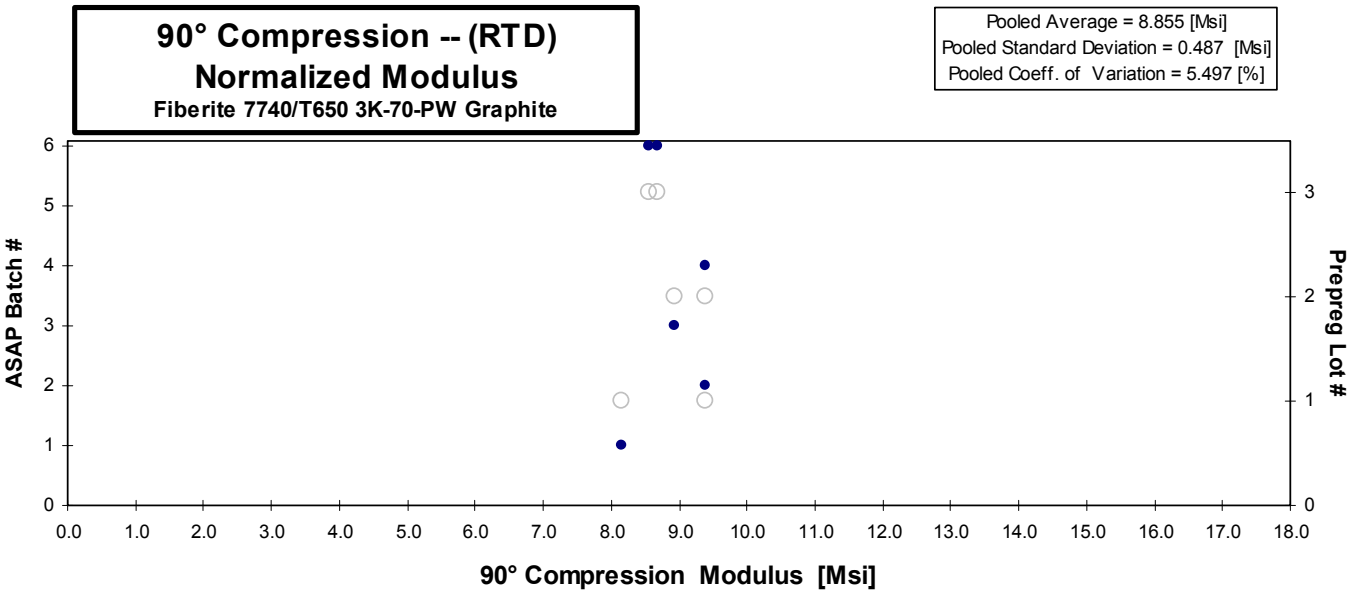
90° Compression -- (RTD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCW1121A	1	1	1	97.472		0.130	16	0.00814	100.422	
BCW1122A	1	1	1	96.484		0.130	16	0.00811	99.003	
BCW1123A	1	1	1	103.422		0.127	16	0.00794	103.954	
BCZ11X7A	1	1	1		7.947	0.130	16	0.00812		8.165
BCW1221A	3	1	2	101.129		0.127	16	0.00792	101.389	
BCW1222A	3	1	2	98.750		0.127	16	0.00793	99.082	
BCW1223A	3	1	2	104.312		0.127	16	0.00793	104.746	
BCZ12X6A	3	1	2		9.600	0.124	16	0.00773		9.397
BCW2127A	2	2	3	97.620		0.127	16	0.00795	98.295	
BCW2128A	2	2	3	96.837		0.127	16	0.00792	97.105	
BCW2129A	2	2	3	95.391		0.128	16	0.00798	96.334	
BCZ21X6A	2	2	3		8.887	0.127	16	0.00793		8.925
BCW2216A	3	2	4	98.033		0.120	16	0.00747	92.720	
BCW2217A	3	2	4	104.291		0.120	16	0.00747	98.598	
BCW2218A	3	2	4	108.391		0.120	16	0.00753	103.246	
BCZ22X6A	3	2	4		10.113	0.117	16	0.00734		9.395
BCW31X2A	3	3	5	92.751		0.125	16	0.00780	91.522	
BCW31X3A	3	3	5	94.607		0.124	16	0.00777	92.998	
BCW31X4A	3	3	5	86.254		0.125	16	0.00781	85.264	
BCW3116A	4	3	6	89.247		0.127	16	0.00793	89.635	
BCW3117A	4	3	6	88.073		0.128	16	0.00799	89.048	
BCW3118A	4	3	6	90.531		0.127	16	0.00791	90.603	
BCZ31X6A	4	3	6		8.624	0.127	16	0.00797		8.695
BCZ32X6A	4	3	6		8.474	0.128	16	0.00797		8.550

Average	**96.866**	**8.941**	**$Average_{norm}$**	**0.00786**	**96.331**	**8.855**
Standard Dev.	**6.053**	**0.790**	**Standard $Dev._{norm}$**		**5.656**	**0.487**
Coeff. of Var. [%]	**6.249**	**8.832**	**Coeff. of Var. $[\%]_{norm}$**		**5.871**	**5.497**
Min.	**86.254**	**7.947**	**Min.**	**0.0073**	**85.264**	**8.165**
Max.	**108.391**	**10.113**	**Max.**	**0.0081**	**104.746**	**9.397**
Number of Spec.	**18**	**6**	**Number of Spec.**		**18**	**6**



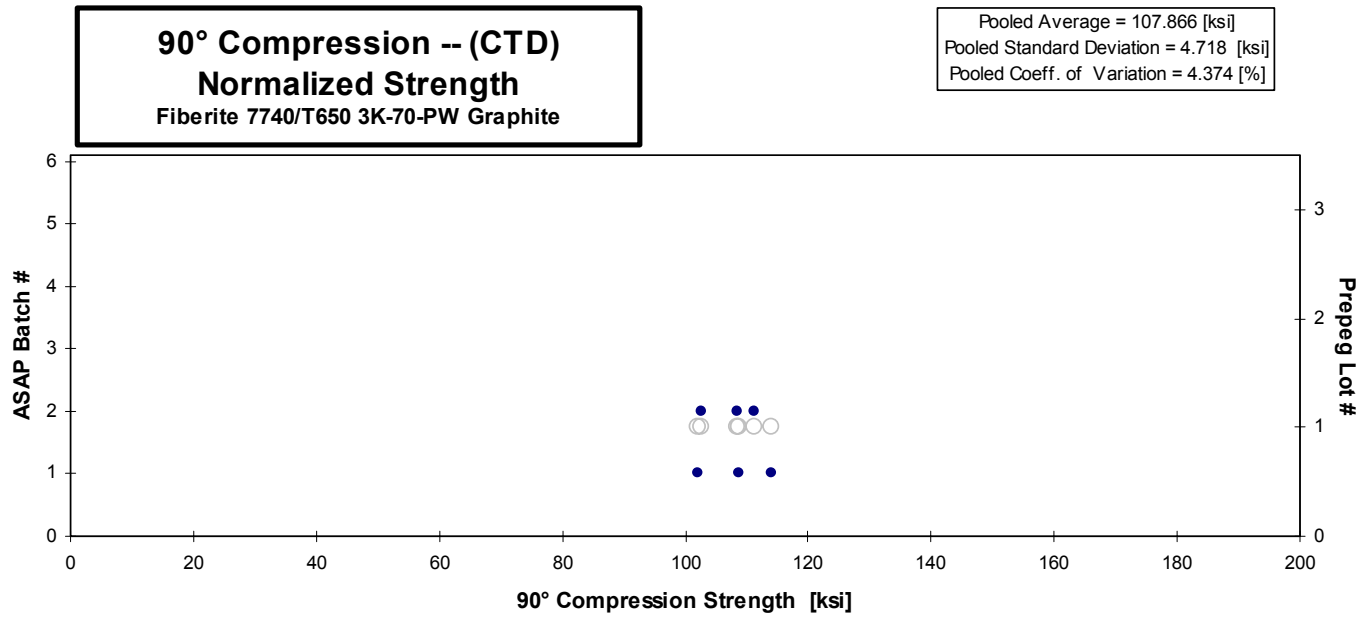


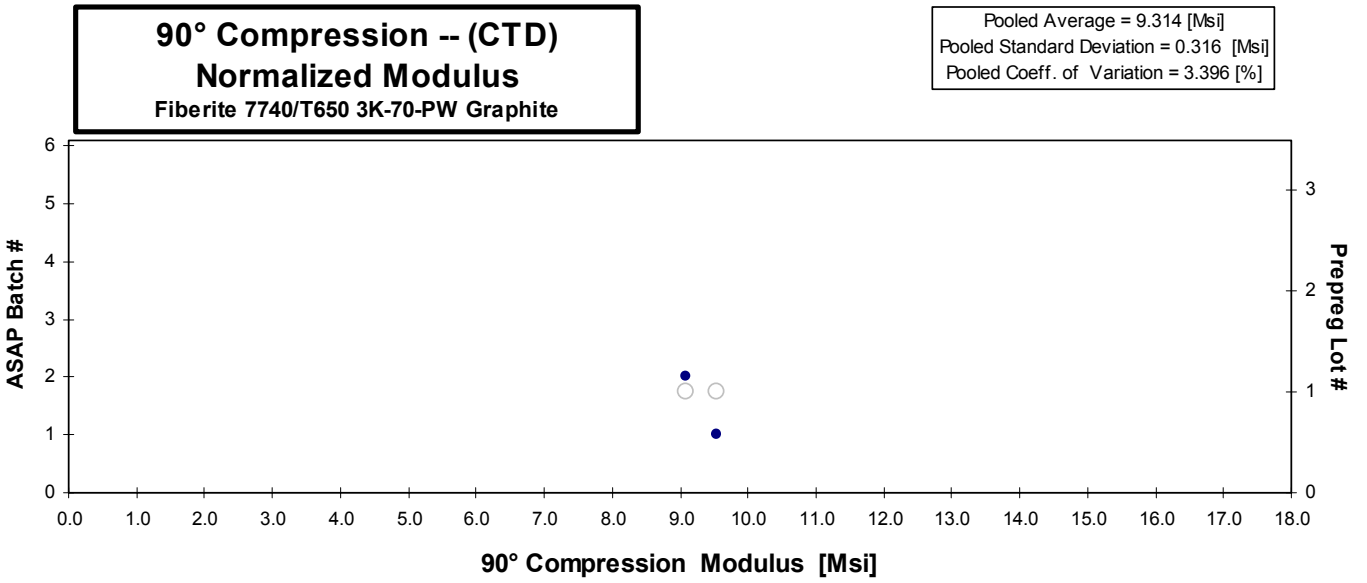
90° Compression -- (CTD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCW1125B	1	1	1	107.152		0.128	16	0.00801	108.699	
BCW1126B	1	1	1	112.311		0.128	16	0.00802	114.022	
BCW1127B	1	1	1	99.993		0.129	16	0.00806	101.990	
BCZ11X9B	1	1	1		9.277	0.130	16	0.00812		9.537
BCW1211B	3	1	2	111.126		0.123	16	0.00771	108.423	
BCW1214B	3	1	2	105.107		0.124	16	0.00772	102.758	
BCW1215B	3	1	2	114.775		0.123	16	0.00766	111.302	
BCZ12X9B	3	1	2		9.268	0.124	16	0.00775		9.090

Average	**108.411**	**9.272**	**$Average_{norm}$**	**0.00788**	**107.866**	**9.314**
Standard Dev.	**5.412**	**0.006**	**$Standard\ Dev._{norm}$**		**4.718**	**0.316**
Coeff. of Var. [%]	**4.992**	**0.068**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**4.374**	**3.396**
Min.	**99.993**	**9.268**	**Min.**	**0.0077**	**101.990**	**9.090**
Max.	**114.775**	**9.277**	**Max.**	**0.0081**	**114.022**	**9.537**
Number of Spec.	**6**	**2**	**Number of Spec.**		**6**	**2**



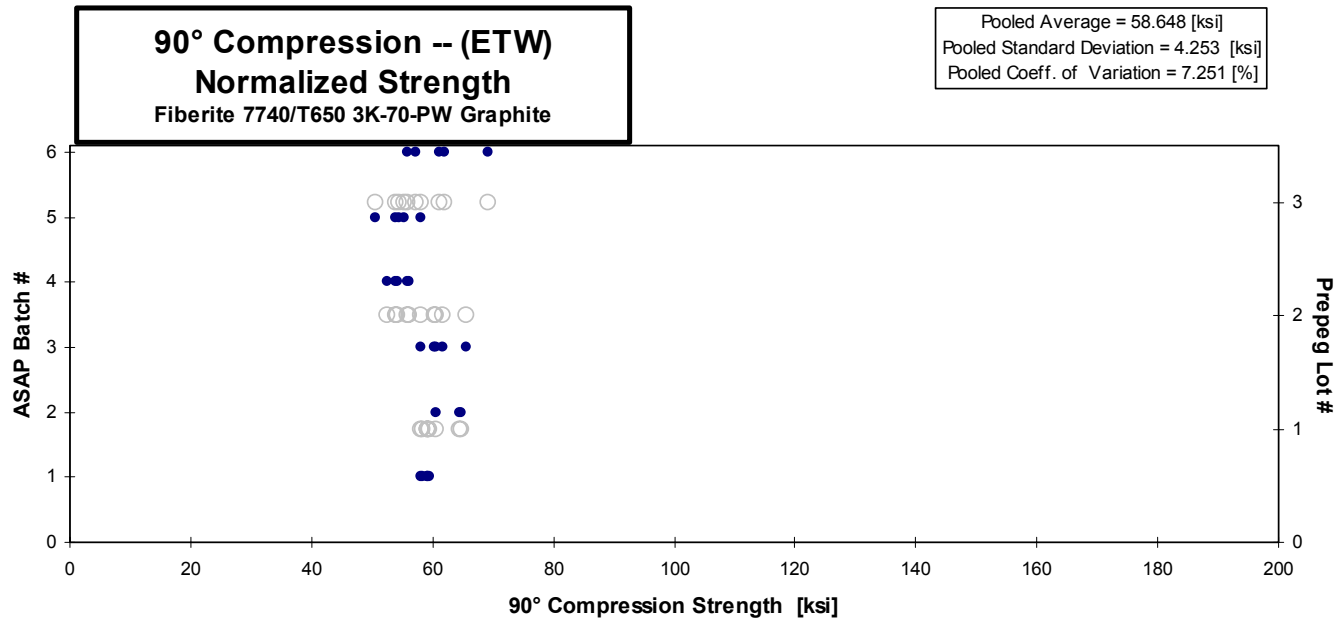


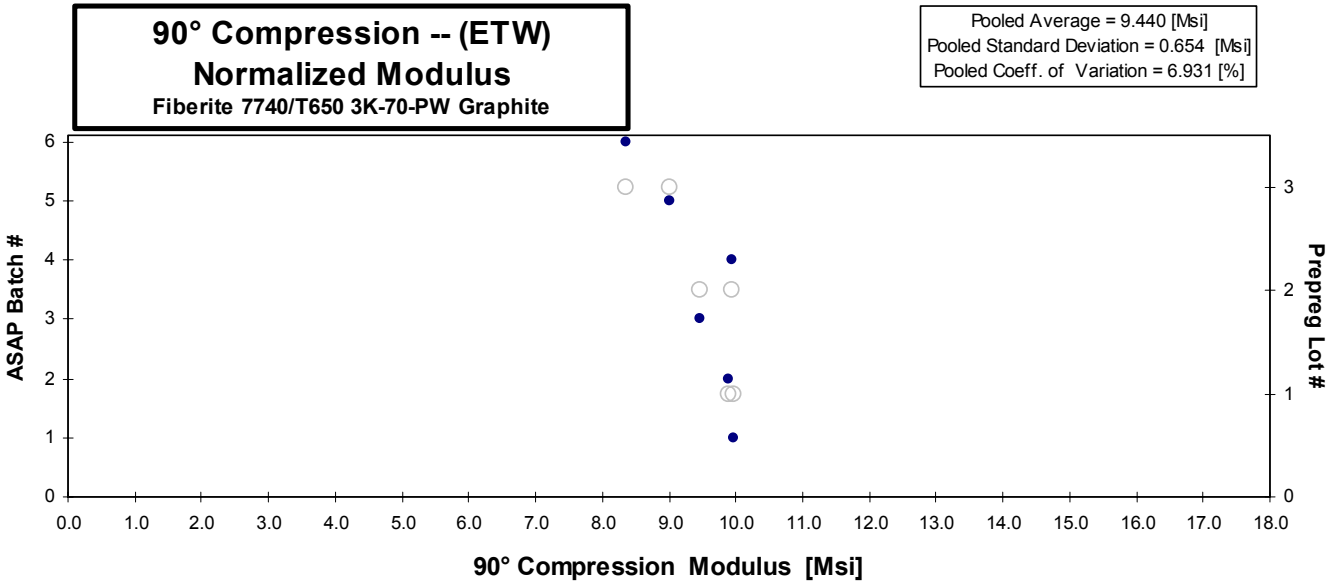
90° Compression -- (ETW)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCW1118F	1	1	1	59.856		0.125	16	0.00784	59.370	
BCW1119F	1	1	1	59.323		0.126	16	0.00789	59.229	
BCW111AF	1	1	1	56.971		0.130	16	0.00811	58.504	
BCW111BF	1	1	1	57.588		0.127	16	0.00797	58.078	
BCW111CF	1	1	1	59.199		0.127	16	0.00796	59.620	
BCZ11X1F	1	1	1		9.674	0.130	16	0.00815		9.976
BCW1228F	3	1	2	64.187		0.128	16	0.00797	64.784	
BCW1229F	3	1	2	59.971		0.128	16	0.00798	60.600	
BCW122BF	3	1	2	63.578		0.128	16	0.00802	64.571	
BCZ12X2F	3	1	2		10.383	0.120	16	0.00753		9.892
BCW2121F	2	2	3	57.800		0.127	16	0.00794	58.109	
BCW2122F	2	2	3	59.839		0.127	16	0.00795	60.242	
BCW2123F	2	2	3	62.782		0.125	16	0.00779	61.876	
BCW2124F	2	2	3	64.995		0.128	16	0.00797	65.573	
BCW2125F	2	2	3	60.639		0.126	16	0.00789	60.531	
BCZ21X1F	2	2	3		9.342	0.128	16	0.00800		9.464
BCW2211F	3	2	4	59.405		0.119	16	0.00743	55.833	
BCW2212F	3	2	4	55.027		0.121	16	0.00755	52.568	
BCW2213F	3	2	4	56.558		0.120	16	0.00753	53.896	
BCW2214F	3	2	4	57.464		0.120	16	0.00747	54.350	
BCW2215F	3	2	4	59.706		0.119	16	0.00744	56.258	
BCZ22X1F	3	2	4		10.803	0.116	16	0.00728		9.954
BCW3211F	4	3	5	54.252		0.127	16	0.00795	54.606	
BCW3212F	4	3	5	50.061		0.128	16	0.00797	50.507	
BCW3213F	4	3	5	54.580		0.128	16	0.00800	55.303	
BCW3214F	4	3	5	53.574		0.128	16	0.00798	54.094	
BCW3215F	4	3	5	57.283		0.128	16	0.00801	58.098	
BCZ31X1F	4	3	5		8.925	0.128	16	0.00797		9.008
BCW3111F	4	3	6	69.124		0.127	16	0.00791	69.233	
BCW3112F	4	3	6	62.089		0.126	16	0.00789	62.027	
BCW3113F	4	3	6	55.656		0.127	16	0.00795	56.008	
BCW3114F	4	3	6	57.226		0.126	16	0.00790	57.215	
BCW3115F	4	3	6	60.519		0.128	16	0.00797	61.070	
BCZ32X1F	4	3	6		8.359	0.126	16	0.00789		8.346

Average	**58.902**	**9.581**	**Average$_{norm}$**	**0.00785**	**58.648**	**9.440**
Standard Dev.	**3.936**	**0.908**	**Standard Dev.$_{norm}$**		**4.253**	**0.654**
Coeff. of Var. [%]	**6.683**	**9.479**	**Coeff. of Var. [%]$_{norm}$**		**7.251**	**6.931**
Min.	**50.061**	**8.359**	**Min.**	**0.0073**	**50.507**	**8.346**
Max.	**69.124**	**10.803**	**Max.**	**0.0081**	**69.233**	**9.976**
Number of Spec.	**28**	**6**	**Number of Spec.**		**28**	**6**



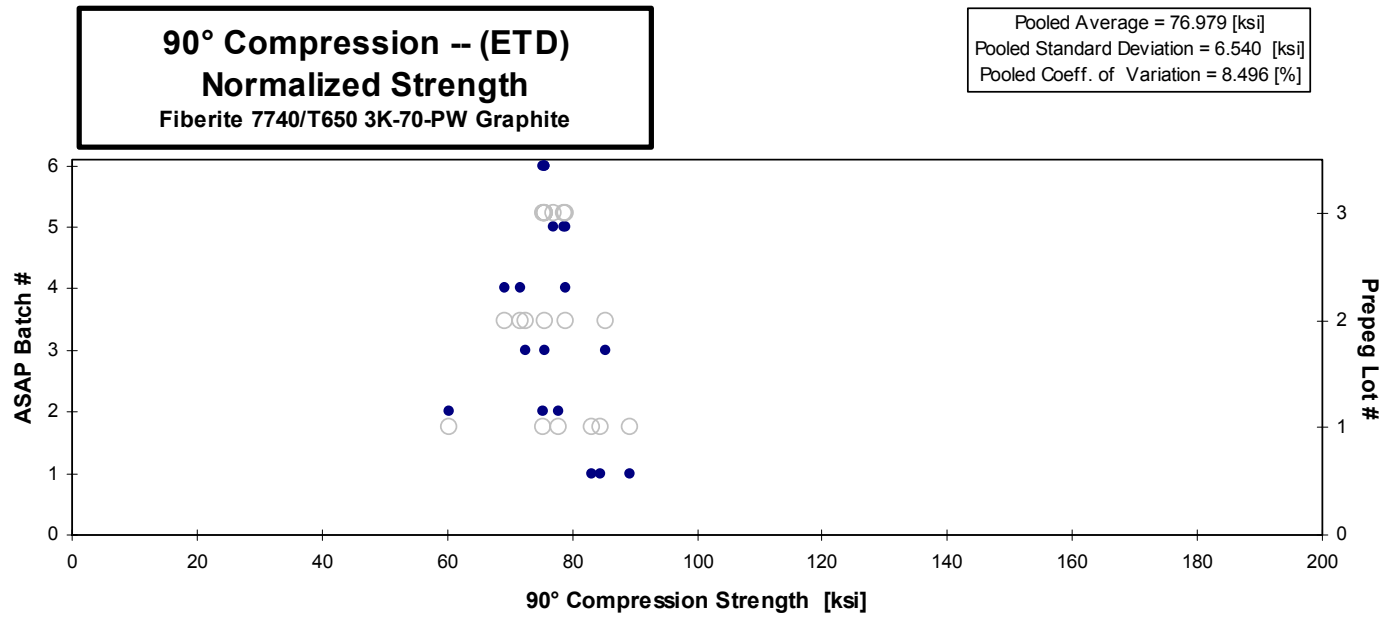


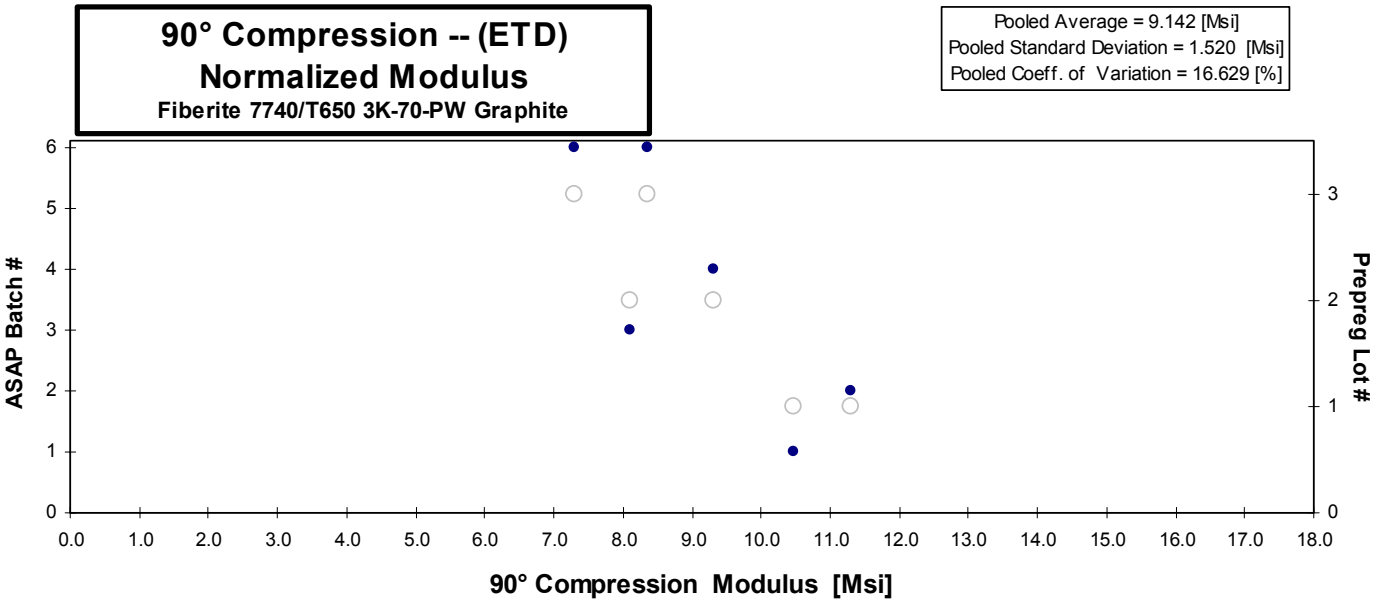
90° Compression -- (ETD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

normalizing t_{ply} [in]: 0.0079

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
BCW1129G	1	1	1	86.821		0.130	16	0.00814	89.414	
BCW112AG	1	1	1	80.597		0.130	16	0.00814	83.036	
BCW112BG	1	1	1	83.353		0.128	16	0.00801	84.540	
BCZ11XCG	1	1	1		10.181	0.130	16	0.00813		10.477
BCW1217G	3	1	2	61.895		0.123	16	0.00770	60.340	
BCW1219G	3	1	2	79.236		0.124	16	0.00776	77.810	
BCW121AG	3	1	2	78.951		0.120	16	0.00753	75.251	
BCZ12XCG	3	1	2		11.543	0.124	16	0.00773		11.299
BCW2111G	2	2	3	85.997		0.126	16	0.00786	85.520	
BCW2112G	2	2	3	73.745		0.125	16	0.00778	72.636	
BCW2113G	2	2	3	75.925		0.126	16	0.00788	75.684	
BCZ21X9G	2	2	3		8.015	0.128	16	0.00799		8.106
BCW2222G	3	2	4	73.630		0.119	16	0.00742	69.159	
BCW2223G	3	2	4	85.263		0.117	16	0.00732	79.007	
BCW2226G	3	2	4	77.304		0.117	16	0.00734	71.815	
BCZ22XAG	3	2	4		9.908	0.119	16	0.00742		9.311
BCW31X6G	3	3	5	80.265		0.124	16	0.00773	78.582	
BCW31X7G	3	3	5	80.960		0.123	16	0.00772	79.071	
BCW31X9G	3	3	5	78.020		0.125	16	0.00779	76.971	
BCW3121G	4	3	6	74.900		0.128	16	0.00799	75.715	
BCW3122G	4	3	6	75.154		0.127	16	0.00795	75.630	
BCW3123G	4	3	6	75.268		0.127	16	0.00792	75.446	
BCZ31X9G	4	3	6		7.193	0.128	16	0.00801		7.293
BCZ32X9G	4	3	6		8.332	0.127	16	0.00793		8.367

Average	**78.182**	**9.195**	**$Average_{norm}$**	**0.00780**	**76.979**	**9.142**
Standard Dev.	**5.802**	**1.621**	**Standard $Dev._{norm}$**		**6.540**	**1.520**
Coeff. of Var. [%]	**7.421**	**17.627**	**Coeff. of Var. $[\%]_{norm}$**		**8.496**	**16.629**
Min.	**61.895**	**7.193**	**Min.**	**0.0073**	**60.340**	**7.293**
Max.	**86.821**	**11.543**	**Max.**	**0.0081**	**89.414**	**11.299**
Number of Spec.	**18**	**6**	**Number of Spec.**		**18**	**6**

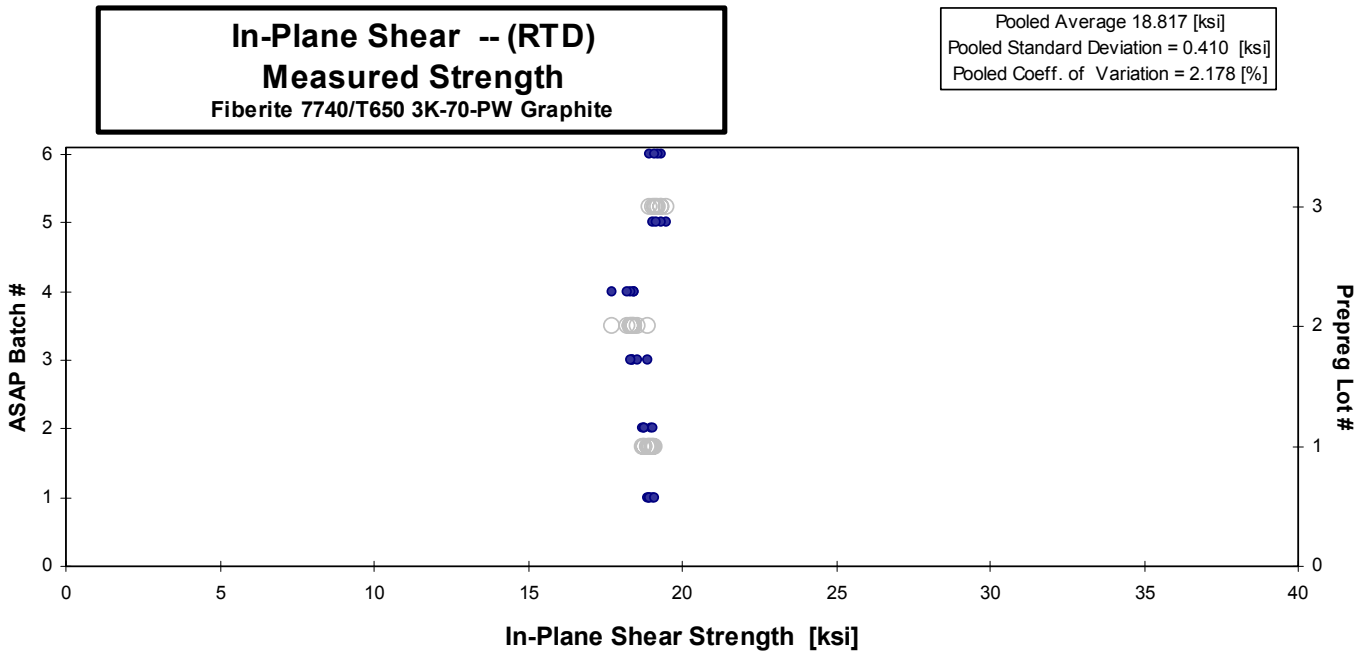


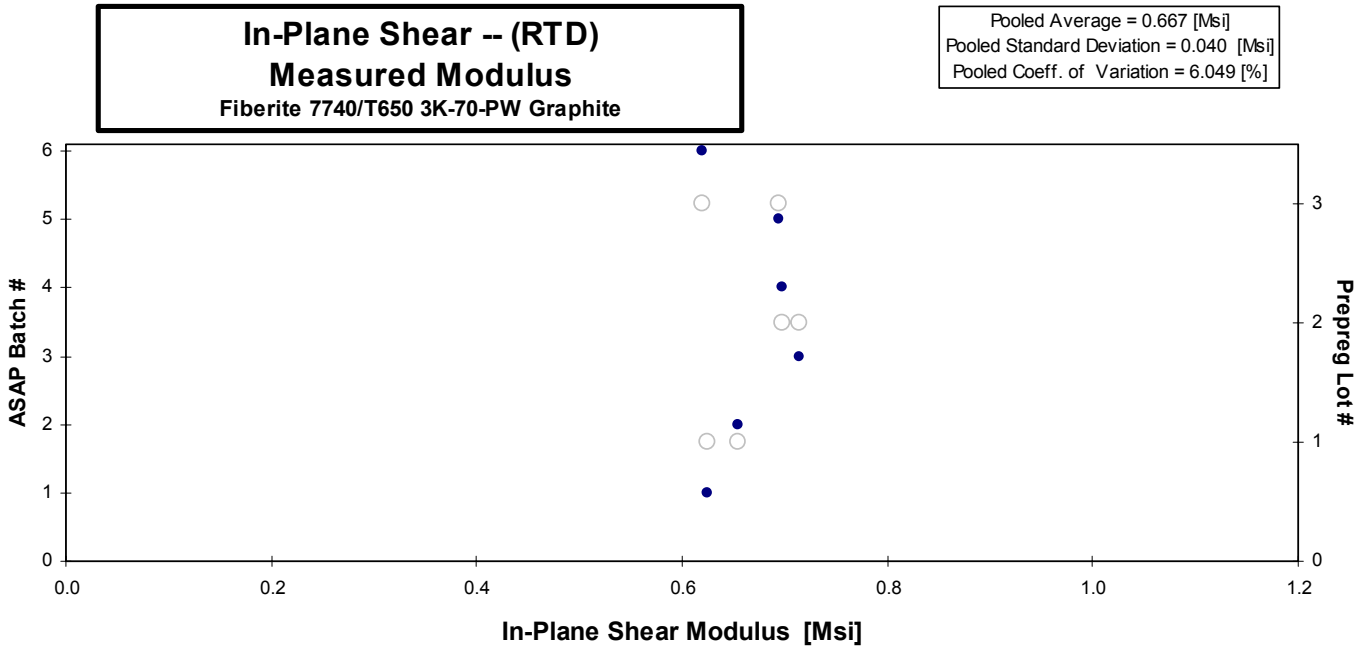


In-Plane Shear -- (RTD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
BCN1116A	1	1	1	18.868	0.624	0.145	18	0.00805
BCN1117A	1	1	1	18.944		0.146	18	0.00812
BCN1118A	1	1	1	19.074		0.146	18	0.00810
BCN1119A	1	1	1	18.924		0.146	18	0.00809
BCN111AA	1	1	1	19.139		0.146	18	0.00810
BCN1216A	4	1	2	19.024	0.655	0.146	18	0.00814
BCN1217A	4	1	2	19.081		0.140	18	0.00778
BCN1218A	4	1	2	18.711		0.146	18	0.00811
BCN1219A	4	1	2	18.773		0.146	18	0.00812
BCN121AA	4	1	2	18.797		0.145	18	0.00806
BCN2116A	2	2	3	18.901	0.714	0.142	18	0.00786
BCN2117A	2	2	3	18.392		0.142	18	0.00788
BCN2118A	2	2	3	18.399		0.142	18	0.00790
BCN2119A	2	2	3	18.563		0.140	18	0.00780
BCN211AA	2	2	3	18.352		0.141	18	0.00785
BCN2216A	3	2	4	18.442	0.697	0.142	18	0.00790
BCN2217A	3	2	4	18.474		0.136	18	0.00753
BCN2218A	3	2	4	18.323		0.142	18	0.00790
BCN2219A	3	2	4	17.710		0.142	18	0.00787
BCN221AA	3	2	4	18.244		0.142	18	0.00789
BCN3112A	3	3	5	19.526	0.695	0.148	18	0.00820
BCN3113A	3	3	5	19.045		0.149	18	0.00826
BCN3114A	3	3	5	19.339		0.149	18	0.00825
BCN3115A	3	3	5	19.189		0.149	18	0.00826
BCN3216A	4	3	6	19.333	0.619	0.140	18	0.00778
BCN3217A	4	3	6	18.969		0.141	18	0.00783
BCN3218A	4	3	6	19.227		0.140	18	0.00779
BCN321AA	4	3	6	19.111		0.142	18	0.00786

Average	**18.817**	**0.667**		**0.0080**
Standard Dev.	**0.410**	**0.040**		
Coeff. of Var. [%]	**2.178**	**6.049**		
Min.	**17.710**	**0.619**	**Min.**	**0.0075**
Max.	**19.526**	**0.714**	**Max.**	**0.0083**
Number of Spec.	**28**	**6**		

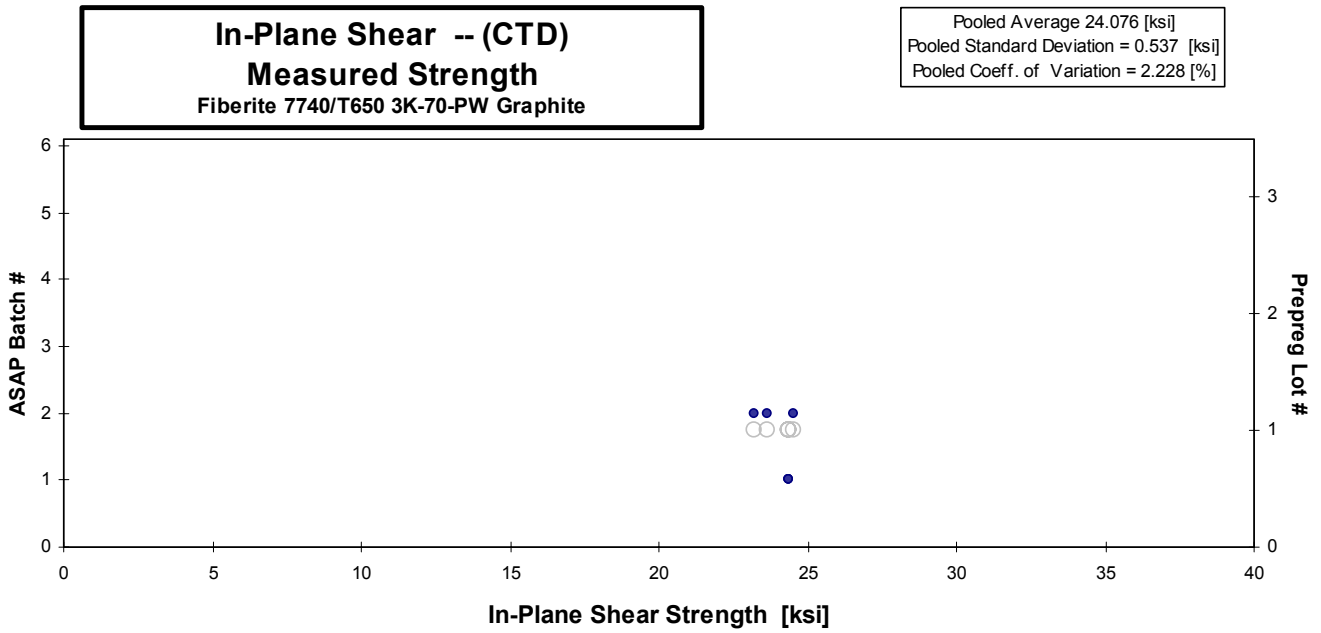


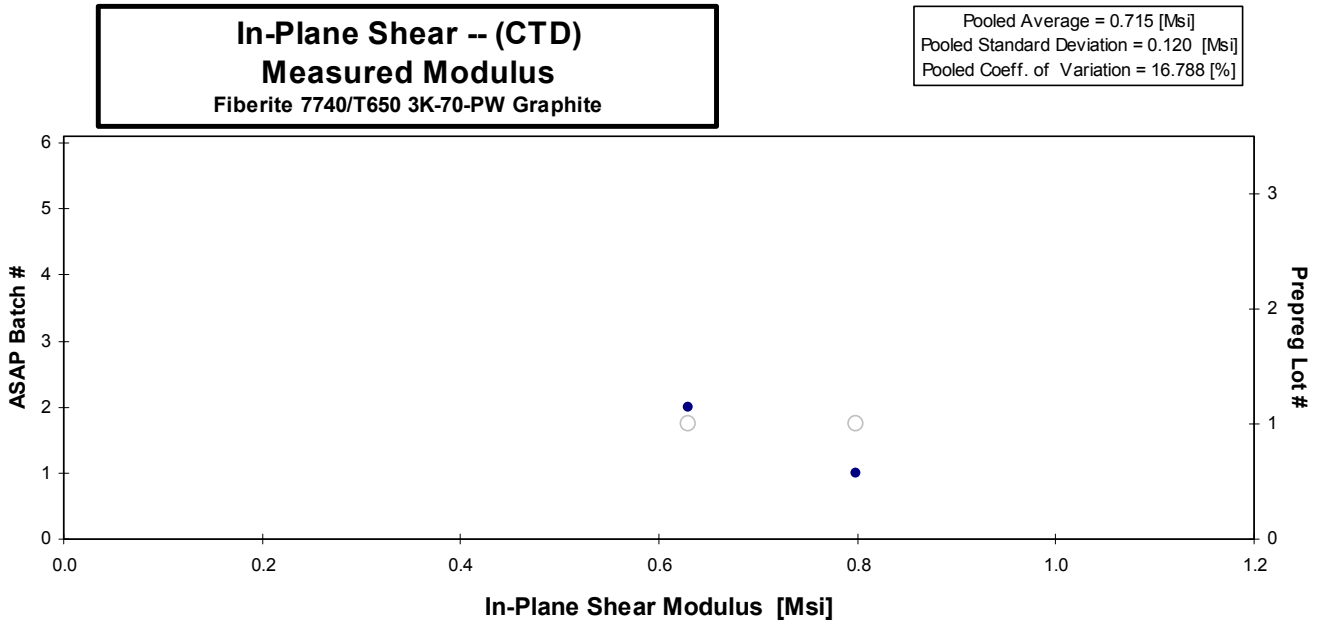


In-Plane Shear -- (CTD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
BCN1128B	1	1	1	24.360	0.799	0.144	18	0.00799
BCN1129B	1	1	1	24.386		0.144	18	0.00801
BCN112AB	1	1	1	24.349		0.143	18	0.00792
BCN1226B	4	1	2	23.195	0.630	0.143	18	0.00796
BCN1227B	4	1	2	24.537		0.143	18	0.00792
BCN1228B	4	1	2	23.630		0.144	18	0.00799

Average	**24.076**	**0.715**		**0.0080**
Standard Dev.	**0.537**	**0.120**		
Coeff. of Var. [%]	**2.228**	**16.788**		
Min.	**23.195**	**0.630**	**Min.**	**0.0079**
Max.	**24.537**	**0.799**	**Max.**	**0.0080**
Number of Spec.	**6**	**2**		

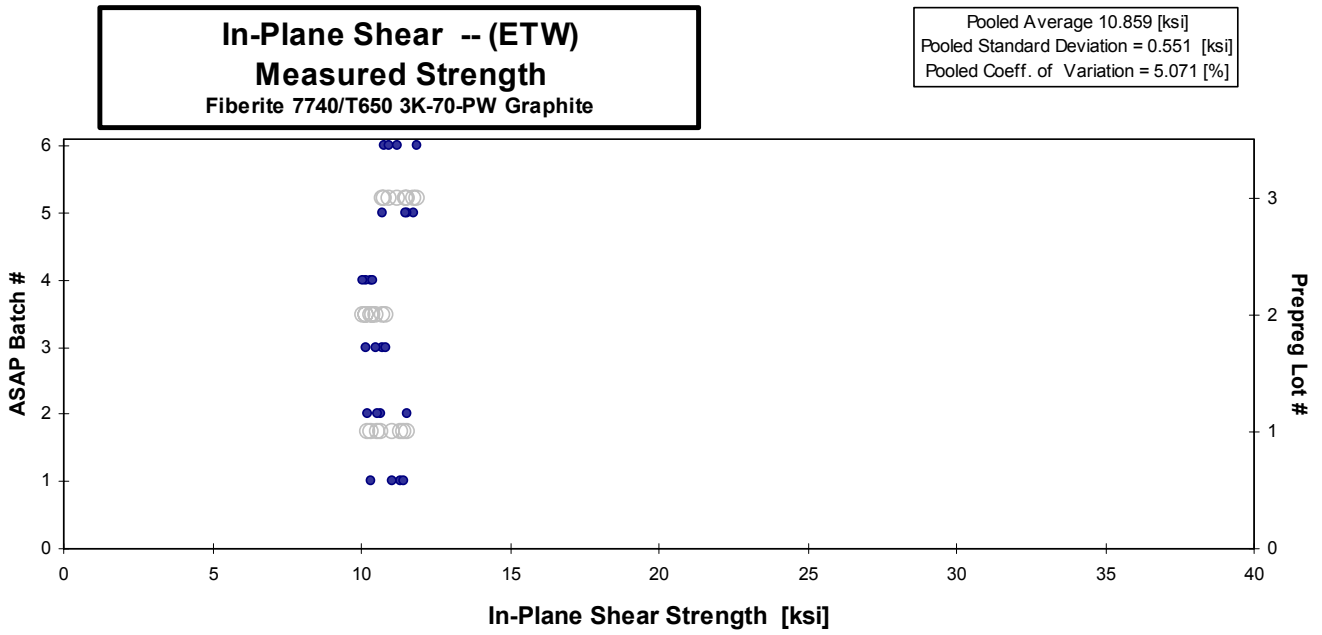


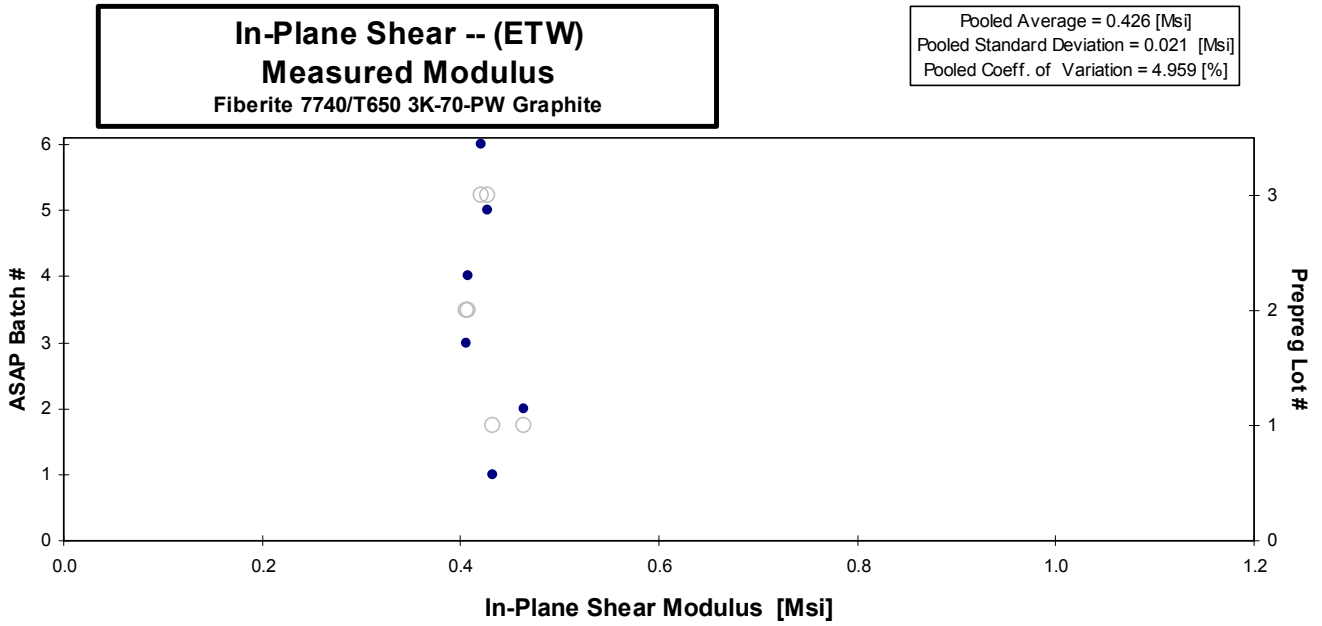


In-Plane Shear -- (ETW)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
BCN1112F	1	1	1	10.353		0.144	18	0.00800
BCN1113F	1	1	1	11.351	0.433	0.145	18	0.00803
BCN1114F	1	1	1	11.420		0.143	18	0.00792
BCN1115F	1	1	1	11.051		0.146	18	0.00812
BCN1212F	4	1	2	10.229		0.146	18	0.00811
BCN1213F	4	1	2	11.565	0.464	0.146	18	0.00812
BCN1214F	4	1	2	10.673		0.145	18	0.00804
BCN1215F	4	1	2	10.526		0.147	18	0.00816
BCN2112F	2	2	3	10.700		0.142	18	0.00790
BCN2113F	2	2	3	10.189	0.406	0.142	18	0.00791
BCN2114F	2	2	3	10.841		0.143	18	0.00793
BCN2115F	2	2	3	10.490		0.142	18	0.00789
BCN2212F	3	2	4	10.338		0.140	18	0.00780
BCN2213F	3	2	4	10.180	0.408	0.141	18	0.00783
BCN2214F	3	2	4	10.040		0.141	18	0.00781
BCN2215F	3	2	4	10.365		0.140	18	0.00777
BCN3126F	3	3	5	10.738		0.147	18	0.00816
BCN3127F	3	3	5	11.748	0.427	0.146	18	0.00811
BCN3128F	3	3	5	11.533		0.148	18	0.00820
BCN312AF	3	3	5	11.486		0.137	18	0.00763
BCN3212F	4	3	6	10.762		0.143	18	0.00792
BCN3213F	4	3	6	11.870	0.421	0.142	18	0.00790
BCN3214F	4	3	6	10.943		0.141	18	0.00783
BCN3215F	4	3	6	11.223		0.141	18	0.00785

Average	**10.859**	**0.426**		**0.0080**
Standard Dev.	**0.551**	**0.021**		
Coeff. of Var. [%]	**5.071**	**4.959**		
Min.	**10.040**	**0.406**	**Min.**	**0.0076**
Max.	**11.870**	**0.464**	**Max.**	**0.0082**
Number of Spec.	**24**	**6**		

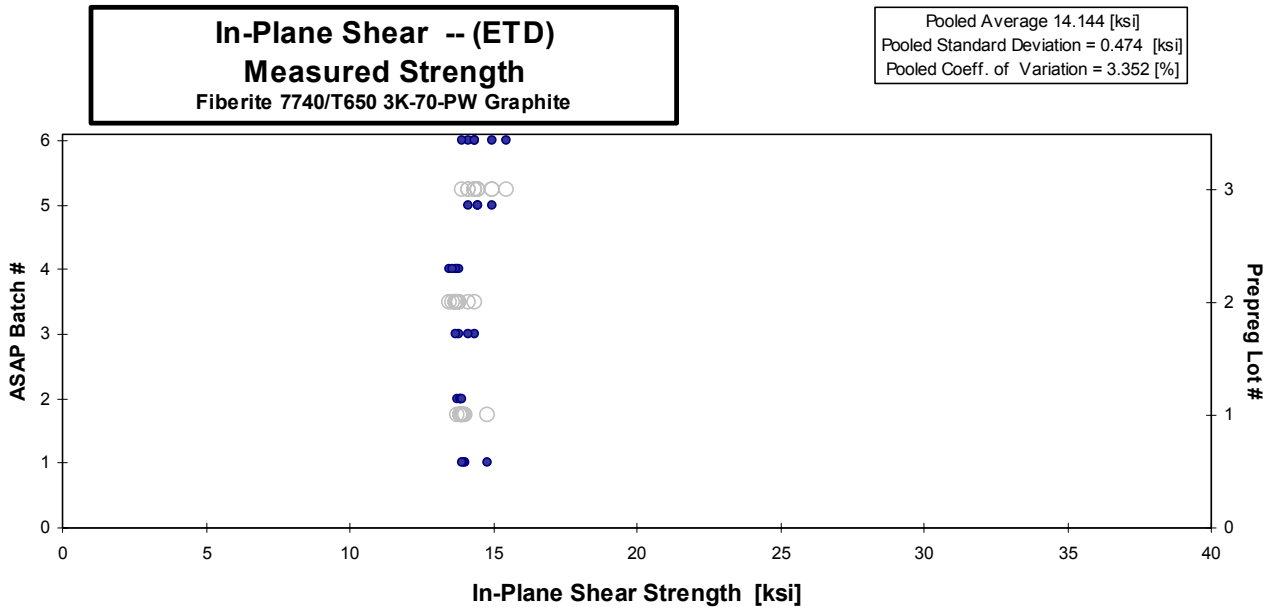


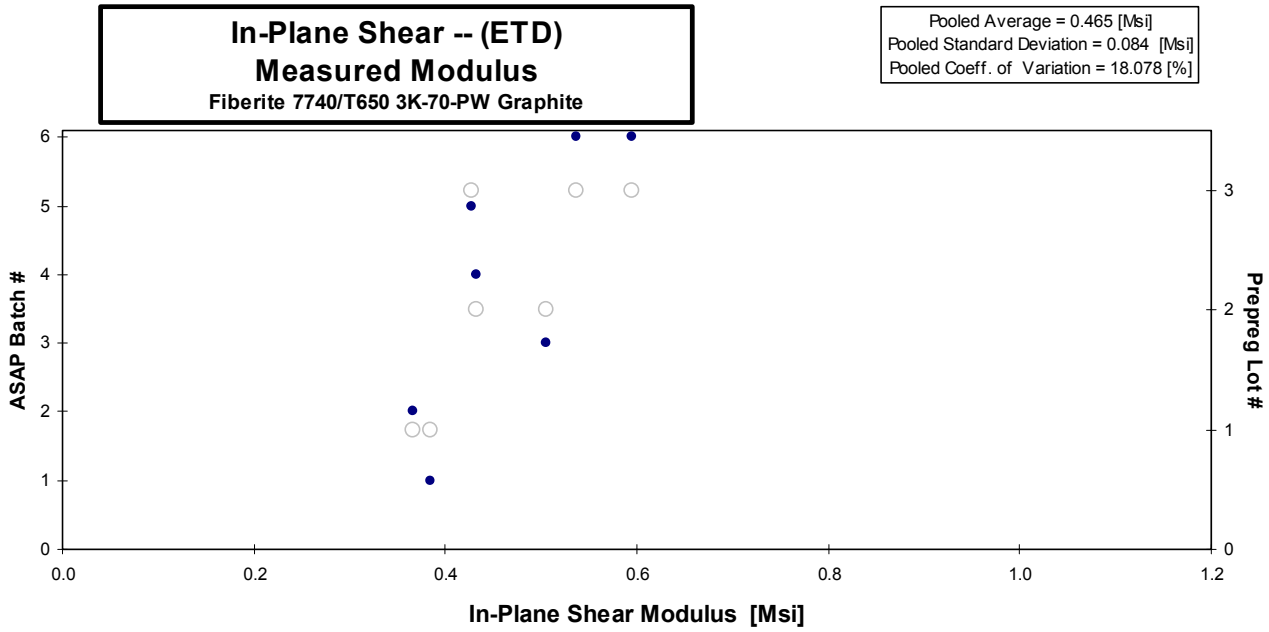


In-Plane Shear -- (ETD)
Strength & Modulus
Fiberite 7740/T650 3K-70-PW Graphite

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
BCN1121G	1	1	1	14.784	0.385	0.145	18	0.00803
BCN1122G	1	1	1	14.041		0.144	18	0.00799
BCN1123G	1	1	1	13.977		0.145	18	0.00803
BCN1124G	1	1	1	13.926		0.143	18	0.00793
BCN1222G	2	1	2	13.745	0.367	0.144	18	0.00801
BCN1223G	2	1	2	13.885		0.143	18	0.00796
BCN1224G	2	1	2	13.855		0.144	18	0.00799
BCN1225G	2	1	2	13.938		0.143	18	0.00794
BCN2122G	2	2	3	14.370	0.506	0.142	18	0.00791
BCN2123G	2	2	3	13.801		0.144	18	0.00799
BCN2124G	2	2	3	14.136		0.143	18	0.00794
BCN2125G	2	2	3	13.724		0.143	18	0.00797
BCN2222G	3	2	4	13.757	0.432	0.138	18	0.00765
BCN2223G	3	2	4	13.823		0.137	18	0.00761
BCN2224G	3	2	4	13.699		0.137	18	0.00760
BCN2226G	3	2	4	13.488		0.137	18	0.00759
BCN2227G	3	2	4	13.587		0.136	18	0.00758
BCN3116G	3	3	5	14.971	0.428	0.149	18	0.00825
BCN3117G	3	3	5	14.163		0.147	18	0.00818
BCN3118G	3	3	5	14.492		0.148	18	0.00821
BCN3119G	3	3	5	14.476		0.138	18	0.00768
BCN3222G	4	3	6	15.463	0.537	0.140	18	0.00776
BCN3223G	4	3	6	14.390		0.140	18	0.00777
BCN3224G	4	3	6	14.129		0.135	18	0.00752
BCN3228G	4	3	6	14.377		0.140	18	0.00778
BCN3229G	4	3	6	13.950		0.141	18	0.00782
BCN3231G	4	3	6	14.952	0.595	0.137	18	0.00761

Average	**14.144**	**0.465**		**0.0079**
Standard Dev.	**0.474**	**0.084**		
Coeff. of Var. [%]	**3.352**	**18.078**		
Min.	**13.488**	**0.367**	**Min.**	**0.0075**
Max.	**15.463**	**0.595**	**Max.**	**0.0083**
Number of Spec.	**27**	**7**		



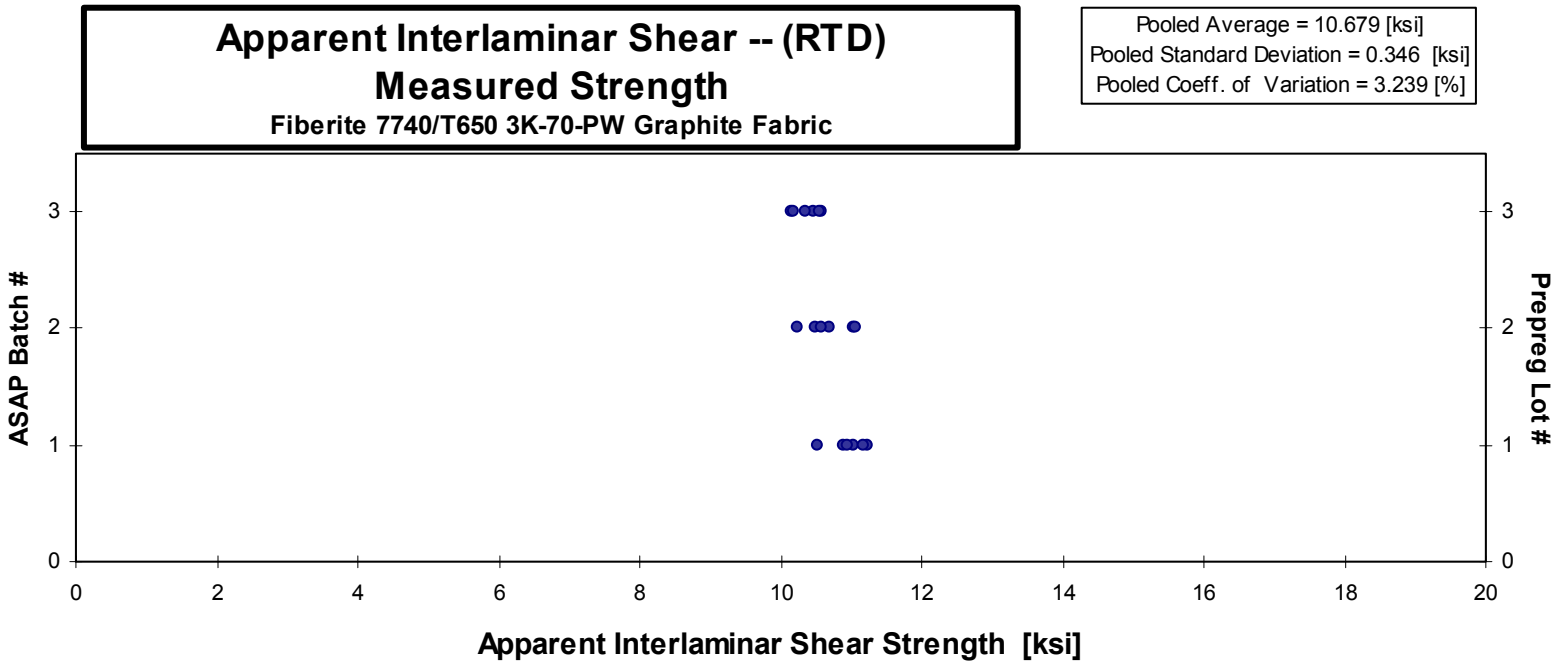


Apparent Interlaminar Shear -- (RTD) Strength

Fiberite 7740/T650 3K-70-PW Graphite Fabric

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
BCQ1111A		1	1	10.907	0.111	14	0.00790
BCQ1112A		1	1	11.037	0.110	14	0.00787
BCQ1113A		1	1	10.948	0.110	14	0.00784
BCQ1114A		1	1	11.237	0.113	14	0.00805
BCQ1115A		1	1	10.513	0.112	14	0.00799
BCQ1116A		1	1	11.185	0.111	14	0.00791
BCQ2111A		2	2	11.028	0.108	14	0.00773
BCQ2112A		2	2	11.050	0.107	14	0.00761
BCQ2113A		2	2	10.695	0.109	14	0.00778
BCQ2114A		2	2	10.498	0.109	14	0.00776
BCQ2115A		2	2	10.592	0.108	14	0.00768
BCQ2116A		2	2	10.234	0.107	14	0.00768
BCQ3111A		3	3	10.161	0.102	14	0.00729
BCQ3112A		3	3	10.460	0.101	14	0.00719
BCQ3113A		3	3	10.569	0.102	14	0.00731
BCQ3114A		3	3	10.188	0.102	14	0.00729
BCQ3115A		3	3	10.554	0.102	14	0.00727
BCQ3116A		3	3	10.359	0.102	14	0.00729

Average	**10.679**		**0.0076**
Standard Dev.	**0.346**		
Coeff. of Var. [%]	**3.239**		
Min.	**10.161**	**Min.**	**0.0072**
Max.	**11.237**	**Max.**	**0.0081**
Number of Spec.	**18**		



3.2.2 Fluid Sensitivity Raw Data Spreadsheets and Scatter Charts

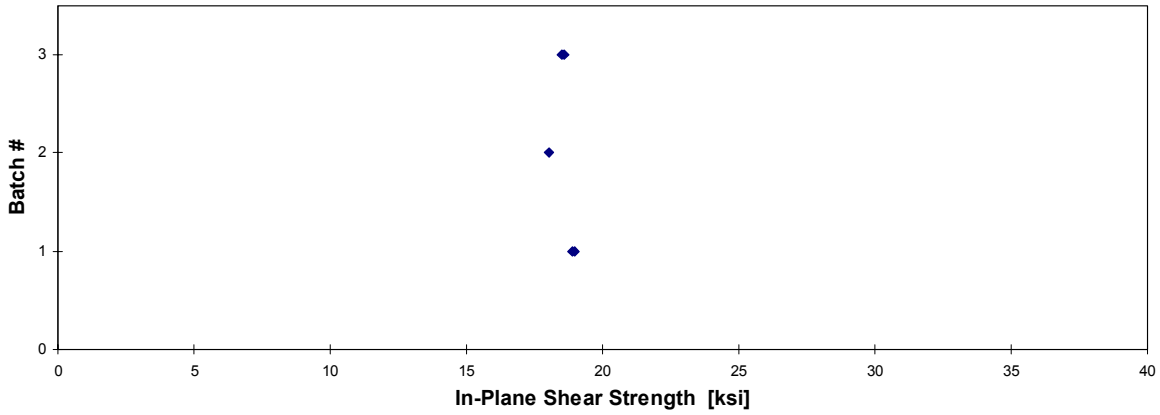
In-Plane Shear -- (MEK - RTD)
Strength
Fiberite 7740/T650 3K-70-PW Graphite

Specimen Number	Batch Number	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
BCN3237T	3	18.574	0.142	18	0.00789
BCN1229T	1	18.986	0.143	18	0.00795
BCN122AT	1	18.884	0.144	18	0.00800
BCN222AT	2	18.037	0.136	18	0.00758
BCN322AT	3	18.503	0.140	18	0.00778

Average	**18.597**		**0.0078**
Standard Dev.	**0.373**		
Coeff. of Var. [%]	**2.006**		
Min.	**18.037**	**Min.**	**0.0076**
Max.	**18.986**	**Max.**	**0.0080**
Number of Spec.	**5**		

In-Plane Shear -- (MEK - RTD)
Measured Strength
Fiberite 7740/T650 3K-70-PW Graphite

Pooled Average = 18.597 [ksi]
Pooled Standard Deviation = 0.373 [ksi]
Pooled Coeff. of Variation = 2.006 [%]



In-Plane Shear -- (JP-4 JET FUEL - ETD) Strength

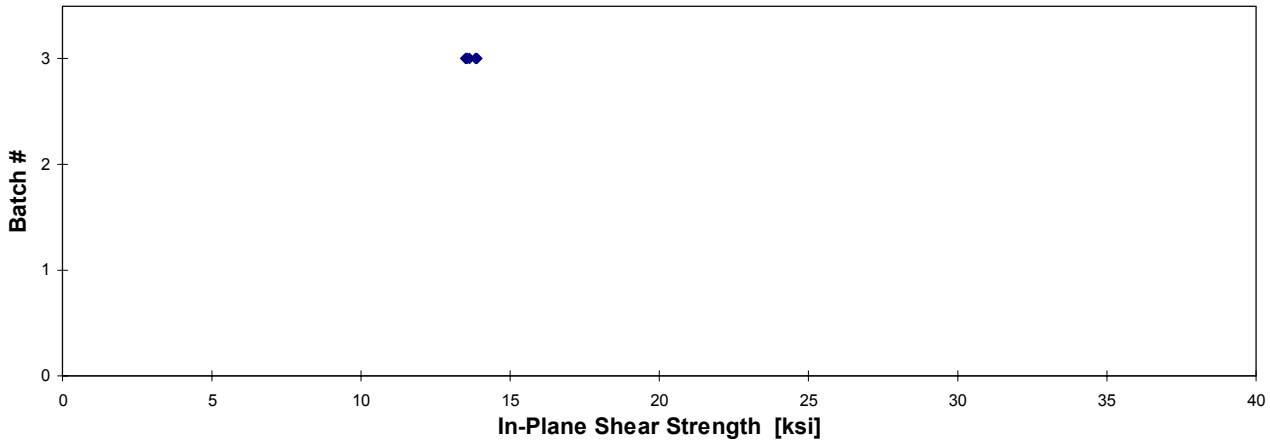
Fiberite 7740/T650 3K-70-PW Graphite

Specimen Number	Batch Number	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
BCN3232R	3	13.894	0.141	18	0.00782
BCN3233R	3	13.625	0.142	18	0.00787
BCN3234R	3	13.831	0.142	18	0.00787
BCN3235R	3	13.519	0.143	18	0.00792
BCN3236R	3	13.554	0.143	18	0.00793

Average	**13.685**		**0.0079**
Standard Dev.	**0.168**		
Coeff. of Var. [%]	**1.231**		
Min.	**13.519**	**Min.**	**0.0078**
Max.	**13.894**	**Max.**	**0.0079**
Number of Spec.	**5**		

In-Plane Shear -- (JP-4 JET FUEL - ETD) Measured Strength

Pooled Average = 13.685 [ksi]
Pooled Standard Deviation = 0.168 [ksi]
Pooled Coeff. of Variation = 1.231 [%]



In-Plane Shear -- (Hydraulic Fluid - ETD) Strength

Fiberite 7740/T650 3K-70-PW Graphite

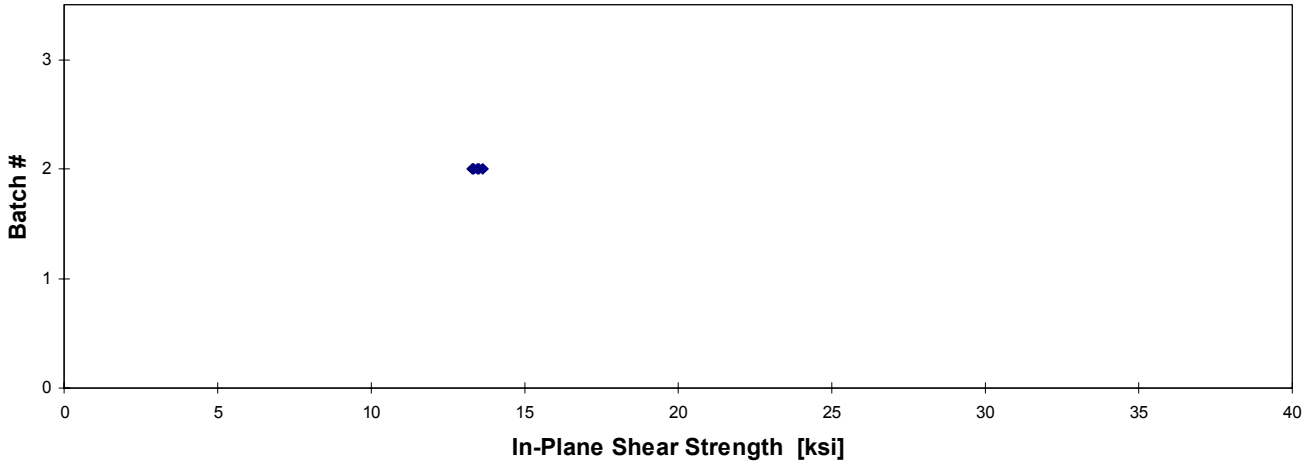
Specimen Number	Batch Number	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
BCN2126V	2	13.465	0.142	18	0.00789
BCN2127V	2	13.641	0.143	18	0.00795
BCN2128V	2	13.353	0.143	18	0.00794
BCN2129V	2	13.502	0.142	18	0.00789
BCN212AV	2	13.284	0.143	18	0.00796

Average	**13.449**		**0.0079**
Standard Dev.	**0.138**		
Coeff. of Var. [%]	**1.026**		
Min.	**13.284**	**Min.**	**0.0079**
Max.	**13.641**	**Max.**	**0.0080**
Number of Spec.	**5**		

In-Plane Shear -- (Hydraulic Fluid - ETD) Measured Strength

Fiberite 7740/T650 3K-70-PW Graphite

Pooled Average = 13.449 [ksi]
Pooled Standard Deviation = 0.138 [ksi]
Pooled Coeff. of Variation = 1.026 [%]



Fluid Sensitivity Comparison:

Average In-Plane Shear Strength with Fluid (ksi)	Same Environment In-Plane Shear Strength without Fluid (ksi)	Worst Case Environment In-Plane Shear Strength (ksi)
MEK (RTD)	(RTD)	(ETW)
18.60	18.82	10.86

The RTD average in-plane shear strength was reduced by 1% after exposure to MEK. However it remained 71% higher than water exposure in ETW conditions.

Average In-Plane Shear Strength with Fluid (ksi)	Same Environment In-Plane Shear Strength without Fluid (ksi)	Worst Case Environment In-Plane Shear Strength (ksi)
JP-4 JET FUEL (ETD)	(ETD)	(ETW)
13.69	14.14	10.86

The ETD average in-plane shear strength was reduced by 3% after exposure to MEK. However it remained 26% higher than water exposure in ETW conditions.

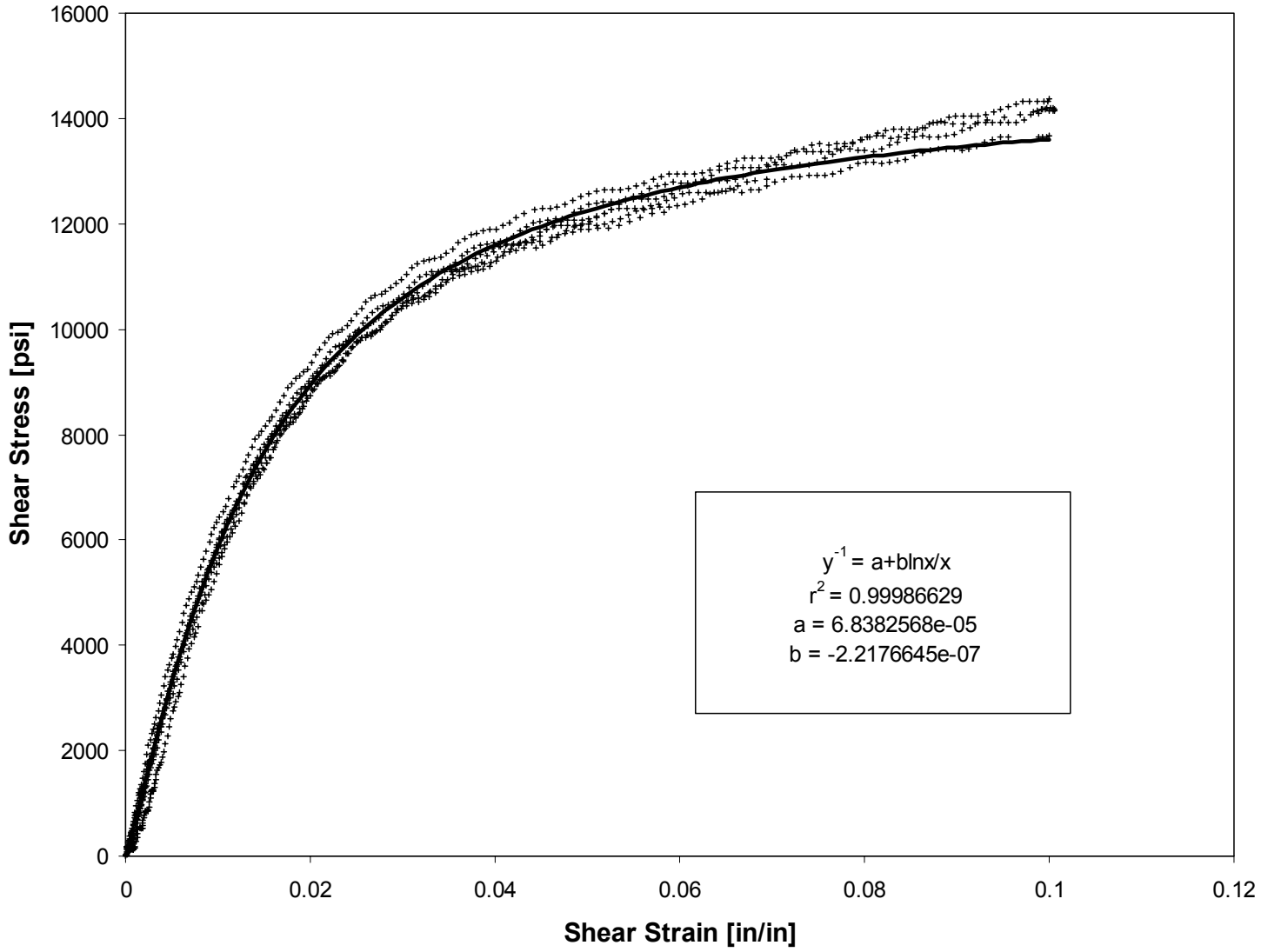
Average In-Plane Shear Strength with Fluid (ksi)	Same Environment In-Plane Shear Strength without Fluid (ksi)	Worst Case Environment In-Plane Shear Strength (ksi)
HYDRAULIC FLUID (ETD)	(ETD)	(ETW)
13.45	14.14	10.86

The ETD average in-plane shear strength was reduced by 5% after exposure to MEK. However it remained 24% higher than water exposure in ETW conditions.

3.2.3 Representative Shear Stress-Strain Curve

The following stress-strain curve is representative of the T650 3K-70-PW / 7740 prepreg system. The tension and compression stress-strain curves are not presented in graphical form. If strain design allowables from these tests are required, simple one-dimensional linear stress-strain relationships may be used to obtain corresponding strain design values. This process should approximate tensile and compressive strain behavior relatively well but may produce extremely conservative strain values in shear due to the nonlinear behavior. A more realistic approach for shear strain design allowables is to use a maximum strain value of 5% (reference MIL-HDBK-17-1E, section 5.7.6). If a nonlinear analysis of the material's shear behavior is required, the curve-fit of the shear stress-strain curve may be used. The representative shear stress-strain curve was obtained by taking the average of all the sample shear curves and determining the best-fit line through the data. The actual data points also presented on the chart to demonstrate material variability.

Shear Stress vs. Shear Strain, RTD

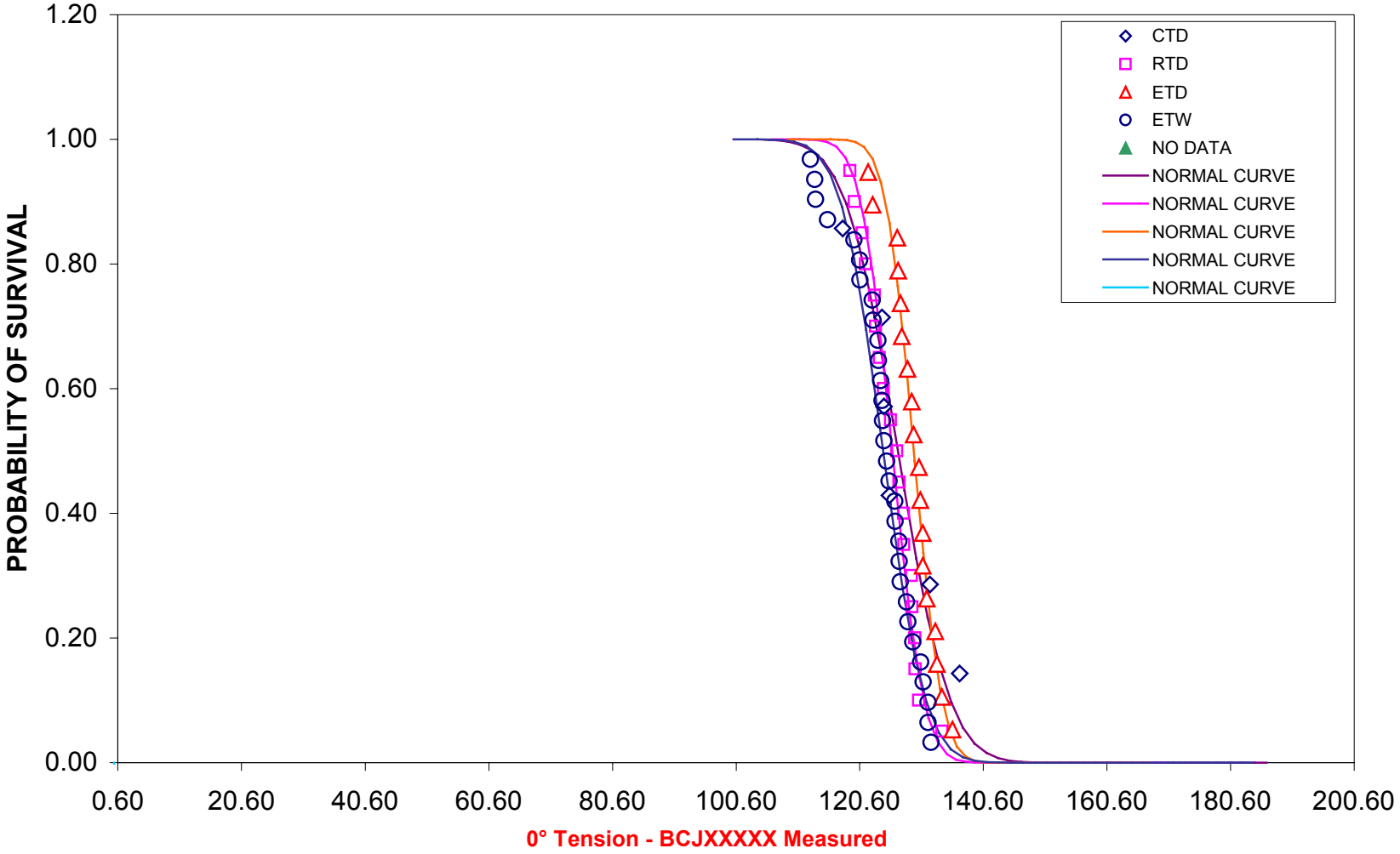


3.3 Statistical Results

3.3.1 Plot by Condition

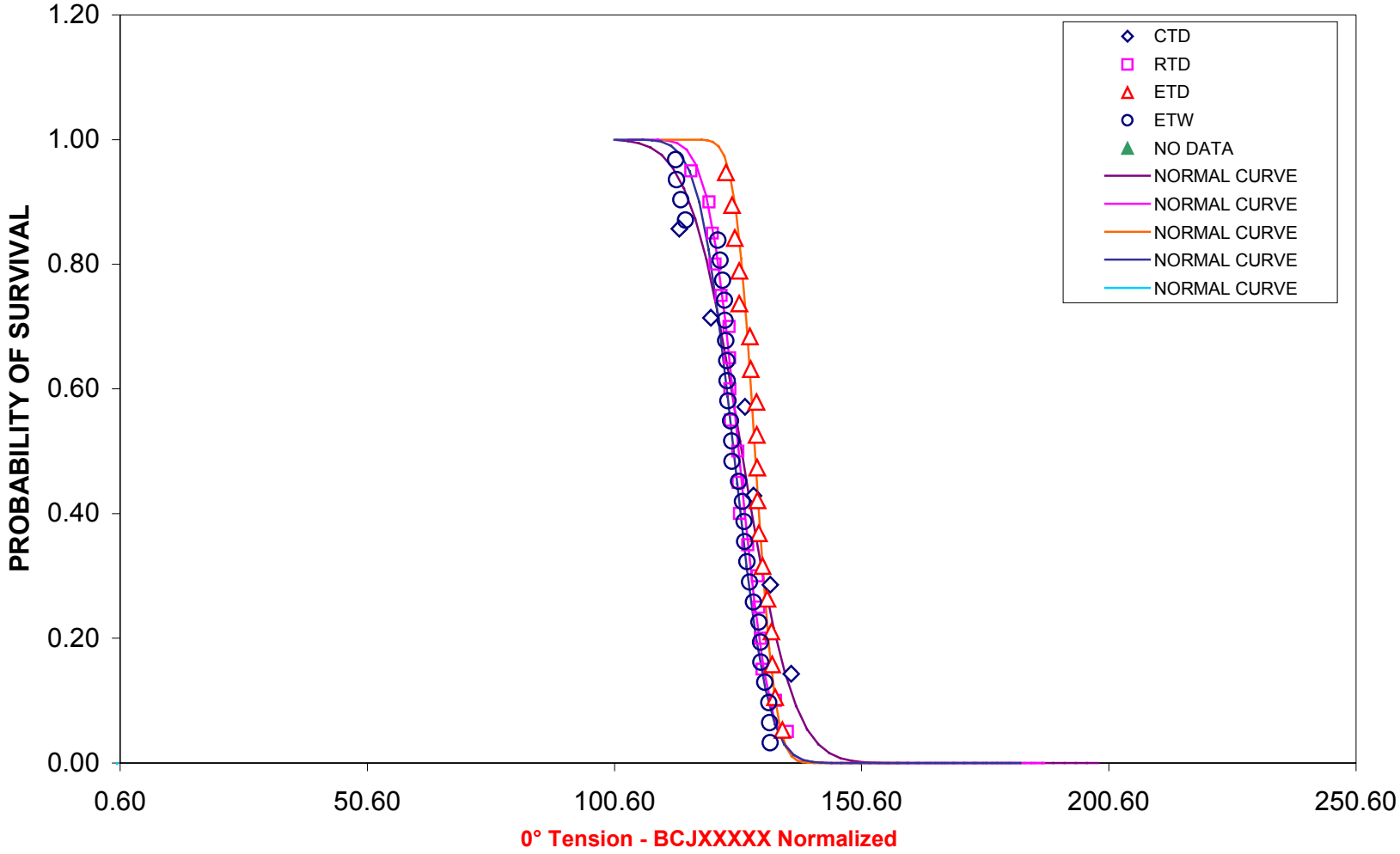
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

Fiberite 7740/T650 3K-70-PW Graphite
Cessna



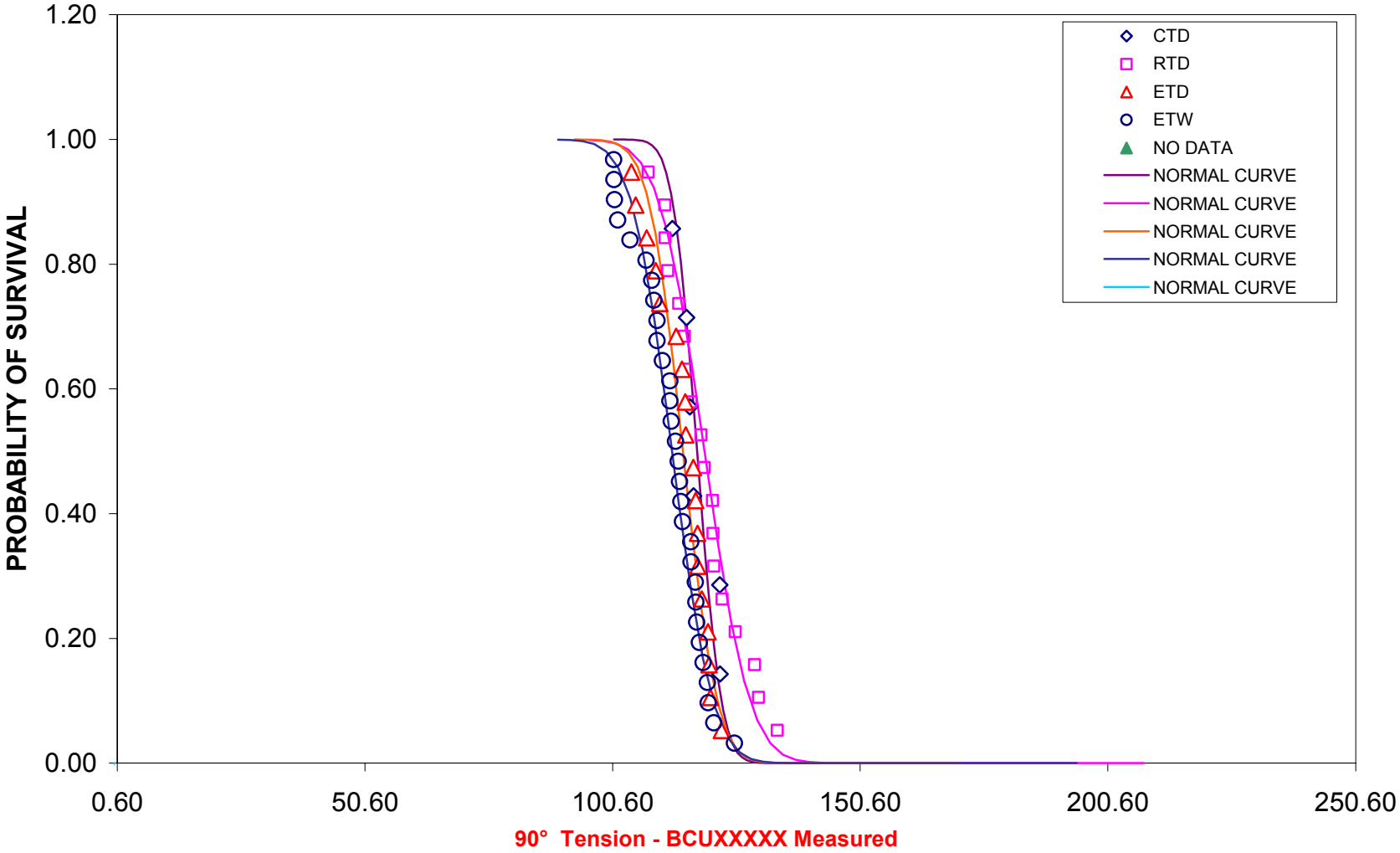
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

Fiberite 7740/T650 3K-70-PW Graphite
Cessna



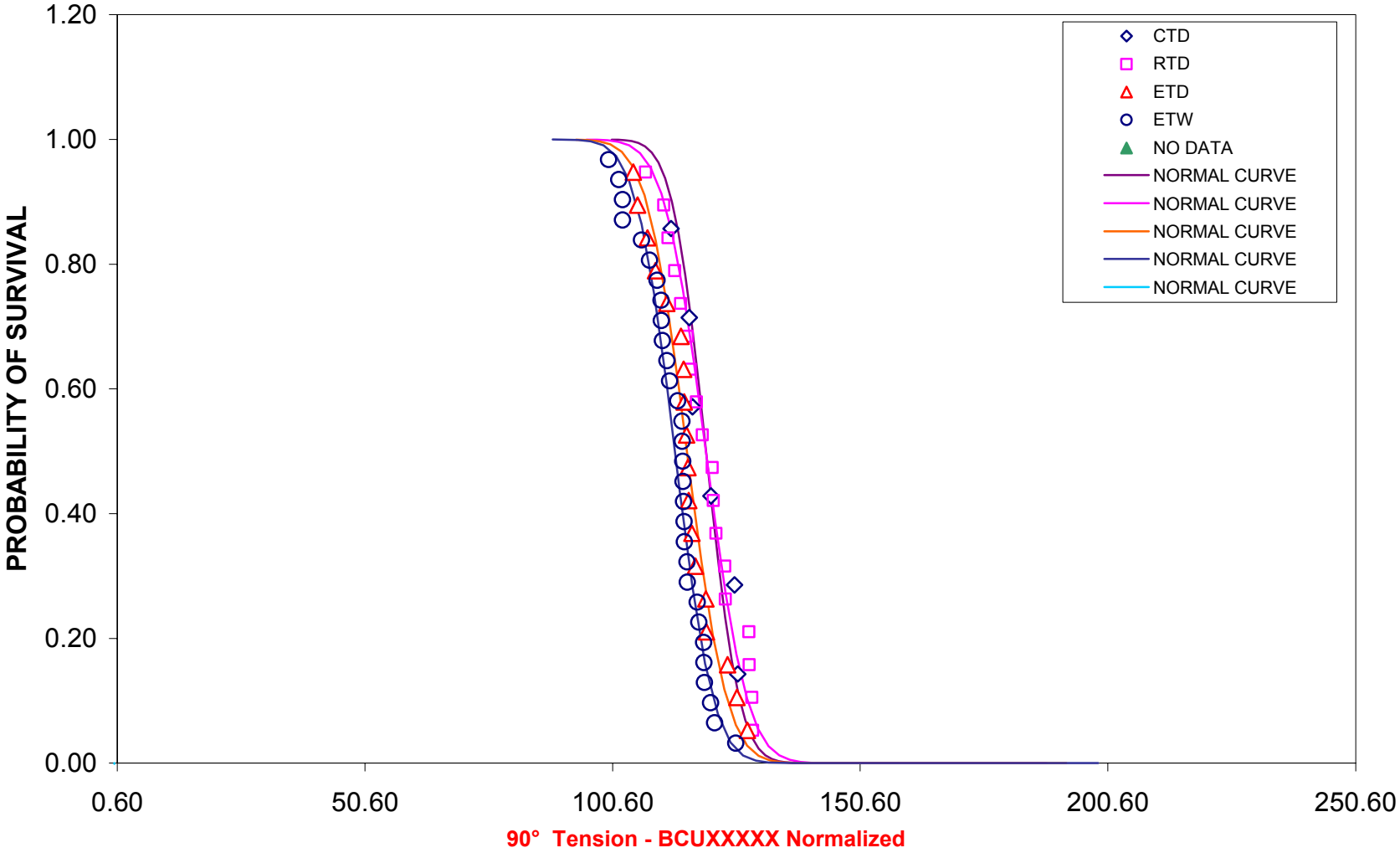
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

Fiberite 7740/T650 3K-70-PW Graphite
Cessna



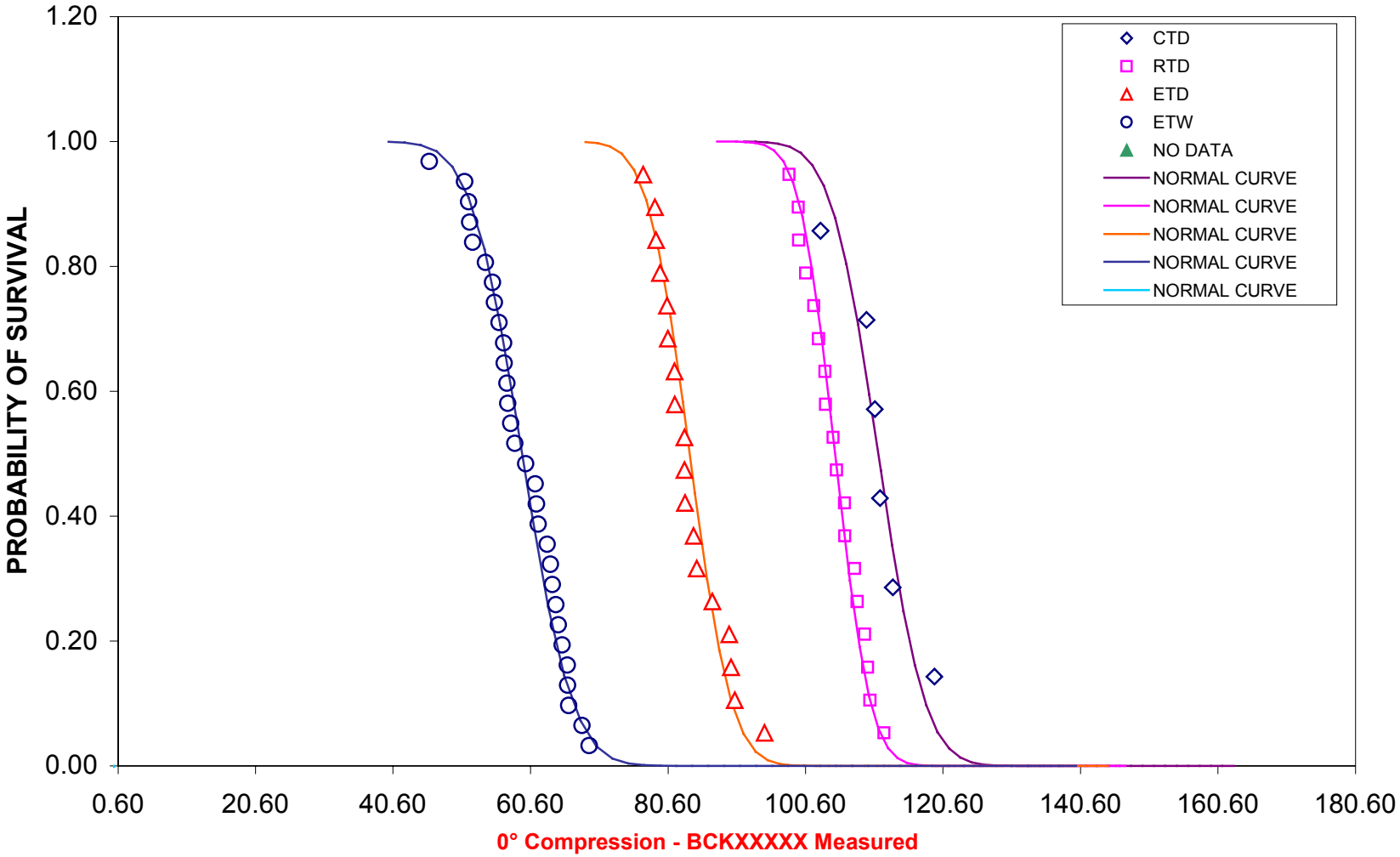
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

Fiberite 7740/T650 3K-70-PW Graphite
Cessna



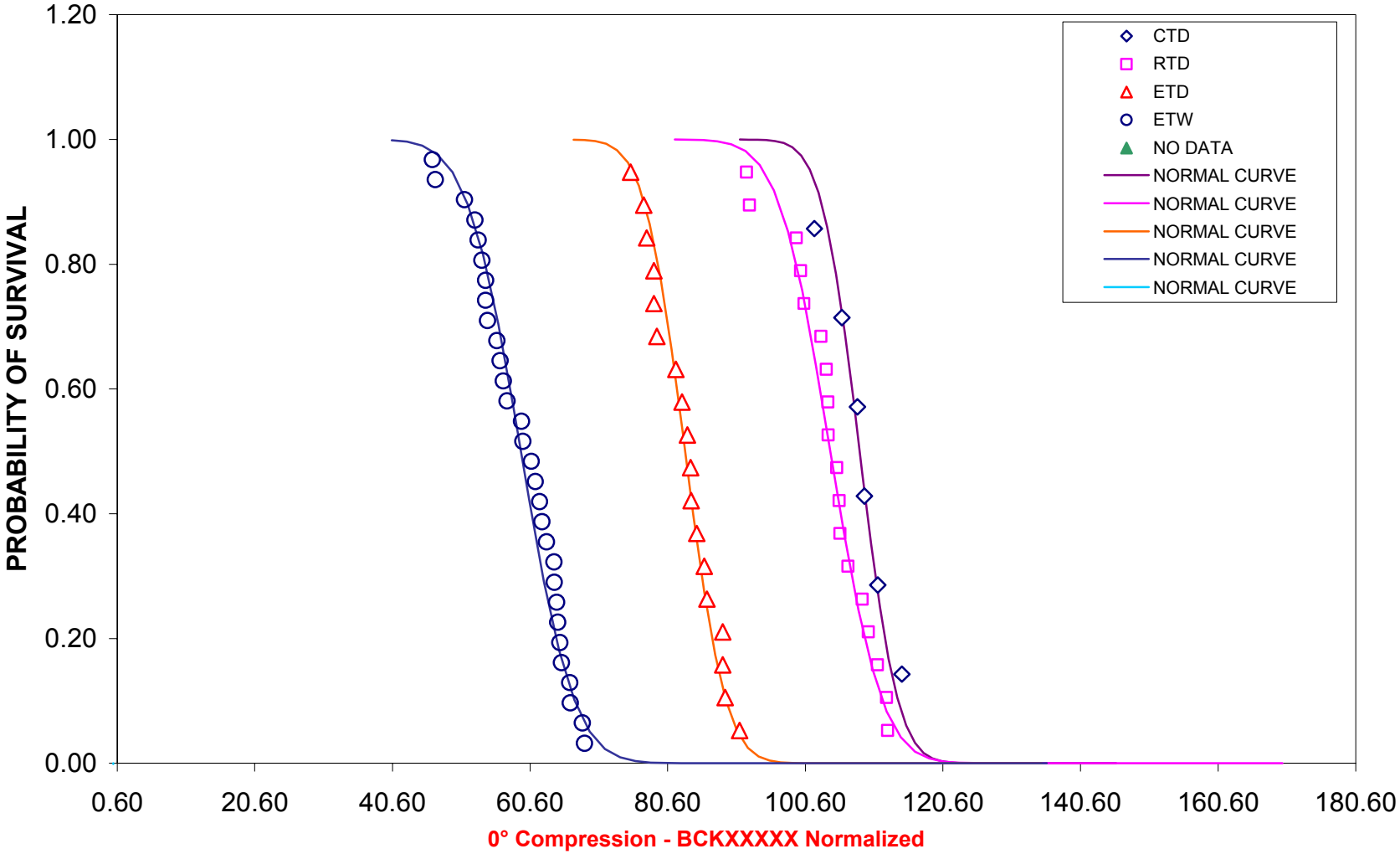
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

Fiberite 7740/T650 3K-70-PW Graphite
Cessna



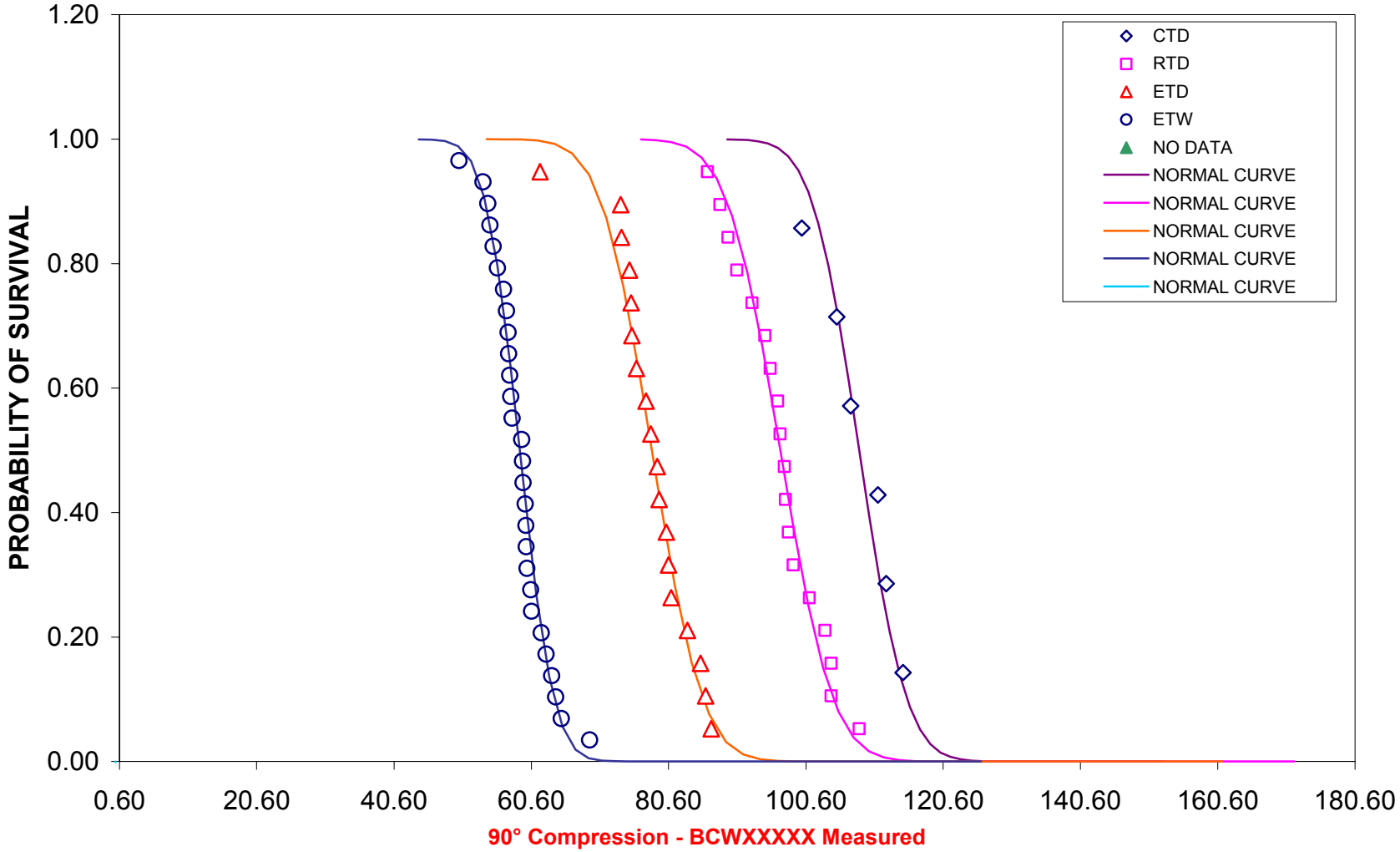
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

Fiberite 7740/T650 3K-70-PW Graphite
Cessna

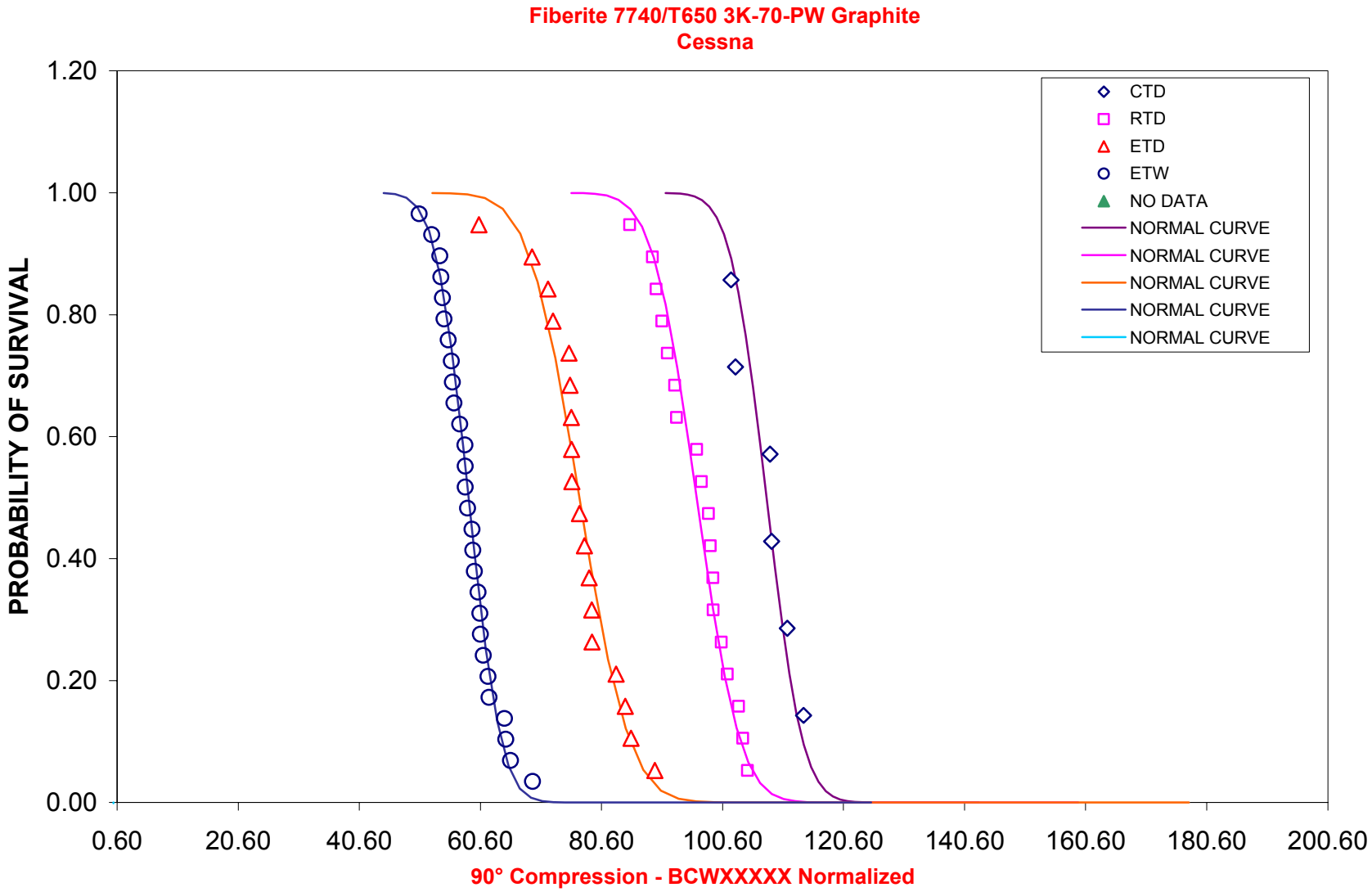


DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

Fiberite 7740/T650 3K-70-PW Graphite
Cessna

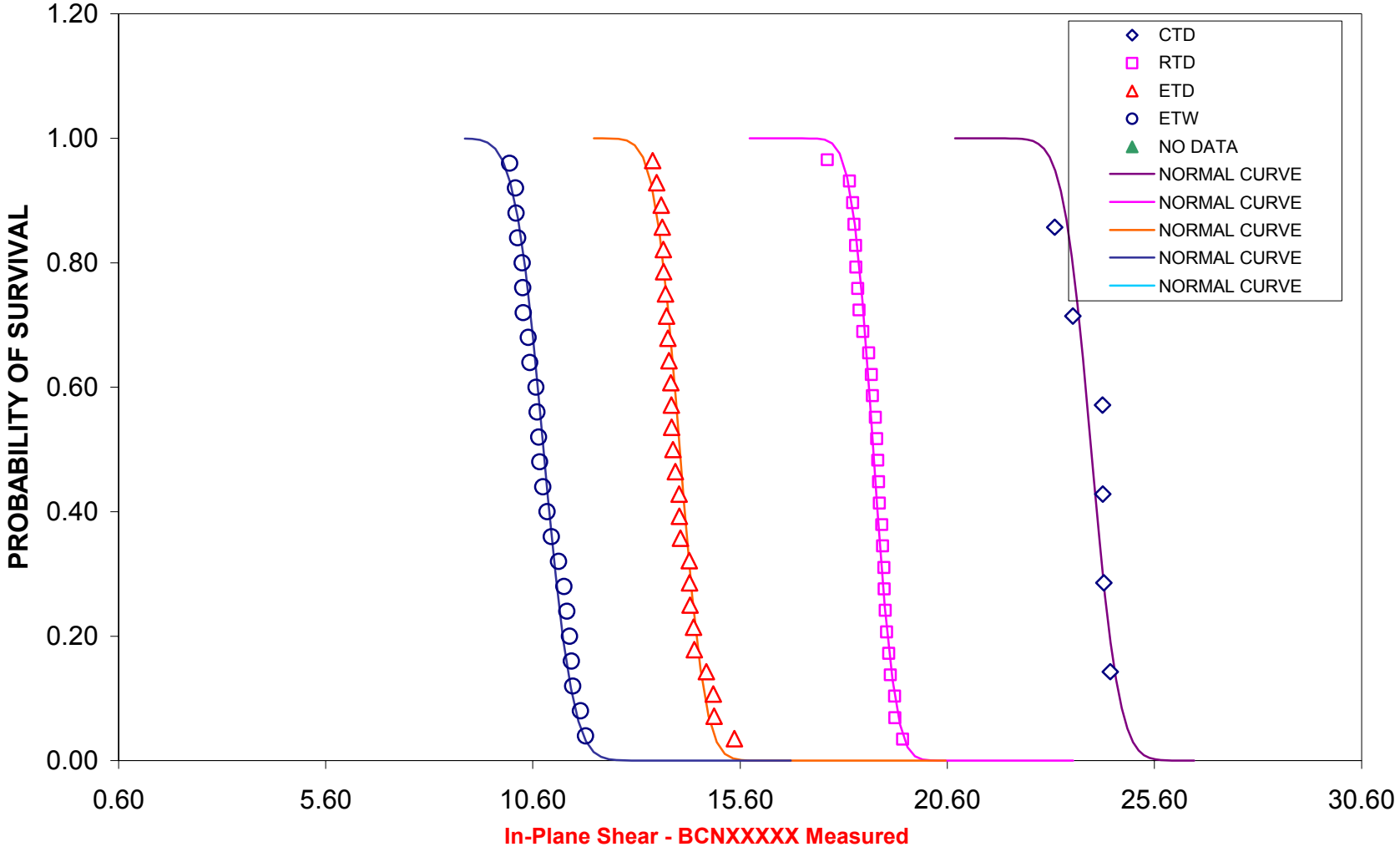


DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS



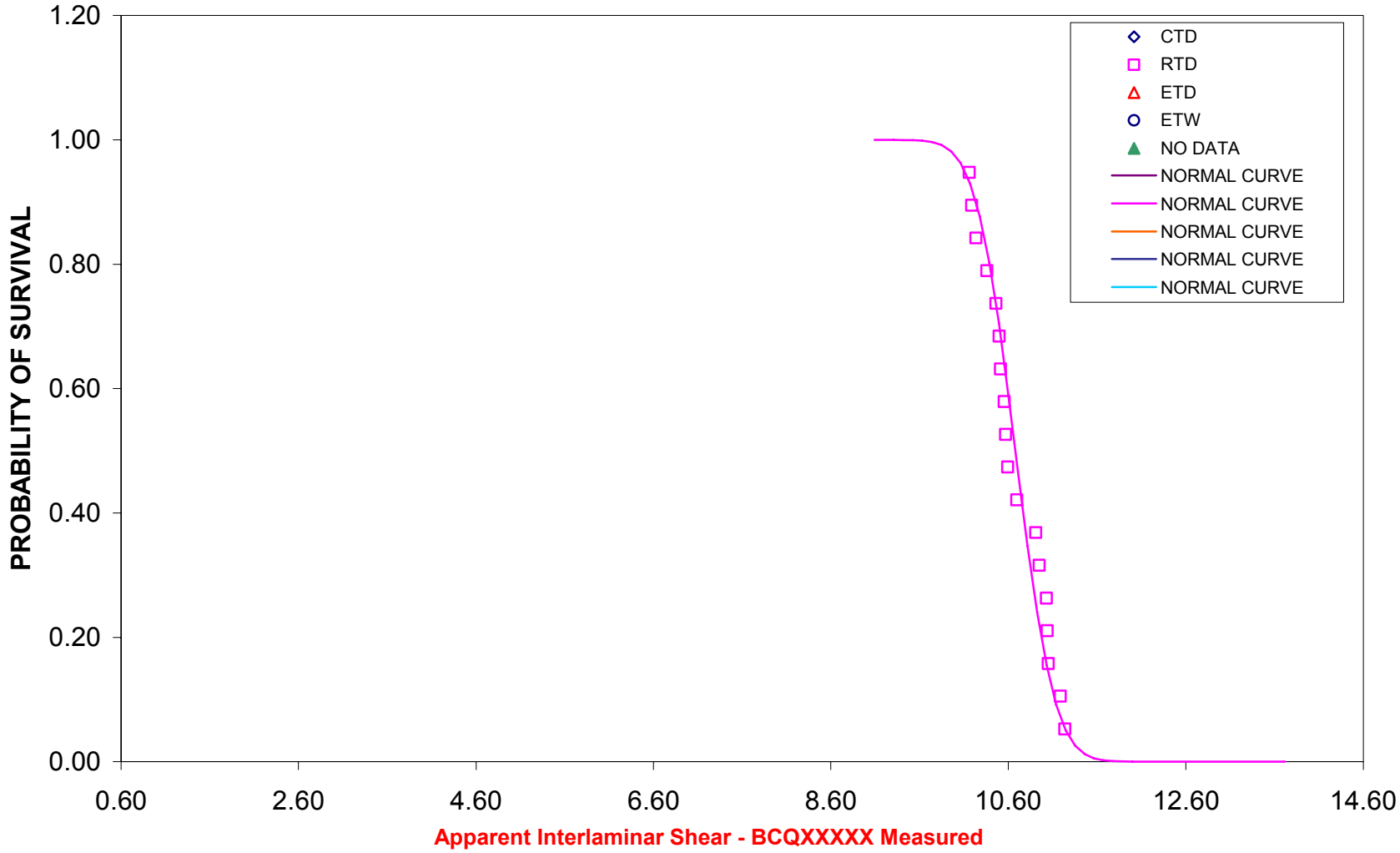
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

Fiberite 7740/T650 3K-70-PW Graphite
Cessna



DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

Fiberite 7740/T650 3K-70-PW Graphite
Cessna



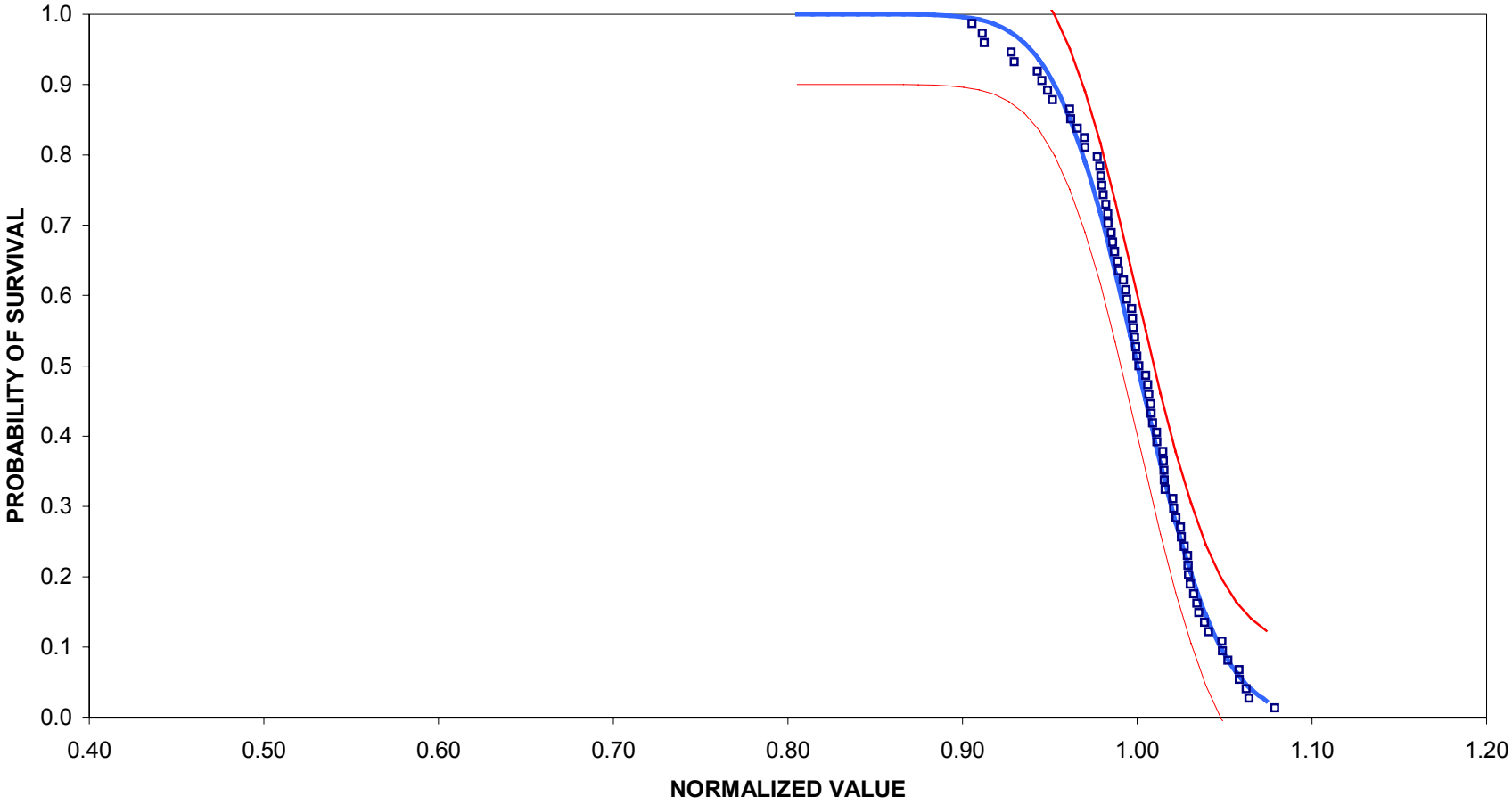
3.3.2 Plot of Pooled Data

DISTRIBUTION OF POOLED DATA

Fiberite 7740/T650 3K-70-PW Graphite

Cessna

0° Tension - BCJXXXXX Measured

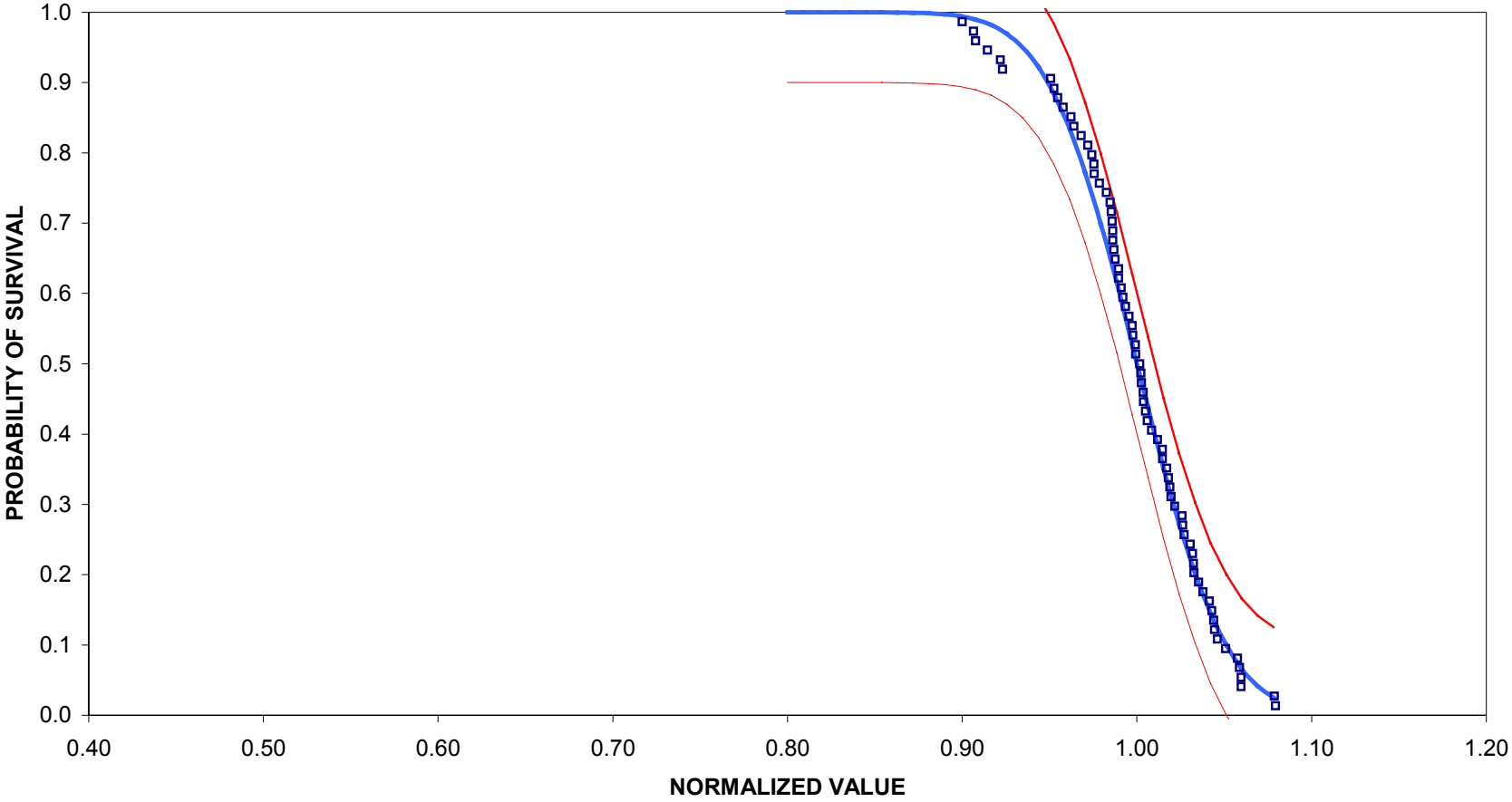


DISTRIBUTION OF POOLED DATA

Fiberite 7740/T650 3K-70-PW Graphite

Cessna

0° Tension - BCJXXXXX Normalized

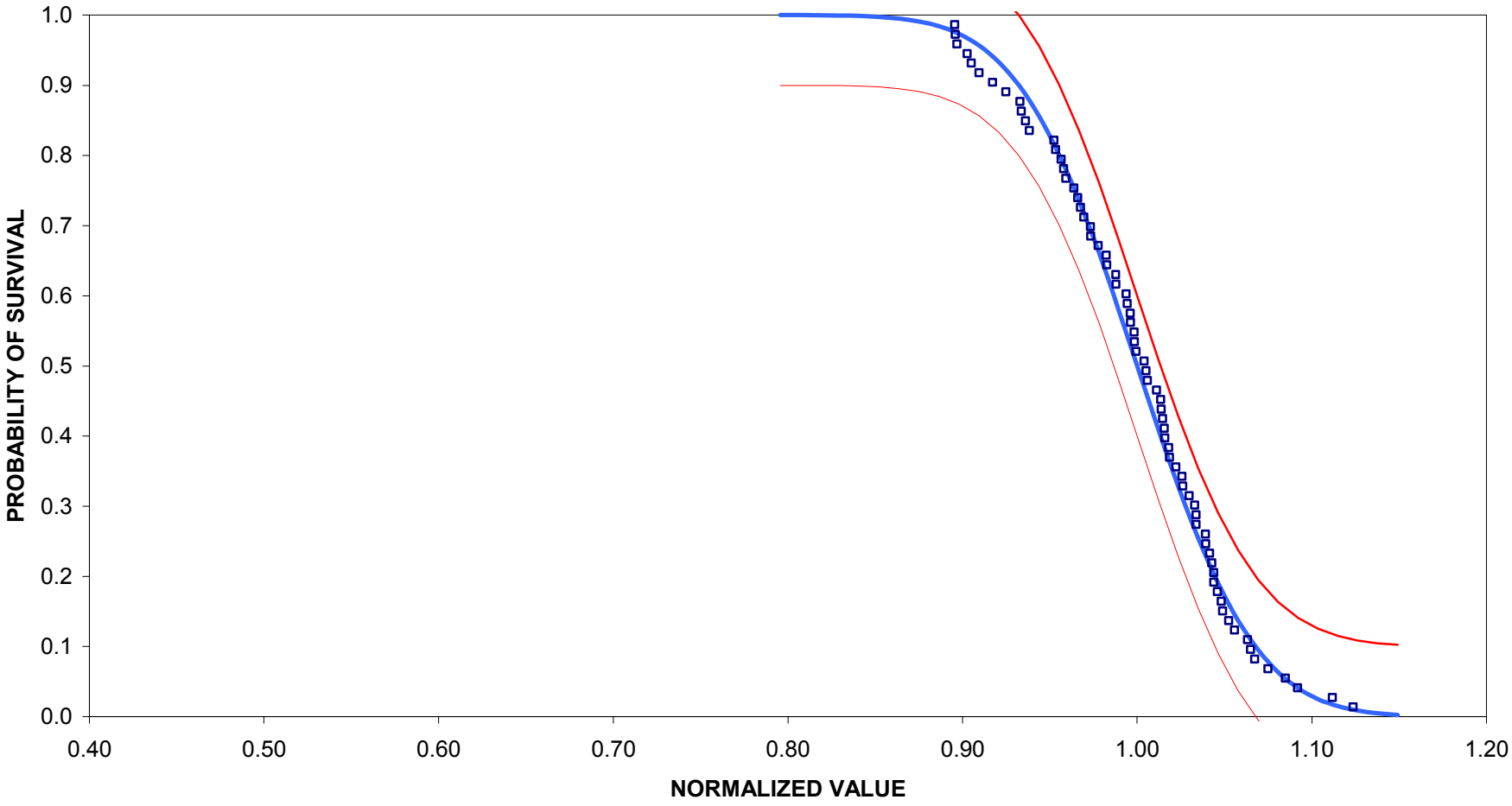


DISTRIBUTION OF POOLED DATA

Fiberite 7740/T650 3K-70-PW Graphite

Cessna

90° Tension - BCUXXXXX Measured

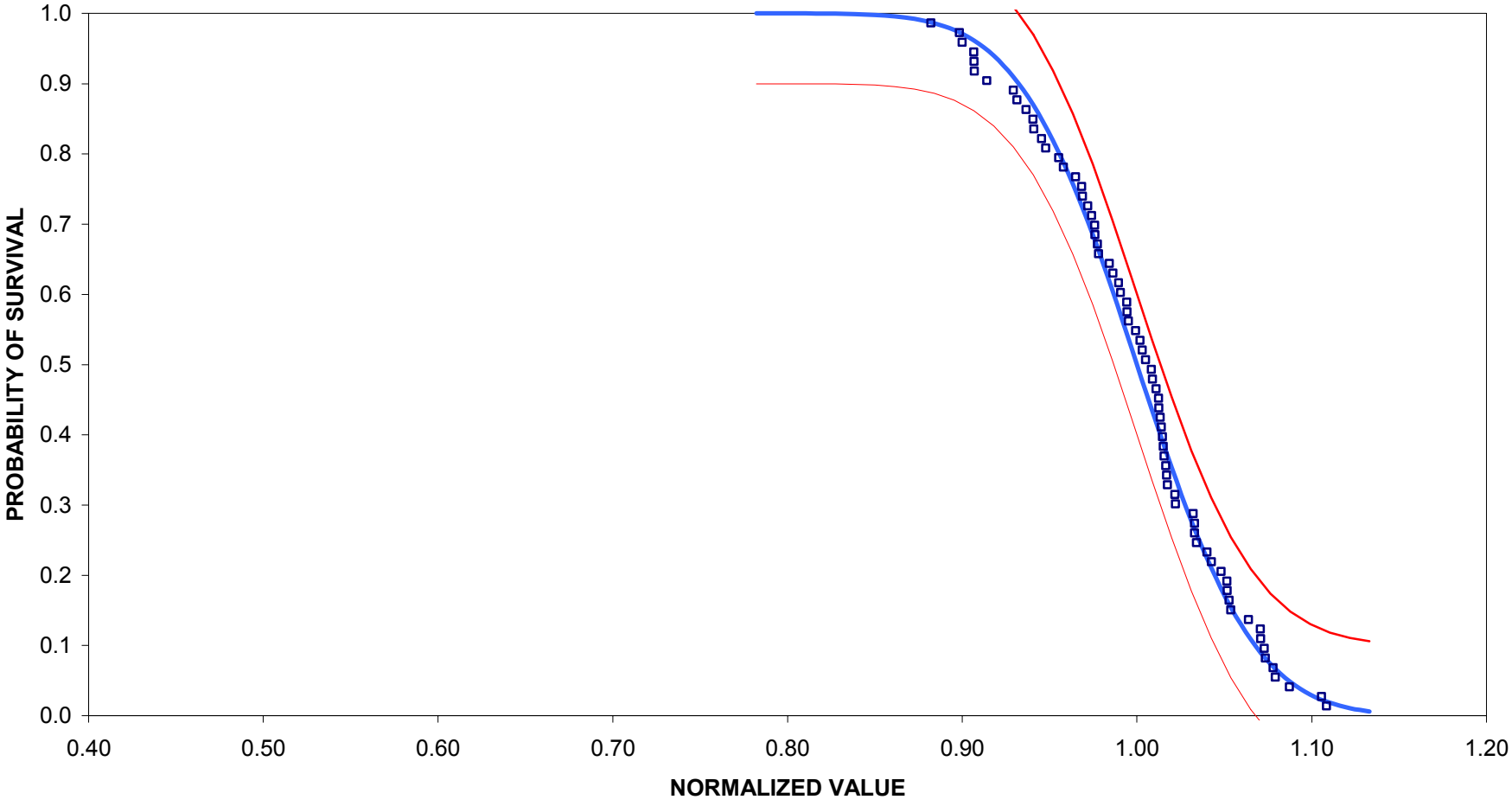


DISTRIBUTION OF POOLED DATA

Fiberite 7740/T650 3K-70-PW Graphite

Cessna

90° Tension - BCUXXXXX Normalized

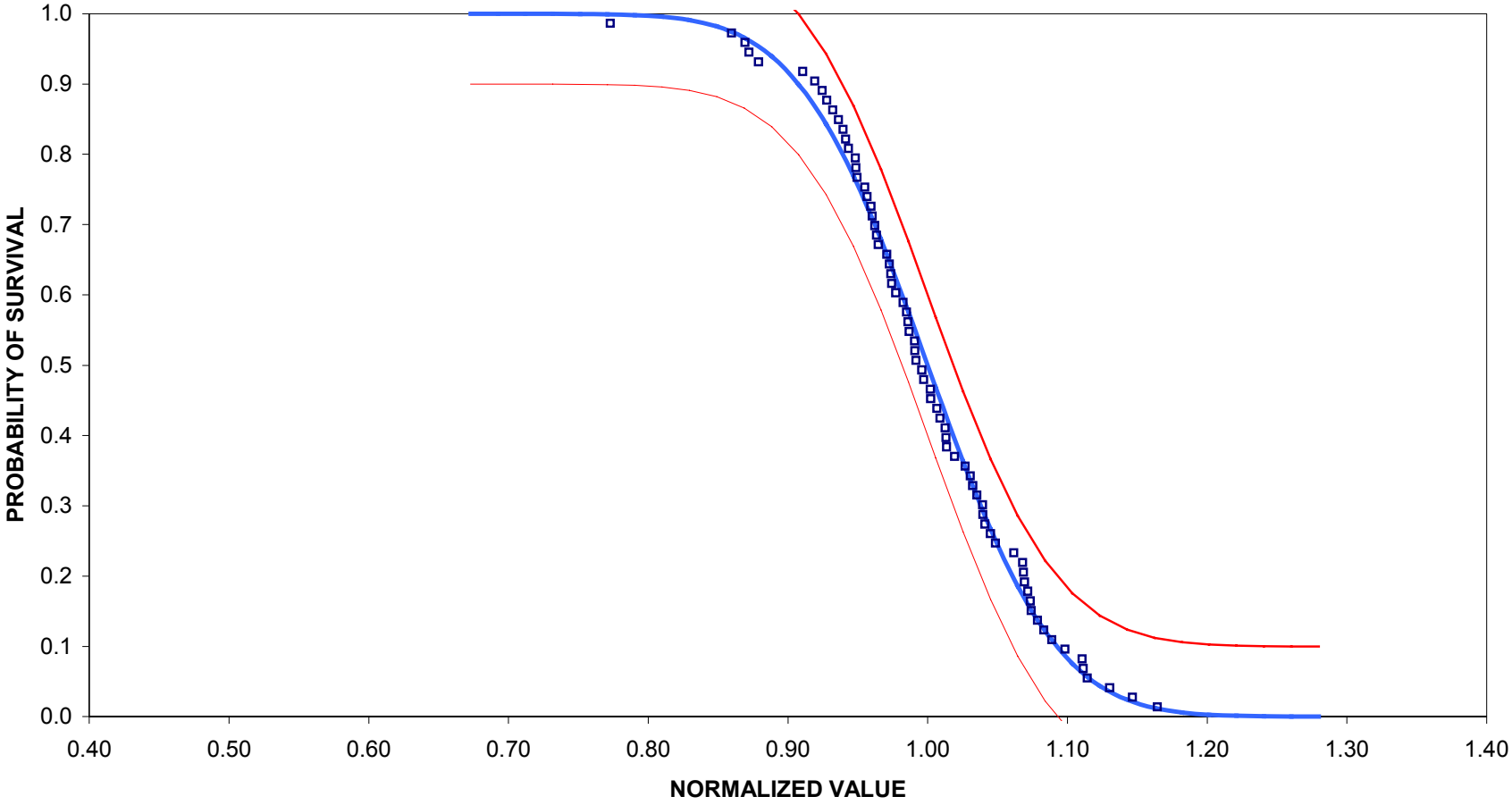


DISTRIBUTION OF POOLED DATA

Fiberite 7740/T650 3K-70-PW Graphite

Cessna

0° Compression - BCKXXXXX Measured

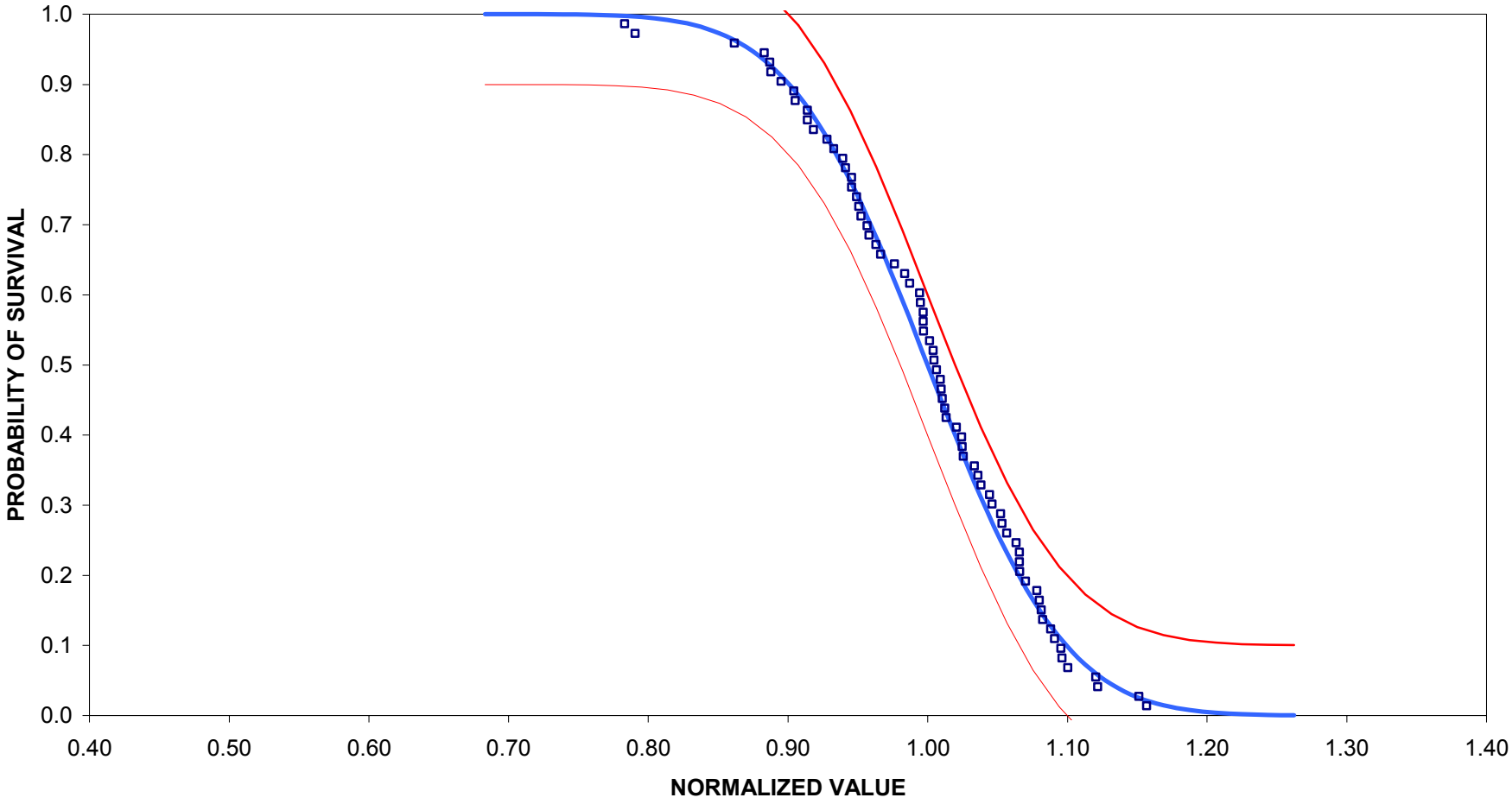


DISTRIBUTION OF POOLED DATA

Fiberite 7740/T650 3K-70-PW Graphite

Cessna

0° Compression - BCKXXXXX Normalized

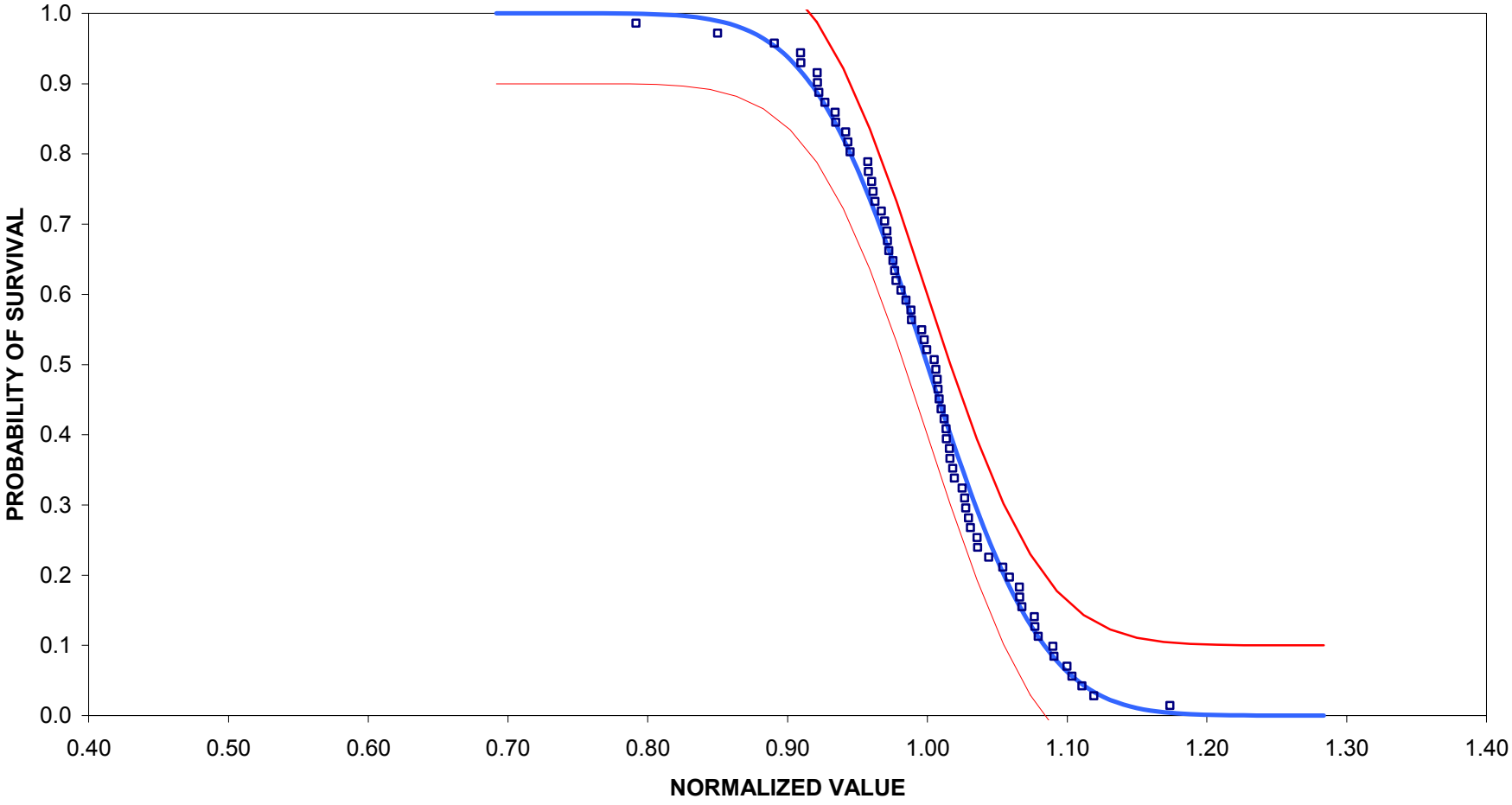


DISTRIBUTION OF POOLED DATA

Fiberite 7740/T650 3K-70-PW Graphite

Cessna

90° Compression - BCWXXXXX Measured

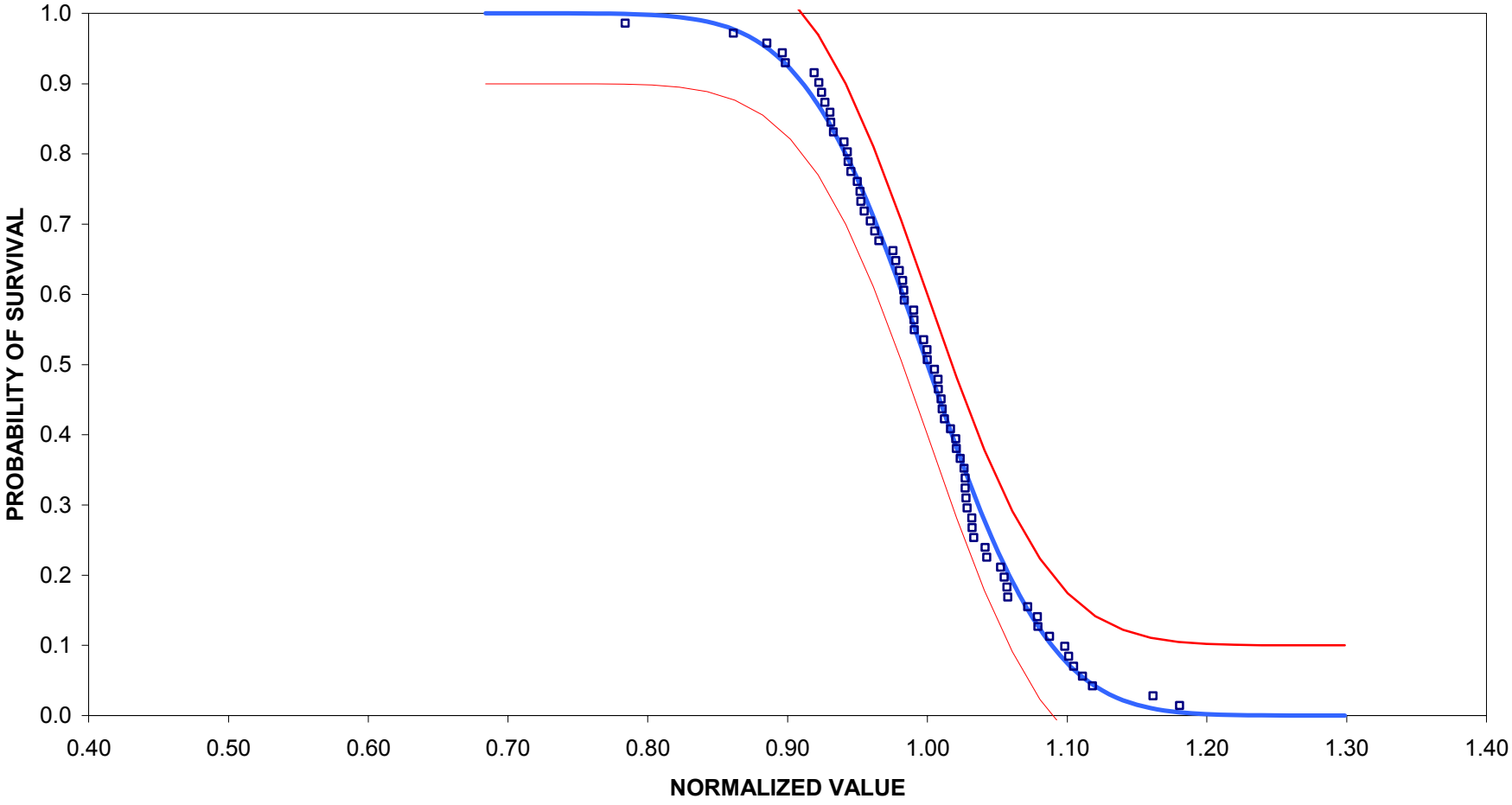


DISTRIBUTION OF POOLED DATA

Fiberite 7740/T650 3K-70-PW Graphite

Cessna

90° Compression - BCWXXXXX Normalized

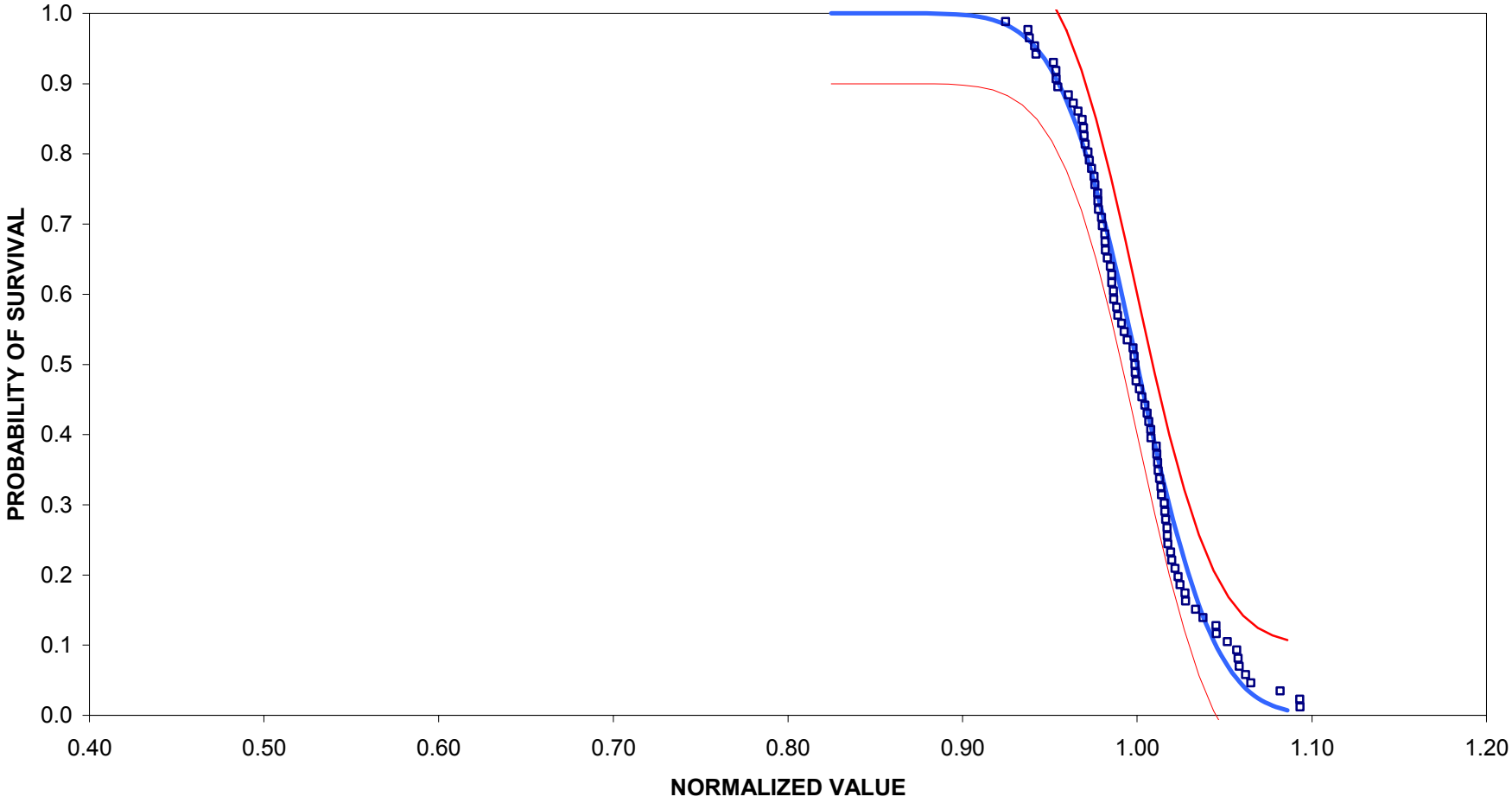


DISTRIBUTION OF POOLED DATA

Fiberite 7740/T650 3K-70-PW Graphite

Cessna

In-Plane Shear - BCNXXXXX Measured

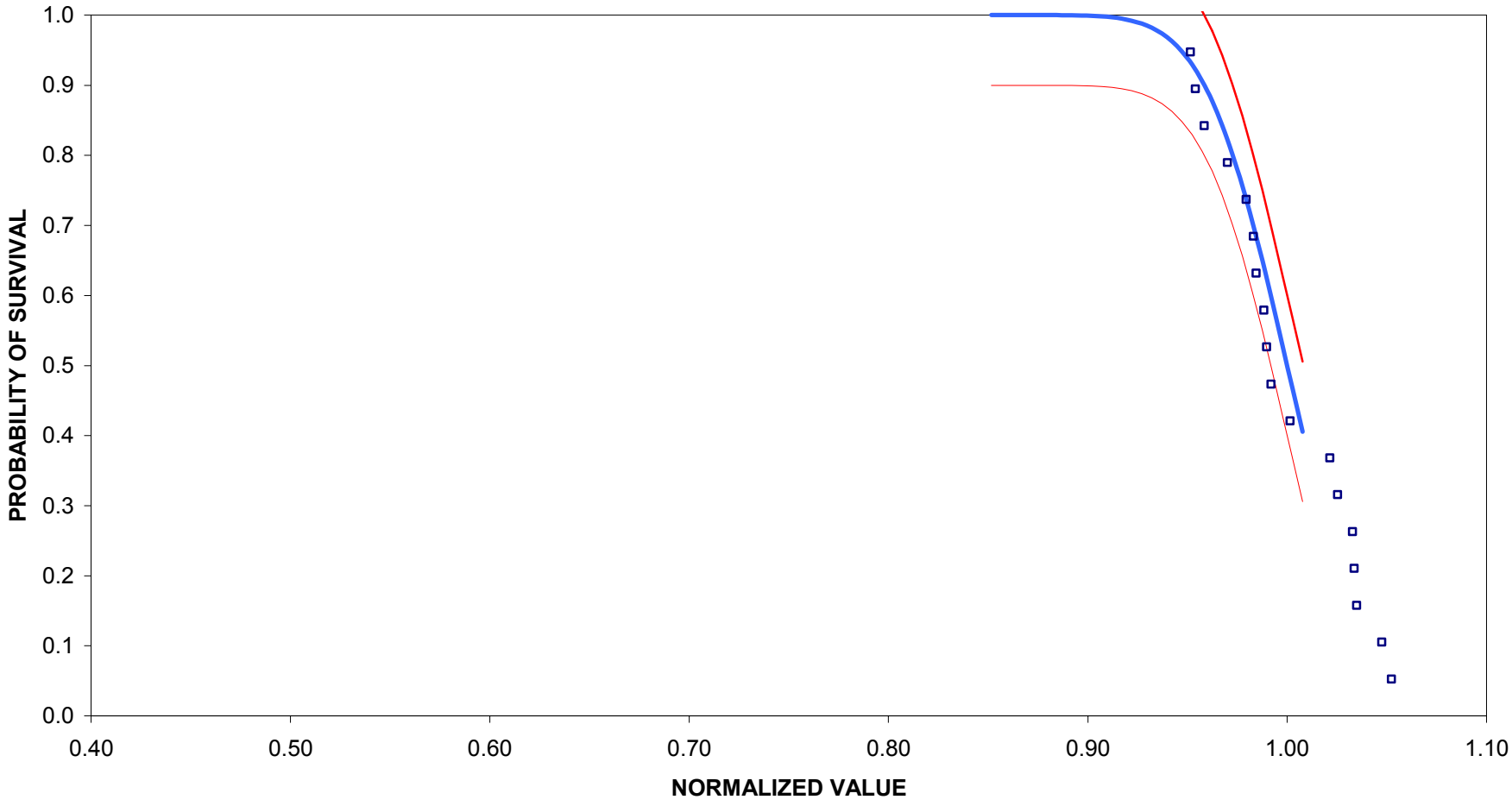


DISTRIBUTION OF POOLED DATA

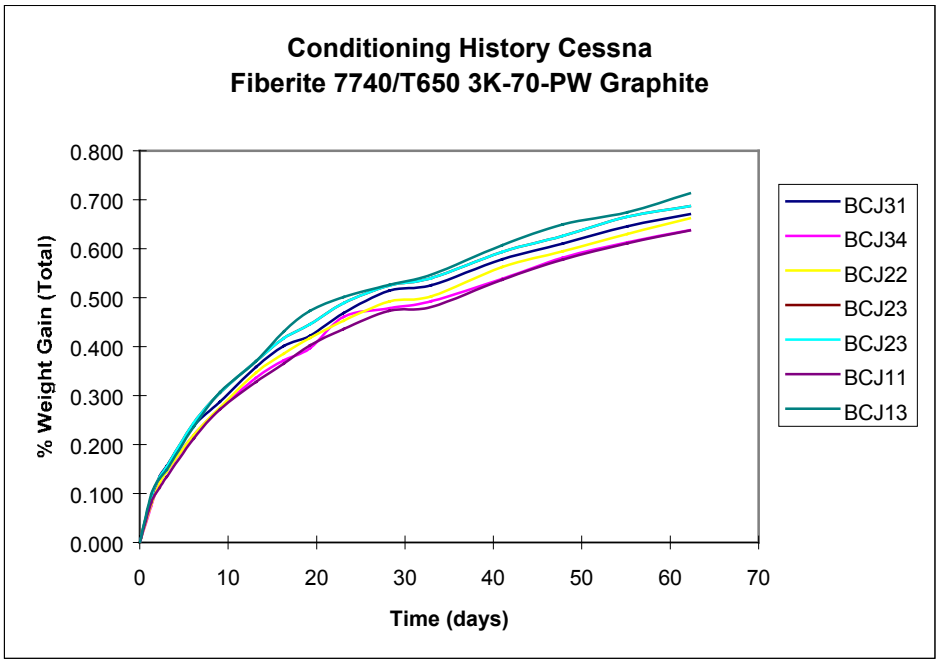
Fiberite 7740/T650 3K-70-PW Graphite

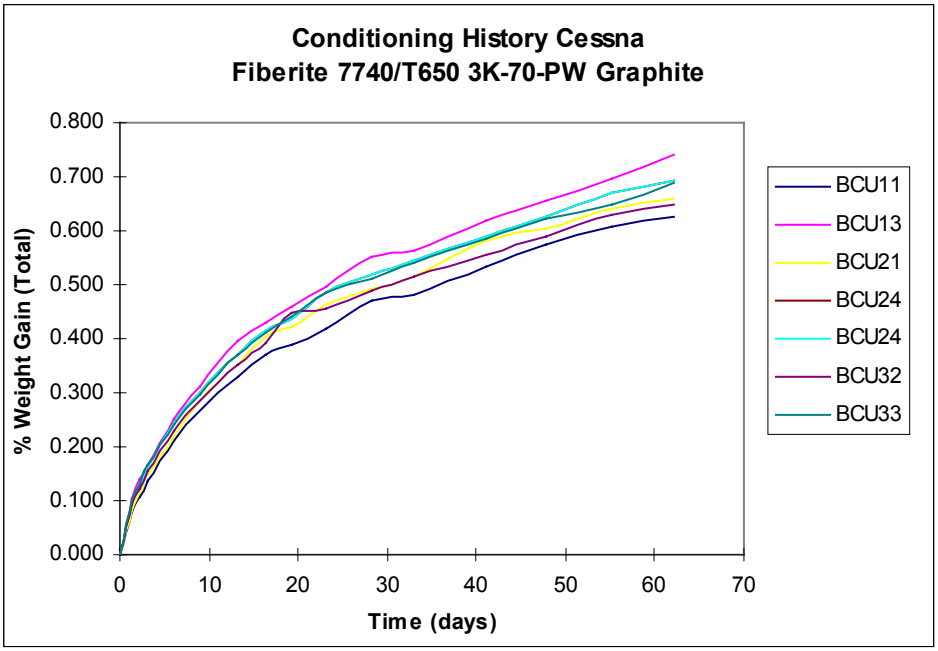
Cessna

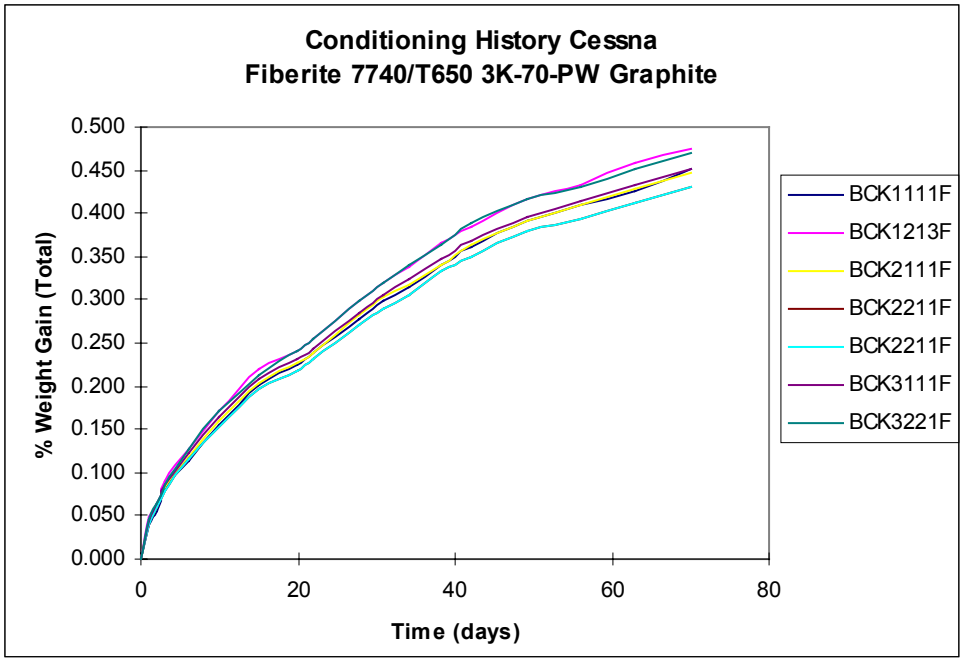
Apparent Interlaminar Shear - BCQXXXXX Measured

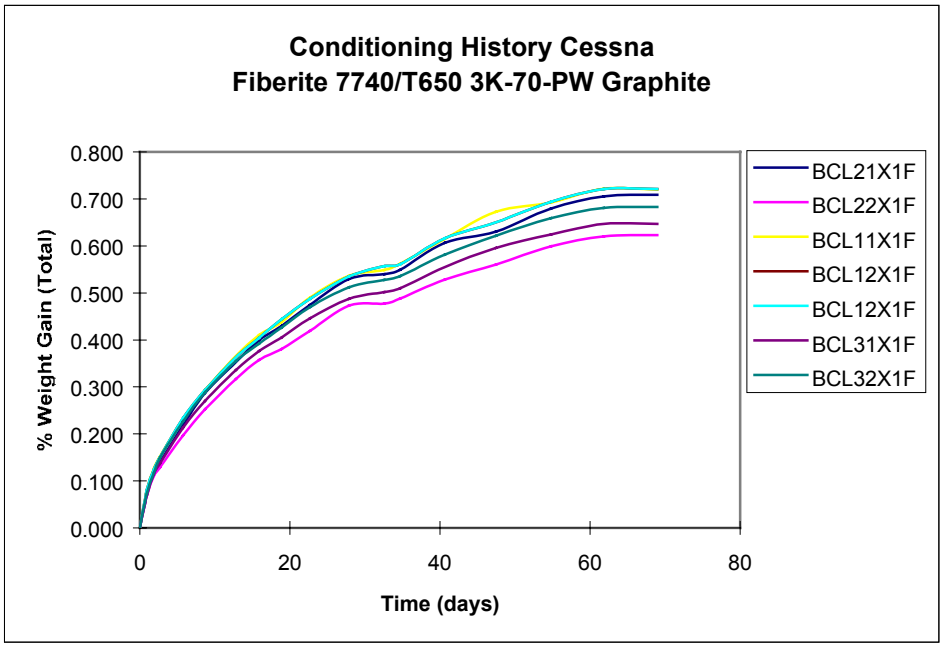


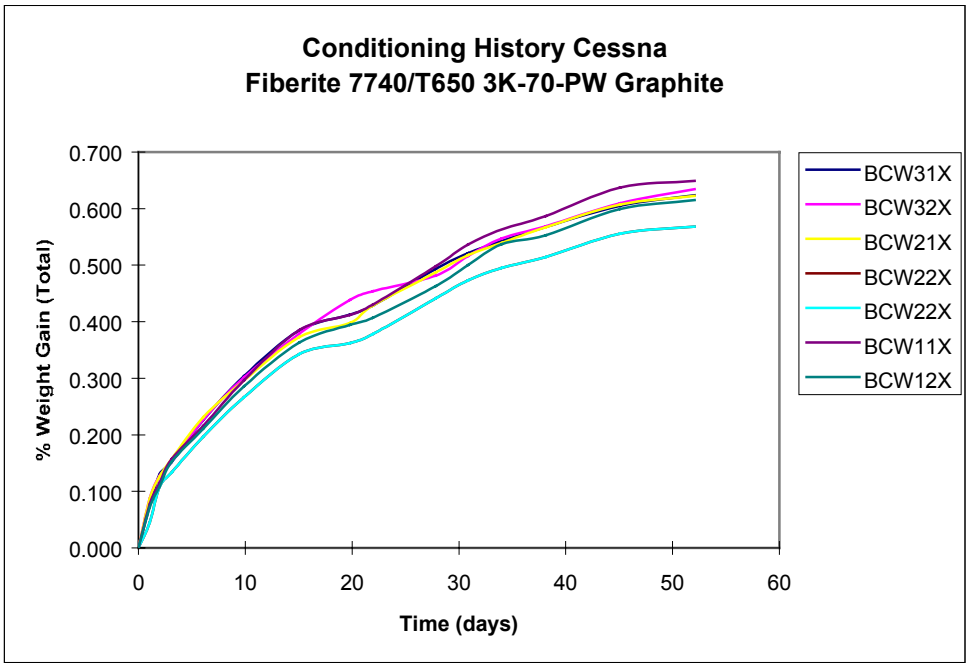
3.4 Moisture Conditioning History Charts

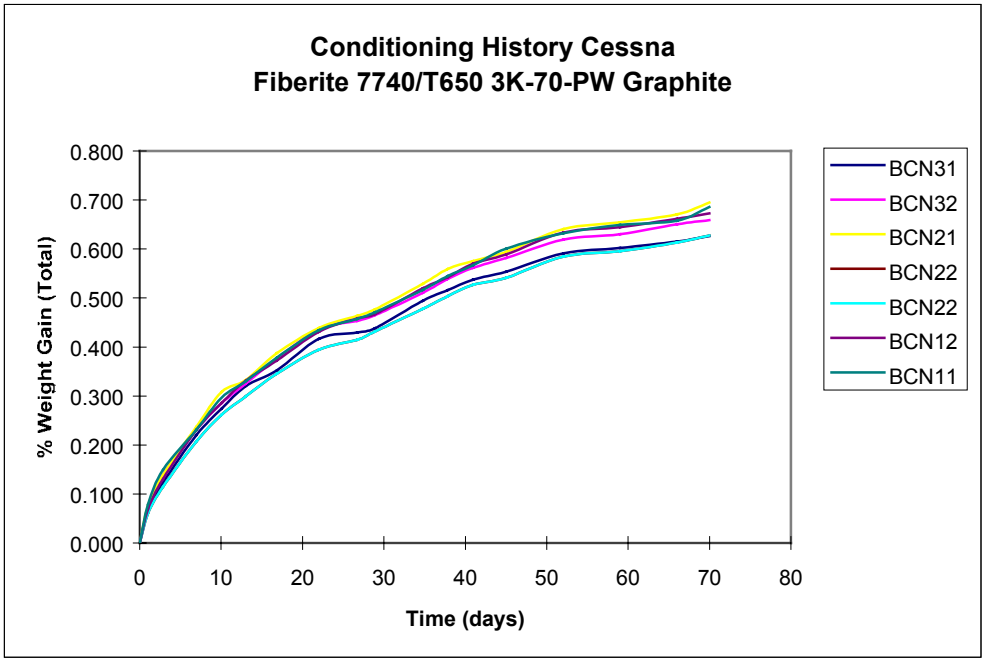


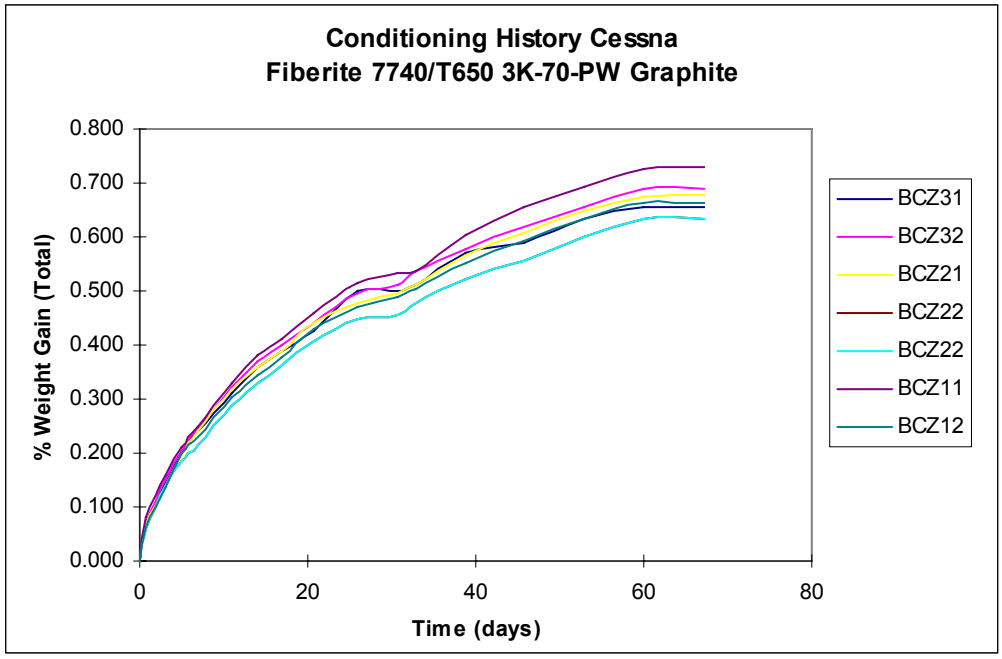


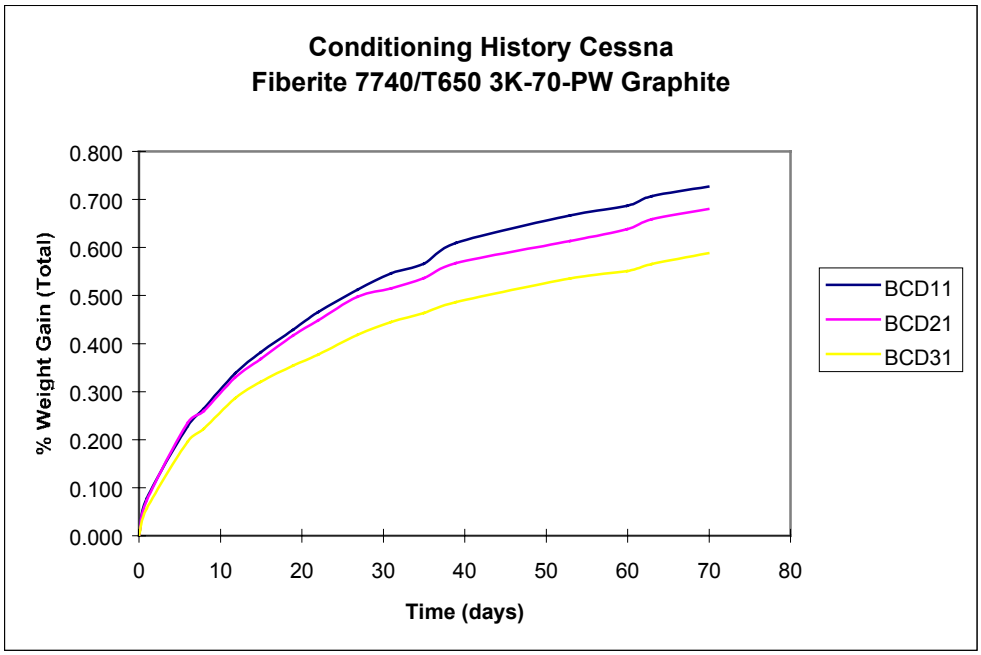












3.5 Physical Test Results

Physical Test Summary
Fiberite 7740/T650 3K-70-PW Graphite

	Composite Density [g/cc]	Resin Content [wt%]	Fiber Volume [vol%]	Void Content [vol%]
0° Tension (BCJXXXXX)				
No. of Specimens	12	12	12	12
Mean	1.521	36.587	54.243	1.965
Standard Deviation	0.013	1.840	1.991	0.402
90° Tension (BCUXXXXX)				
No. of Specimens	12	12	12	12
Mean	1.516	36.297	54.324	2.342
Standard Deviation	0.012	2.018	1.781	1.030
0° Compression (BCKXXXXX)				
No. of Specimens	6	6	6	6
Mean	1.522	33.791	56.687	2.806
Standard Deviation	0.012	1.228	1.079	0.928
90° Compression (BCWXXXXX)				
No. of Specimens	6	6	6	6
Mean	1.519	34.203	56.211	2.887
Standard Deviation	0.013	4.374	3.814	1.632
In-Plane Shear (BCNXXXXX)				
No. of Specimens	6	6	6	6
Mean	1.517	36.375	54.296	2.237
Standard Deviation	0.012	1.103	0.708	1.073
Interlaminar Shear (BCQXXXXX)				
No. of Specimens	3	3	3	3
Mean	1.526	35.026	55.779	2.183
Standard Deviation	0.023	3.690	3.905	0.785
Overall No. of Specimens	**45**	**45**	**45**	**45**
Overall Mean	**1.519**	**35.687**	**54.962**	**2.352**
Overall Std. Deviation	**0.013**	**2.485**	**2.301**	**0.988**

COMPANY : **Cessna**
MATERIAL SYSTEM : **Fiberite 7740/T650 3K-70-PW Graphite**
PROJECT : **980409C1**

DMA Results -- Onset Storage Modulus

DRY

As Fabricated		
Sample #	**Tg [°C]**	**Tg [°F]**
BCD1X1FA	121.84	251.30
BCD1X1GA	115.72	240.29
BCD1X1HA	120.82	249.48
BCD2X1FA	119.24	246.62
BCD2X1GA	116.73	242.11
BCD2X1HA	116.79	242.23
BCD3X1FA	120.58	249.04
BCD3X1GA	113.63	236.54
BCD3X1HA	116.88	242.38
Average [°F]		**244.44**
Standard Dev. [°F]		**4.91**
Coeff. Of Var. [%]		**2.01**

WET

Moisture Equilibirum at 85% RH		
Sample #	**Tg [°C]**	**Tg [°F]**
BCD1X1BC	97.35	207.23
BCD1X1CC	96.87	206.37
BCD1X1DC	97.17	206.90
BCD2X1BC	94.17	201.50
BCD2X1CC	97.11	206.80
BCD2X1DC	96.39	205.50
BCD3X1BC	96.93	206.47
BCD3X1CC	96.58	205.84
BCD3X1DC	95.89	204.61
Average [°F]		**205.69**
Standard Dev. [°F]		**1.76**
Coeff. Of Var. [%]		**0.86**

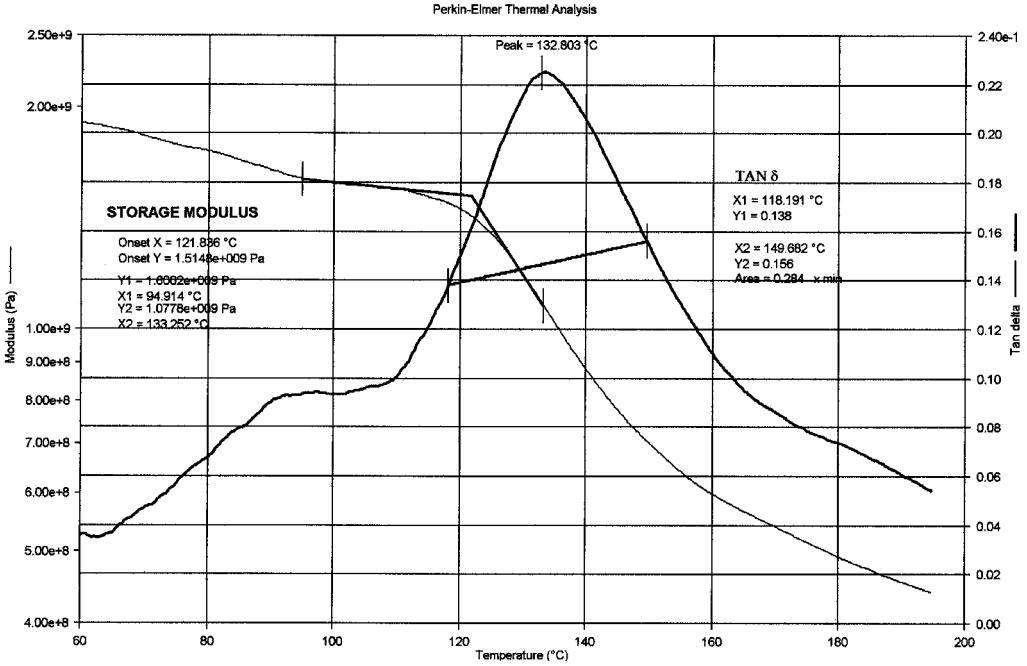
DMA Results - Peak Tan Delta

DRY

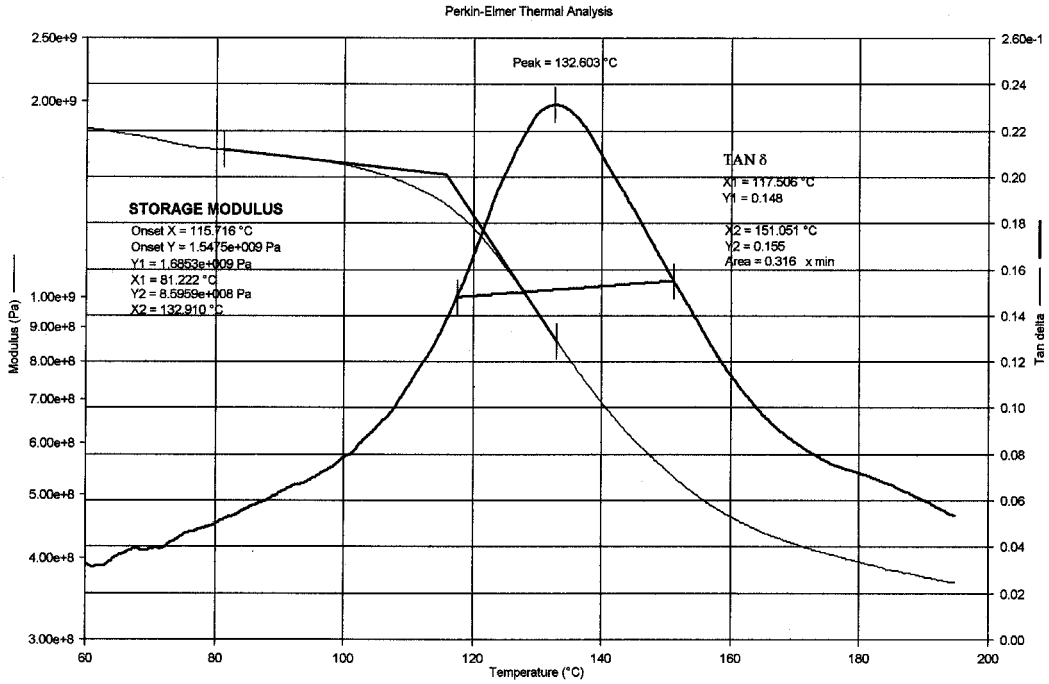
As Fabricated		
Sample #	**Tg [°C]**	**Tg [°F]**
BCD1X1FA	132.80	271.05
BCD1X1GA	132.60	270.69
BCD1X1HA	132.45	270.42
BCD2X1FA	133.03	271.45
BCD2X1GA	131.50	268.69
BCD2X1HA	132.61	270.69
BCD3X1FA	133.87	272.97
BCD3X1GA	134.54	274.17
BCD3X1HA	131.93	269.48
Average [°F]		**271.07**
Standard Dev. [°F]		**1.67**
Coeff. Of Var. [%]		**0.62**

WET

Moisture Equilibirum at 85% RH		
Sample #	**Tg [°C]**	**Tg [°F]**
BCD1X1BC	110.14	230.25
BCD1X1CC	110.39	230.70
BCD1X1DC	109.60	229.28
BCD2X1BC	109.19	228.55
BCD2X1CC	110.11	230.20
BCD2X1DC	109.03	228.25
BCD3X1BC	116.06	240.90
BCD3X1CC	112.93	235.28
BCD3X1DC	114.51	238.12
Average [°F]		**232.39**
Standard Dev. [°F]		**4.57**
Coeff. Of Var. [%]		**1.97**



BCD1X1FA



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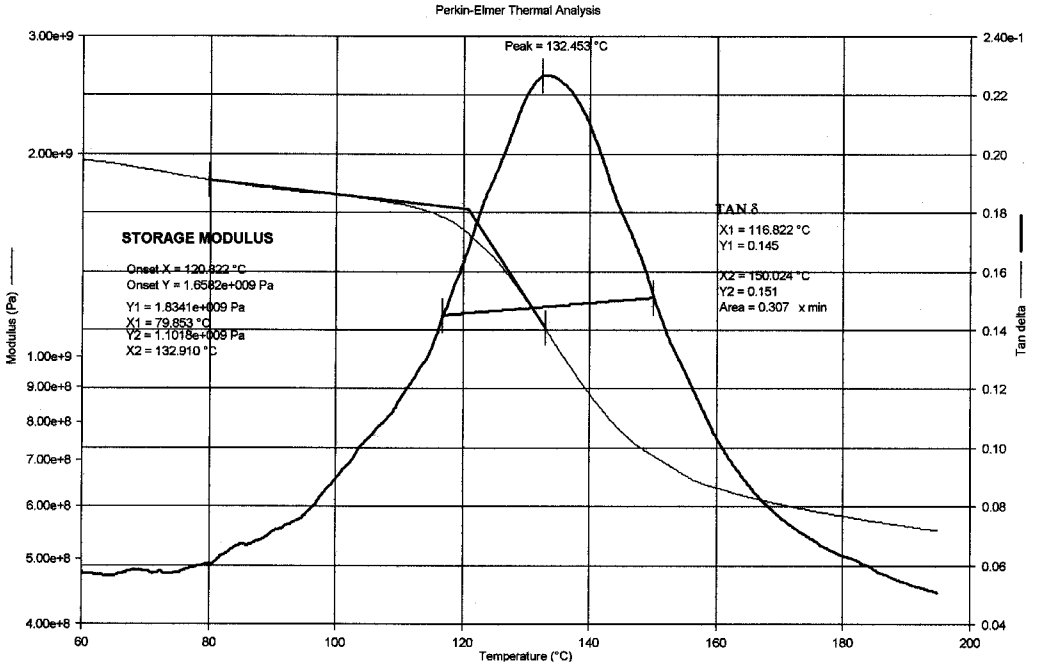

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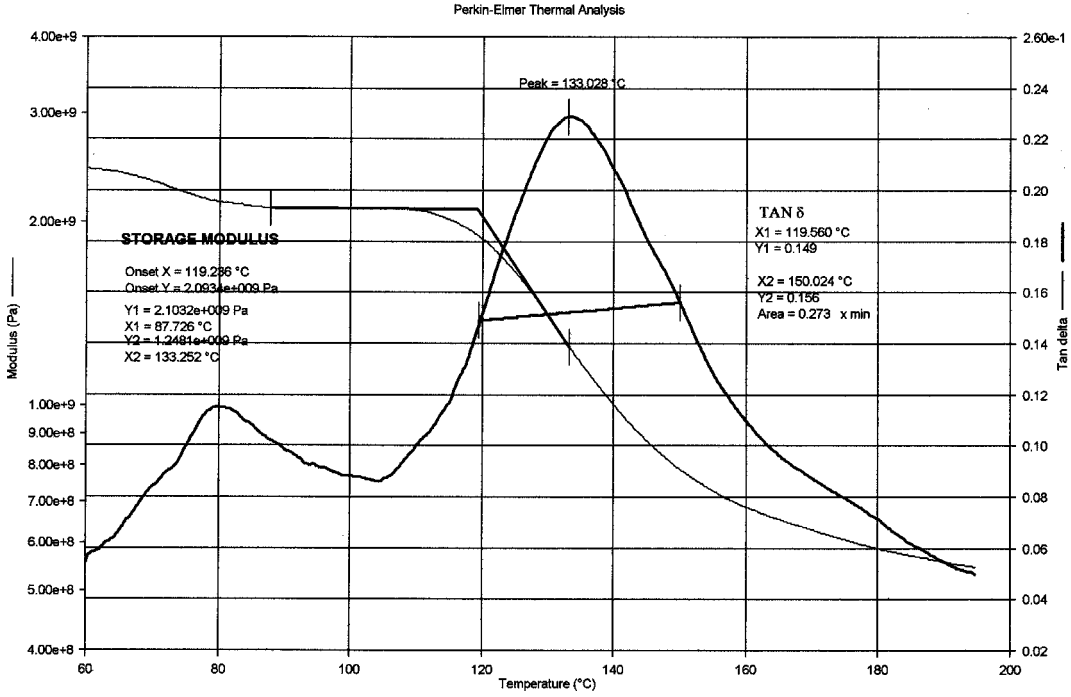

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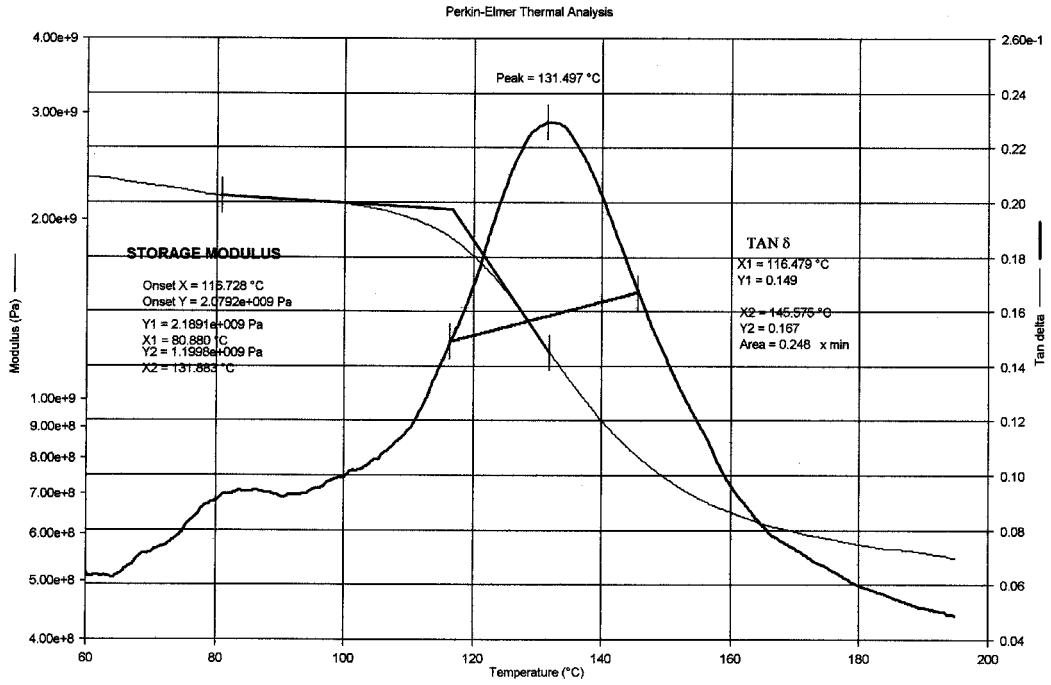

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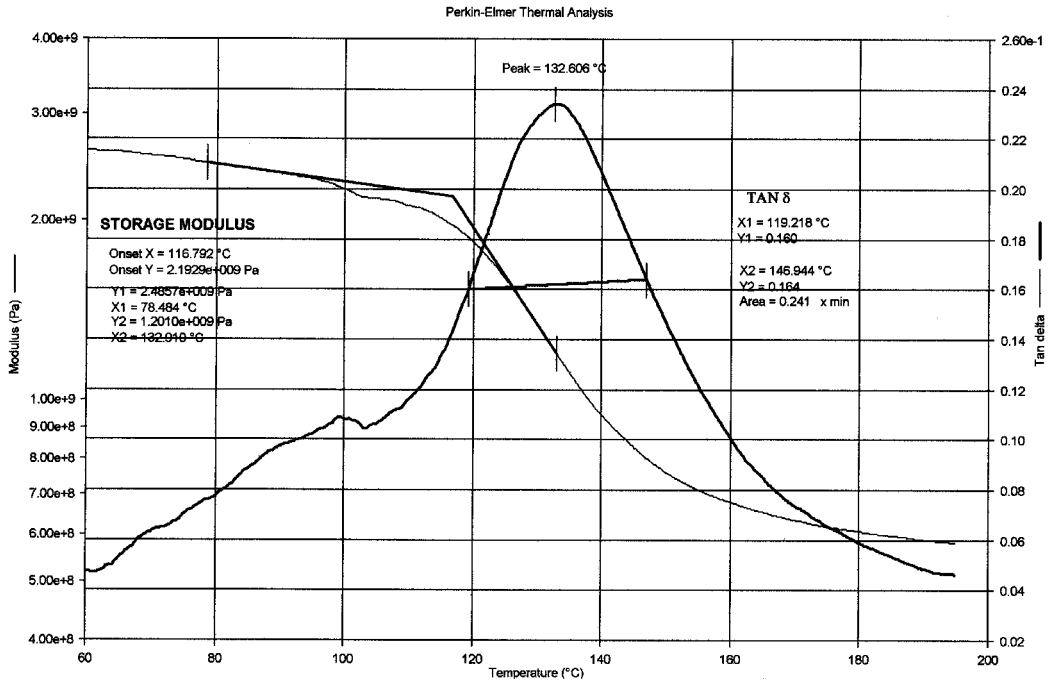

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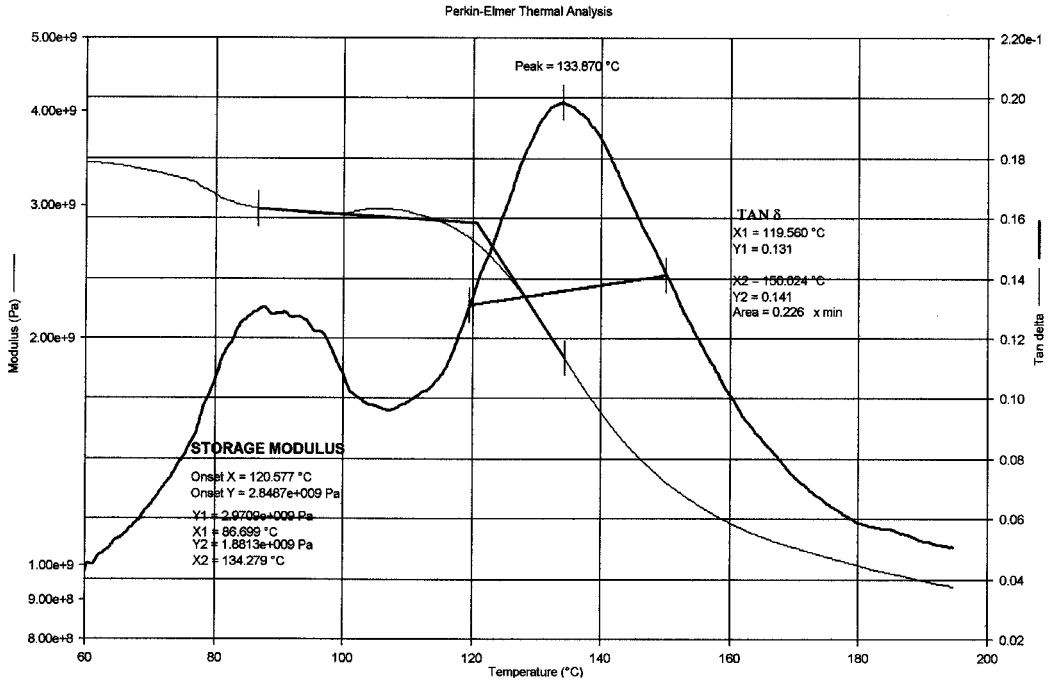

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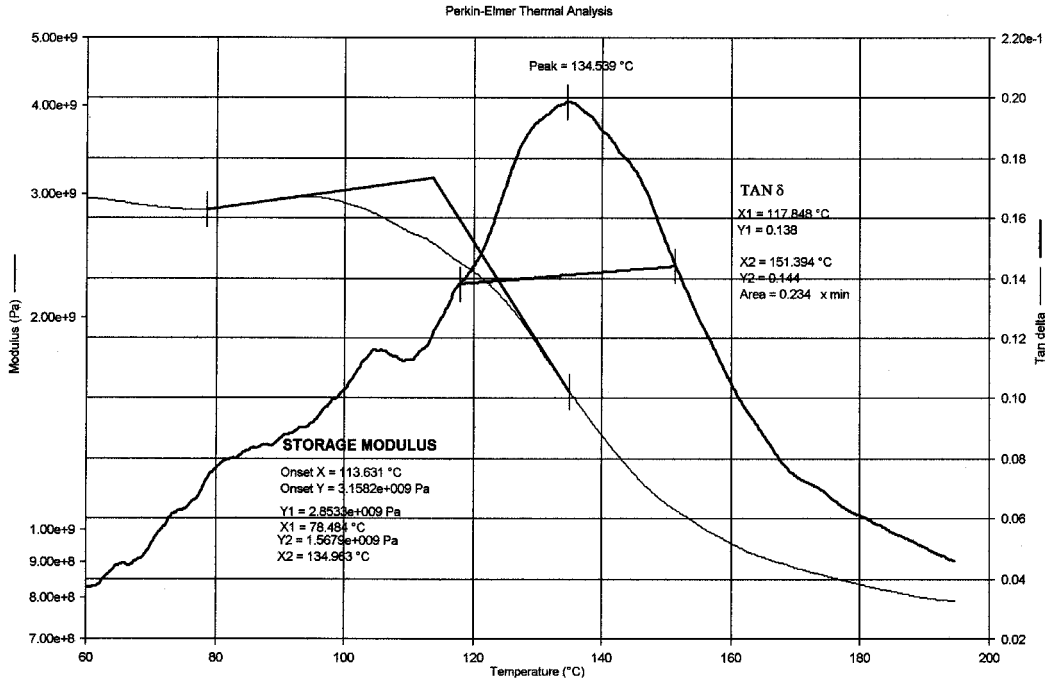

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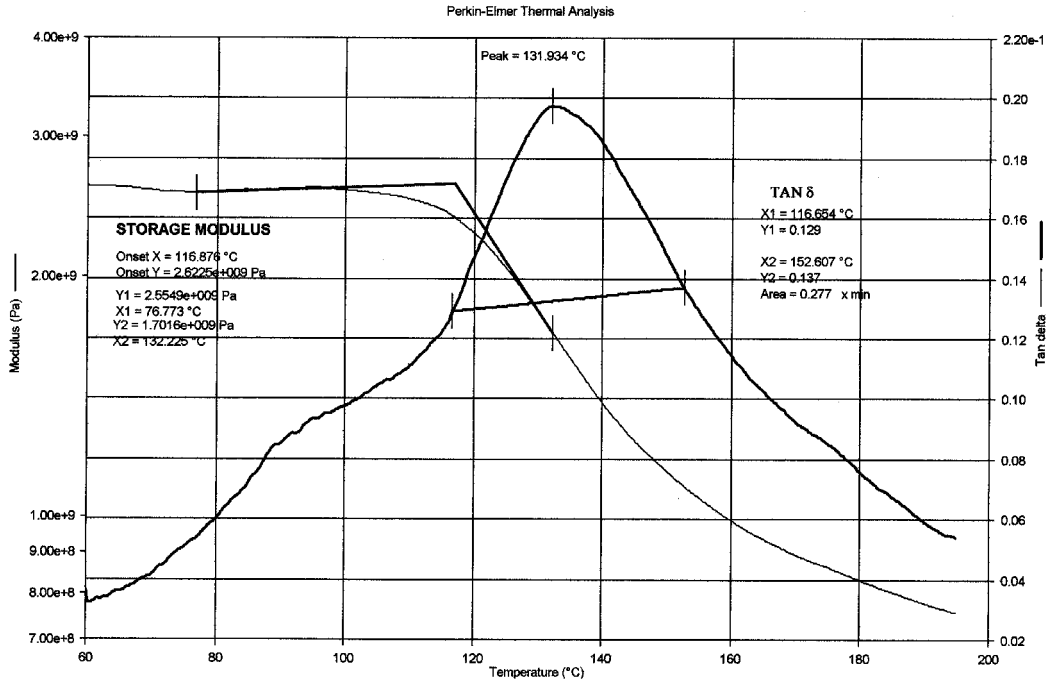
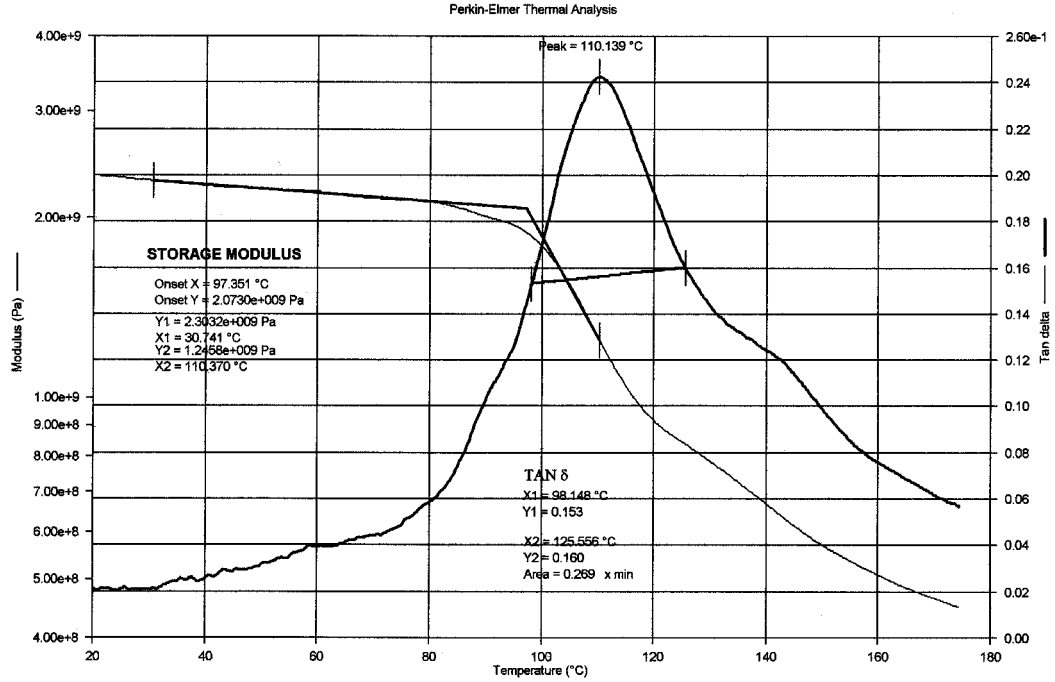


Figure 1. BCD3X1HA



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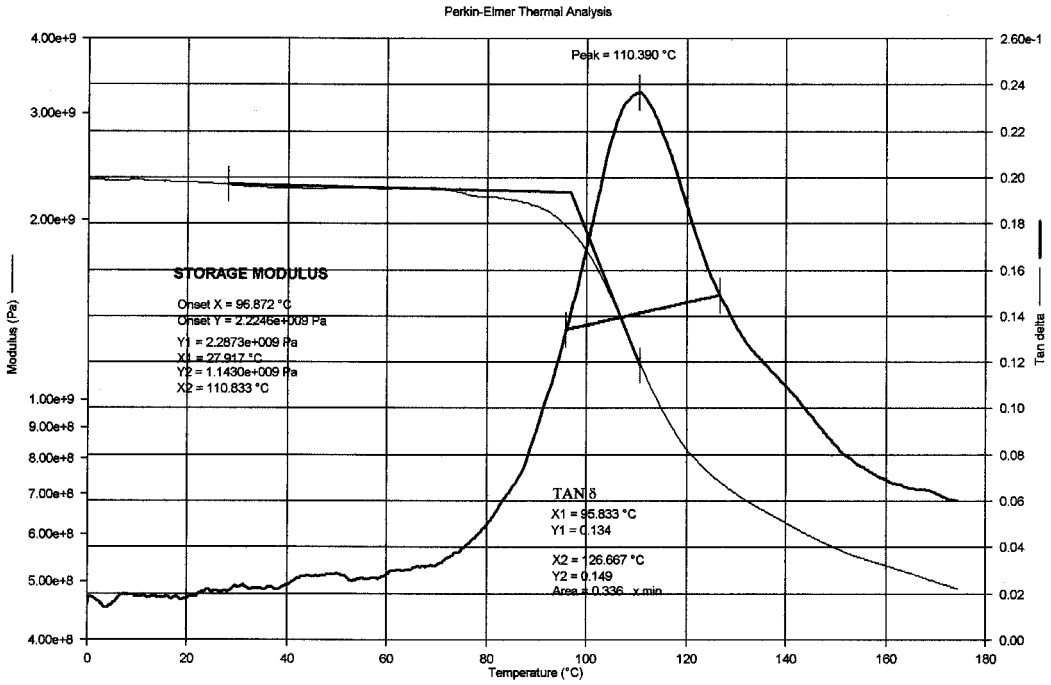
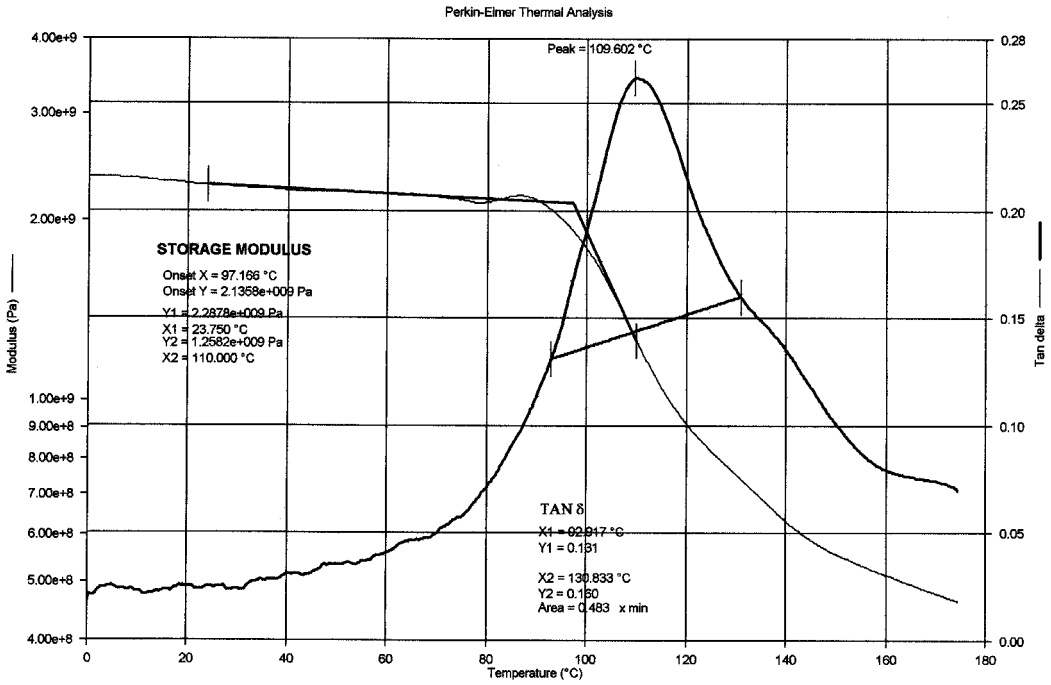


Figure 2. BCD1X1CC



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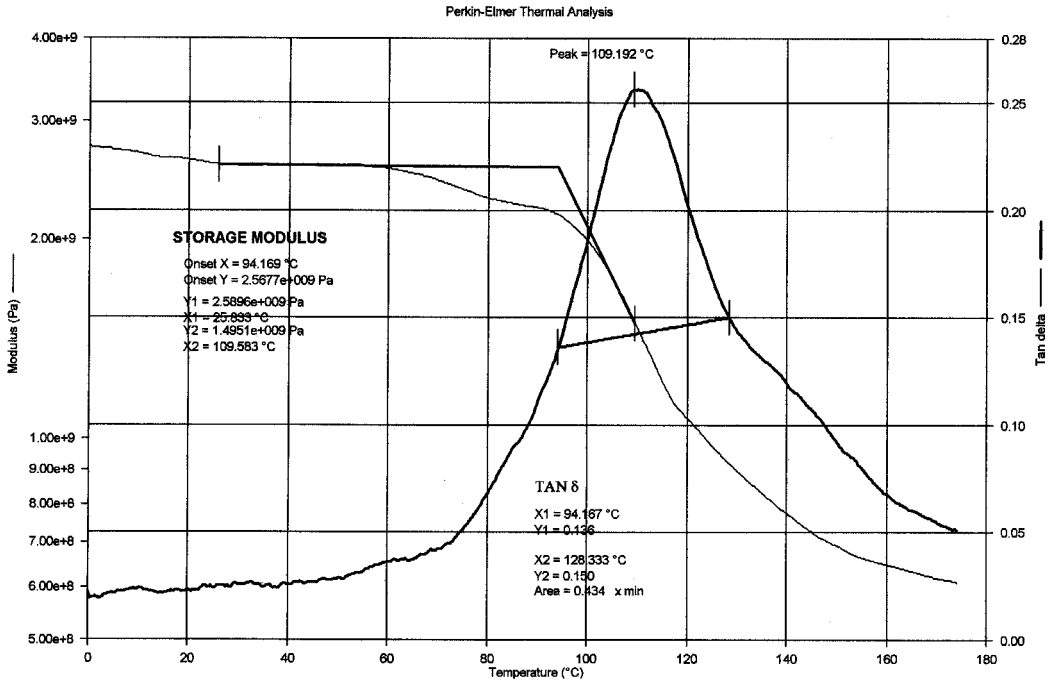

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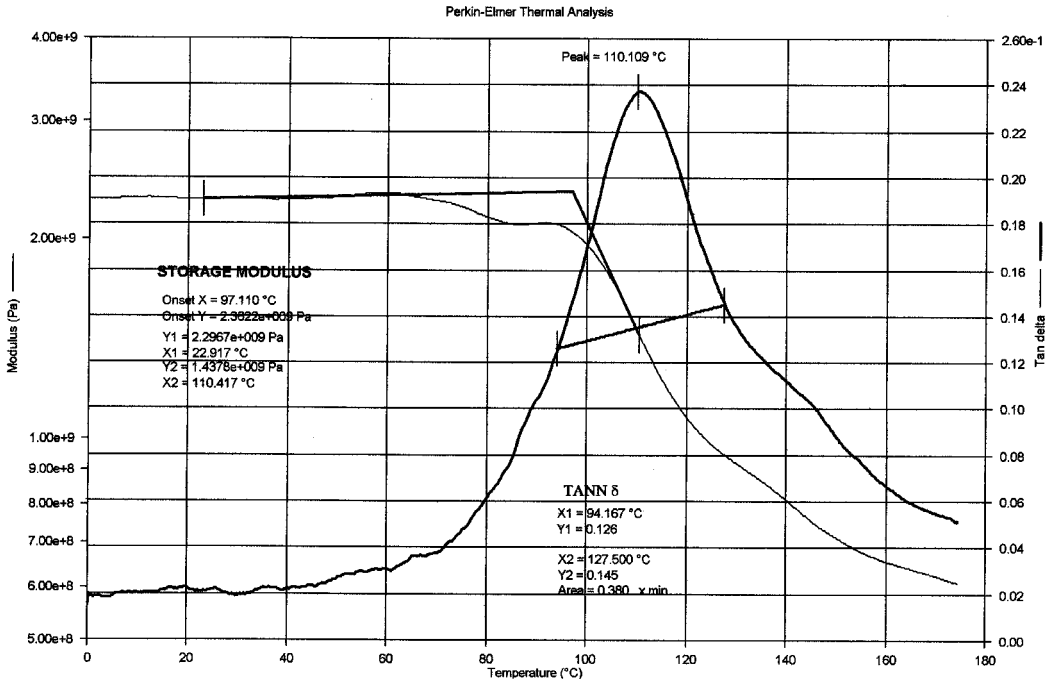

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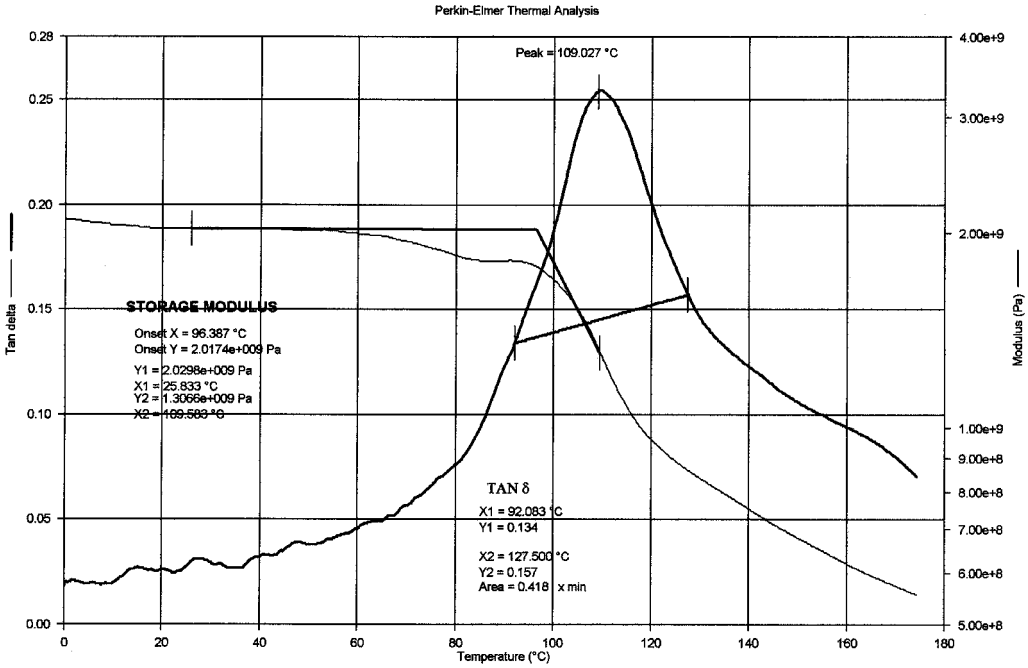
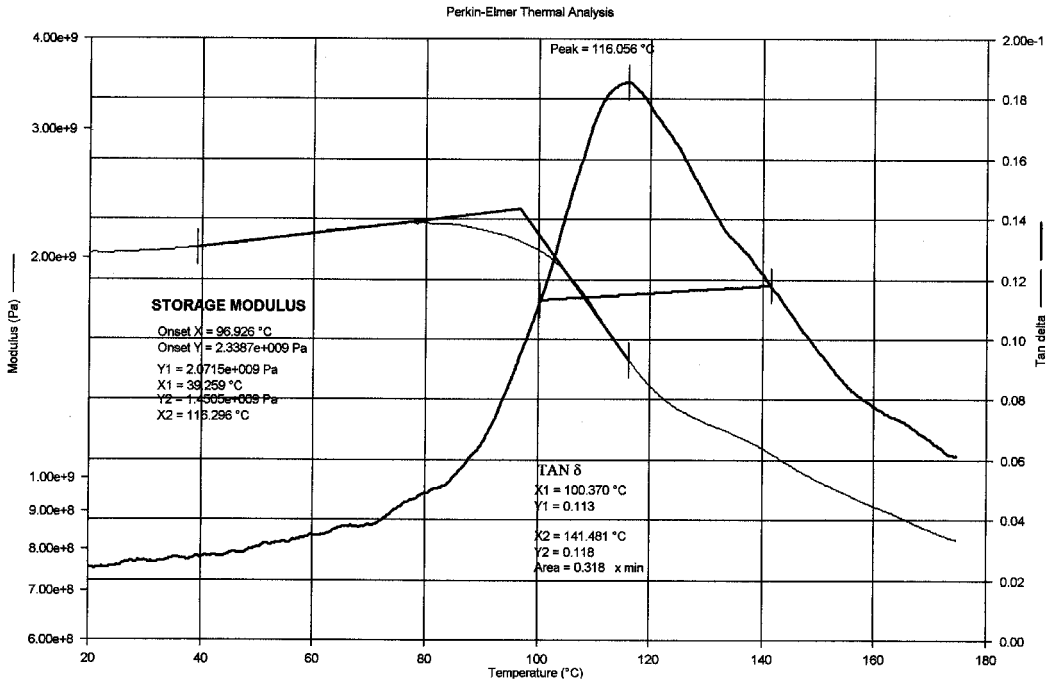


BCD2X1DC



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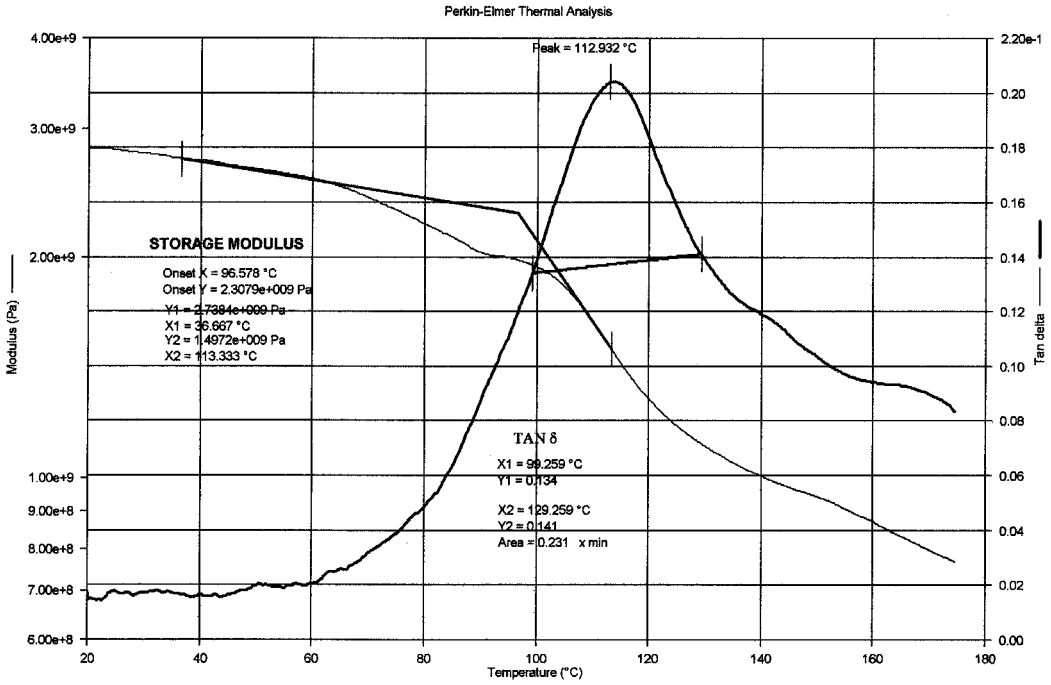

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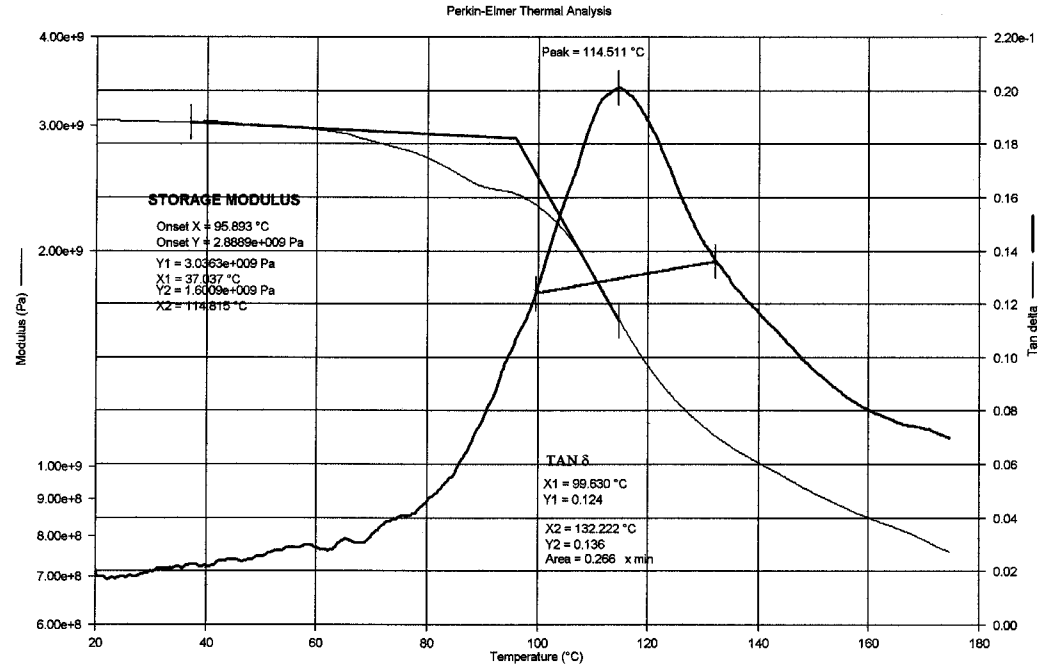


BCD3X1DC

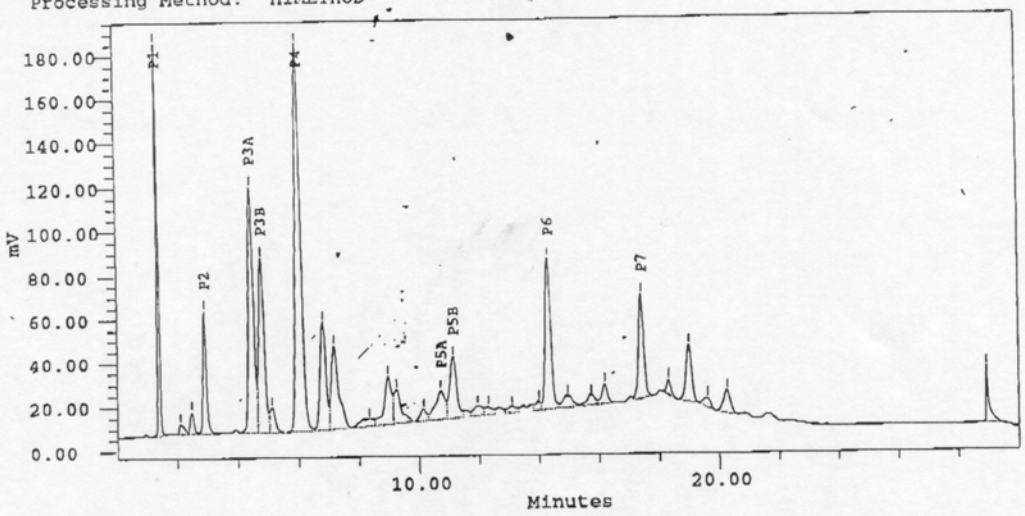
4.0 TESTING AND REPORTING COMMENTS

All tests were conformed under Designated Option Authority (DOA) by Cessna Aircraft Co., Inc.

APPENDIX A. PHYSICAL TEST DATA SUPPLIED BY MATERIAL VENDOR

FIBERITE INC.
ANALYTICAL LABORATORY
GREENVILLE, TEXAS

Project Name:	SYSTEM1	Sample Type:	Unknown
Sample Name:	310604/1	Volume:	10.00
Vial:	13	Run Time:	30.00 min
Injection:	2	Date Processed:	11/05/97 09:21:19 AM
Channel:	SIM Ch1	Dilution:	1.00000
Date Acquired:	11/05/97 08:50:20 AM	Column_ID	206294
Scale Factor:	1.00		
Acq Meth Set:	H1METHODSET		
Processing Method:	H1METHOD		

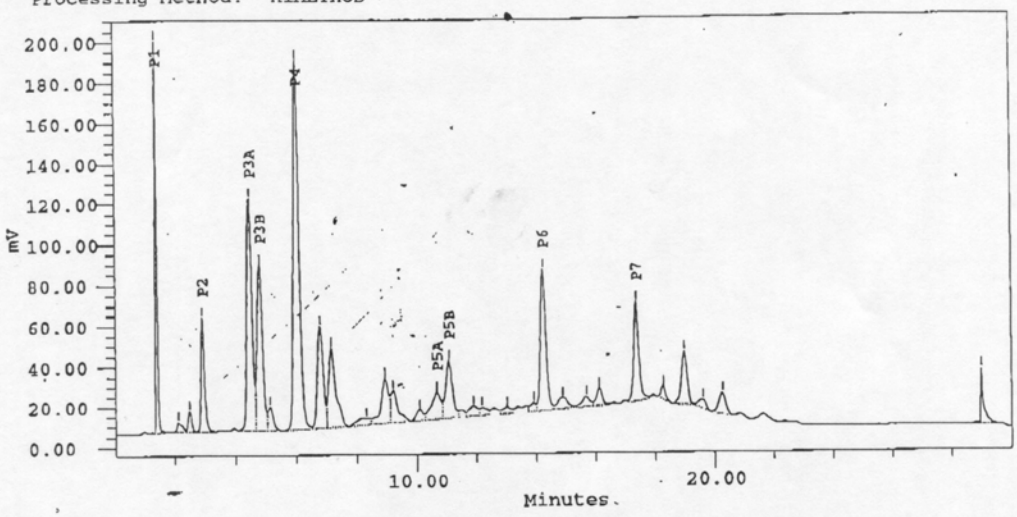


Peak Results

#	Name	Ret Time (min)	Area (uV*sec)	Height (uV)	% Area	arearatio
1	P1	1.383	733622	179081	6.17	0.312
2	P2	2.917	443580	56065	3.73	0.188
3	P3A	4.467	1309385	111753	11.02	0.556
4	P3B	4.800	993139	79910	8.36	0.422
5	P3 GROUP	4.800	2302524	191663	19.38	0.978
6	P4	6.050	2354939	176968	19.82	1.000
7	P5A	10.733	301546	13273	2.54	0.128
8	P5B	11.150	447584	28033	3.77	0.190
9	P5 GROUP	11.150	749130	41306	6.30	0.318
10	P6	14.333	892454	69092	7.51	0.379
11	P7	17.433	566065	47855	4.76	0.240

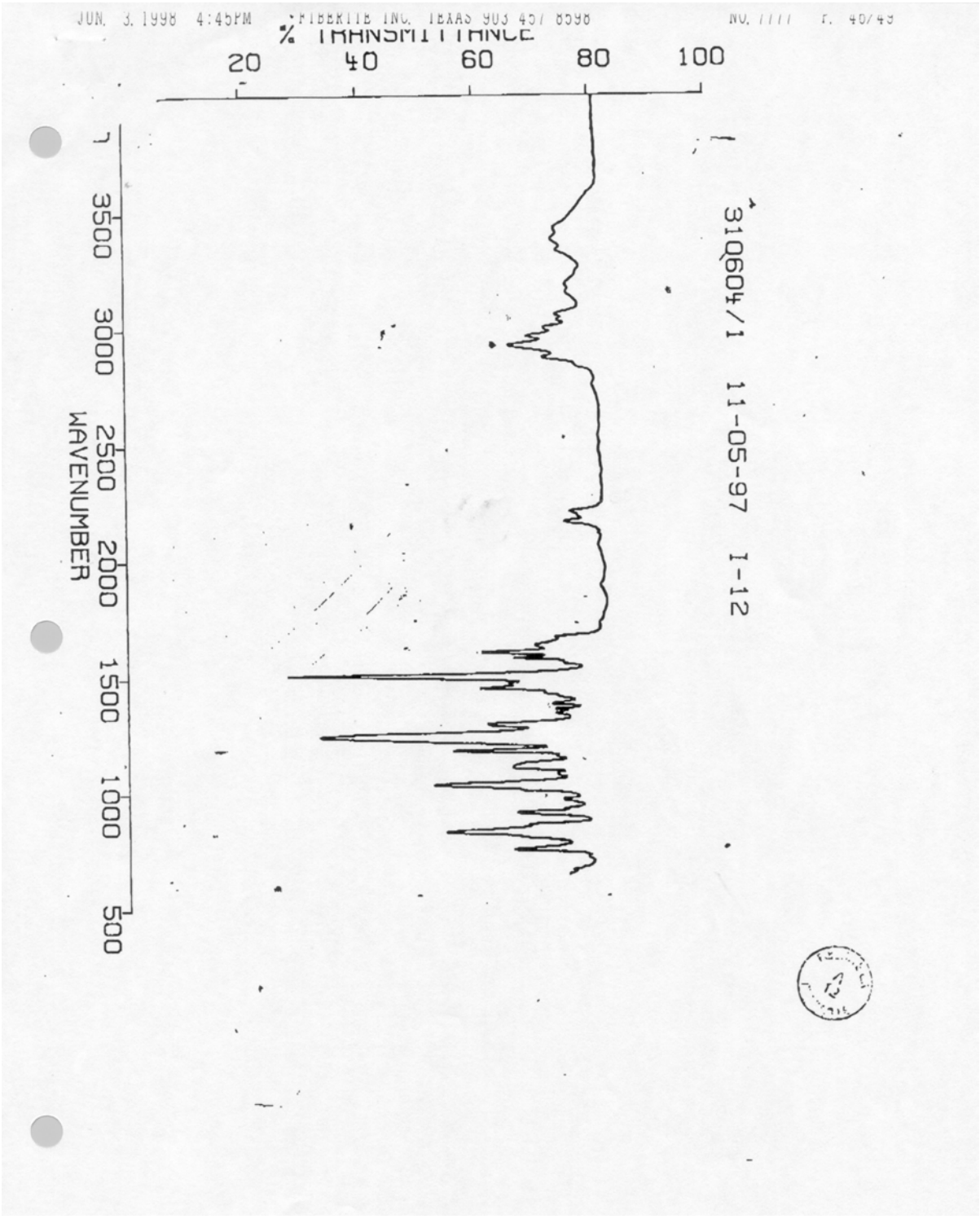
FIBERITE INC.
ANALYTICAL LABORATORY
GREENVILLE, TEXAS

Project Name:	SYSTEM1	Sample Type:	Unknown
Sample Name:	310604/1	Volume:	10.00
Vial:	13	Run Time:	30.0 min
Injection:	1	Date Processed:	11/05/97 08:50:06 AM
Channel:	SIM Ch1	Dilution:	1.00000
Date Acquired:	11/05/97 08:19:06 AM	Column_ID	206294
Scale Factor:	1.00		
Acq Meth Set:	H1METHODSET		
Processing Method:	H1METHOD		



Peak Results

#	Name	Ret Time (min)	Area (uV*sec)	Height (uV)	% Area	arearatio
1	P1	1.400	749332	193449	6.21	0.313
2	P2	2.933	450298	56449	3.73	0.188
3	P3A	4.500	1322155	114274	10.95	0.553
4	P3 GROUP	4.833	2336779	195949	19.36	0.977
5	P3B	4.833	1014624	81675	8.40	0.424
6	P4	6.050	2390745	182295	19.80	1.000
7	P5A	10.683	301532	13506	2.50	0.126
8	P5B	11.100	458872	28347	3.80	0.192
9	P5 GROUP	11.100	760405	41853	6.30	0.318
10	P6	14.267	893864	69312	7.40	0.374
11	P7	17.383	586348	48410	4.86	0.245



FIBERITE INC.
ANALYTICAL LABORATORY
GREENVILLE, TEXAS

Project Name:	SYSTEM1	Sample Type:	Unknown
Sample Name:	310605/1	Volume:	10.00
Vial:	14	Run Time:	30.00 min
Injection:	1	Date Processed:	11/05/97 09:52:44 AM
Channel:	SIM Ch1	Dilution:	1.00000
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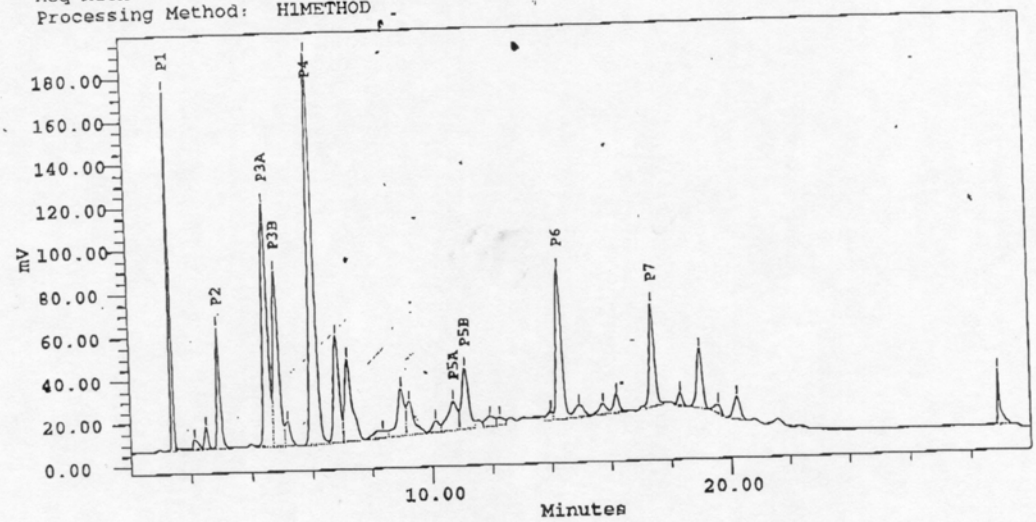
Processing Method:	H1METHOD		



Peak Results

#	Name	Ret Time (min)	Area (uV*sec)	Height (uV)	% Area	arearatio
1	P1	1.400	666057	166851	5.62	0.280
2	P2	2.933	449690	56074	3.80	0.189
3	P3A	4.533	1313686	112457	11.09	0.553
4	P3 GROUP	4.850	2317861	193288	19.57	0.976
5	P3B	4.850	1004176	80831	8.48	0.423
6	P4	6.083	2375194	181711	20.06	1.000
7	P5A	10.733	309948	13562	2.62	0.130
8	P5B	11.133	454441	28354	3.84	0.191
9	P5 GROUP	11.133	764389	41916	6.46	0.322
10	P6	14.317	903153	69555	7.63	0.380
11	P7	17.417	568340	47750	4.80	0.239

FIBERITE INC.
ANALYTICAL LABORATORY
GREENVILLE, TEXAS

Project Name:	SYSTEM1	Sample Type:	Unknown
Sample Name:	310605/1	Volume:	10.00
Vial:	14	Run Time:	30.0 min
Injection:	2	Date Processed:	11/05/97 10:24:06 AM
Channel:	SIM Ch1	Dilution:	1.00000
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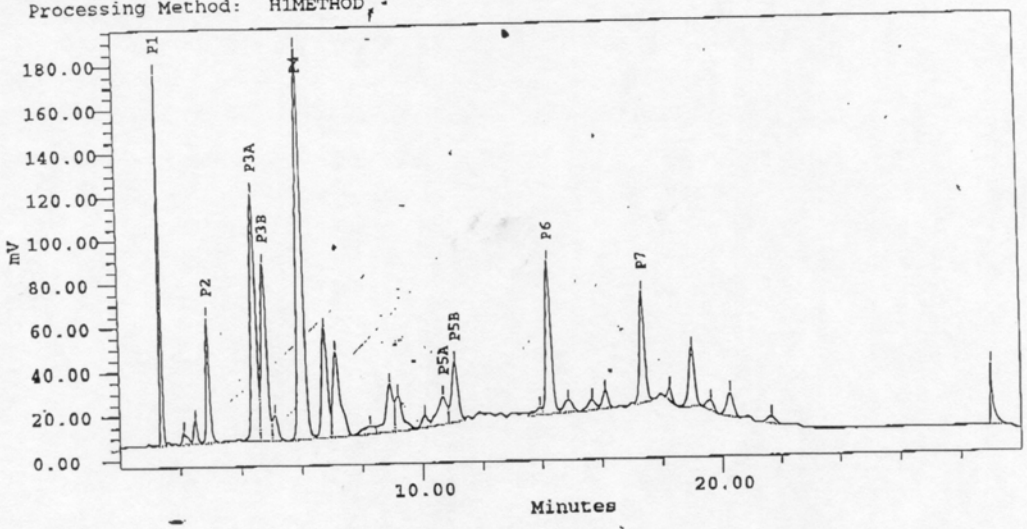
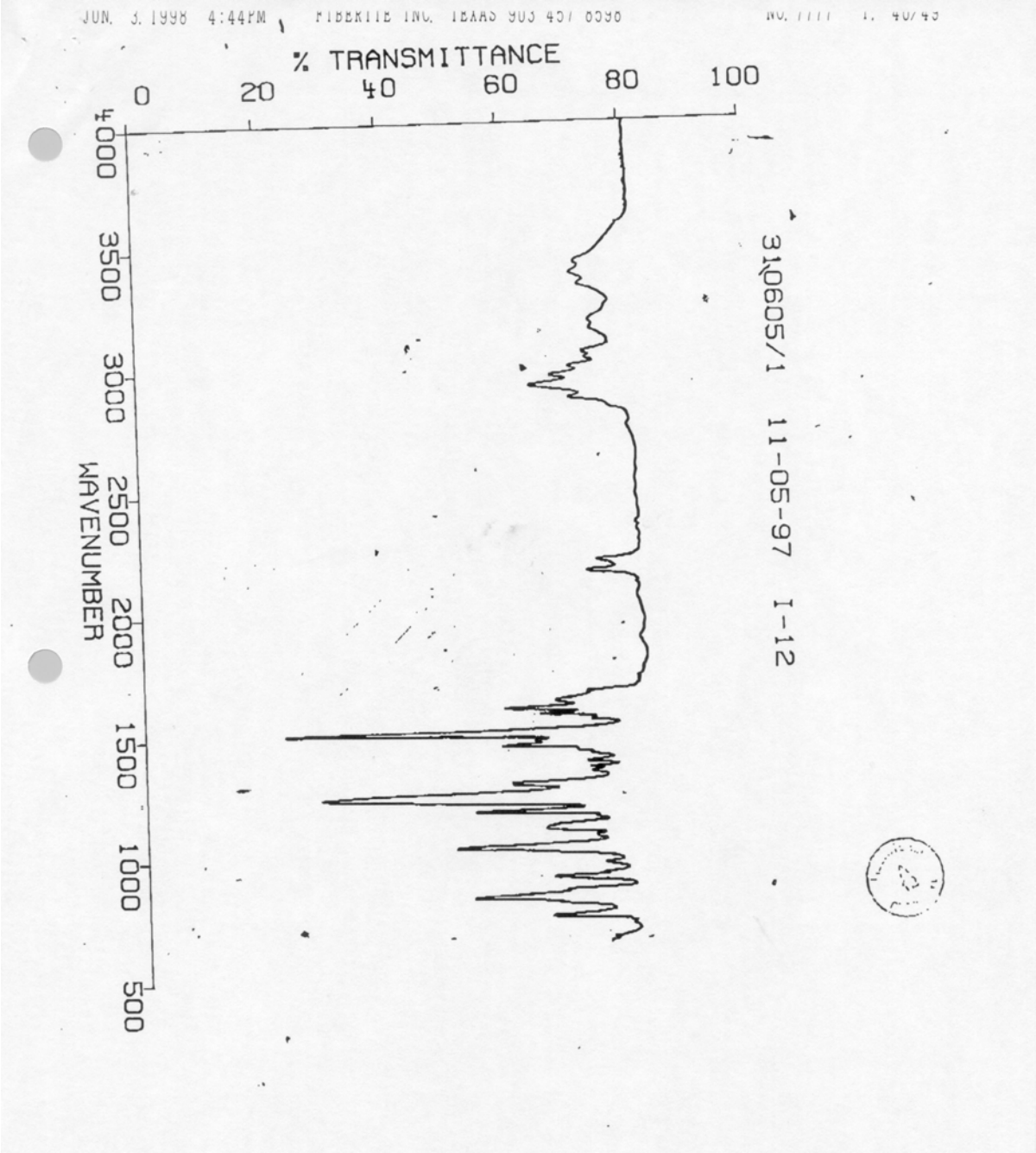
Processing Method:	H1METHOD		



Peak Results

#	Name	Ret Time (min)	Area (uV*sec)	Height (uV)	% Area	arearatio
1	P1	1.400	664981	168764	5.73	0.281
2	P2	2.917	452079	56369	3.90	0.191
3	P3A	4.467	1300787	112830	11.22	0.550
4	P3B	4.800	1000391	80127	8.63	0.423
5	P3 GROUP	4.800	2301178	192957	19.84	0.972
6	P4	6.017	2366654	178230	20.41	1.000
7	P5A	10.700	264140	12411	2.28	0.112
8	P5 GROUP	11.100	670673	39151	5.78	0.283
9	P5B	11.100	406533	26740	3.51	0.172
10	P6	14.267	874132	69480	7.54	0.369
11	P7	17.383	584417	50665	5.04	0.247



FIBERITE INC.
ANALYTICAL LABORATORY
GREENVILLE, TEXAS

Project Name:	SYSTEM1	Sample Type:	Unknown
Sample Name:	310606/1	Volume:	10.00
Vial:	15	Run Time:	30.0 min
Injection:	2	Date Processed:	11/05/97 01:32:14 PM
Channel:	SIM Ch1	Dilution:	1.00000
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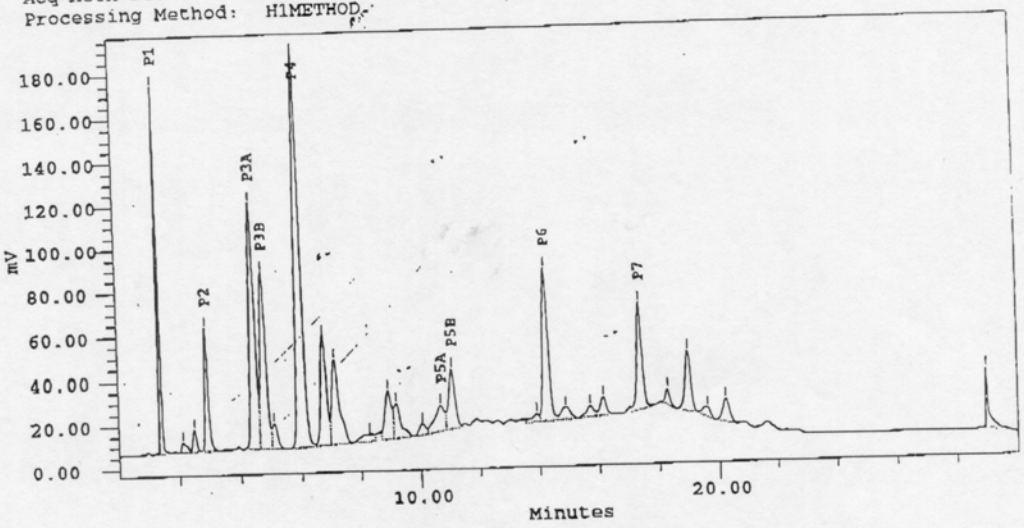
Processing Method:	H1METHOD		



Peak Results

#	Name	Ret Time (min)	Area (uV*sec)	Height (uV)	% Area	arearatio
1	P1	1.400	658143	167670	5.69	0.276
2	P2	2.917	443609	55535	3.83	0.186
3	P3A	4.450	1315970	112416	11.38	0.553
4	P3 GROUP	4.783	2317704	192510	20.04	0.973
5	P3B	4.783	1001734	80094	8.66	0.421
6	P4	6.017	2381663	179267	20.59	1.000
7	P5A	10.700	270493	11553	2.34	0.114
8	P5 GROUP	11.083	680267	38276	5.88	0.286
9	P5B	11.083	409774	26723	3.54	0.172
10	P6	14.267	895861	69106	7.74	0.376
11	P7	17.400	586242	48140	5.07	0.246

FIBERITE INC.
ANALYTICAL LABORATORY
GREENVILLE, TEXAS

Project Name:	SYSTEM1	Sample Type:	Unknown
Sample Name:	310606/1	Volume:	10.00
Vial:	15	Run Time:	30.0 min
Injection:	1	Date Processed:	11/05/97 01:00:54 PM
Channel:	SIM Ch1	Dilution:	1.00000
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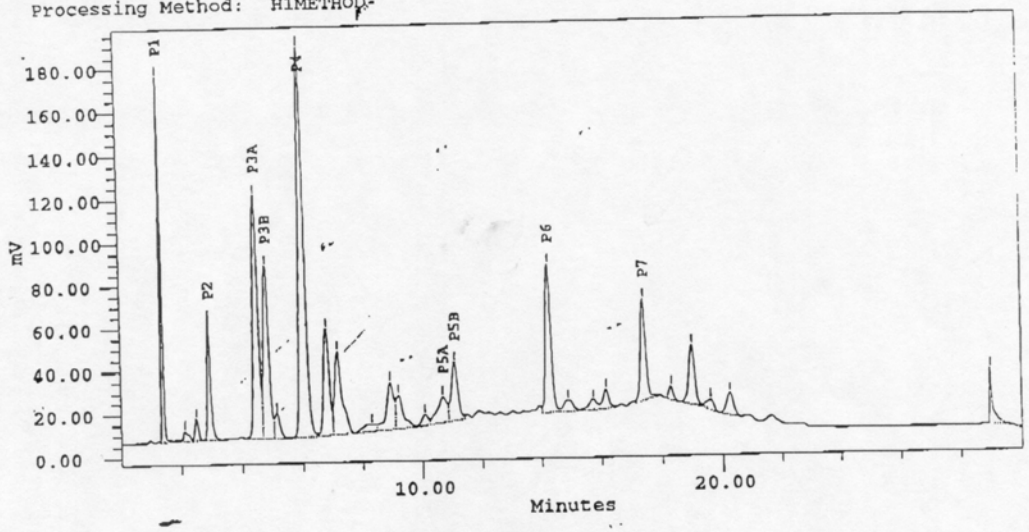
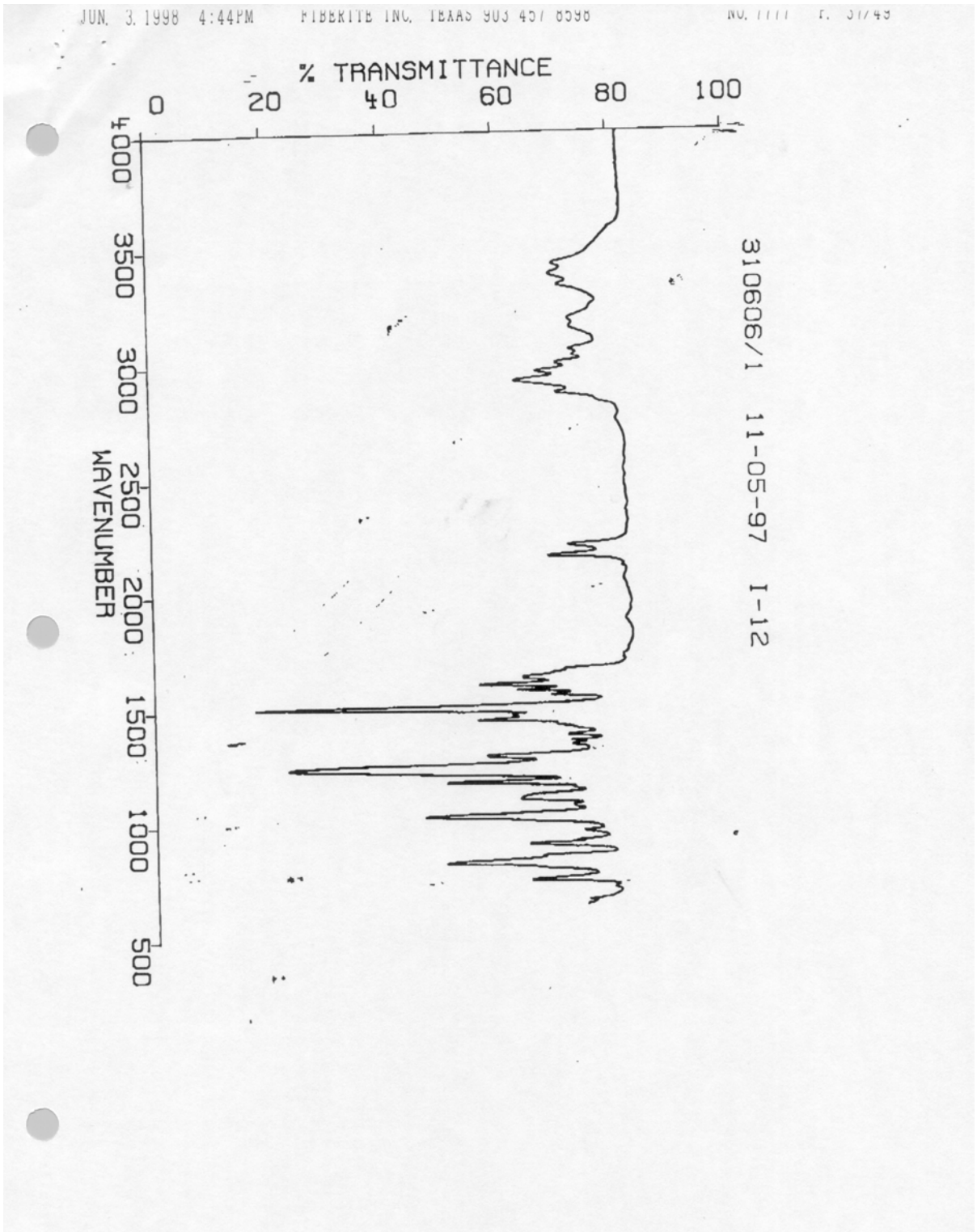


Peak Results

#	Name	Ret Time (min)	Area (uV*sec)	Height (uV)	% Area	arearatio
1	P1	1.400	666591	169317	5.75	0.279
2	P2	2.933	444872	55576	3.83	0.186
3	P3A	4.500	1308134	112859	11.28	0.548
4	P3 GROUP	4.833	2318744	193451	19.99	0.971
5	P3B	4.833	1010610	80592	8.71	0.423
6	P4	6.050	2388328	180580	20.59	1.000
7	P5A	10.700	275484	12331	2.37	0.115
8	P5 GROUP	11.100	691172	39217	5.96	0.289
9	P5B	11.100	415688	26885	3.58	0.174
10	P6	14.283	890520	68887	7.68	0.373
11	P7	17.417	568688	47023	4.90	0.238



APPENDIX B. DATES OF PANEL MANUFACTURE AND COPY OF FAA FORM 8130-3

3

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking No. AGATE-2
4. Organization CESSNA AIRCRAFT CO.		5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibility *	10. Quantity	11. Serial/Batch Number	12. Status/Work
2.	CARBON EPOXY TEST PANELS	SEE ITEM #13	TEST	53	N/A	COMPLETE

13. Remarks

Conformity only: Ship to Wichita State University. This item contains the following part numbers (1ea.):

BCJ11	BCJ31	BCJ13	BCJ33	BCJ15	BCL21	BCN12
BCJ12	BCJ32	BCJ14	BCJ34	BCK12	BCW22	BCN32
BCU11	BCU31	BCU13	BCU33	BCL11	BCZ21	
BCU12	BCU32	BCU14	BCU34	BCU15	BCQ31	
BCJ21	BCN11	BCJ23	BCK21	BCW12	BCN31	BCK32
BCJ22	BCK11	BCJ24	BCN21	BCZ11	BCK31	BCW31
BCU21	BCW11	BCU23	BCQ21	BCN22	BCL31	BCW32
BCU22	BCQ11	BCU24	BCW21	BCK22		BCZ31

Reviewed FAA Form 8130-9, Dated _____

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
Newly Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special reqirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Maurice M. Linneburn	DMIACE 501529		
17. Name *(Typed or Printed)*:	**18. Date:**	**22. Name *(Typed or Printed)***	**23. Date:**
MAURICE M. LINNEBURN	8-4-98		

* (Optional) Installer must cross check eligibility with applicable technical data