Advanced General Aviation Transport Experiments

B – Basis Design Allowables for 2X2 Biaxially Braided RTM Composite Material Systems

Carbon Braid
AS4 6K GP / PR520

AGATE-WP3.3-033048-117

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1.0 INTRODUCTION

1.1 Scope

The Advanced General Aviation Transport Experiments (AGATE) consortium is an industry-university-government partnership initiated by NASA to create the technological basis for revitalization of the United States general aviation industry. It was founded in 1994 to develop affordable new technology as well as the industrial standards and certification methods for composite airframe, cockpit, flight systems and airspace infrastructure for Federal Aviation Regulations (FAR) Part 23 aircraft. The composite material properties contained within the document were generated under Work Package 3 : Integrated Design and Manufacturing Methods.

Although AGATE was focused towards the small general aviation aircraft (Part 23), 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) as part of the AGATE effort. 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.

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.

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
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
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 braid direction)
12	in – plane
13	interlaminar

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/Ep	Carbon-Epoxy
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
NASA	National Aeronautics and Space Administration
RTD	room temperature dry
RTM	Resin Transfer Molding
RUC	Repeating Unit Cell
SACMA	Suppliers of Advanced Composite Materials Association
SRM	SACMA Recommended Method
T_g	glass transition temperature
t_{ply}	cured ply thickness
V_f	fiber volume
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

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

Standard Test Method for Determining the Compressive Properties of Polymer Matrix Composite Materials using the Combined Loading Compression (CLC) Test Fixture, ASTM Proposed New Standard; working document

1.5 Methodology

1.5.1 Braided Material Forms

The mechanical behavior of braids hinges upon the fiber geometry. The geometry of a periodic textile can be conveniently illustrated in terms of a repeating pattern, referred as the Repeating Unit Cell or RUC (Figure 1.5.1).

Braided preform is produced in a tubular shape. The braid angle is the angle of the braided yarns measured relative to the axis parallel to the axis of the tube (braid direction). The diameter of the resulting braid is usually defined at the braid angle of ±45°. By stretching or compressing the braid, the braid angle can be changed between the tensile and compressive jam angles.

When a braided layer is said to be oriented 0°, the braider yarns are not aligned with the 0° (see Figures 1.5.2 - 1.5.4). The orientation of the layer represents the direction of the braid axis.

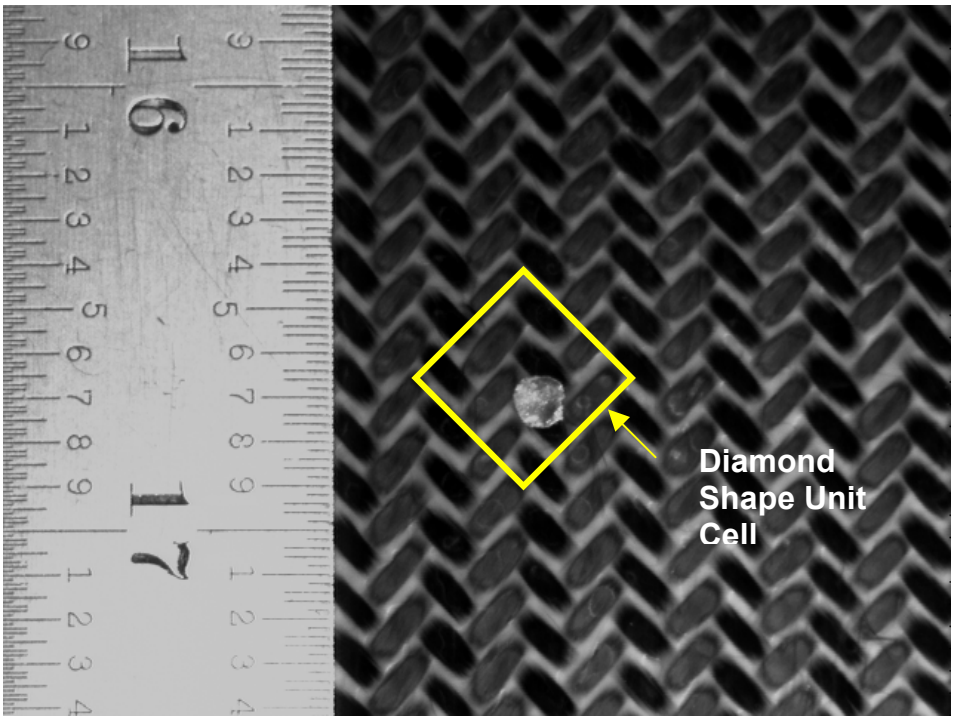

Figure 1.5.1 Diamond shaped unit cell of a 2-D 2x2 biaxial braid

1.5.2 The Repeating Unit Cell (RUC) of ±30° Braid

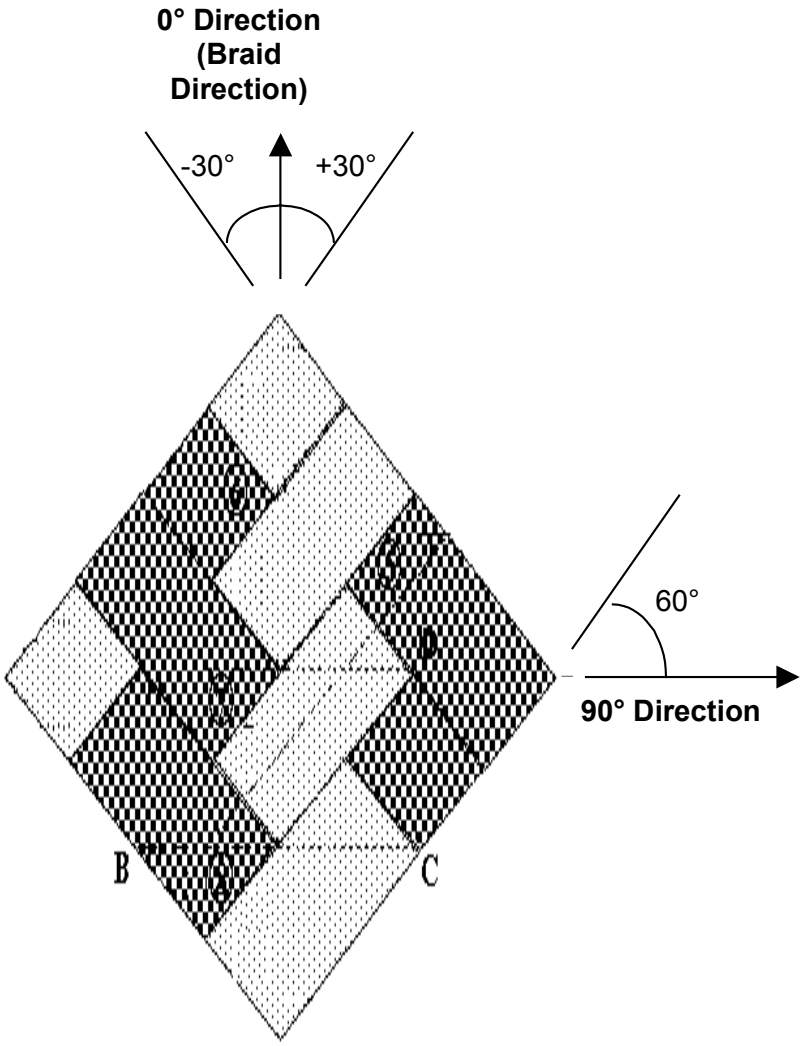

Figure 1.5.2 Repeating Unit Cell (RUC) of ±30° braid.

1.5.3 The Repeating Unit Cell (RUC) of ±45° Braid

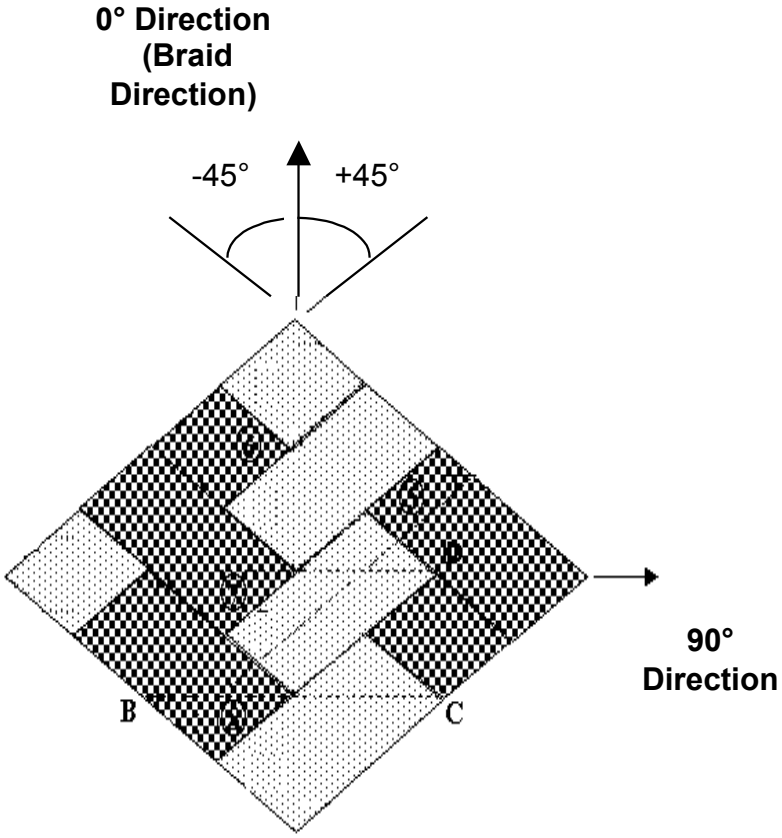

Figure 1.5.3 Repeating Unit Cell (RUC) of ±45° braid.

1.5.4 The Repeating Unit Cell (RUC) of ±60° Braid

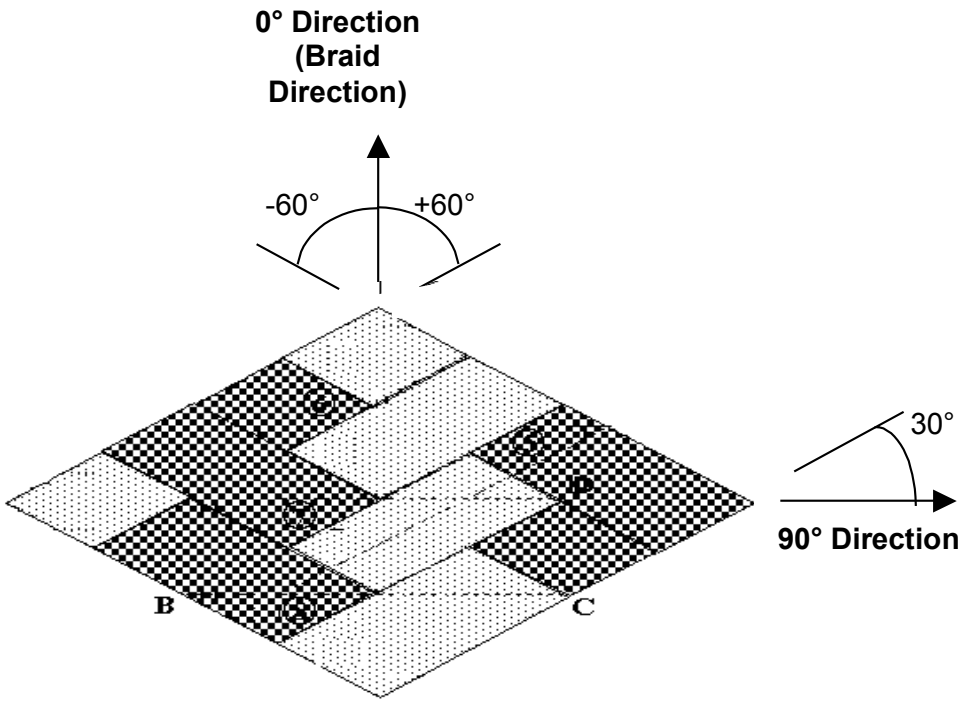

Figure 1.5.4 Repeating Unit Cell (RUC) of ±60° braid.

Note that the ±60° braid RUC is a 90° rotation (in-plane) of the ±30° braid RUC. Therefore, the 90° properties of ±60° braid are equivalent to the 0° direction properties of ±30° braid and 0° properties of ±60° braid are equivalent to the 90° direction properties of ±30° braid.

1.5.5 Test Matrix

Three batches of materials were fabricated combining two batches of resin systems and two batches of fiber systems as shown in Table 1.5.1.

Table 1.5.1 Batch Variability in the Material Database

	Resin 1	**Resin 2**
Braid A	Batch 1	N/A
Braid B	Batch 2	Batch 3

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 in Table 1.5.2, with the following notation cited in each column:

 # x #

where the first # represents the required number of material batches per braid angle and the second # represents the required number of replicates per batch. For example, "3 x 6" refers to three batches of material and six specimens per batch for a total requirement of 18 test specimens. The minimum sample requirements are shown, but more samples may have been tested.

Table 1.5.2 Test Matrix for each Braid Angle and Standards Used

TEST	METHOD	NO. OF REPLICATES PER TEST CONDITION			
		CTD[1,5]	RTD[2,5]	ETW[3]	ETD[4,5]
0° Tension Strength	ASTM D3039-95	1x4	3x4	3x4	1x4
0° Tension Modulus, Strength and Poisson's Ratio	ASTM D3039-95	1x2	3x2	3x2	1x2
0° Compression Strength	Combined Loading Compression	1x4	3x4	3x4	1x4
0° Compression Strength & Modulus	Combined Loading Compression	1x2	3x2	3x2	1x2
In-Plane Shear Strength[6]	ASTM D5379-93	1x6	3x6	3x6	1x6
In-Plane Shear Modulus and Strength[6]	ASTM D5379-93	1x2	3x2	3x2	1x2
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	1 dry, 1 wet per panel			

Notes :

1 CTD: One batch of material tested (test temperature = -65 ± 5° F, moisture content = as fabricated, soak time at –65 was 3 min.)

2 RTD: Three batches of material tested (test temperature = 70 ± 10° F, moisture content = as fabricated)

3 ETW: Three batches of material tested (test temperature = 180 ± 5° F, moisture content = equilibrium per section 1.5.2, soak time at 180 was 2 min.)

4 ETD: Three batches of material tested (test temperature = 180 ± 5° F, moisture content = as fabricated, soak time at 180 was 2 min.)

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

6 In-plane shear results are not reported for ±30° braid (specimens cut with fibers oriented ±30° to the specimen lengthwise axis)

1.5.6 Environmental Conditioning

All 'wet' conditioned samples were exposed to elevated temperature and humidity conditions to ensure moisture equilibrium 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) is 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% within a span of 7 ± 0.5 days for two consecutive readings and may be 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 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, placed in a sealed bag with a moist paper towel for a maximum of 14 days until mechanical testing. The specimens were at room temperature (70 ± 5^{o} F) for at least 12 hours prior to testing. Strain gauged specimens were removed from the controlled environment for a maximum of 2 hours for application of gages in ambient laboratory conditions.

1.5.7 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 *Material Qualification and Equivalency for Polymer Matrix Composite Material Systems.*

2.0 RAYTHEON AS4 6K GP / PR 520 PREPREG PROPERTIES

2.1 Raw Material Documentation by Batch

RTM Documentation	**RTM Manufacturer & Product ID: WSU NIAR Composites Lab** **Material Identification (weave, form, class, etc.): 2-D Biaxial Braid** **Impregnation Method: N/A**		
Batch (Lot) ID as labeled on samples	**1**	**2**	**3**
Date of Manufacture	8/6/99 – 11/4/99	8/6/99 – 11/4/99	8/6/99 – 11/4/99
Expiration Date	N/A	N/A	N/A
Resin Content [%]	26 - 41	26 – 41	26 – 41
Reinforcement Areal Weight ASTM D-3776	.0422 - .0458	.0422 - .0458	.0422 - .0458
Gel Time 370°F	30 min	30 min	30 min
Volatile Content [%]	1.0 – 2.5	1.0 – 2.5	1.0 – 2.5
Reinforcement Documentation	**Braid Manufacturer & Product ID: A&P Technology - RA2971** **Customer Part No: 132539 – 035 – 6** **Nominal Filament Count: 6000** **Fiber Angle (±3°): 45° @ 3.5" inside diameter** **Yards/LB (±10%): 3.825 @ 3.5" inside diameter**		
Fiber Lot #	1716 – 5B 051999	1775 – 2C 051999	N/A
Date of Fiber Manufacture	5/25/99	2/24/99	N/A
Braid Lot #	AP110	AP109	N/A
Date of Braid Manufacture	6/8/99	6/8/99	N/A
Average Fiber Density per Lot Manufacturer's Test Method	1.799 g/cc	1.799 g/cc	N/A
Matrix Documentation	**Resin Manufacturer & Product ID: 3M PR 520 Epoxy**		
Matrix Batch or Lot #	8207D8	9210D9	N/A
Date of Manufacture	4/30/98	4/28/99	N/A
Average Neat Resin Density by Lot ASTM D-792	1.2495 g/cc	1.2495 g/cc	N/A

2.2 Process Specification – RTM Braided Panel Manufacturing

2.2.1 Tool Preparation

1. The tool shown in Figure 2.1 was cleaned with Acetone (CH_3COCH_3).
2. 4-5 coats of C mold sealer were applied.
   - A clean, lint free, 100% woven cloth was soaked with sealer (FREKOTE® B-15) until it was wet, but not dripping.
   - Starting at one end of the mold surface, a smooth, continuous, wet film was wiped on. (Only a thin wet film was required.) As the sealer dried rapidly, care was taken not to wipe back over the area just coated, once the solvents had flashed off.
   - When coating a large area, the application cloth was re-soaked several times to maintain the thin, wet film.
   - At least 20 to 30 minutes was allowed between each coat, at room temperature.

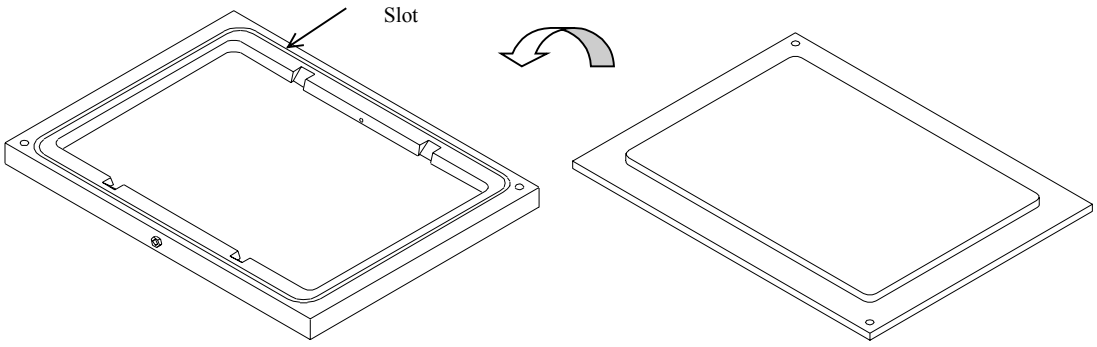

Figure 2.1 Aluminum mold for the panel manufacturing

3. FREKOTE® NC 44 (or 770-NC) releasing agent was applied.
   - The same procedure as in step 2 was followed.
   - 4 coats were applied for the first time, and 2 coats per use of mold.
   - 5 to 10 minutes were allowed between each coat.

4. The Silicon sealer (O-ring type) was placed inside the slot.
   - The Silicon sealer was inserted into the slot.
   - 2 to 3 hours was allowed for the silicon gasket to cure.

2.2.2 Layup

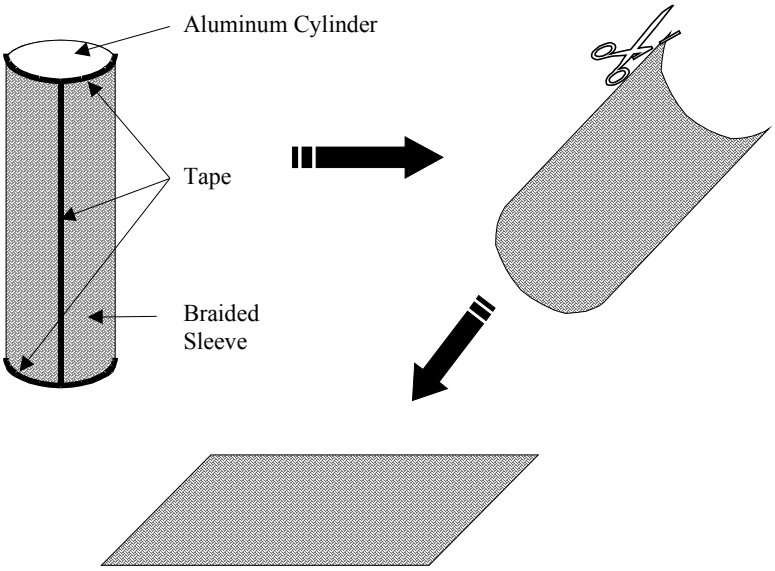

Figure 2.2 Cutting the preform to a given braid angle using an Aluminum cylinder

5. The braided Carbon layers were cut (Must be performed in the Layup Room.)
   - White cotton gloves were worn.
   - The braided sleeve was slid through the appropriate aluminum cylinder.
   - The end of the braid was held tight, the sleeve was pulled and the braid angle was locked.
   - Flashbreaker pressure sensitive tape was used to secure the braid angle as shown in Figure 2.2.
   - The top tape was cut along its centerline and the braided sleeve was separated.
   - The braided sock was slid out of the aluminum cylinder, making sure all the tapes were still attached to the sock.)
   - The lengthwise tape was cut in half and the braid was opened.
   - Step 6 was repeated until the appropriate layers of braid were obtained.

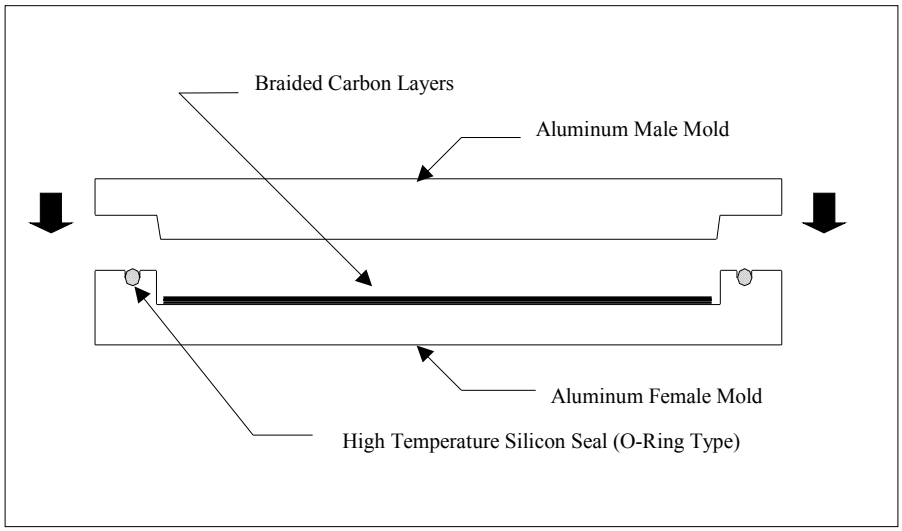

Figure 2.3 Cross-section of the mold

6. The perform was placed in the mold.
   - The flashbreaker tape was trimmed if necessary.
   - Each layer was placed against the reference edge.
   - No ply wrinkling or foreign materials were present.
   - The fiber distortion was no more than ±5°.
   - The mold was closed (Figure 2.3).

2.2.3 Resin Injection

7. The Aluminum mold was placed inside the 150-ton Twin Deck Pneumatic Press.
   - The force was set to 200,000 lbs, and the mold was placed between the heated platens of the press (Figure 2.4.)
   - The temperature was set to 320^{o} F, and the tool temperature thermocouple was inserted.
   - After the tool temperature stabilized at 320^{o} F, the resin was injected.

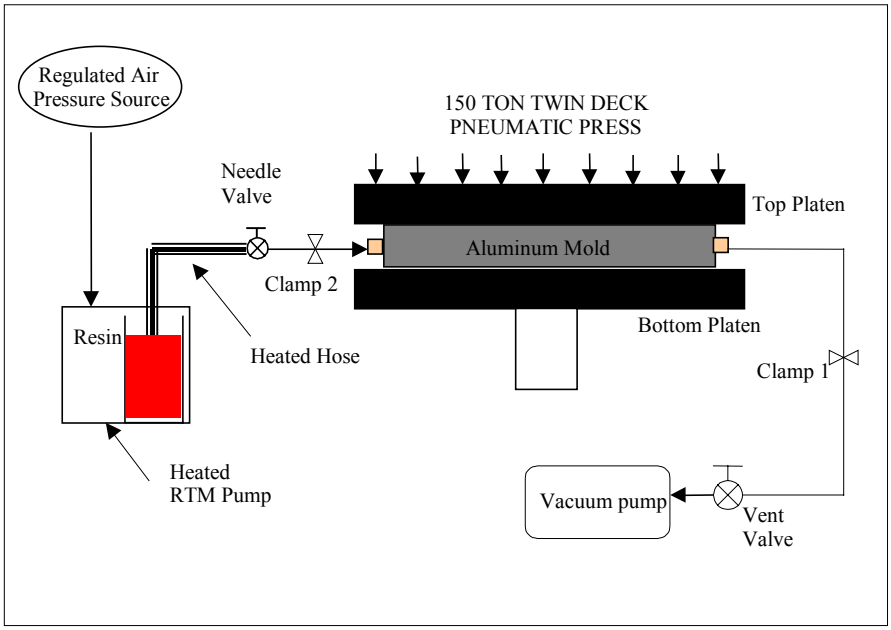

Figure 2.4 Resin Transfer Molding Setup

8. The Heated RTM Pump was prepared for resin injection.
   - The air pressure source was connected to the RTM pump.
   - The PR 520 resin can was removed from refrigerated storage 24 hours before injection.
   - All air regulators and bleed-type valves were closed.
   - The air valve in main line was opened.
   - The Ram air regulator was set to 15-18 psi. (lower gage)
   - The pump air regulator was set to 0 psi. (upper gage)
   - The Ram plate temperature and the Hose temperature were set to 200° F.

9. The tool was checked for vacuum integrity.
   - One end of the high temperature tube (3 to 4 ft.) was connected to the vacuum source and the other end to the outlet of the mold.
   - The vacuum pump was switched on.
   - The vacuum gage was inserted into the inlet of the mold.
   - The vacuum valve was opened and held for 10 minutes.
   - The vacuum valve was closed and held for 5 minutes.
   - The decay rate was less than 2 Hg/5 minutes. If the decay rate was higher than 2 Hg/5 minutes, all the connections were checked and/or step 4 was repeated until the specified vacuum integrity was obtained.
   - The inlet vacuum gage was removed and the heated hose was connected to the inlet of the mold.
   - The vacuum pump was turned on.

10. Resin injection
   - The vent valve was closed halfway.

- The initial injection pressure was increased to 80 psi.
- The ball valve was opened, and the needle valve was slowly opened.
- The resin was allowed to flow at the outlet until the bubbles disappeared.
- The outlet tube was clamped 6-inches away from the mold, before the resin flow reached the vent valve.
- The tube was disconnected from the vent valve.
- The injection pressure was increased to 100 psi.
- The Hose temperature was decreased to 160° F and the Ram plate temperature was turned off.
- The press temperature was increased to 370^{o} F.

2.2.4 Cure Profile

11. Dwell time
    - The injection pressure was maintained between 75 and 125 psi until 30 minutes after the tool temperature reached 370° F.
    - The injection line was clamped.
    - The Hose temperature was turned off.
    - The injection tube was cut between clamp 2 and the needle valve, and the heated hose was removed.
    - The mold maintained vacuum integrity throughout the procedure.

12. The resin was cured for 2 hours at 370°F.
    - The tool was at 370°F for 2 hours after the gel time, for the complete cure.
    - After the cure cycle was complete, the mold was cooled down while the press remained closed.

13. The part was removed.
    - The press was opened after the tool temperature reached 200°F.
    - The part was removed before it reached room temperature.
    - The panel ID, reference edge, and the 0° and 90° directions were labeled on the panel.

3.0 RAYTHEON AS4 6K GP / PR 520 LAMINA PROPERTIES

3.1 Test Results

3.1.1 Summary

MATERIAL:	Raytheon PR 520/ AS4 Carbon ±30° Braid		**PR 520/ AS4 ±30° Braid Summary**
BRAID MFG.:	A & P Technology		
FIBER:	Hexcel AS4 6K GP	**RESIN:**	3M PR 520 RTM Epoxy Resin
T_g (dry): 304.7°F	**T_g (wet):** 282.4°F	**T_g METHOD:**	DMA (SRM 18-94)
PROCESSING:	RTM (injection pressure 100 ± 25 psi): cured at 370 ± 5°F for 150 minutes		

Date of fiber manufacture	4/22/99	**Date of testing**	11/4/99 – 1/11/00
Date of resin manufacture	4/30/98 – 4/28/99	**Date of data submittal**	1/31/00
Date of braid manufacture	6/8/99	**Date of analysis**	1/5/00 – 1/20/00
Date of composite manufacture	8/26/99 – 11/4/99		

LAMINA MECHANICAL PROPERTY SUMMARY

	CTD		RTD Low V_f		RTD		RTD High V_f		ETD		ETW	
	B-Basis	Mean	B-Basis	Mean	B-Basis	Mean	B-Basis	Mean	B-Basis	Mean	B-Basis	Mean
F_1^{tu} (ksi)	90.07	101.79	72.37	81.78	82.77	91.85	77.48	87.56	61.59	69.50	59.74	66.19
E_1^t (Msi)	---	8.54	---	6.68	---	5.94	---	7.42	---	6.34	---	5.46
ν_{12}^t	---	1.20	---	1.42	---	1.09	---	1.23	---	1.46	---	1.20
F_1^{cu} (ksi)	49.35	57.63	37.44	43.72	41.85	47.79	43.16	50.40	33.57	39.20	29.23	33.41
E_1^c (Msi)	---	4.13	---	4.10	---	4.94	---	5.88	---	4.85	---	4.72
F_{12}^{su} (ksi)	**	**	**	**	**	**	**	**	**	**	**	**
G_{12}^s (Msi)	---	**	---	**	---	**	---	**	---	**	---	**
F_{13}^{su*}(ksi)	---	---	7.28	9.09	7.86	9.81	---	---	---	---	---	---

* *Apparent* interlaminar shear strength
** See ±60° summary sheet

MATERIAL:	Raytheon PR 520/ AS4 Carbon ±45° Braid	**PR 520/ AS4 ±45° Braid Summary**
BRAID MFG.:	A & P Technology	
FIBER:	Hexcel AS4 6K GP	**RESIN:** 3M PR 520 RTM Epoxy Resin
T_g (dry): 303.7°F	**T_g (wet):** 281.1°F	**T_g METHOD:** DMA (SRM 18-94)
PROCESSING:	RTM (injection pressure 100 ± 25 psi): cured at 370 ± 5°F for 150 minutes	

Date of fiber manufacture	4/25/99	**Date of testing**	11/4/99 – 1/11/00
Date of resin manufacture	4/30/98 – 4/28/99	**Date of data submittal**	1/31/00
Date of braid manufacture	6/8/99	**Date of analysis**	1/5/00 – 1/20/00
Date of composite manufacture	8/26/99 – 11/4/99		

LAMINA MECHANICAL PROPERTY SUMMARY

	CTD		RTD Low V_f		RTD		RTD High V_f		ETD		ETW	
	B-Basis	Mean	B-Basis	Mean	B-Basis	Mean	B-Basis	Mean	B-Basis	Mean	B-Basis	Mean
F_1^{tu} (ksi)	35.04	37.67	27.76	29.84	29.10	30.98	32.44	34.87	22.47	24.15	19.44	20.69
E_1^t (Msi)	---	2.92	---	2.03	---	2.34	---	2.94	---	1.94	---	1.96
ν_{12}^t	---	0.74	---	0.65	---	0.67	---	0.72	---	0.76	---	0.69
F_1^{cu} (ksi)	36.00	38.32	25.14	26.76	27.62	29.16	31.16	33.17	21.00	22.36	20.68	21.83
E_1^c (Msi)	---	1.68	---	1.62	---	1.86	---	2.73	---	1.55	---	1.65
F_{12}^{su} (ksi)	52.16	58.57	42.68	48.11	45.15	50.11	45.85	51.69	33.25	37.48	32.35	35.86
G_{12}^s (Msi)	---	3.47	---	3.44	---	3.92	---	4.67	---	3.61	---	3.54
F_{13}^{su*}(ksi)	---	---	5.62	6.06	5.57	6.01	5.91	6.38	---	---	---	---

* *Apparent* interlaminar shear strength

MATERIAL:	Raytheon PR 520/ AS4 Carbon ±60° Braid		**PR 520/ AS4 ±60° Braid Summary**
BRAID MFG.:	A & P Technology		
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Date of fiber manufacture	4/25/99	**Date of testing**	11/4/99 – 1/11/00
Date of resin manufacture	4/30/98 – 4/28/99	**Date of data submittal**	1/31/00
Date of braid manufacture	6/8/99	**Date of analysis**	1/5/00 – 1/20/00
Date of composite manufacture	8/26/99 – 11/4/99		

LAMINA MECHANICAL PROPERTY SUMMARY

	CTD		RTD Low V_f		RTD		RTD High V_f		ETD		ETW	
	B-Basis	Mean	B-Basis	Mean	B-Basis	Mean	B-Basis	Mean	B-Basis	Mean	B-Basis	Mean
F_1^{tu} (ksi)	15.81	17.10	13.40	14.50	14.31	15.32	14.64	15.84	11.18	12.10	10.31	11.02
E_1^t (Msi)	---	2.01	---	1.34	---	1.65	---	2.00	---	1.14	---	1.32
ν_{12}^t	---	0.29	---	0.31	---	0.28	---	0.30	---	0.23	---	0.28
F_1^{cu} (ksi)	34.52	38.76	23.94	26.97	26.59	29.46	27.32	30.77	19.14	21.56	16.81	18.62
E_1^c (Msi)	---	1.42	---	0.98	---	1.22	---	1.35	---	1.03	---	1.14
F_{12}^{su} (ksi)	41.84	44.59	40.62	43.29	39.16	41.44	34.59	36.86	32.77	34.92	30.47	32.22
G_{12}^s (Msi)	---	2.66	---	2.44	---	2.97	---	3.60	---	2.48	---	2.76
F_{13}^{su*}(ksi)	---	---	2.46	3.51	2.63	3.85	2.38	3.48	---	---	---	---

* *Apparent* interlaminar shear strength

3.1.2 Individual Test Summaries

3.1.2.1 Tension, 1-axis

Tension, 1-axis
C/Ep
Raytheon-PR 520/ AS4 Carbon ±30°
$[\pm 30]_{5\text{-}7}$

Material: Raytheon-PR 520/ AS4 Carbon ±30°

Test method: D3039-95 (Untabbed) **Modulus calculation:** linear fit from 1000 - 3000 με

Average Tg (Dry) : 304.72 °F **B_{normal}:** 0.8849
Average Tg (Wet) : 282.41 °F **A_{normal}:** 0.8202

Normalized by: N/A

		CTD		RTD Low V_f		RTD		RTD High V_f		ETD		ETW	
Test Temperature [°F]		-65		75		75		75		180		180	
Moisture Conditioning		dry		dry		dry		dry		dry		equilibrium	
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		as fabricated		as fabricated		145 F, 85 %	
Resin content (wt%)		30 - 33		38 - 39		30 - 33		23 - 25		30 - 33		30 - 33	
Fiber Volume (vol%)		58 - 61		51 - 53		58 - 61		67 - 68		58 - 61		58 - 61	
Comp. Density g/cc		1.55 - 1.57		1.51 - 1.52		1.55 - 1.57		1.59 - 1.60		1.55 - 1.57		1.55 - 1.57	
Void Content (vol%)		0.5 - 2.0		1.6		0.5 - 2.0		1.9 - 2.5		0.5 - 2.0		0.5 - 2.0	
Ply thickness (in.)		0.0189 - 0.0190		0.0226 - 0.0227		0.0186 - 0.0190		0.0173 - 0.0176		0.0189 - 0.0190		0.0187 - 0.0190	
Ply range		6 plies		5 plies		6 plies		7 plies		6 plies		6 plies	
Source code		ECUXXXXB		ECUXXLXA		ECUXXXXA		ECUXXGXA		ECUXXXXG		ECUXXXXF	
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean		101.79		81.78		91.85		87.56		69.6		66.2
	Minimum		90.57		79.27		80.38		83.10		66.2		59.6
	Maximum		114.14		84.37		101.83		90.67		76.0		71.6
	C.V.(%)		9.48		2.14		5.60		3.63		5.3		5.0
F_1^{tu} (ksi)	**B-value**		90.07		72.37		82.77		77.48		61.59		59.74
	A-value		83.49		67.08		76.64		71.82		57.09		55.31
	No. Specimens	6		6		20		6		6		24	
	No. Batches	1		1		3		1		1		3	
	Mean		8.54		6.68		5.94		7.42		6.34		5.46
	Minimum		8.01		5.98		5.09		6.93		5.95		4.98
	Maximum		9.07		7.38		6.50		7.92		6.72		6.42
E_1^t (Msi)	**C.V.(%)**		8.80		14.73		8.91		9.48		8.6		9.6
	No. Specimens	2		2		6		2		2		8	
	No. Batches	1		1		3		1		1		3	
	Mean		1.20		1.42		1.09		1.23		1.46		1.20
ν_{12}^t	**No. Specimens**	2		2		6		2		2		8	
	No. Batches	1		1		3		1		1		3	

Material: Raytheon-PR 520/ AS4 Carbon ±45° Braid

Test method: D3039-95 (Untabbed) **Modulus calculation:** linear fit from 1000 - 3000 με

Average Tg (Dry) : 302.69 °F **B_{normal}:** 0.9303

Average Tg (Wet) : 281.12 °F **A_{normal}:** 0.8909

Normalized by: N/A

Tension, 1-axis
C/Ep
Raytheon-PR 520/ AS4 Carbon ±45° Braid
$[\pm 45]_{6\text{-}8}$

		CTD		RTD Low V_f		RTD		RTD High V_f		ETD		ETW	
Test Temperature [°F]		-65		75		75		75		180		180	
Moisture Conditioning		dry		dry		dry		dry		dry		equilibrium	
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		as fabricated		as fabricated		145 F, 85 %	
Resin content (wt%)		30 - 34		40 - 41		30 - 34		26 - 27		30 - 34		30 - 34	
Fiber Volume (vol%)		56 - 60		49 - 50		56 - 60		64 - 65		56 - 60		56 - 60	
Comp. Density g/cc		1.54 - 1.56		1.50		1.54 - 1.56		1.58		1.54 - 1.56		1.54 - 1.56	
Void Content (vol%)		1.0 - 2.5		1.4 - 1.9		1.0 - 2.5		1.6 - 1.7		1.0 - 2.5		1.0 - 2.5	
Ply thickness (in.)		0.0169 - 0.0171		0.0195 - 0.0196		0.0167 - 0.0171		0.0150 - 0.0151		0.0169 - 0.0171		0.0168 - 0.0170	
Ply range		7 plies		6 plies		7 plies		8 plies		7 plies		7 plies	
Source code		EBJXXXXB		EBJXXLXA		EBJXXXXA		EBJXXGXA		EBJXXXXG		EBJXXXXF	
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
F_1^{tu} (ksi)	**Mean**		37.67		29.84		30.98		34.87		24.15		20.69
	Minimum		36.53		28.66		28.82		34.05		23.57		19.34
	Maximum		39.46		31.00		33.20		35.50		25.30		21.99
	C.V.(%)		2.59		2.86		3.46		1.35		2.68		4.00
	B-value		35.04		27.76		29.10		32.44		22.47		19.44
	A-value		33.56		26.58		27.84		31.07		21.52		18.60
	No. Specimens	6		6		18		6		6		18	
	No. Batches	1		1		3		1		1		3	
E_1^t (Msi)	**Mean**		2.92		2.03		2.34		2.94		1.94		1.96
	Minimum		2.61		1.92		1.93		2.90		1.90		1.79
	Maximum		3.23		2.13		2.51		2.98		1.97		2.26
	C.V.(%)												
	No. Specimens	2		2		6		2		2		6	
	No. Batches	1		1		3		1		1		3	
ν_{12}^t	**Mean**		0.74		0.65		0.67		0.72		0.76		0.69
	No. Specimens	2		2		6		2		2		6	
	No. Batches	1		1		3		1		1		3	

Material: Raytheon-PR 520/ AS4 Carbon ±60°

Test method: D3039-95 (Untabbed) **Modulus calculation:** linear fit from 1000 - 3000 με

Average Tg (Dry) : 304.72 °F B_{normal}: 0.9243

Average Tg (Wet) : 282.41 °F A_{normal}: 0.8816

Normalized by: N/A

Tension, 1-axis
C/Ep
Raytheon-PR 520/ AS4 Carbon ±60°
$[\pm 60]_{5\text{-}7}$

		CTD		RTD Low V_f		RTD		RTD High V_f		ETD		ETW	
Test Temperature [°F]		-65		75		75		75		180		180	
Moisture Conditioning		dry		dry		dry		dry		dry		equilibrium	
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		as fabricated		as fabricated		145 F, 85 %	
Resin content (wt%)		29 - 32		40 - 41		29 - 32		21 - 23		29 - 32		29 - 32	
Fiber Volume (vol%)		59 - 63		49 - 50		59 - 63		69 - 71		59 - 63		59 - 63	
Comp. Density g/cc		1.56 - 1.58		1.50 - 1.51		1.56 - 1.58		1.60 - 1.62		1.56 - 1.58		1.56 - 1.58	
Void Content (vol%)		0.7 - 1.8		1.1 - 1.2		0.7 - 1.8		1.2 - 2.6		0.7 - 1.8		0.7 - 1.8	
Ply thickness (in.)		0.0186 - 0.0191		0.0228 - 0.0229		0.0187 - 0.0197		0.0168 - 0.0168		0.0187 - 0.0190		0.0186 - 0.0193	
Ply range		6 plies		5 plies		6 plies		7 plies		6 plies		6 plies	
Source code		ECJXXXXB		ECJXXLXA		ECJXXXXA		ECJXXGXA		ECJXXXXG		ECJXXXXF	
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean		17.10		14.50		15.32		15.84		12.1		11.02
	Minimum		16.20		14.11		14.53		15.52		11.8		9.97
	Maximum		17.89		14.74		16.39		16.24		12.4		11.79
	C.V.(%)		3.44		1.49		2.92		1.79		1.7		4.84
F_1^{tu} (ksi)	**B-value**		15.81		13.40		14.31		14.64		11.18		10.31
	A-value		15.08		12.78		13.64		13.96		10.66		9.82
	No. Specimens	6		8		18		6		6		21	
	No. Batches	1		1		3		1		1		3	
	Mean		2.01		1.34		1.65		2.00		1.14		1.32
	Minimum		1.90		1.26		1.56		1.98		1.14		1.25
	Maximum		2.11		1.40		1.73		2.02		1.14		1.37
E_1^t (Msi)	**C.V.(%)**		7.25		5.17		3.54		1.20		0.2		3.93
	No. Specimens	2		3		6		2		2		6	
	No. Batches	1		1		1		1		1		3	
	Mean		0.29		0.31		0.28		0.30		0.23		0.28
ν_{12}^t	**No. Specimens**	2		2		6		2		2		6	
	No. Batches	1		1		3		1		1		3	

3.1.2.2 Compression, 1-axis

Compression, 1-axis
C/Ep
Raytheon-PR 520/ AS4 Carbon ±30°
$[\pm 30]_{5\text{-}7}$

Material: Raytheon-PR 520/ AS4 Carbon ±30°

Test method: Combined Loading Compression **Modulus calculation:** linear fit from 1000 - 3000 με

Average Tg (Dry) : 304.72 °F **B_{normal}:** 0.8563
Average Tg (Wet) : 282.41 °F **A_{normal}:** 0.7752

Normalized by: N/A

		CTD		RTD Low V_f		RTD		RTD High V_f		ETD		ETW	
Test Temperature [°F]		-65		75		75		75		180		180	
Moisture Conditioning		dry		dry		dry		dry		dry		equilibrium	
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		as fabricated		as fabricated		145 F, 85 %	
Resin content (wt%)		30 - 32		38 - 39		30 - 32		23 - 25		30 - 32		30 - 32	
Fiber Volume (vol%)		59 - 61		51 - 53		59 - 61		67 - 68		59 - 61		59 - 61	
Comp. Density g/cc		1.56 - 1.57		1.51 - 1.52		1.56 - 1.57		1.59 - 1.60		1.56 - 1.57		1.56 - 1.57	
Void Content (vol%)		0.9 - 1.4		1.6		0.9 - 1.4		1.9 - 2.5		0.9 - 1.4		0.9 - 1.4	
Ply thickness (in.)		0.0189 - 0.0190		0.0222 - 0.0227		0.0187 - 0.0191		0.0173 - 0.0175		0.0189 - 0.0189		0.0187 - 0.0190	
Ply range		6 plies		5 plies		6 plies		7 plies		6 plies		6 plies	
Source code		ECRXXXXB		ECRXXLXA		ECRXXXXA		ECRXXGXA		ECRXXXXG		ECRXXXXF	
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean		57.63		43.72		47.79		50.40		39.20		33.41
	Minimum		53.66		39.77		42.70		49.21		38.01		27.46
	Maximum		61.59		47.62		54.49		51.56		40.31		37.88
	C.V.(%)		5.69		7.01		7.23		1.54		2.31		8.53
F_1^{cu} (ksi)	**B-value**		49.35		37.44		41.85		43.16		33.57		29.23
	A-value		44.67		33.89		37.85		39.07		30.39		26.44
	No. Specimens		6		6		19		6		6		18
	No. Batches		1		1		3		1		1		3
	Mean		4.13		4.10		4.94		5.88		4.85		4.72
	Minimum		3.88		3.57		4.26		5.83		4.54		4.24
	Maximum		4.37		4.63		5.89		5.92		5.16		5.30
E_1^c (Msi)	**C.V.(%)**		8.36		18.44		11.60		1.14		9.04		8.29
	No. Specimens		2		2		6		2		2		6
	No. Batches		1		1		3		1		1		3

Compression, 1-axis / 2-axis
C/Ep
Raytheon-PR 520/ AS4 Carbon ±45° Braid
$[\pm 45]_{6\text{-}8}$

Material: Raytheon-PR 520/ AS4 Carbon ±45° Braid

Test method: Combined Loading Compression **Modulus calculation:** linear fit from 1000 - 3000 με

Average Tg (Dry) : 302.69 °F **B_{normal}:** 0.9394
Average Tg (Wet) : 281.12 °F **A_{normal}:** 0.9051

Normalized by: N/A

		CTD		RTD Low V_f		RTD		RTD High V_f		ETD		ETW	
Test Temperature [°F]		-65		75		75		75		180		180	
Moisture Conditioning		dry		dry		dry		dry		dry		equilibrium	
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		as fabricated		as fabricated		145 F, 85 %	
Resin content (wt%)		31 - 34		40 - 41		31 - 34		26 - 27		31 - 34		31 - 34	
Fiber Volume (vol%)		56 - 59		49 - 50		56 - 59		64 - 65		56 - 59		56 - 59	
Comp. Density g/cc		1.54 - 1.55		1.50		1.54 - 1.55		1.58		1.54 - 1.55		1.54 - 1.55	
Void Content (vol%)		1.1 - 2.2		1.4 - 1.9		1.1 - 2.2		1.6 - 1.7		1.1 - 2.2		1.1 - 2.2	
Ply thickness (in.)		0.0167 - 0.0171		0.0197 - 0.0198		0.0167 - 0.0175		0.0150 - 0.0152		0.0169 - 0.0171		0.0168 - 0.0172	
Ply range		7 plies		6 plies		7 plies		8 plies		7 plies		7 plies	
Source code		EBPXXXXB		EBRXXLXA		EBPXXXXA		EBRXXGXA		EBPXXXXG		EBPXXXXF	
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean		38.32		26.76		29.16		33.17		22.36		21.83
	Minimum		36.90		26.42		27.52		32.44		21.20		20.92
	Maximum		40.47		27.49		30.35		34.06		23.85		22.68
	C.V.(%)		3.54		1.61		2.83		1.82		4.59		2.51
F_1^{cu} (ksi)	**B-value**		36.00		25.14		27.62		31.16		21.00		20.68
	A-value		34.68		24.22		26.59		30.02		20.24		19.91
	No. Specimens	6		6		18		6		6		18	
	No. Batches	1		1		3		1		1		3	
	Mean		1.68		1.62		1.86		2.73		1.55		1.65
	Minimum		1.65		1.49		1.59		2.62		1.53		1.51
	Maximum		1.70		1.75		2.51		2.84		1.58		1.80
E_1^c (Msi)	**C.V.(%)**		2.14		11.35		18.09		5.79		2.39		7.61
	No. Specimens	2		2		6		2		2		6	
	No. Batches	1		1		3		1		1		3	

Material: Raytheon-PR 520/ AS4 Carbon ±60°

Test method: Combined Loading Compression **Modulus calculation:** linear fit from 1000 - 3000 με

Average Tg (Dry) : 304.72 °F **B_{normal}:** 0.8878

Average Tg (Wet) : 282.41 °F **A_{normal}:** 0.8244

Normalized by: N/A

Compression,1-axis
C/Ep
Raytheon-PR 520/ AS4 Carbon ±60°
$[\pm 60]_{5\text{-}7}$

		CTD		RTD Low V_f		RTD		RTD High V_f		ETD		ETW	
Test Temperature [°F]		-65		75		75		75		180		180	
Moisture Conditioning		dry		dry		dry		dry		dry		equilibrium	
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		as fabricated		as fabricated		145 F, 85 %	
Resin content (wt%)		31 - 34		40 - 41		31 - 34		21 - 23		31 - 34		31 - 34	
Fiber Volume (vol%)		57 - 61		49 - 50		57 - 61		69 - 71		57 - 61		57 - 61	
Comp. Density g/cc		1.55 - 1.57		1.50 - 1.51		1.55 - 1.57		1.60 - 1.62		1.55 - 1.57		1.55 - 1.57	
Void Content (vol%)		0.8 - 1.0		1.1 - 1.2		0.8 - 1.0		1.2 - 2.6		0.8 - 1.0		0.8 - 1.0	
Ply thickness (in.)		0.0187 - 0.0192		0.0225 - 0.0226		0.0185 - 0.0190		0.0169 - 0.0170		0.0187 - 0.0207		0.0186 - 0.0192	
Ply range		6 plies		5 plies		6 plies		7 plies		6 plies		6 plies	
Source code		ECPXXXXB		ECPXXLXA		ECPXXXXA		ECPXXGXA		ECPXXXXG		ECPXXXXF	
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean		38.76		26.97		29.46		30.77		21.56		18.62
	Minimum		33.82		26.39		27.93		28.46		19.78		16.98
	Maximum		41.22		27.35		31.18		31.96		22.91		21.18
	C.V.(%)		6.49		1.28		3.14		3.99		5.30		7.20
F_1^{cu} (ksi)	**B-value**		34.52		23.94		26.59		27.32		19.14		16.81
	A-value		32.05		22.23		24.66		25.37		17.77		15.59
	No. Specimens	7		6		18		6		6		18	
	No. Batches	1		1		3		1		1		3	
	Mean		1.42		0.98		1.22		1.35		1.03		1.14
	Minimum		1.39		0.97		1.18		1.30		1.02		1.06
	Maximum		1.46		0.99		1.28		1.40		1.03		1.22
E_1^c (Msi)	**C.V.(%)**		3.64		1.24		2.97		5.29		1.0		5.7
	No. Specimens	2		2		6		2		2		6	
	No. Batches	1		1		3		1		1		3	

3.1.2.3 Shear, 12 axis

Shear, 12-axis
C/Ep
Raytheon-PR 520/ AS4 Carbon ±45° Braid
$[\pm 45]_{6\text{-}8}$

Material: Raytheon-PR 520/ AS4 Carbon ±45° Braid

Test method: Modified D5379-93 **Modulus calculation:** linear fit from 1000 - 6000 με

Average Tg (Dry) : 302.69 °F **B_{normal}:** 0.8906
Average Tg (Wet) : 281.12 °F **A_{normal}:** 0.8211

Normalized by: N/A

		CTD		RTD Low V_f		RTD		RTD High V_f		ETD		ETW	
Test Temperature [°F]		-65		75		75		75		180		180	
Moisture Conditioning		dry		dry		dry		dry		dry		equilibrium	
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		as fabricated		as fabricated		145 F, 85 %	
Resin content (wt%)		31 - 33		40 - 41		31 - 33		26 - 27		31 - 33		31 - 33	
Fiber Volume (vol%)		57 - 60		49 - 50		57 - 60		64 - 65		57 - 60		57 - 60	
Comp. Density g/cc		1.54 - 1.56		1.50		1.54 - 1.56		1.58		1.54 - 1.56		1.54 - 1.56	
Void Content (vol%)		1.6 - 2.1		1.4 - 1.9		1.6 - 2.1		1.6 - 1.7		1.6 - 2.1		1.6 - 2.1	
Ply thickness (in.)		0.0169 - 0.0171		0.0194 - 0.0198		0.0169 - 0.0172		0.0149 - 0.0150		0.0168 - 0.0170		0.0168 - 0.0173	
Ply range		7 plies		6 plies		7 plies		8 plies		7 plies		7 plies	
Source code		EBTXXXXB		EBTXXLXA		EBTXXXXA		EBTXXGXA		EBTXXXXG		EBTXXXXF	
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
F_{12}^{su} (ksi)	**Mean**		58.57		48.11		50.11		51.69		37.48		35.86
	Minimum		55.28		43.44		43.13		40.50		34.79		31.53
	Maximum		62.73		49.85		55.13		58.13		39.55		40.37
	C.V.(%)		4.16		3.91		7.41		10.81		5.34		5.18
	B-value		52.16		42.68		45.15		45.85		33.25		32.35
	A-value		48.27		39.50		41.75		42.44		30.77		29.91
	No. Specimens	10		10		25		10		8		28	
	No. Batches	1		1		3		1		1		3	
G_{12}^{s} (Msi)	**Mean**		3.47		3.44		3.92		4.67		3.61		3.54
	Minimum		3.32		3.35		3.28		4.38		3.45		3.17
	Maximum		3.62		3.53		4.42		4.95		3.77		3.80
	C.V.(%)		6.25		3.71		10.62		8.60		6.28		7.03
	No. Specimens	2		2		8		2		2		7	
	No. Batches	1		1		3		1		1		3	

Shear, 12-axis
C/Ep
Raytheon-PR 520/ AS4 Carbon ±60°
$[\pm 60]_{5\text{-}7}$

Material: Raytheon-PR 520/ AS4 Carbon ±60°

Test method: Modified D5379-93 **Modulus calculation:** linear fit from 1000 - 6000 με

Average Tg (Dry) : 304.72 °F **B_{normal}:** 0.9384
Average Tg (Wet) : 282.41 °F **A_{normal}:** 0.9017

Normalized by: N/A

		CTD		RTD Low V_f		RTD		RTD High V_f		ETD		ETW	
Test Temperature [°F]		-65		75		75		75		180		180	
Moisture Conditioning		dry		dry		dry		dry		dry		equilibrium	
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		as fabricated		as fabricated		145 F, 85 %	
Resin content (wt%)		29 - 34		38 - 39		29 - 34		23 - 25		29 - 34		29 - 34	
Fiber Volume (vol%)		57 - 61		51 - 53		57 - 61		67 - 68		57 - 61		57 - 61	
Comp. Density g/cc		1.55 - 1.56		1.51 - 1.52		1.55 - 1.56		1.59 - 1.60		1.55 - 1.56		1.55 - 1.56	
Void Content (vol%)		0.8 - 2.3		1.6		0.8 - 2.3		1.9 - 2.5		0.8 - 2.3		0.8 - 2.3	
Ply thickness (in.)		0.0183 - 0.0188		0.0220 - 0.0244		0.0186 - 0.0191		0.0156 - 0.0175		0.0184 - 0.0190		0.0184 - 0.0192	
Ply range		6 plies		5 plies		6 plies		7 plies		6 plies		6 plies	
Source code		ECTXXXXB		ECTXXLXA		ECTXXXXA		ECTXXGXA		ECTXXXXG		ECTXXXXF	
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean		44.59		43.29		41.44		36.86		34.92		32.22
	Minimum		42.95		41.87		38.11		34.79		32.97		29.42
	Maximum		46.44		44.26		44.46		38.84		36.43		34.48
	C.V.(%)		2.53		1.94		3.38		3.95		2.94		3.58
F_{12}^{su} (ksi)	**B-value**		41.84		40.62		39.16		34.59		32.77		30.47
	A-value		40.21		39.03		37.60		33.24		31.49		29.25
	No. Specimens	9		6		25		7		9		27	
	No. Batches	1		1		3		1		1		3	
	Mean		2.66		2.44		2.97		3.60		2.48		2.76
	Minimum		2.61		2.27		2.49		3.24		2.45		2.41
	Maximum		2.72		2.60		3.13		3.95		2.52		3.02
G_{12}^{s} (Msi)	**C.V.(%)**		2.69		9.63		8.10		14.14		1.99		7.87
	No. Specimens	2		2		6		2		2		6	
	No. Batches	1		1		3		1		1		3	

3.1.2.4 Shear, 13 axis

Shear, 13-axis
C/Ep
Raytheon-PR 520/ AS4 Carbon ±30°
$[\pm 30]_{5\text{-}6}$

Material: Raytheon-PR 520/ AS4 Carbon ±30°

Test method: D2344-89 **Modulus calculation:** N/A

Average Tg (Dry) : 304.72 °F **B_{normal}:** 0.8006
Average Tg (Wet) : 282.41 °F **A_{normal}:** 0.6584

Normalized by: N/A

				RTD Low V_f		RTD							
Test Temperature [°F]				75		75							
Moisture Conditioning				dry		dry							
Equilibrium at T, RH				as fabricated		as fabricated							
Resin content (wt%)				38 - 39		30 - 33							
Fiber Volume (vol%)				51 - 53		58 - 61							
Comp. Density g/cc				1.51 - 1.52		1.55 - 1.57							
Void Content (vol%)				1.6		0.5 - 2.0							
Ply thickness (in.)				0.0220 - 0.0222		0.0186 - 0.0192							
Ply range				5 plies		6 plies							
Source code				ECBXXLXA		ECBXXXXA							
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean				9.09		9.81						
	Minimum				8.47		8.36						
	Maximum				9.72		11.37						
	C.V.(%)				4.71		10.27						
F_{13}^{su}													
(ksi)	**B-value**				7.28		7.86						
	A-value				5.98		6.46						
	No. Specimens			6		20							
	No. Batches			1		3							

NOTE: 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.

Shear, 13-axis
C/Ep
Raytheon-PR 520/ AS4 Carbon ±45° Braid
$[\pm 45]_{6\text{-}8}$

Material: Raytheon-PR 520/ AS4 Carbon ±45° Braid

Test method: D2344-89 **Modulus calculation:** N/A

Average Tg (Dry) : 302.69 °F **B_{normal}:** 0.9268
Average Tg (Wet) : 281.12 °F **A_{normal}:** 0.8749

Normalized by: N/A

			RTD Low V_f		RTD		RTD High V_f					
Test Temperature [°F]			75		75		75					
Moisture Conditioning			dry		dry		dry					
Equilibrium at T, RH			as fabricated		as fabricated		as fabricated					
Resin content (wt%)			40 - 41		31 - 33		26 - 27					
Fiber Volume (vol%)			49 - 50		57 - 59		64 - 65					
Comp. Density g/cc			1.50		1.54 - 1.55		1.58					
Void Content (vol%)			1.4 - 1.9		1.6 - 2.1		1.6 - 1.7					
Ply thickness (in.)			0.0197 - 0.0198		0.0169 - 0.0180		0.0151 - 0.0152					
Ply range			6 plies		7 plies		8 plies					
Source code			EBQXXLXA		EBQXXXXA		EBQXXGXA					
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean				6.06		6.01		6.38				
	Minimum				6.00		5.63		6.10				
	Maximum				6.13		6.41		6.70				
	C.V.(%)				0.93		3.67		3.12				
F_{13}^{su}													
(ksi)	**B-value**				5.62		5.57		5.91				
	A-value				5.30		5.26		5.58				
	No. Specimens				6		18		6				
	No. Batches				1		3		1				

NOTE: 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.

Shear, 13-axis
C/Ep
Raytheon-PR 520/ AS4 Carbon ±60°
$[\pm 60]_{5\text{-}7}$

Material: Raytheon-PR 520/ AS4 Carbon ±60°

Test method: D2344-89 **Modulus calculation:** N/A

Average Tg (Dry) : 304.72 °F **B_{normal}:** 0.6828
Average Tg (Wet) : 282.41 °F **A_{normal}:** 0.4570

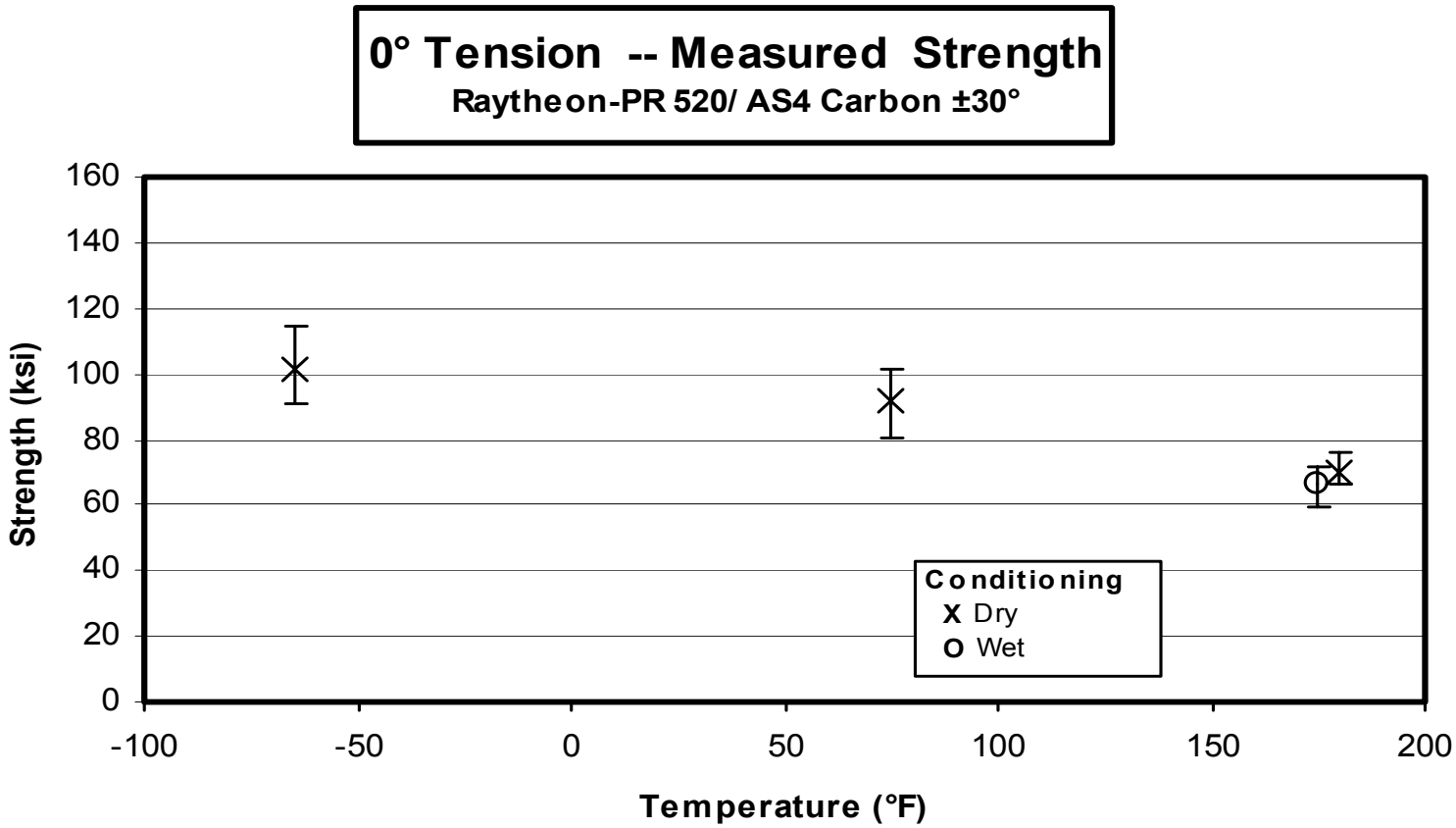
Normalized by: N/A

			RTD Low V_f		RTD		RTD High V_f					
Test Temperature [°F]			75		75		75					
Moisture Conditioning			dry		dry		dry					
Equilibrium at T, RH			as fabricated		as fabricated		as fabricated					
Resin content (wt%)			40 - 41		30 - 33		21 - 23					
Fiber Volume (vol%)			49 - 50		58 - 61		69 - 71					
Comp. Density g/cc			1.50 - 1.51		1.55 - 1.57		1.60 - 1.62					
Void Content (vol%)			1.1 - 1.2		0.5 - 2.0		1.2 - 2.6					
Ply thickness (in.)			0.0221 - 0.0229		0.0187 - 0.0193		0.0167 - 0.0177					
Ply range			5 plies		6 plies		7 plies					
Source code			ECAXXLXA		ECAXXXXA		ECAXXGXA					
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean				3.51		3.85		3.48				
	Minimum				3.22		2.75		3.33				
	Maximum				3.86		4.82		3.66				
	C.V.(%)				6.94		16.13		2.43				
F_{13}^{su} (ksi)	**B-value**				2.46		2.63		2.38				
	A-value				1.60		1.76		1.59				
	No. Specimens				6		19		12				
	No. Batches				1		3		1				

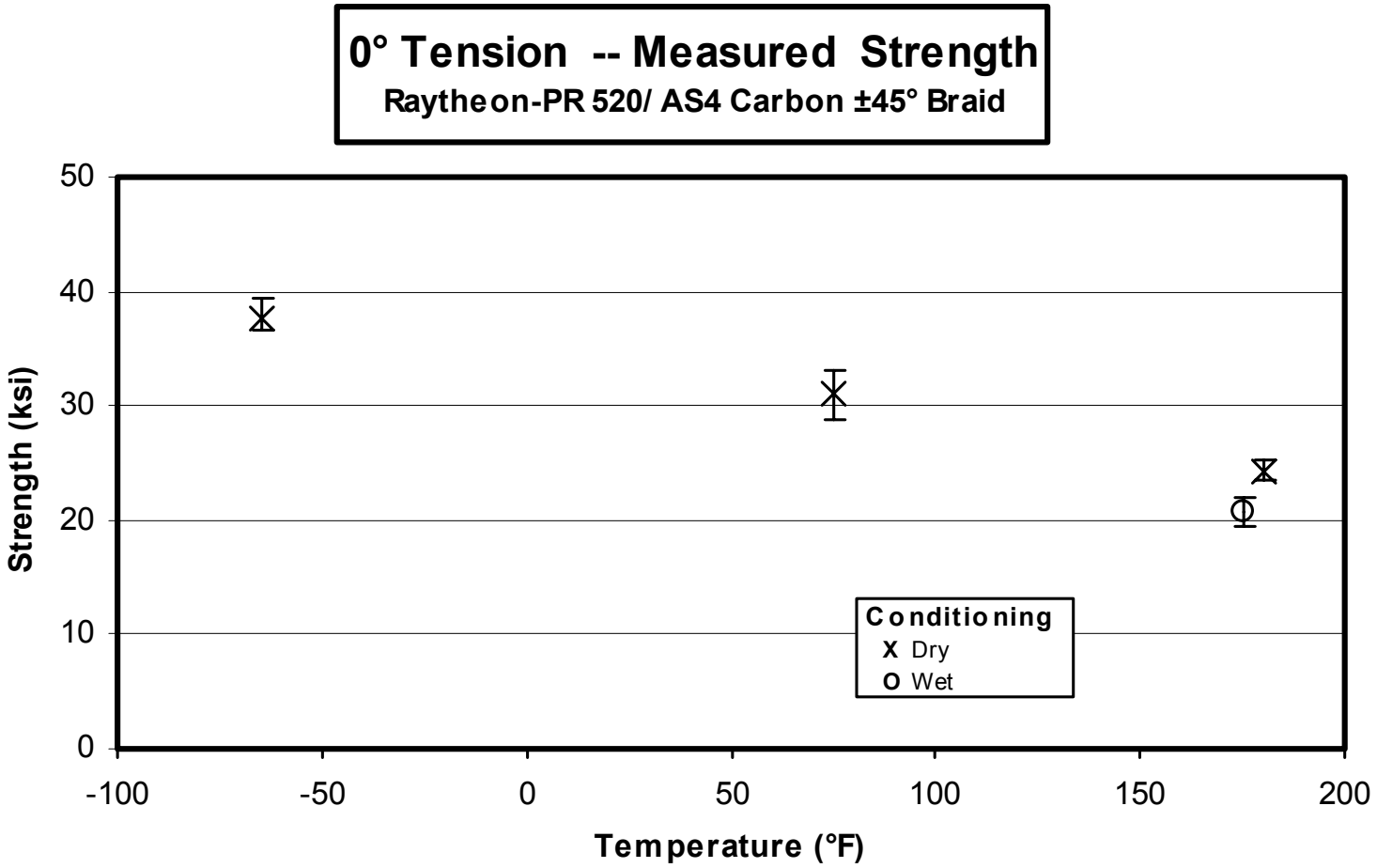
NOTE: These values represent the apparent interlaminar shear properties and are to be used for quality control purposes only. Do not use these values for interlaminar shear strength design values.

3.1.3 Individual Test Charts

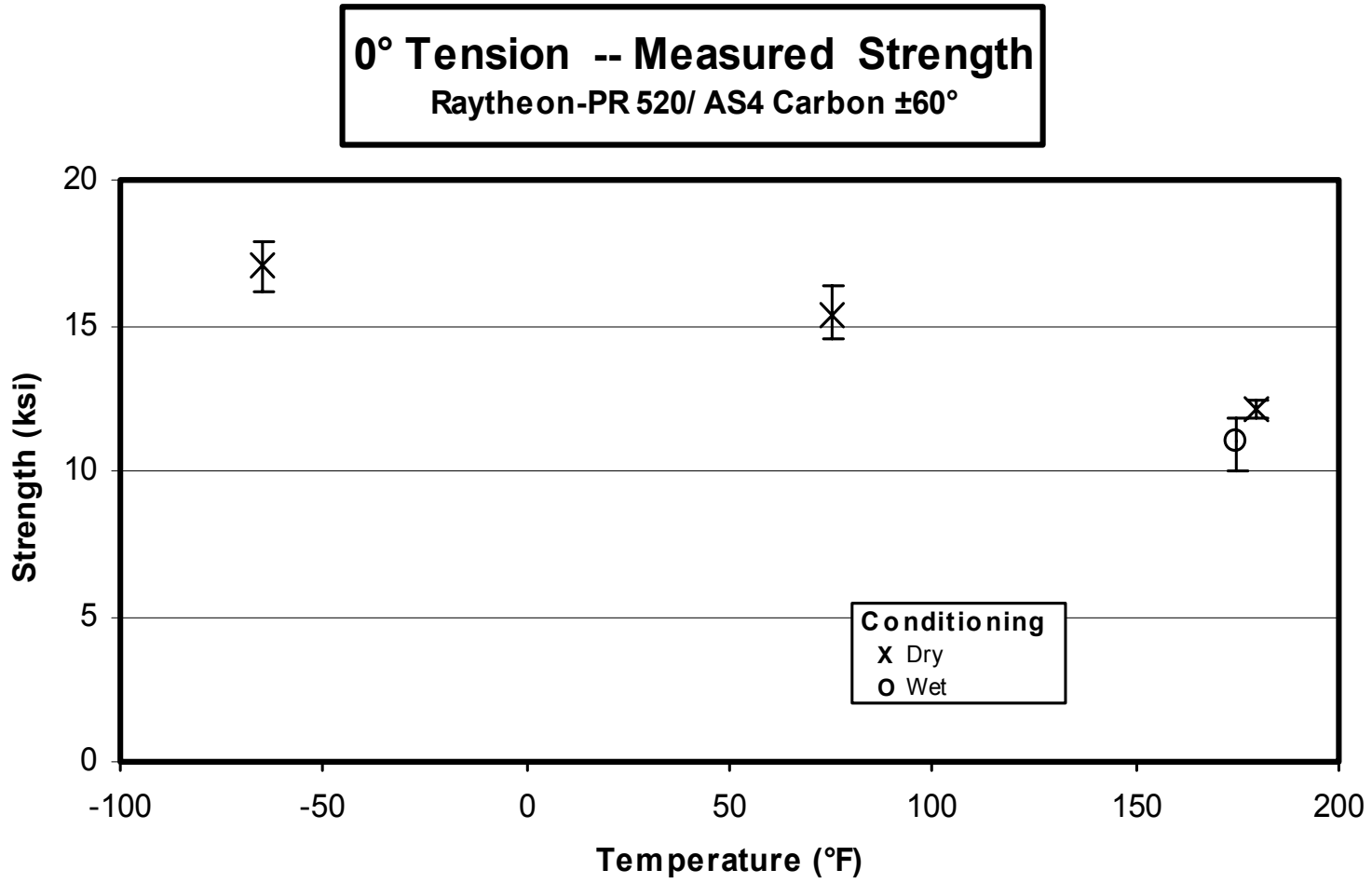
3.1.3.1 Tension, 1-axis



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

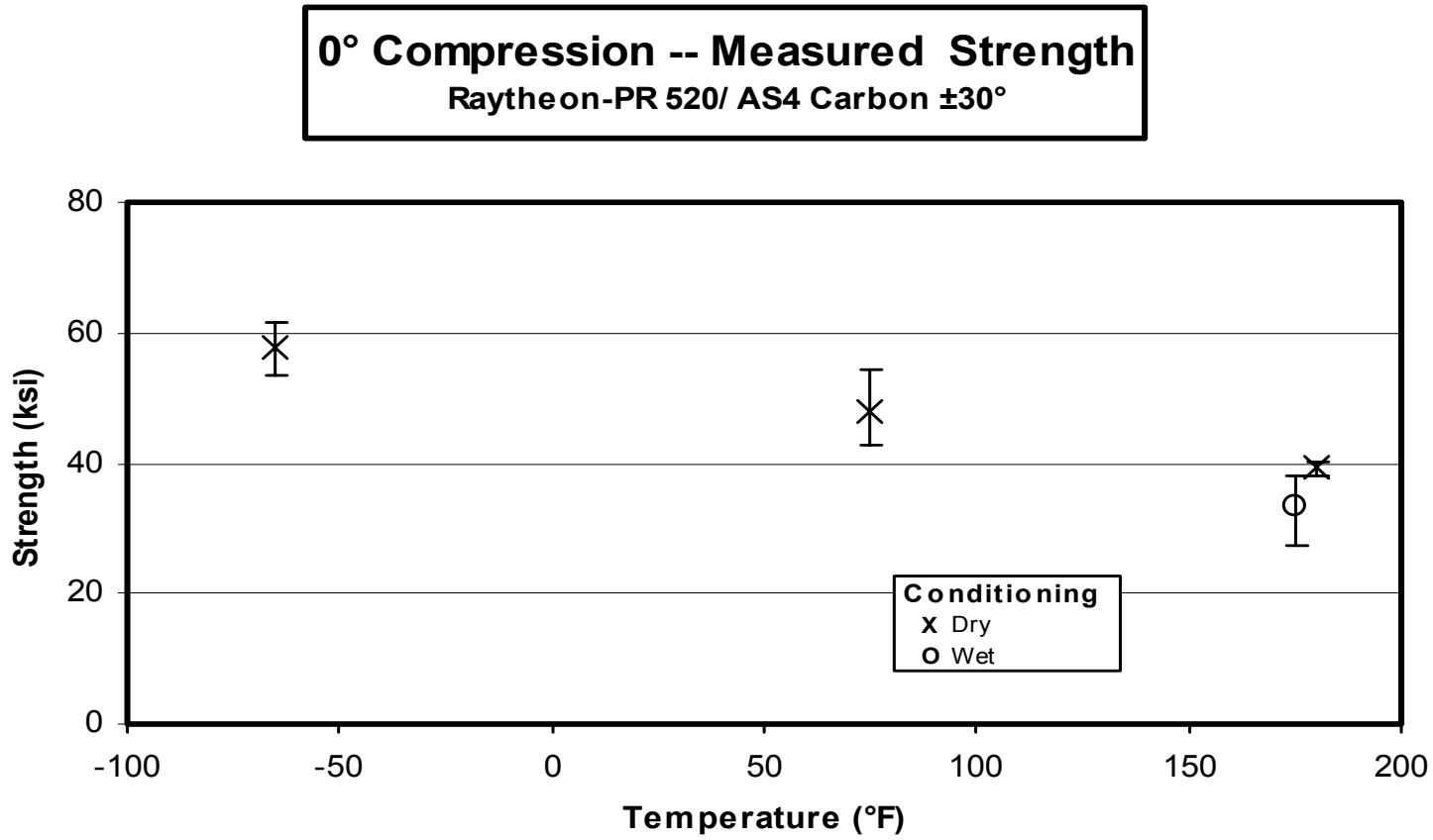


NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limits of the data. The 180° dry and wet data have been staggered for clarity.

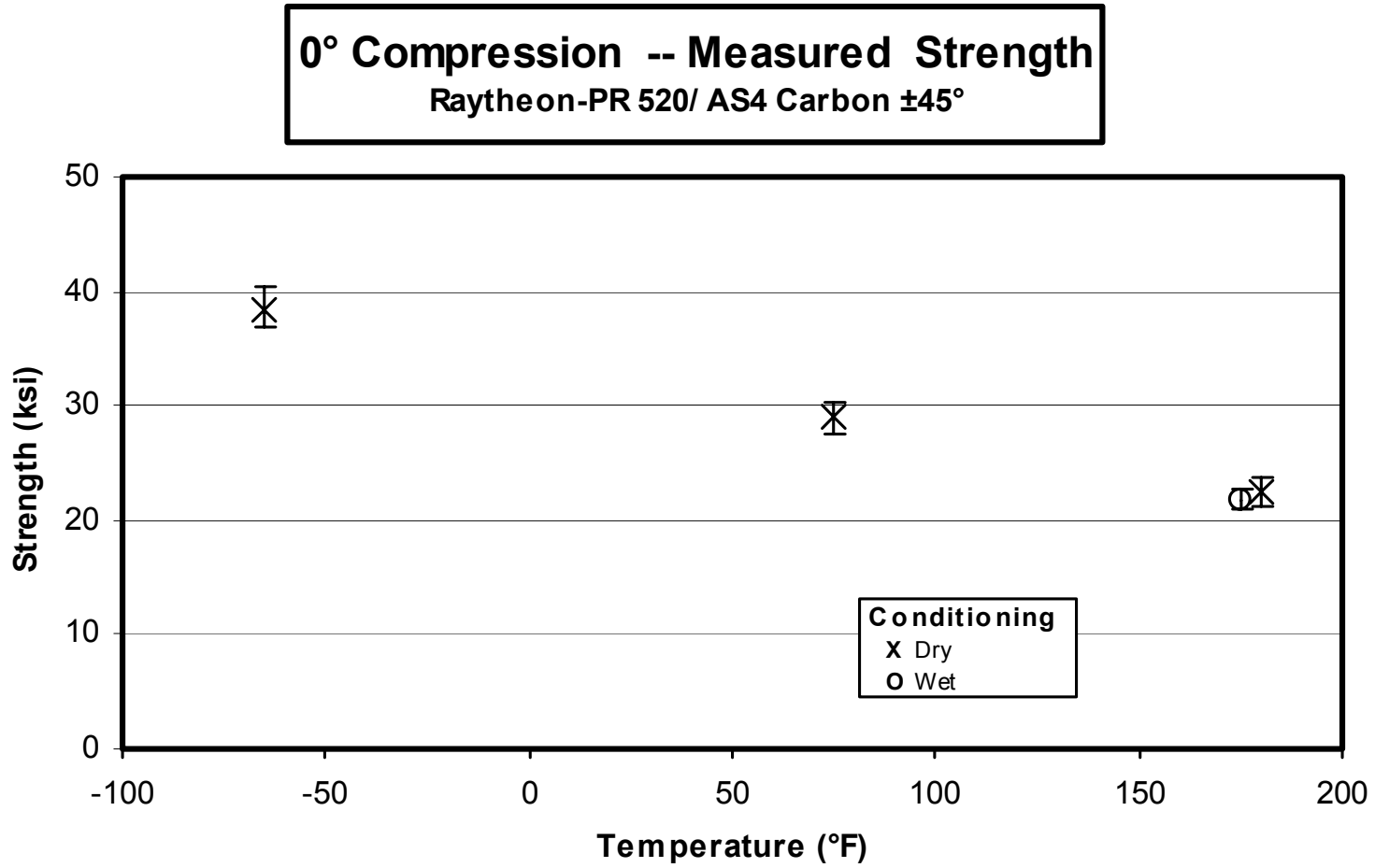


NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limits of the data. The 180° dry and wet data have been staggered for clarity.

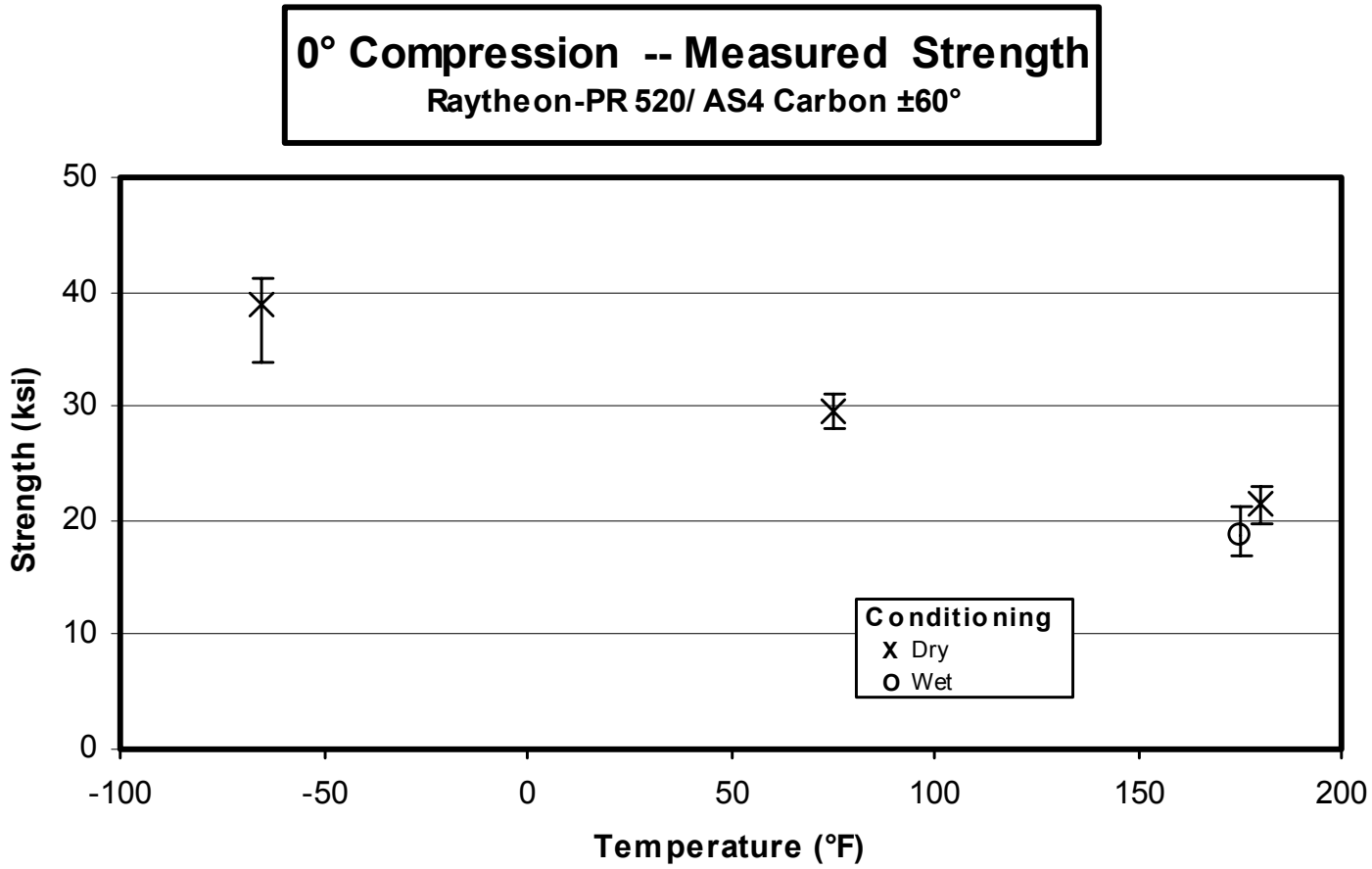
3.1.3.2 Compression, 1-axis



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

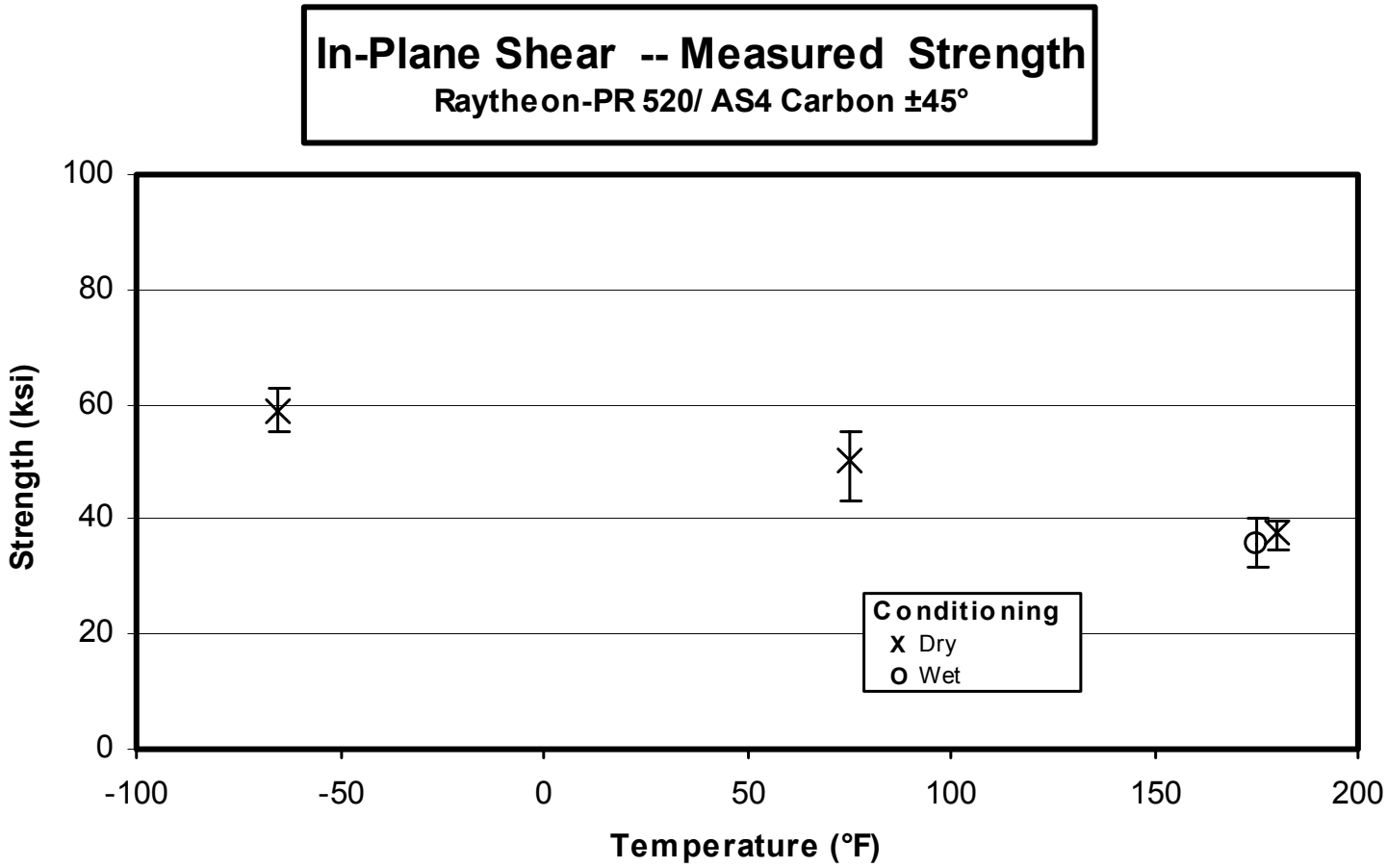


NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limits of the data. The 180° dry and wet data have been staggered for clarity.

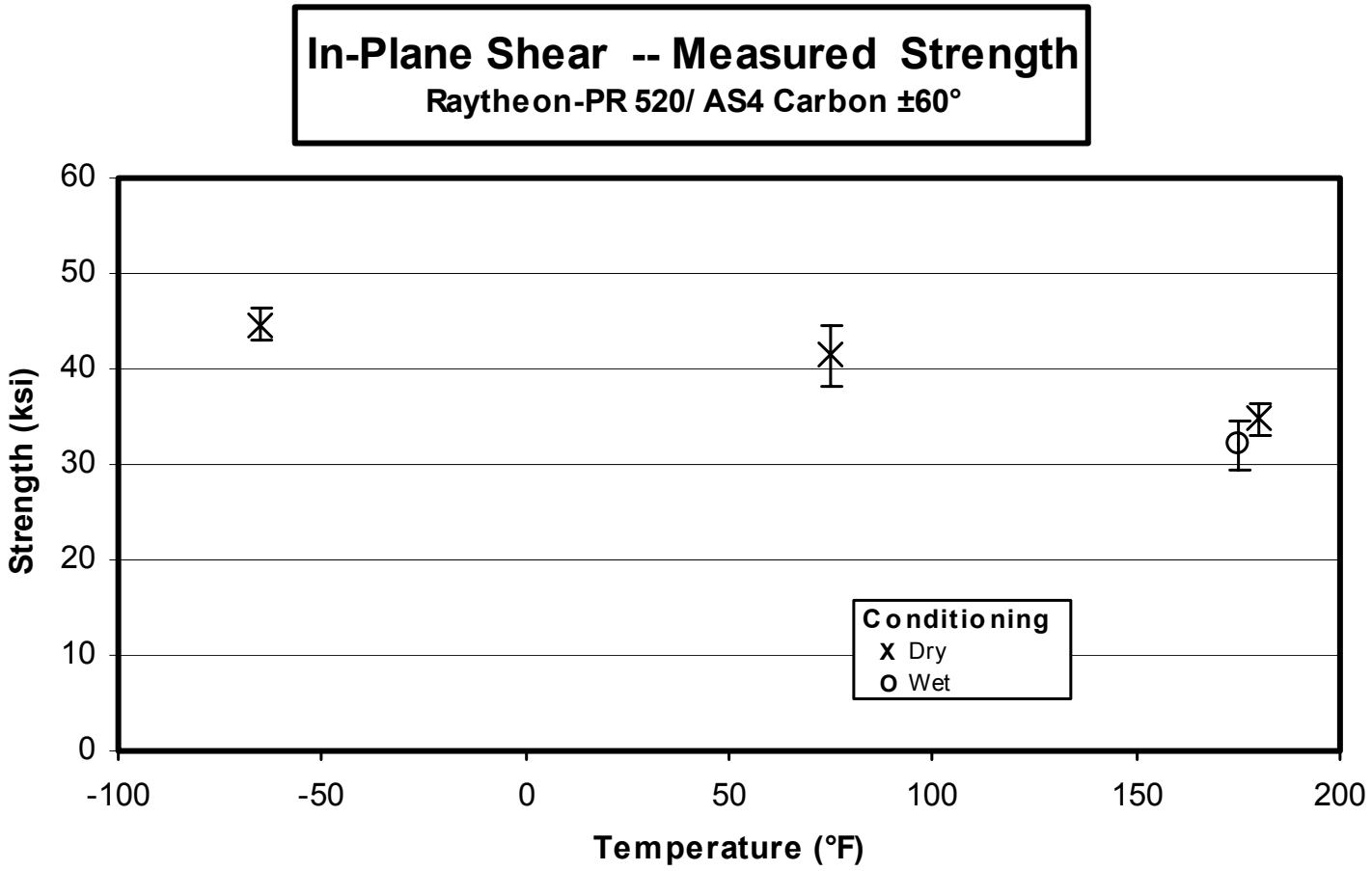


NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limits of the data. The 180° dry and wet data have been staggered for clarity.

3.1.3.3 Shear, 12 axis

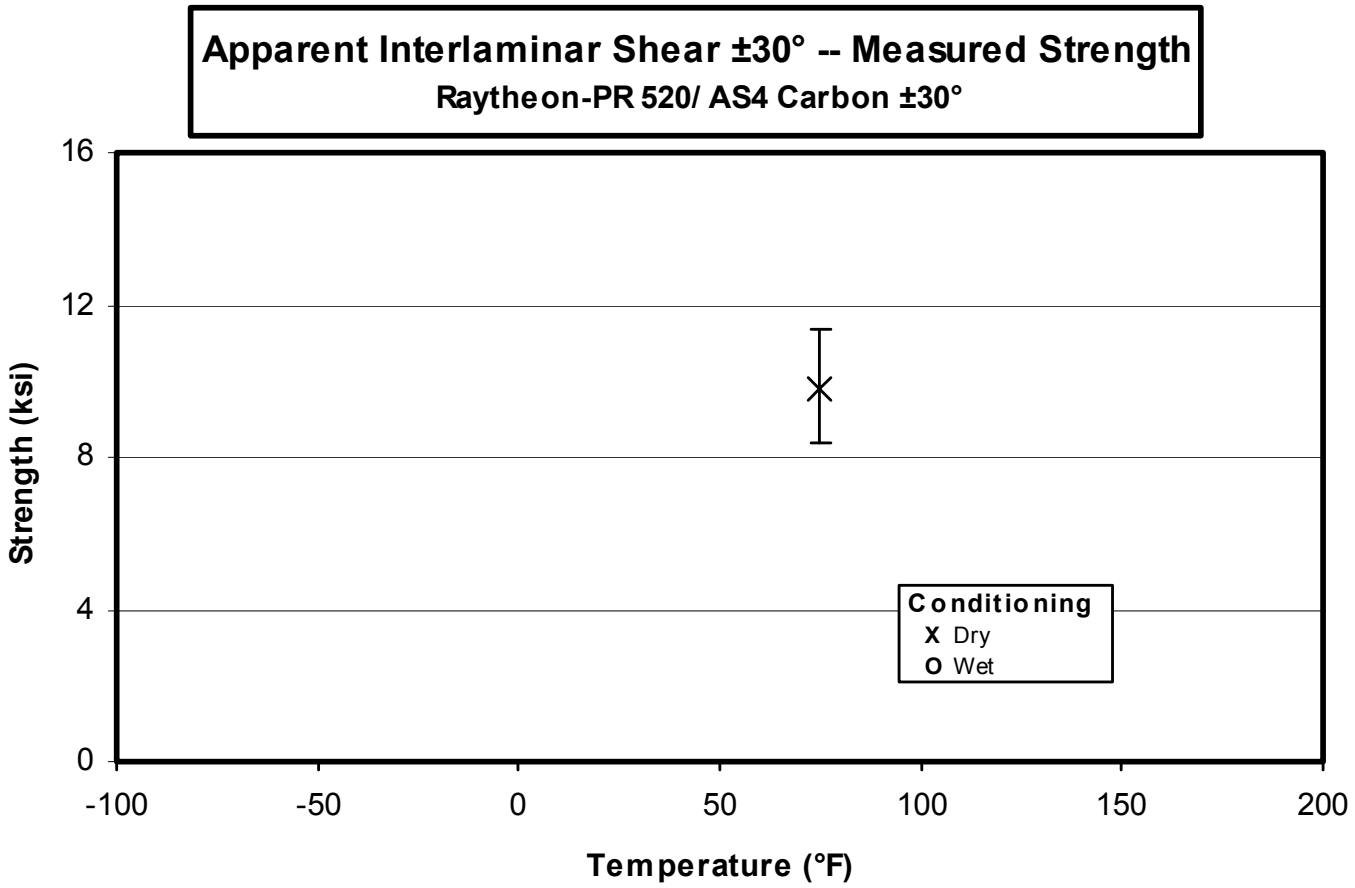


NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limits of the data. The 180° dry and wet data have been staggered for clarity.

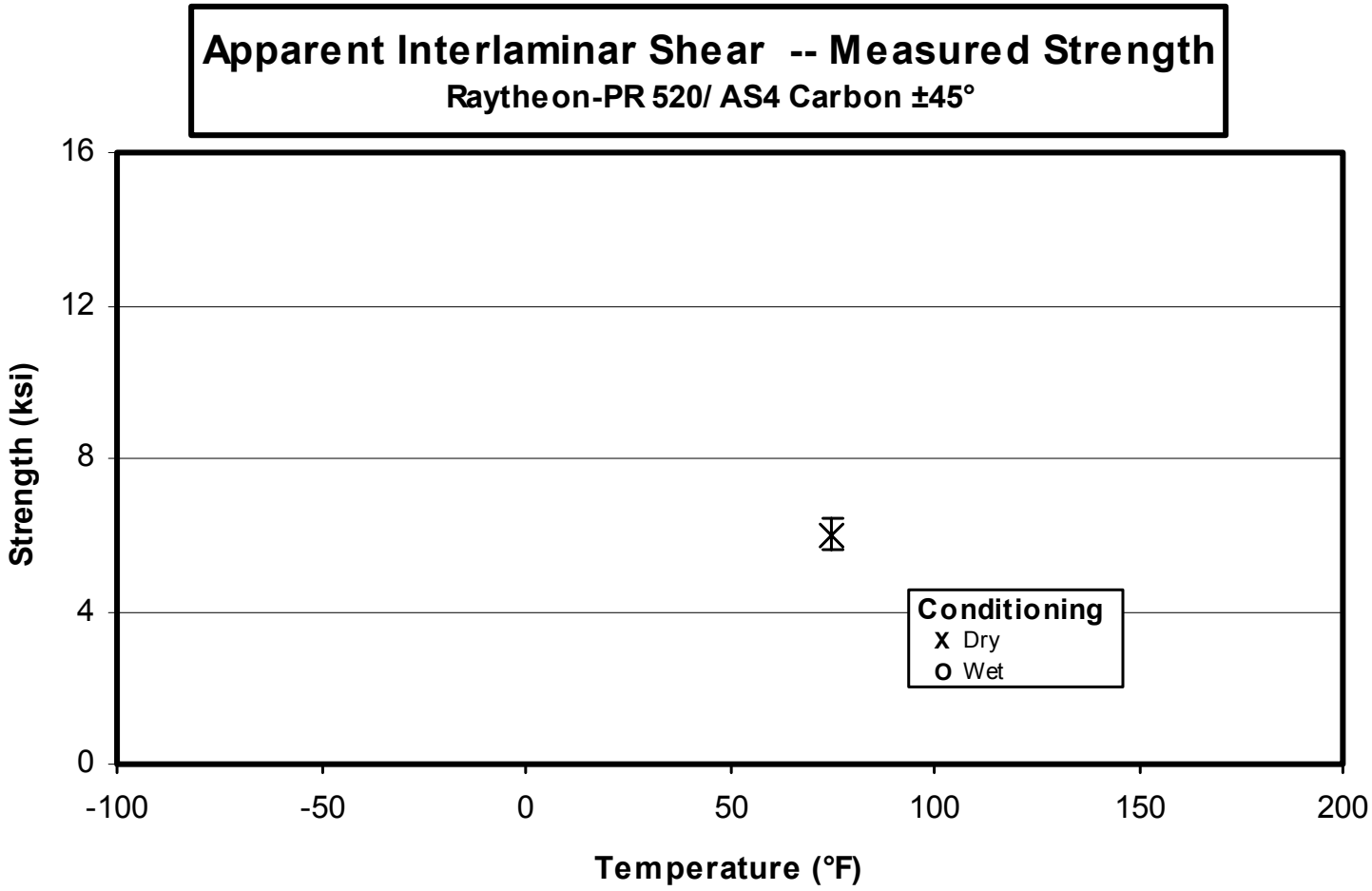


NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limits of the data. The 180° dry and wet data have been staggered for clarity.

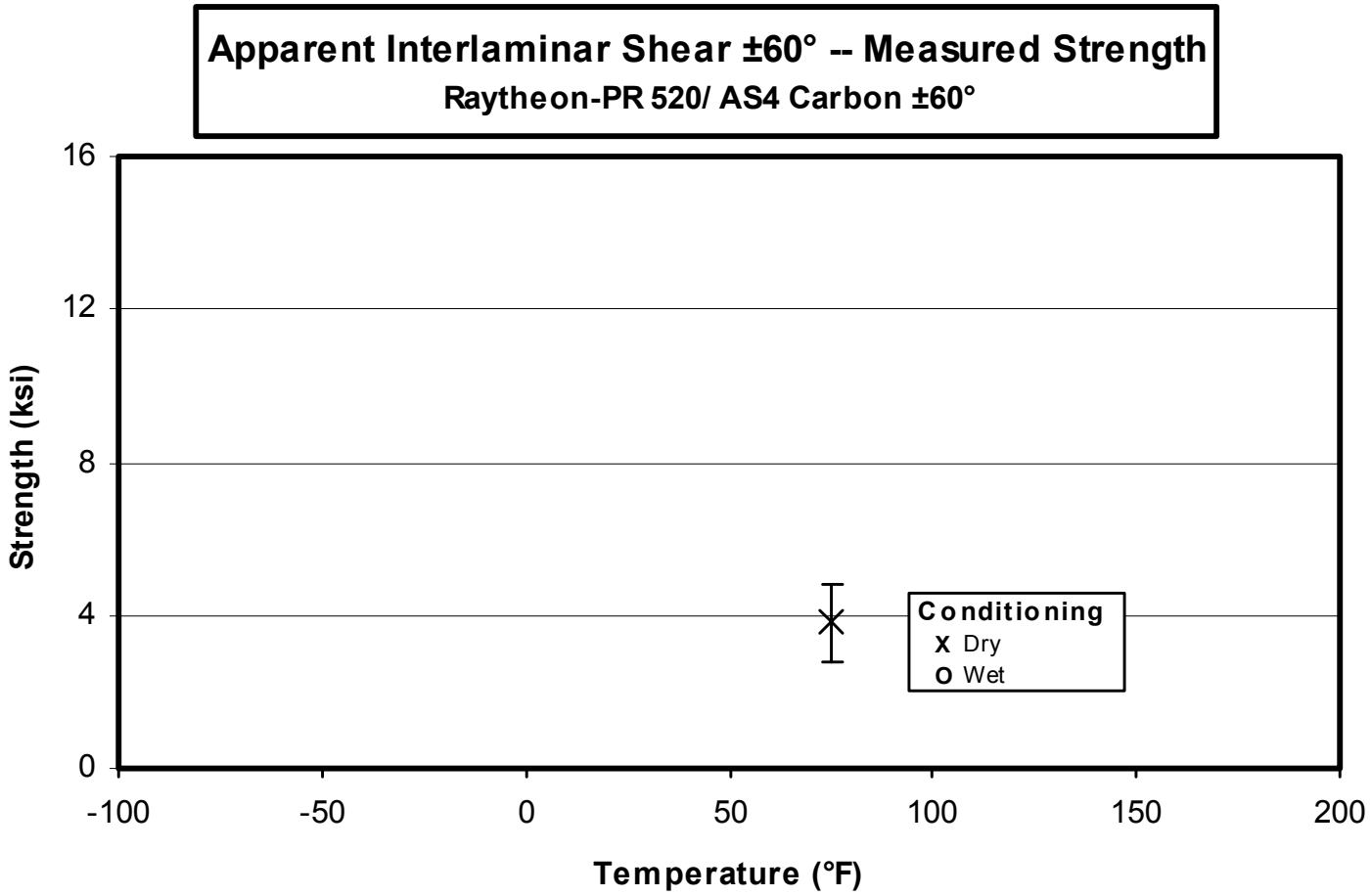
3.1.3.4 Shear, 13 axis



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



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



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

E B J 2 1 2 5 F

1st Character: Fabricator
'E' designates Raytheon

2nd Character: Material System
'B' designates AS4 6K GP / PR520 ±45°
'C' designates AS4 6K GP / PR520 ±30°, ±60°

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: Test Batch ID
See Table 2.1 for Raytheon 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.

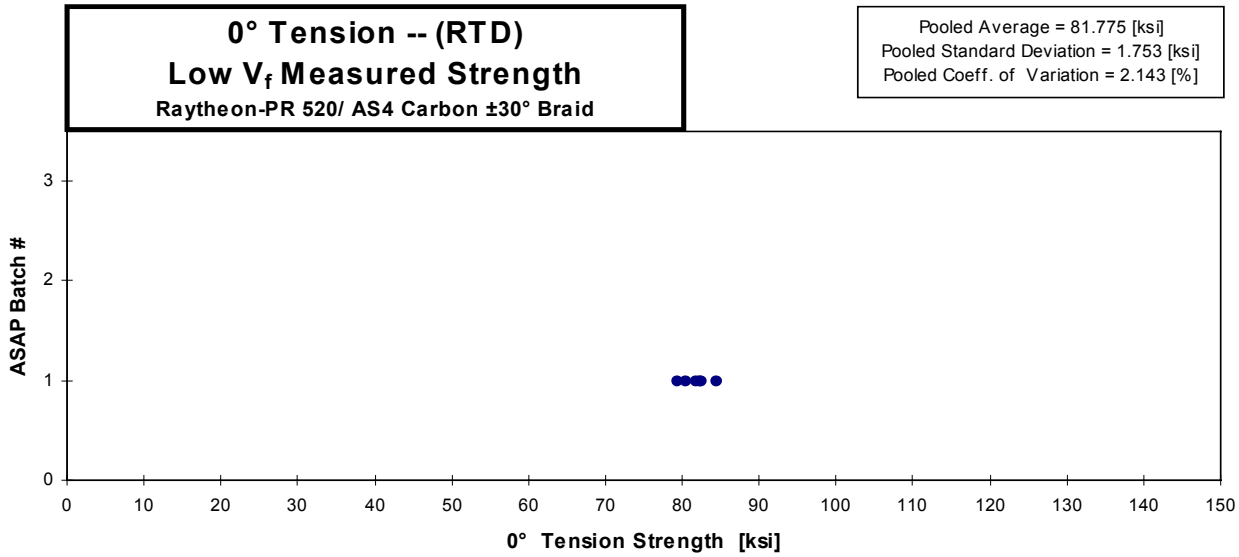
7th Character: Sample Number
The sample(s) cut from each subpanel, with sample numbers labeled increasing from reference edge.

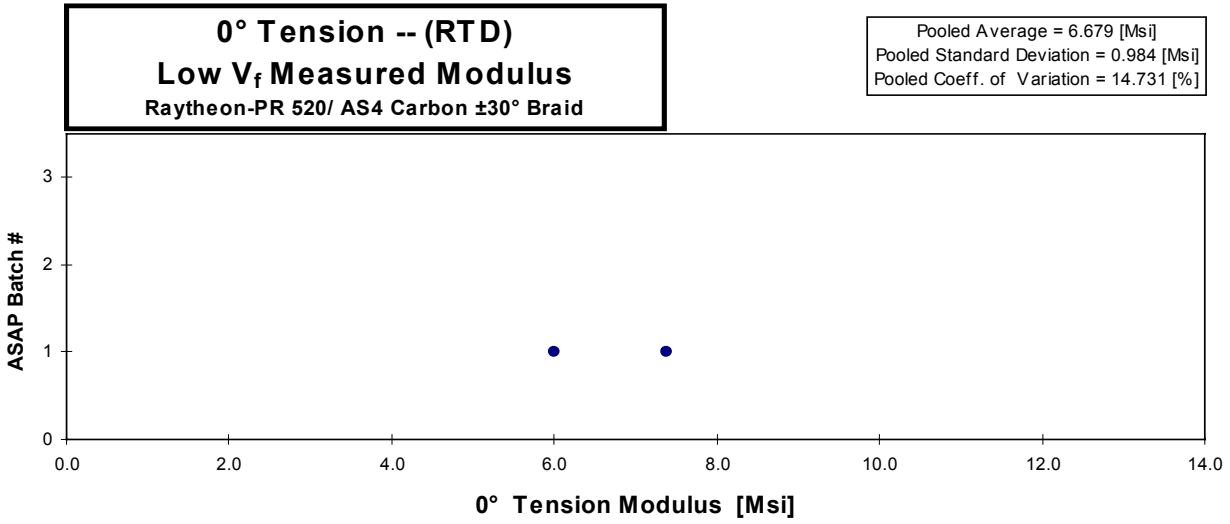
8th Character: Test Condition
'A' --- RTD
'B' --- CTD
'F' --- ETW
'G' --- ETD
See Table 1.5.2 for condition parameters.

3.2.1 Raw Data Spreadsheets and Scatter Charts

0° Tension -- (RTD)
Low V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±30° Braid

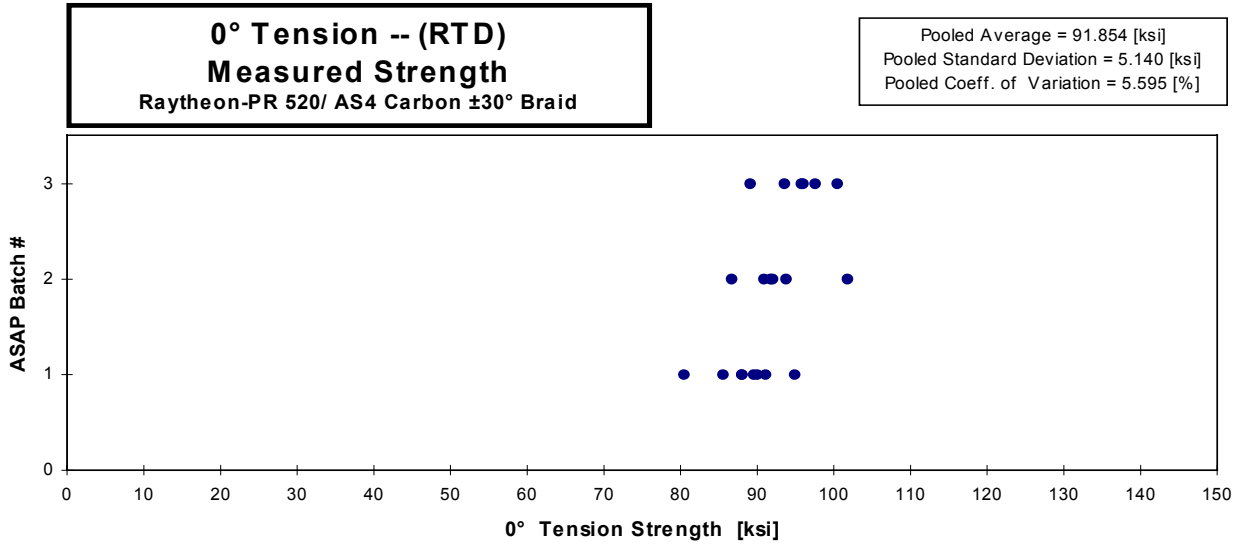
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECUX2L1A	4383	AP 110	1	84.371	7.375	1.396	0.113	5	0.02269	51.325
ECUX2L2A	4383	AP 110	1	79.273	5.984	1.445	0.113	5	0.02263	51.325
ECUX2L3A	4383	AP 110	1	82.276			0.113	5	0.02269	51.325
ECUX2L4A	4383	AP 110	1	80.504			0.114	5	0.02271	51.325
ECUX2L5A	4383	AP 110	1	81.750			0.113	5	0.02266	51.325
ECUX2L6A	4383	AP 110	1	82.479			0.113	5	0.02266	51.325
			Average	**81.775**	**6.679**	**1.420**			**0.02267**	**51.325**
			Standard Dev.	**1.753**	**0.984**	**0.035**				
			Coeff. of Var. [%]	**2.143**	**14.731**	**2.455**				
			Min.	**79.273**	**5.984**	**1.396**			**0.0226**	**51.325**
			Max.	**84.371**	**7.375**	**1.445**			**0.0227**	**51.325**
			Number of Spec.	**6**	**2**	**2**				

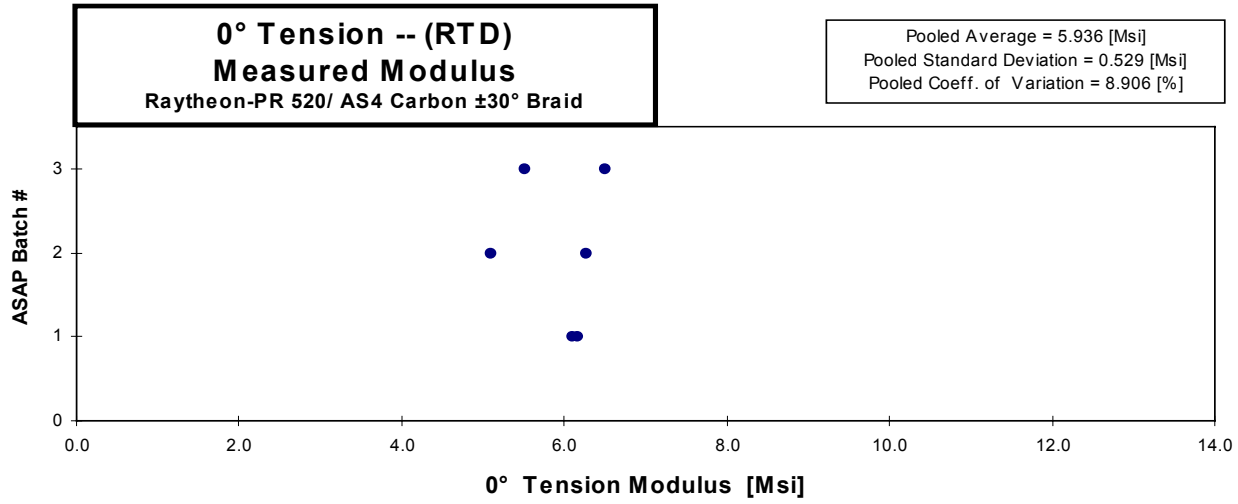




0° Tension -- (RTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±30° Braid

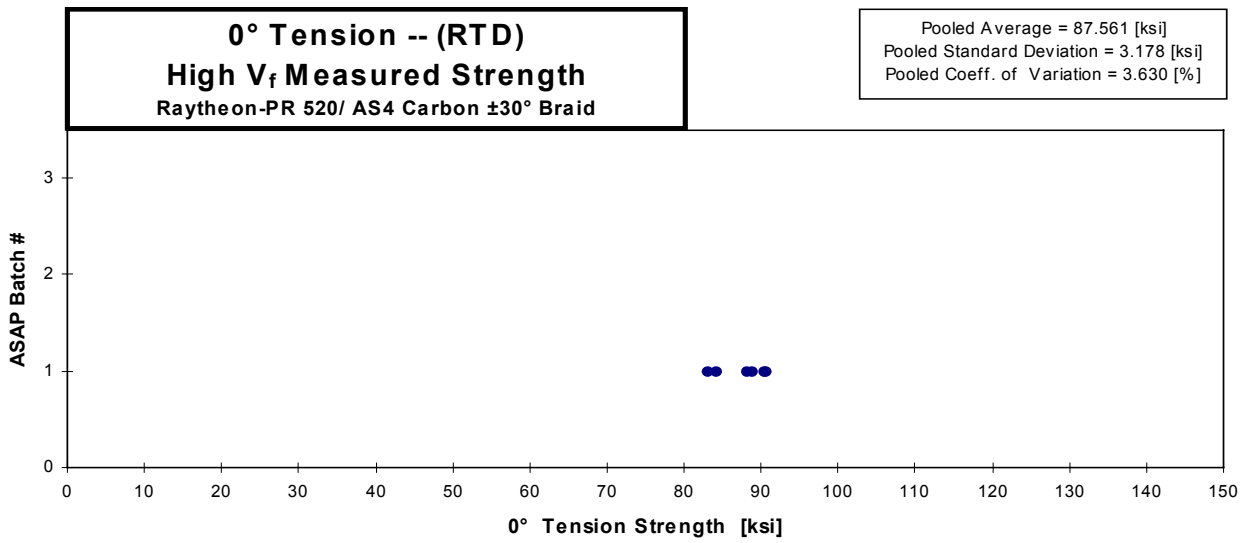
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECU1119A	4383	AP 110	1	89.928			0.113	6	0.01882	60.309
ECU111AA	4383	AP 110	1	91.135			0.113	6	0.01883	60.309
ECU111BA	4383	AP 110	1	89.491			0.113	6	0.01891	60.309
ECU111CA	4383	AP 110	1	94.948			0.113	6	0.01888	60.309
ECU111DA	4383	AP 110	1	88.087			0.113	6	0.01883	60.309
ECU111EA	4383	AP 110	1	88.054			0.113	6	0.01884	60.309
ECU111FA	4383	AP 110	1	85.604	6.158	1.299	0.114	6	0.01901	60.309
ECU1311A	4383	AP 110	1	80.379	6.092	1.281	0.114	6	0.01896	60.309
ECU2119A	4383	AP 109	2	86.604	5.094	1.003	0.113	6	0.01891	58.517
ECU211AA	4383	AP 109	2	101.828	6.273	1.026	0.114	6	0.01894	58.517
ECU211BA	4383	AP 109	2	90.782			0.112	6	0.01863	58.517
ECU211CA	4383	AP 109	2	91.828			0.113	6	0.01884	58.517
ECU211DA	4383	AP 109	2	91.924			0.114	6	0.01893	58.517
ECU22X1A	4383	AP 109	2	93.807			0.114	6	0.01898	58.517
ECU3119A	3968	AP 109	3	89.080	5.503	0.946	0.113	6	0.01880	59.919
ECU311AA	3968	AP 109	3	95.823	6.496	0.983	0.113	6	0.01883	59.919
ECU311BA	3968	AP 109	3	100.403			0.113	6	0.01878	59.919
ECU311CA	3968	AP 109	3	93.662			0.112	6	0.01873	59.919
ECU311DA	3968	AP 109	3	97.642			0.113	6	0.01887	59.919
ECU311EA	3968	AP 109	3	96.074			0.114	6	0.01903	59.919
Average				**91.854**	**5.936**	**1.090**			**0.01887**	**59.654**
Standard Dev.				**5.140**	**0.529**	**0.158**				
Coeff. of Var. [%]				**5.595**	**8.906**	**14.465**				
Min.				**80.379**	**5.094**	**0.946**			**0.0186**	**58.517**
Max.				**101.828**	**6.496**	**1.299**			**0.0190**	**60.309**
Number of Spec.				**20**	**6**	**6**				

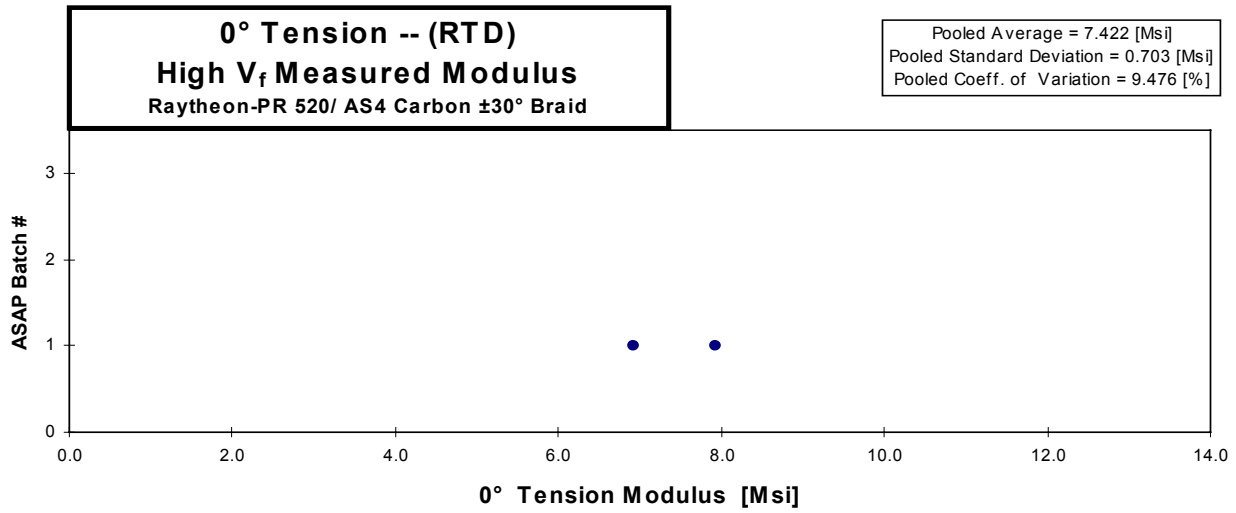




0° Tension -- (RTD)
High V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±30° Braid

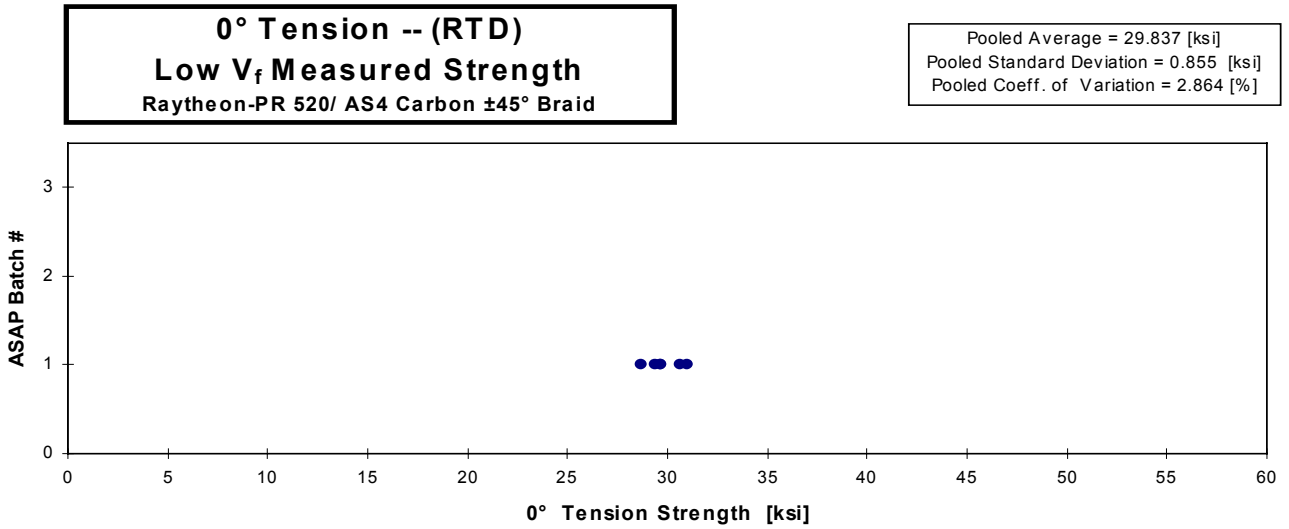
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECUX2G1A	4383	AP 110	1	83.102	7.920	1.283	0.121	7	0.01732	66.604
ECUX2G2A	4383	AP 110	1	84.236	6.925	1.181	0.122	7	0.01738	66.604
ECUX2G3A	4383	AP 110	1	90.379			0.122	7	0.01749	66.604
ECUX2G4A	4383	AP 110	1	88.146			0.122	7	0.01743	66.604
ECUX2G5A	4383	AP 110	1	88.837			0.123	7	0.01761	66.604
ECUX2G6A	4383	AP 110	1	90.669			0.123	7	0.01764	66.604
			Average	**87.561**	**7.422**	**1.232**			**0.01748**	**66.604**
			Standard Dev.	**3.178**	**0.703**	**0.072**				
			Coeff. of Var. [%]	**3.630**	**9.476**	**5.866**				
			Min.	**83.102**	**6.925**	**1.181**			**0.0173**	**66.604**
			Max.	**90.669**	**7.920**	**1.283**			**0.0176**	**66.604**
			Number of Spec.	**6**	**2**	**2**				

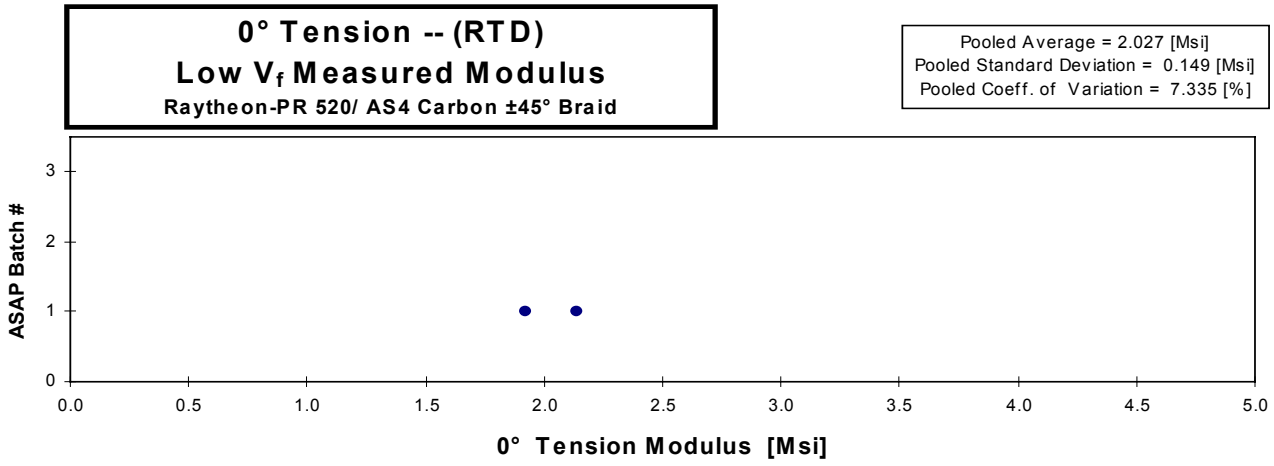




0° Tension -- (RTD)
Low V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

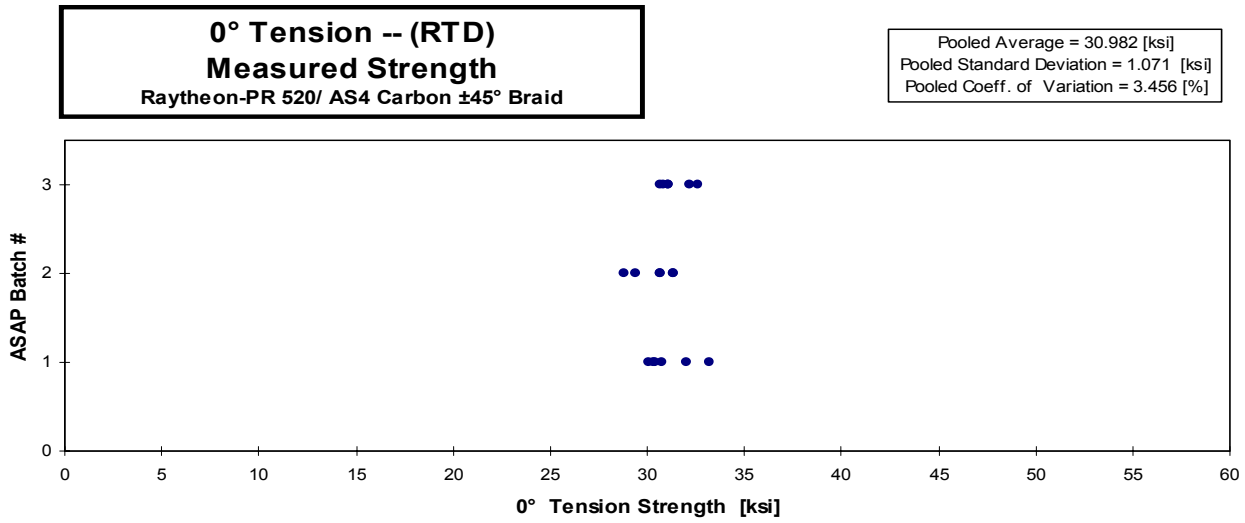
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBJX1XL1A	4383	AP 110	1	29.390	2.132	0.668	0.118	6	0.01958	49.472
EBJX1XL2A	4383	AP 110	1	28.661	1.922	0.630	0.117	6	0.01954	49.472
EBJX1XL3A	4383	AP 110	1	29.665			0.117	6	0.01957	49.472
EBJX1XL4A	4383	AP 110	1	29.664			0.117	6	0.01952	49.472
EBJX1XL5A	4383	AP 110	1	30.640			0.117	6	0.01955	49.472
EBJX1XL6A	4383	AP 110	1	31.005			0.117	6	0.01957	49.472
			Average	**29.837**	**2.027**	**0.649**			**0.01955**	**49.472**
			Standard Dev.	**0.855**	**0.149**	**0.027**				
			Coeff. of Var. [%]	**2.864**	**7.335**	**4.165**				
			Min.	**28.661**	**1.922**	**0.630**			**0.0195**	**49.472**
			Max.	**31.005**	**2.132**	**0.668**			**0.0196**	**49.472**
			Number of Spec.	**6**	**2**	**2**				

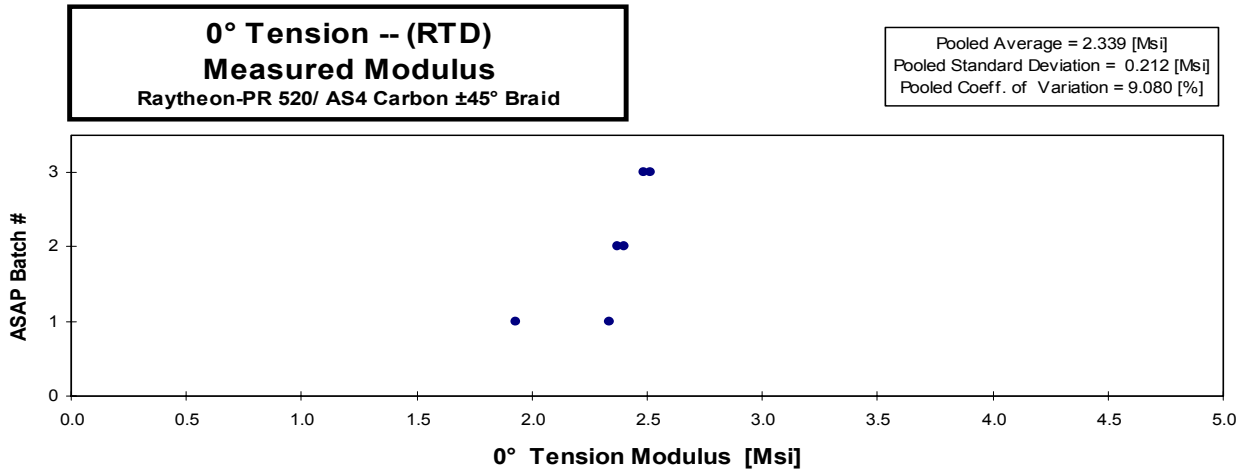




0° Tension -- (RTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

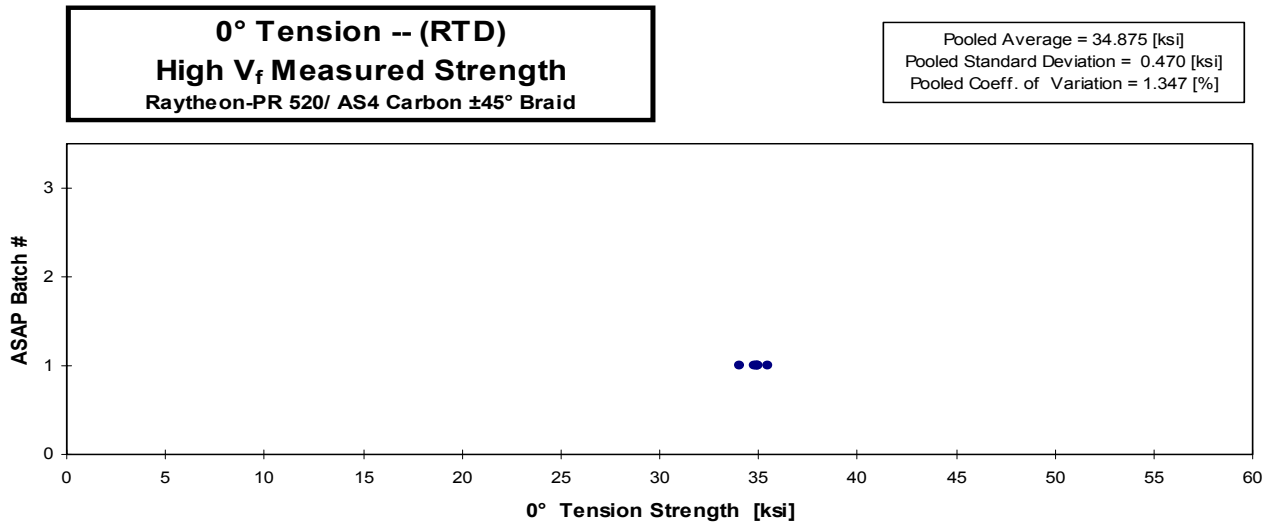
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBJ1122A	4383	AP 110	1	33.196	1.929	0.547	0.120	7	0.01708	57.162
EBJ1123A	4383	AP 110	1	30.328	2.335	0.637	0.120	7	0.01710	57.162
EBJ1124A	4383	AP 110	1	30.046			0.119	7	0.01701	57.162
EBJ1125A	4383	AP 110	1	30.464			0.119	7	0.01705	57.162
EBJ1126A	4383	AP 110	1	32.068			0.119	7	0.01705	57.162
EBJ1127A	4383	AP 110	1	30.748			0.119	7	0.01698	57.162
EBJ2111A	4383	AP 109	2	29.438	2.403	0.689	0.117	7	0.01674	58.611
EBJ2112A	4383	AP 109	2	30.659	2.369	0.755	0.118	7	0.01688	58.611
EBJ2113A	4383	AP 109	2	31.343			0.118	7	0.01683	58.611
EBJ2114A	4383	AP 109	2	28.822			0.117	7	0.01676	58.611
EBJ2115A	4383	AP 109	2	30.703			0.118	7	0.01681	58.611
EBJ2116A	4383	AP 109	2	31.337			0.118	7	0.01680	58.611
EBJ3111A	3968	AP 109	3	32.178	2.511	0.692	0.117	7	0.01672	58.401
EBJ3112A	3968	AP 109	3	30.658	2.489	0.704	0.118	7	0.01681	58.401
EBJ3113A	3968	AP 109	3	30.840			0.118	7	0.01679	58.401
EBJ3114A	3968	AP 109	3	31.097			0.118	7	0.01680	58.401
EBJ3115A	3968	AP 109	3	31.119			0.118	7	0.01681	58.401
EBJ3116A	3968	AP 109	3	32.628			0.117	7	0.01675	58.401
			Average	**30.982**	**2.339**	**0.671**			**0.01688**	**58.058**
			Standard Dev.	**1.071**	**0.212**	**0.071**				
			Coeff. of Var. [%]	**3.456**	**9.080**	**10.625**				
			Min.	**28.822**	**1.929**	**0.547**			**0.0167**	**57.162**
			Max.	**33.196**	**2.511**	**0.755**			**0.0171**	**58.611**
			Number of Spec.	**18**	**6**	**6**				

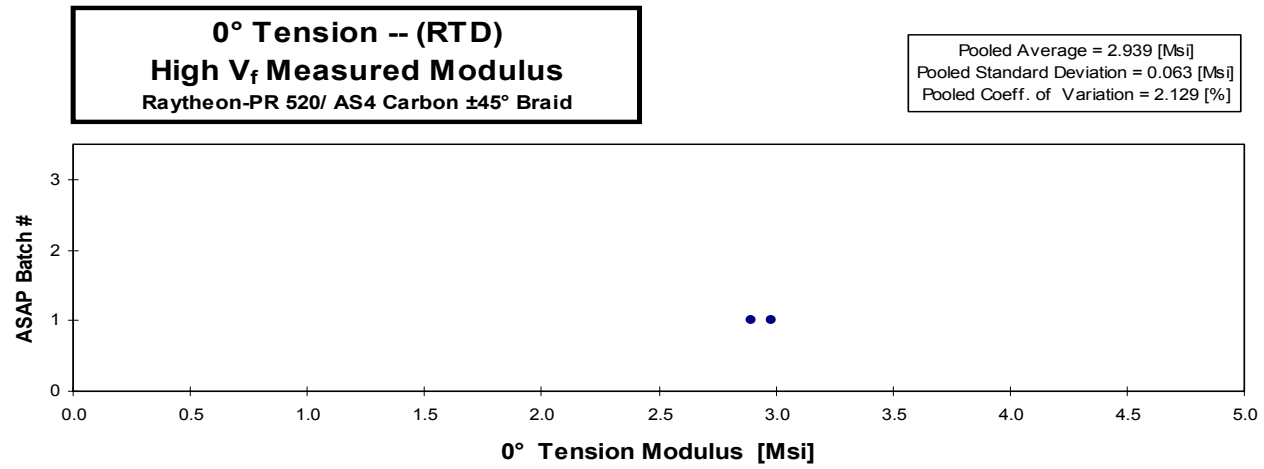




0° Tension -- (RTD)
High V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

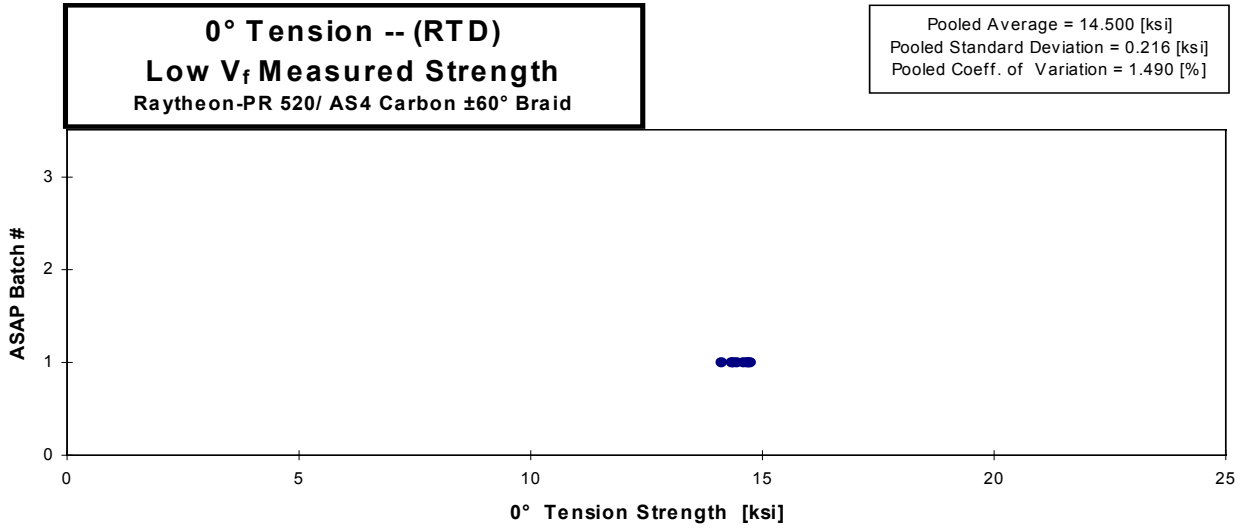
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBJX1XG1A	4383	AP 110	1	34.802	2.984	0.729	0.120	8	0.01498	64.434
EBJX1XG2A	4383	AP 110	1	34.992	2.895	0.703	0.121	8	0.01507	64.434
EBJX1XG3A	4383	AP 110	1	35.021			0.120	8	0.01504	64.434
EBJX1XG4A	4383	AP 110	1	34.053			0.121	8	0.01507	64.434
EBJX1XG5A	4383	AP 110	1	34.885			0.121	8	0.01507	64.434
EBJX1XG6A	4383	AP 110	1	35.497			0.120	8	0.01506	64.434
			Average	**34.875**	**2.939**	**0.716**			**0.01505**	**64.434**
			Standard Dev.	**0.470**	**0.063**	**0.019**				
			Coeff. of Var. [%]	**1.347**	**2.129**	**2.608**				
			Min.	**34.053**	**2.895**	**0.703**			**0.0150**	**64.434**
			Max.	**35.497**	**2.984**	**0.729**			**0.0151**	**64.434**
			Number of Spec.	**6**	**2**	**2**				

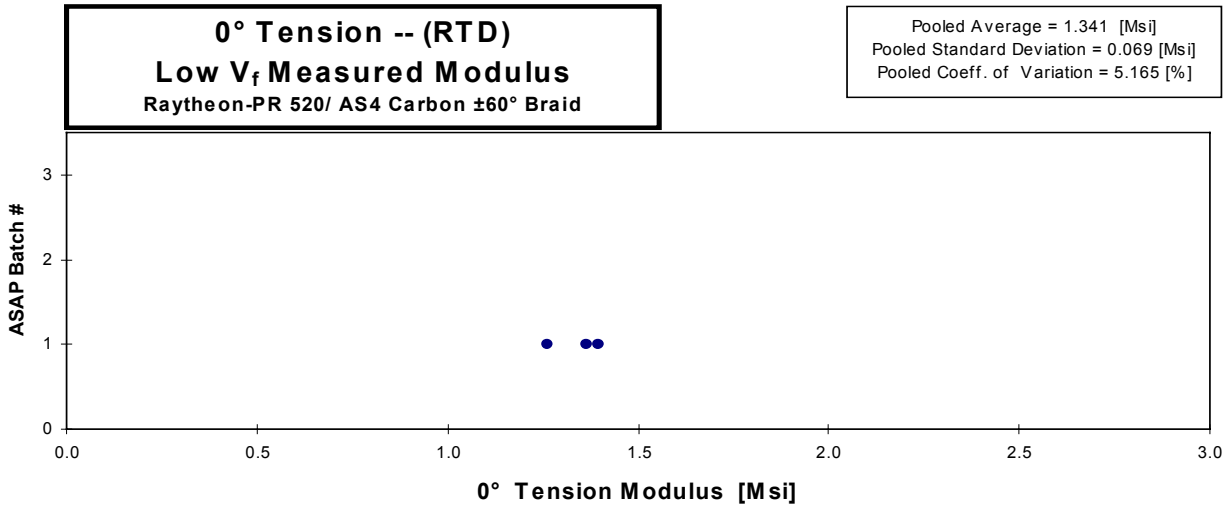




0° Tension -- (RTD)
Low V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

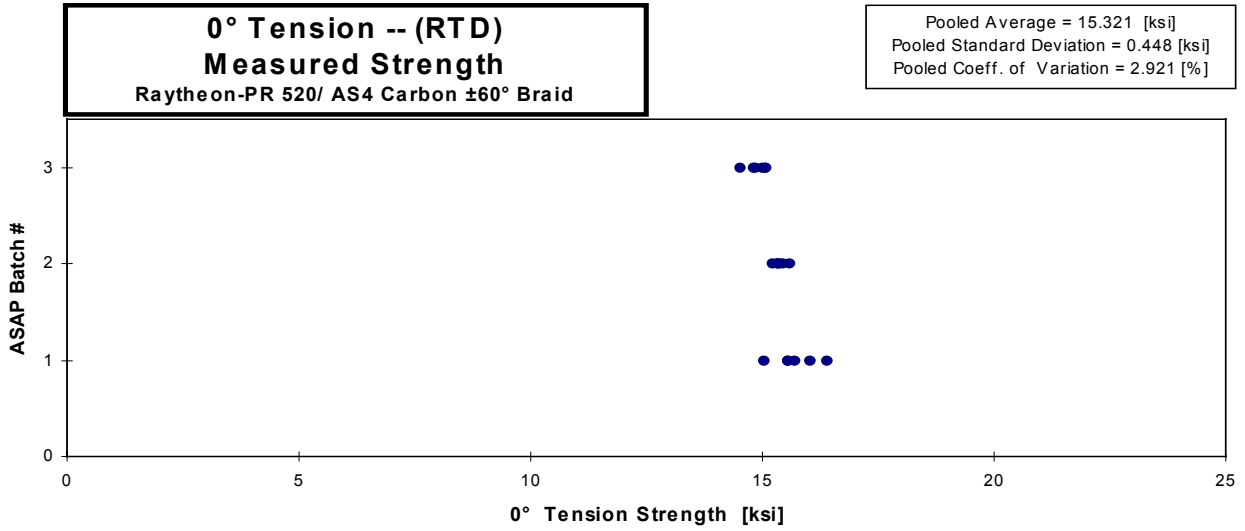
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECJX1L1A	4383	AP 110	1	14.110	1.395	0.325	0.114	5	0.02288	50.038
ECJX1L2A	4383	AP 110	1	14.457			0.114	5	0.02285	50.038
ECJX1L3A	4383	AP 110	1	14.737			0.114	5	0.02284	50.038
ECJX1L4A	4383	AP 110	1	14.382			0.114	5	0.02286	50.038
ECJX1L5A	4383	AP 110	1	14.698			0.114	5	0.02280	50.038
ECJX1L6A	4383	AP 110	1	14.346			0.114	5	0.02287	50.038
ECJX1L7A	4383	AP 110	1	14.676	1.365	0.318	0.114	5	0.02278	50.038
ECJX1L8A	4383	AP 110	1	14.592	1.263	0.299	0.115	5	0.02293	50.038
			Average	**14.500**	**1.341**	**0.314**			**0.02285**	**50.038**
			Standard Dev.	**0.216**	**0.069**	**0.013**				
			Coeff. of Var. [%]	**1.490**	**5.165**	**4.296**				
			Min.	**14.110**	**1.263**	**0.299**			**0.0228**	**50.038**
			Max.	**14.737**	**1.395**	**0.325**			**0.0229**	**50.038**
			Number of Spec.	**8**	**3**	**3**				

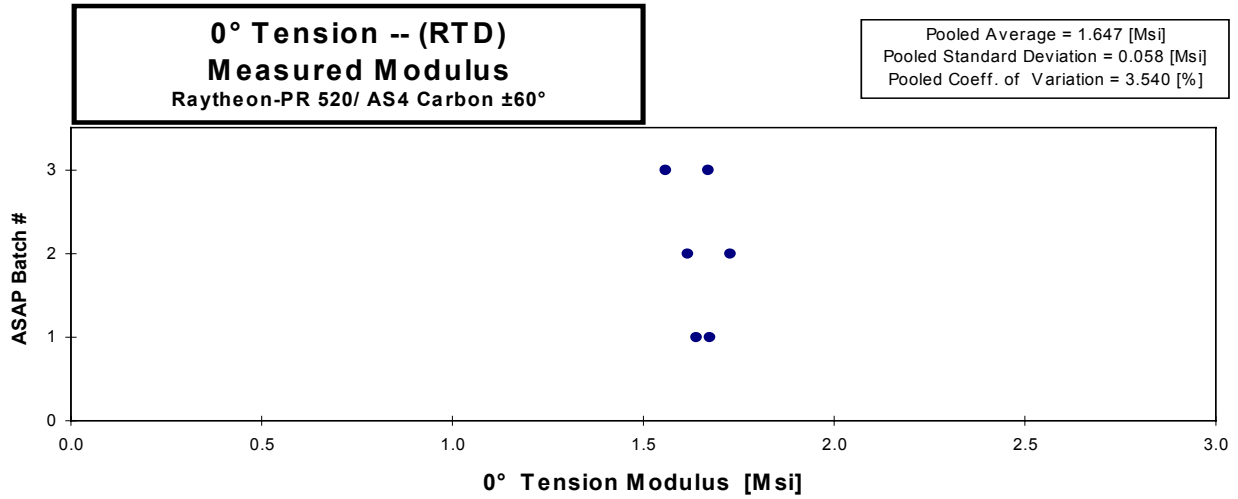




0° Tension -- (RTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

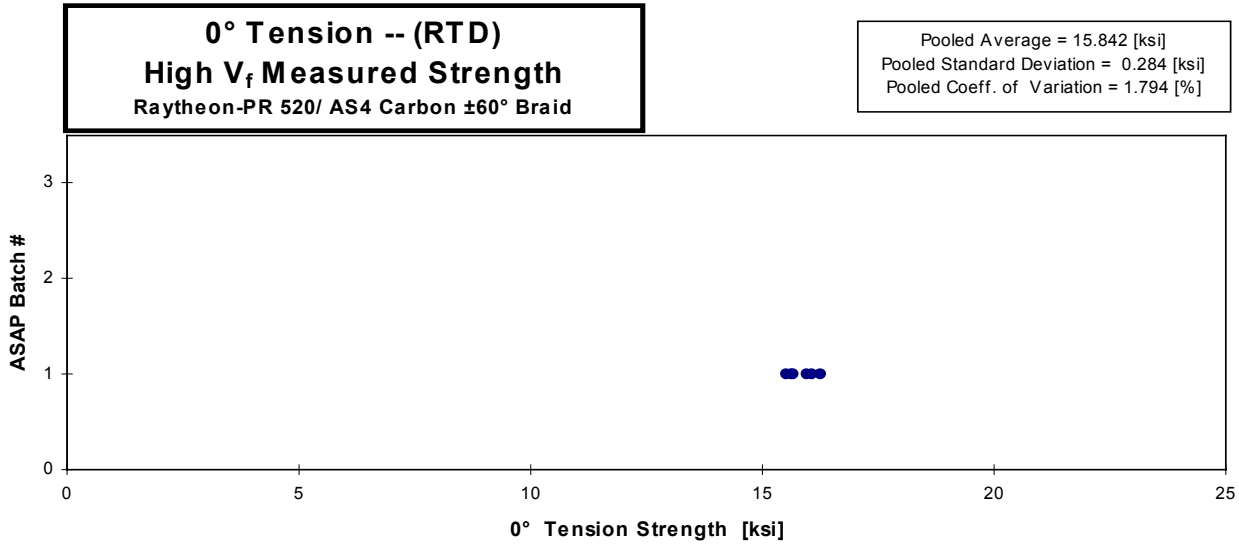
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECJ1121A	4383	AP 110	1	16.025	1.675	0.319	0.112	6	0.01869	59.485
ECJ1122A	4383	AP 110	1	15.547	1.640	0.276	0.113	6	0.01879	59.485
ECJ1123A	4383	AP 110	1	15.691			0.112	6	0.01869	59.485
ECJ1124A	4383	AP 110	1	16.393			0.113	6	0.01885	59.485
ECJ1125A	4383	AP 110	1	15.536			0.113	6	0.01884	59.485
ECJ1126A	4383	AP 110	1	15.018			0.118	6	0.01971	59.485
ECJ2121A	4383	AP 109	2	15.321	1.615	0.254	0.114	6	0.01905	61.447
ECJ2122A	4383	AP 109	2	15.577	1.726	0.313	0.114	6	0.01896	61.447
ECJ2123A	4383	AP 109	2	15.209			0.113	6	0.01887	61.447
ECJ2124A	4383	AP 109	2	15.333			0.113	6	0.01889	61.447
ECJ2125A	4383	AP 109	2	15.366			0.112	6	0.01871	61.447
ECJ2126A	4383	AP 109	2	15.449			0.113	6	0.01878	61.447
ECJ3122A	3968	AP 109	3	14.987	1.671	0.262	0.113	6	0.01891	61.439
ECJ3123A	3968	AP 109	3	14.530	1.556	0.268	0.114	6	0.01898	61.439
ECJ3124A	3968	AP 109	3	15.058			0.113	6	0.01884	61.439
ECJ3125A	3968	AP 109	3	14.871			0.114	6	0.01903	61.439
ECJ3126A	3968	AP 109	3	15.067			0.113	6	0.01878	61.439
ECJ3127A	3968	AP 109	3	14.808			0.114	6	0.01901	61.439
			Average	**15.321**	**1.647**	**0.282**			**0.01891**	**60.790**
			Standard Dev.	**0.448**	**0.058**	**0.027**				
			Coeff. of Var. [%]	**2.921**	**3.540**	**9.695**				
			Min.	**14.530**	**1.556**	**0.254**			**0.0187**	**59.485**
			Max.	**16.393**	**1.726**	**0.319**			**0.0197**	**61.447**
			Number of Spec.	**18**	**6**	**6**				

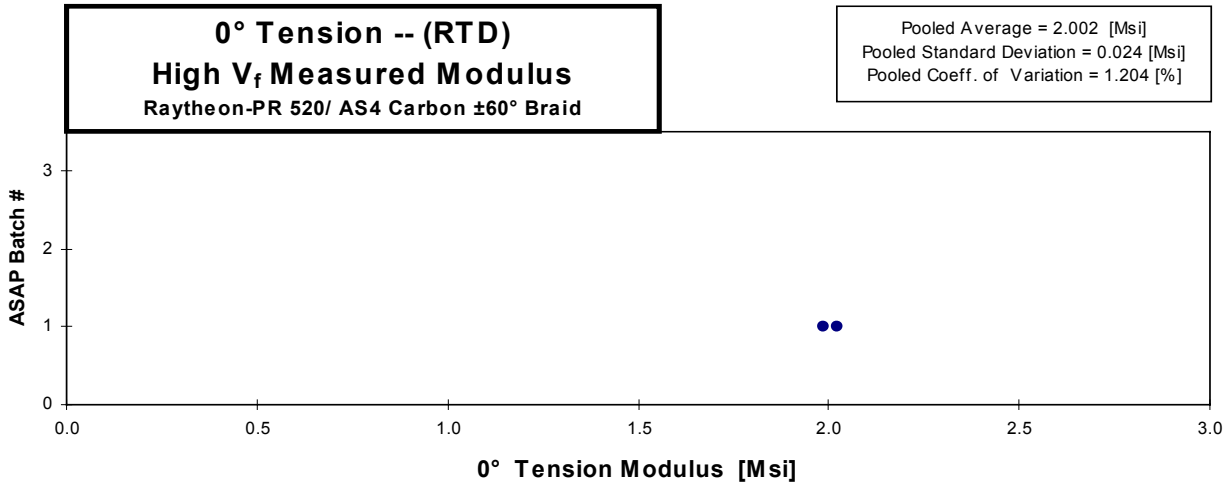




0° Tension -- (RTD)
High V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

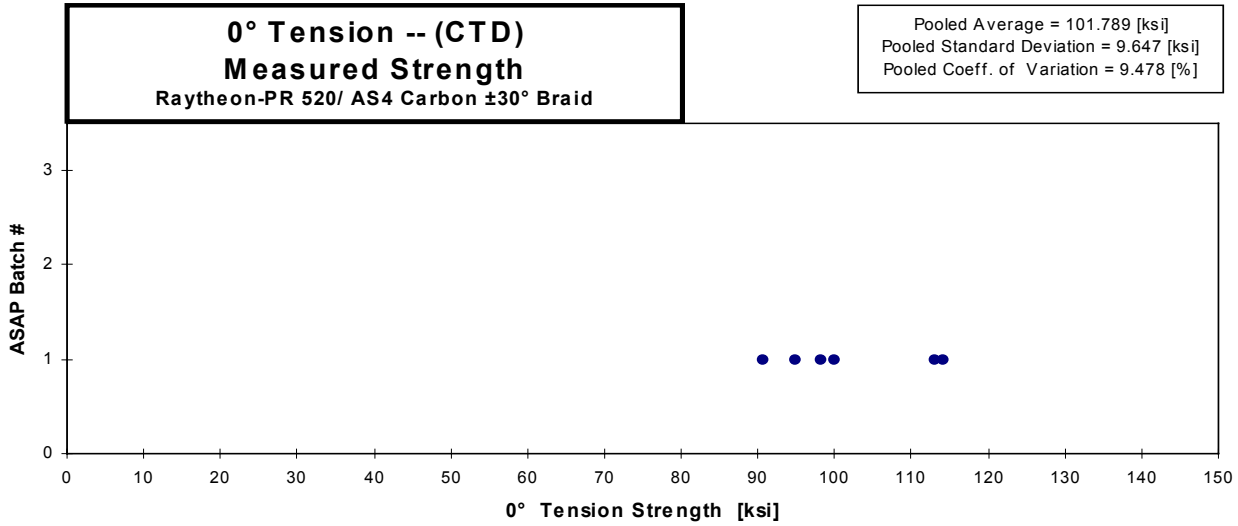
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECJX1G1A	4383	AP 110	1	15.664	2.019	0.285	0.118	7	0.01679	69.346
ECJX1G2A	4383	AP 110	1	15.524	1.985	0.322	0.118	7	0.01679	69.346
ECJX1G3A	4383	AP 110	1	15.614			0.118	7	0.01680	69.346
ECJX1G4A	4383	AP 110	1	16.057			0.118	7	0.01680	69.346
ECJX1G5A	4383	AP 110	1	15.946			0.118	7	0.01679	69.346
ECJX1G6A	4383	AP 110	1	16.244			0.117	7	0.01675	69.346
			Average	**15.842**	**2.002**	**0.303**			**0.01679**	**69.346**
			Standard Dev.	**0.284**	**0.024**	**0.027**				
			Coeff. of Var. [%]	**1.794**	**1.204**	**8.766**				
			Min.	**15.524**	**1.985**	**0.285**			**0.0168**	**69.346**
			Max.	**16.244**	**2.019**	**0.322**			**0.0168**	**69.346**
			Number of Spec.	**6**	**2**	**2**				

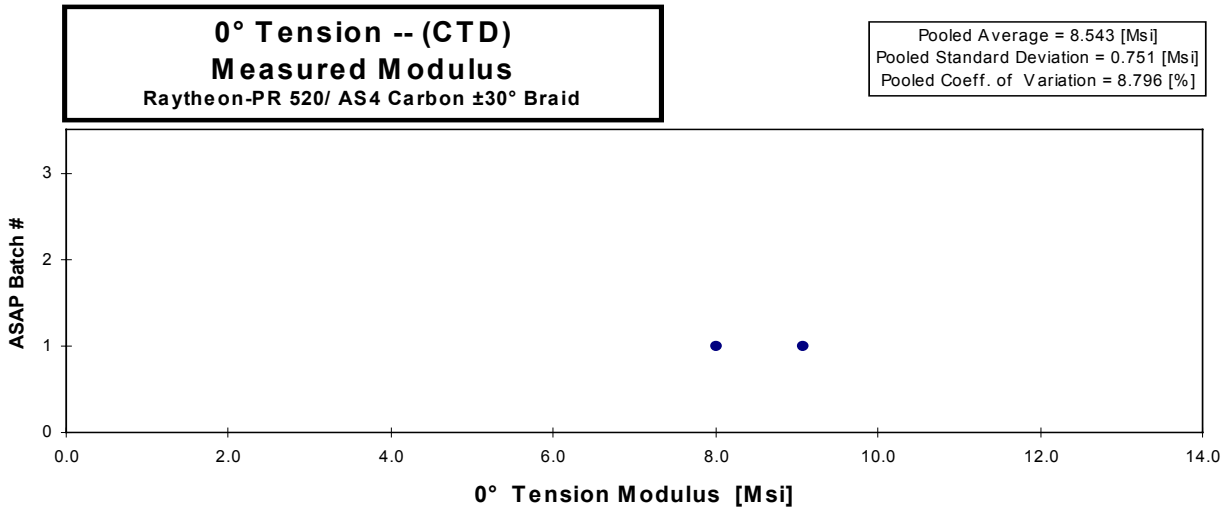




0° Tension -- (CTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±30° Braid

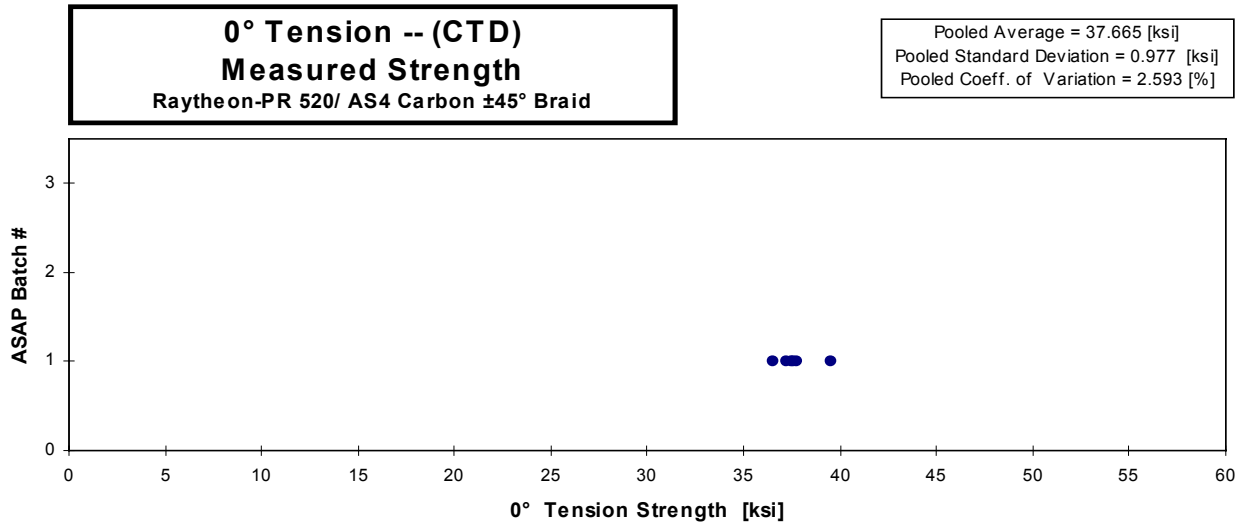
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECU121AB	4383	AP 110	1	112.917	9.075	1.273	0.113	6	0.01889	59.568
ECU121BB	4383	AP 110	1	99.977	8.012	1.130	0.113	6	0.01891	59.568
ECU121CB	4383	AP 110	1	94.940			0.113	6	0.01886	59.568
ECU121DB	4383	AP 110	1	114.136			0.114	6	0.01903	59.568
ECU121EB	4383	AP 110	1	90.565			0.114	6	0.01898	59.568
ECU121FB	4383	AP 110	1	98.198			0.114	6	0.01904	59.568
			Average	**101.789**	**8.543**	**1.202**			**0.01895**	**59.568**
			Standard Dev.	**9.647**	**0.751**	**0.101**				
			Coeff. of Var. [%]	**9.478**	**8.796**	**8.391**				
			Min.	**90.565**	**8.012**	**1.130**			**0.0189**	**59.568**
			Max.	**114.136**	**9.075**	**1.273**			**0.0190**	**59.568**
			Number of Spec.	**6**	**2**	**2**				

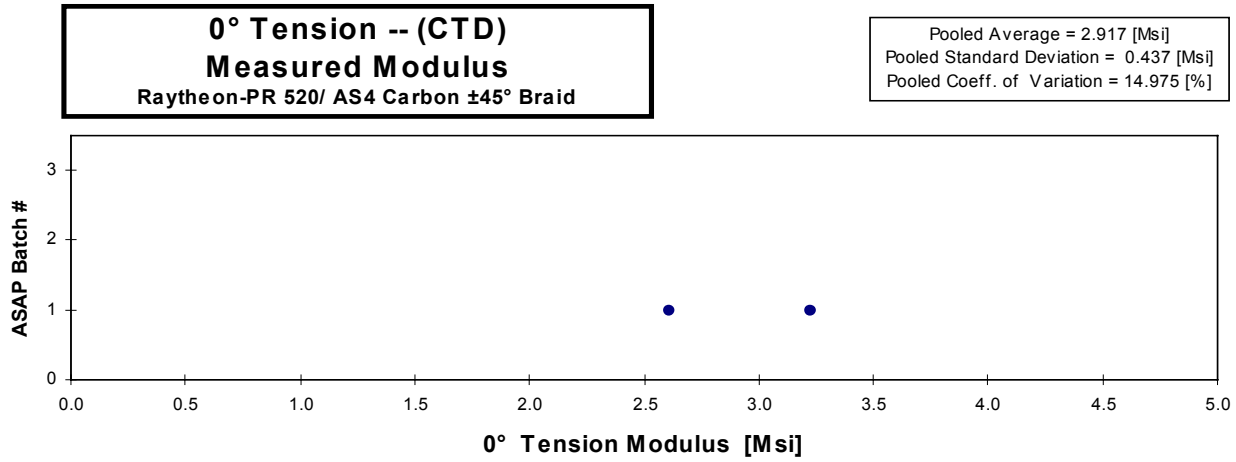




0° Tension -- (CTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

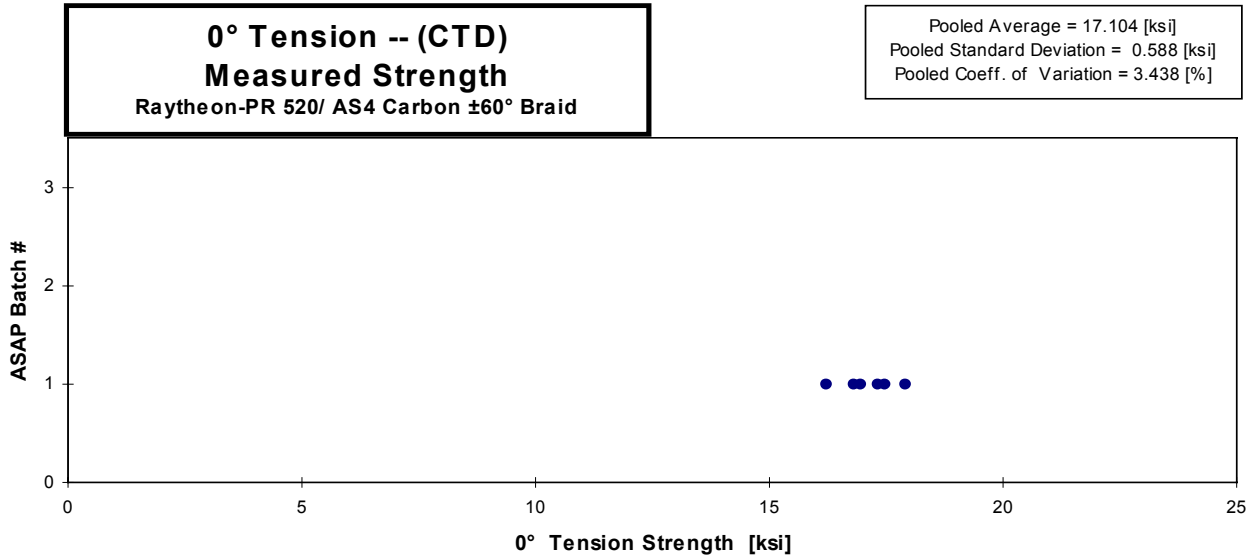
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBJ1222B	4383	AP 110	1	37.768	2.608	0.695	0.119	7	0.01701	57.712
EBJ1223B	4383	AP 110	1	39.457	3.226	0.786	0.119	7	0.01697	57.712
EBJ1224B	4383	AP 110	1	37.461			0.119	7	0.01693	57.712
EBJ1225B	4383	AP 110	1	37.214			0.119	7	0.01706	57.712
EBJ1226B	4383	AP 110	1	36.529			0.120	7	0.01712	57.712
EBJ1227B	4383	AP 110	1	37.561			0.120	7	0.01708	57.712
			Average	**37.665**	**2.917**	**0.741**			**0.01703**	**57.712**
			Standard Dev.	**0.977**	**0.437**	**0.064**				
			Coeff. of Var. [%]	**2.593**	**14.975**	**8.708**				
			Min.	**36.529**	**2.608**	**0.695**			**0.0169**	**57.712**
			Max.	**39.457**	**3.226**	**0.786**			**0.0171**	**57.712**
			Number of Spec.	**6**	**2**	**2**				

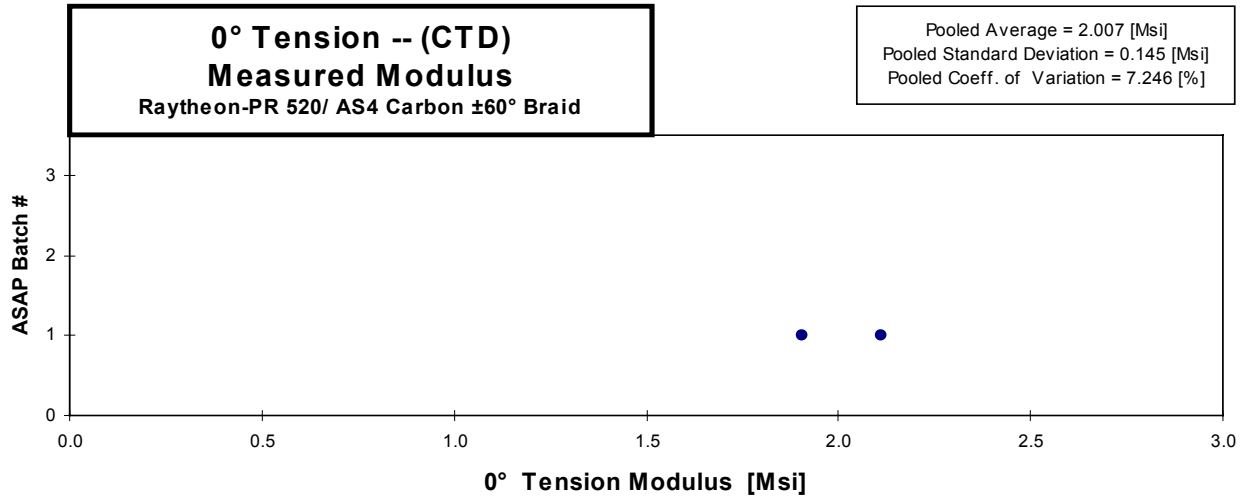




0° Tension -- (CTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

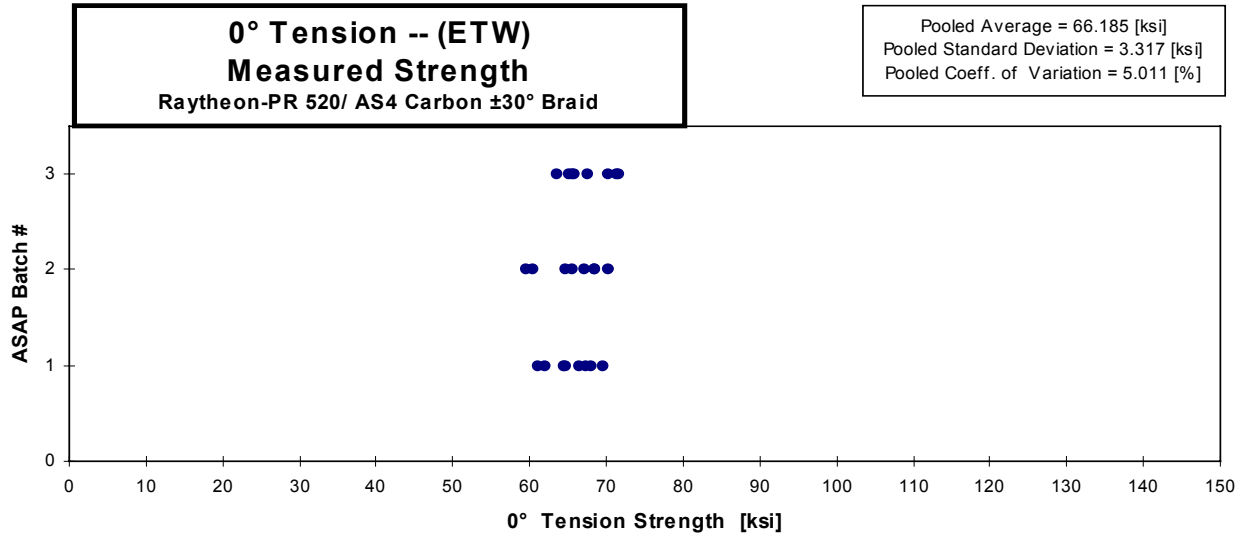
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECJ1218B	4383	AP 110	1	16.790	1.904	0.279	0.113	6	0.01875	62.638
ECJ1219B	4383	AP 110	1	16.960	2.110	0.308	0.113	6	0.01890	62.638
ECJ121AB	4383	AP 110	1	17.311			0.114	6	0.01906	62.638
ECJ1127B	4383	AP 110	1	16.201			0.111	6	0.01858	59.485
ECJ1128B	4383	AP 110	1	17.889			0.112	6	0.01874	59.485
ECJ1129B	4383	AP 110	1	17.473			0.112	6	0.01862	59.485
			Average	**17.104**	**2.007**	**0.293**			**0.01877**	**61.062**
			Standard Dev.	**0.588**	**0.145**	**0.021**				
			Coeff. of Var. [%]	**3.438**	**7.246**	**7.012**				
			Min.	**16.201**	**1.904**	**0.279**			**0.0186**	**59.485**
			Max.	**17.889**	**2.110**	**0.308**			**0.0191**	**62.638**
			Number of Spec.	**6**	**2**	**2**				

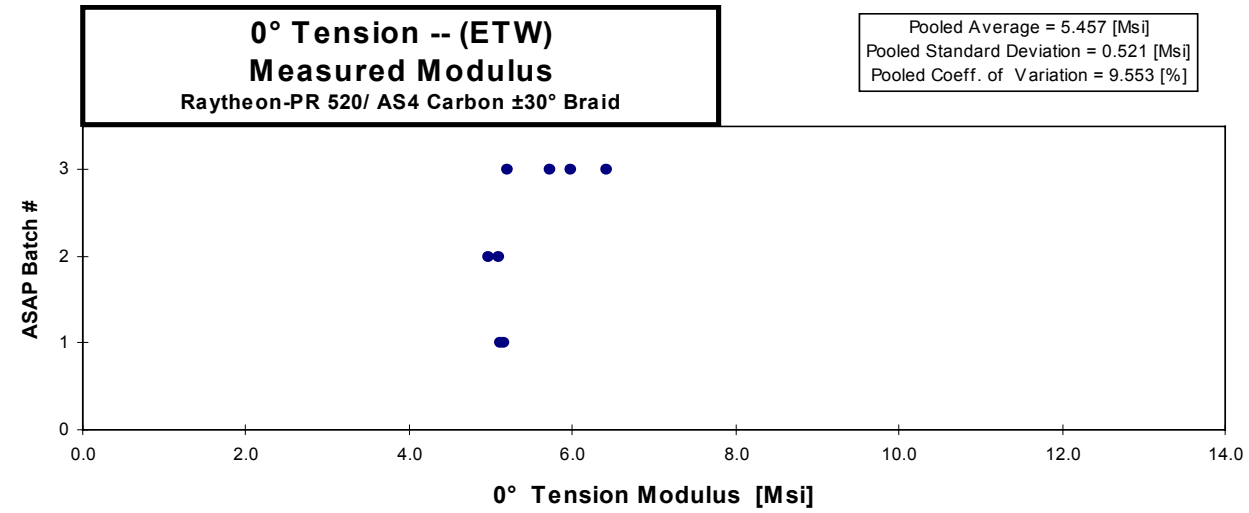




0° Tension -- (ETW)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±30° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECU1111F	4383	AP 110	1	69.629	5.165	1.116	0.112	6	0.01874	60.309
ECU1112F	4383	AP 110	1	68.062	5.119	1.112	0.112	6	0.01873	60.309
ECU1113F	4383	AP 110	1	67.358			0.112	6	0.01874	60.309
ECU1114F	4383	AP 110	1	61.128			0.113	6	0.01880	60.309
ECU1115F	4383	AP 110	1	66.484			0.113	6	0.01881	60.309
ECU1116F	4383	AP 110	1	64.486			0.113	6	0.01886	60.309
ECU1117F	4383	AP 110	1	62.024			0.114	6	0.01896	60.309
ECU1118F	4383	AP 110	1	64.561			0.113	6	0.01881	60.309
ECU2111F	4383	AP 109	2	65.468	5.090	1.166	0.114	6	0.01893	58.517
ECU2112F	4383	AP 109	2	64.544	4.976	1.109	0.113	6	0.01884	58.517
ECU2113F	4383	AP 109	2	60.496			0.114	6	0.01897	58.517
ECU2114F	4383	AP 109	2	68.464			0.113	6	0.01886	58.517
ECU2115F	4383	AP 109	2	59.563			0.114	6	0.01892	58.517
ECU2116F	4383	AP 109	2	68.403			0.114	6	0.01895	58.517
ECU2117F	4383	AP 109	2	70.248			0.113	6	0.01891	58.517
ECU2118F	4383	AP 109	2	67.038			0.113	6	0.01887	58.517
ECU3111F	3968	AP 109	3	71.626	5.719	1.055	0.113	6	0.01881	59.919
ECU3112F	3968	AP 109	3	65.183	5.188	1.159	0.113	6	0.01886	59.919
ECU3113F	3968	AP 109	3	63.538			0.113	6	0.01880	59.919
ECU3114F	3968	AP 109	3	70.151			0.112	6	0.01872	59.919
ECU3115F	3968	AP 109	3	65.821			0.113	6	0.01876	59.919
ECU3116F	3968	AP 109	3	71.221			0.113	6	0.01890	59.919
ECU3117F	3968	AP 109	3	67.464	6.417	1.493	0.113	6	0.01887	59.919
ECU3118F	3968	AP 109	3	65.467	5.980	1.410	0.113	6	0.01888	59.919
			Average	**66.185**	**5.457**	**1.202**			**0.01885**	**59.582**
			Standard Dev.	**3.317**	**0.521**	**0.159**				
			Coeff. of Var. [%]	**5.011**	**9.553**	**13.201**				
			Min.	**59.563**	**4.976**	**1.055**			**0.0187**	**58.517**
			Max.	**71.626**	**6.417**	**1.493**			**0.0190**	**60.309**
			Number of Spec.	**24**	**8**	**8**				

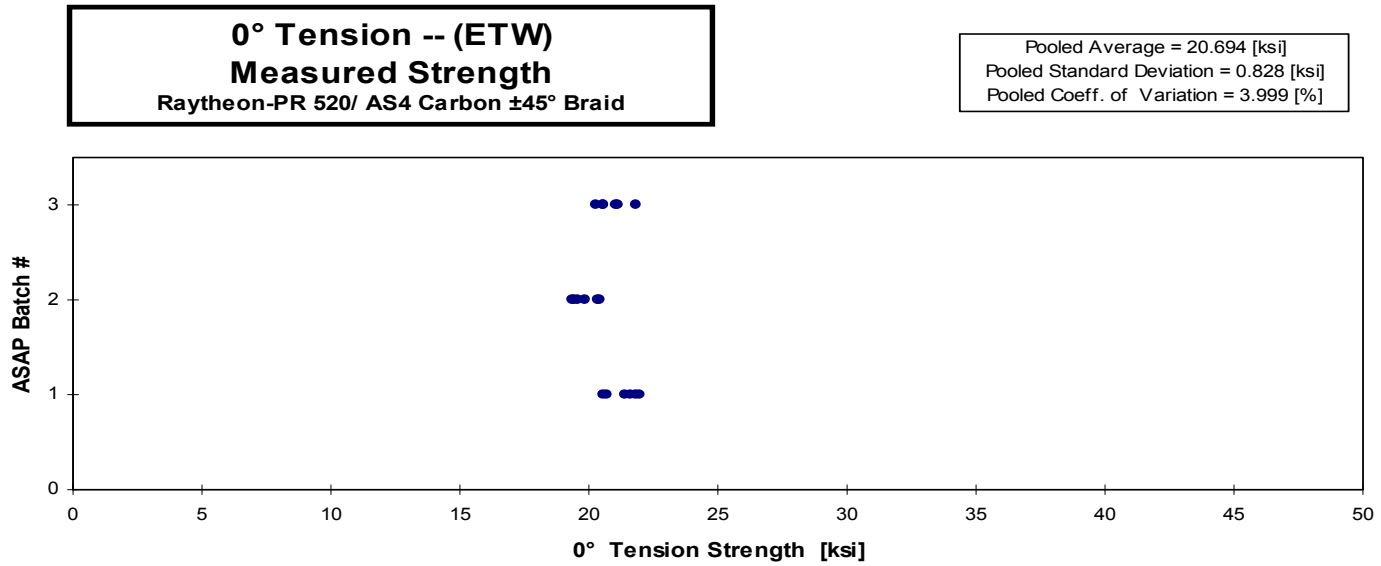


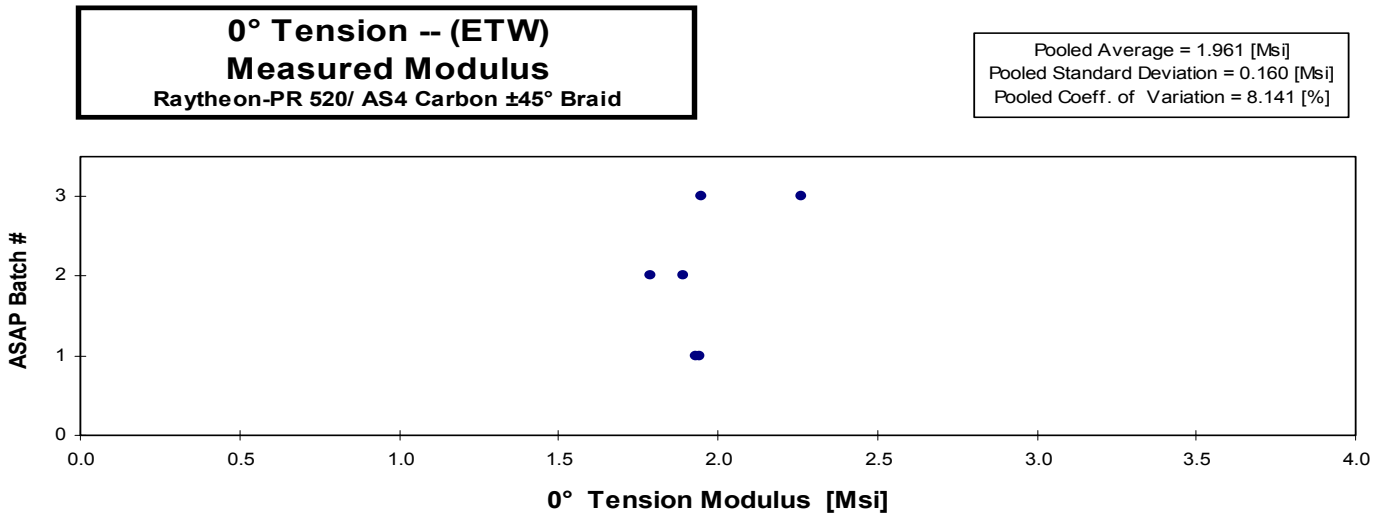


0° Tension -- (ETW)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBJ1111F	4383	AP 110	1	20.694	1.942	0.806	0.118	7	0.01692	57.162
EBJ1112F	4383	AP 110	1	21.621	1.931	0.795	0.118	7	0.01682	57.162
EBJ1113F	4383	AP 110	1	20.540			0.118	7	0.01692	57.162
EBJ1114F	4383	AP 110	1	21.399			0.119	7	0.01693	57.162
EBJ1115F	4383	AP 110	1	21.849			0.119	7	0.01693	57.162
EBJ1116F	4383	AP 110	1	21.995			0.119	7	0.01696	57.162
EBJ2121F	4383	AP 109	2	19.448	1.894	0.614	0.118	7	0.01683	58.611
EBJ2122F	4383	AP 109	2	19.342	1.788	0.626	0.117	7	0.01677	58.611
EBJ2123F	4383	AP 109	2	19.857			0.119	7	0.01695	58.611
EBJ2124F	4383	AP 109	2	20.333			0.118	7	0.01686	58.611
EBJ2125F	4383	AP 109	2	20.432			0.118	7	0.01692	58.611
EBJ2126F	4383	AP 109	2	19.598			0.119	7	0.01694	58.611
EBJ3121F	3968	AP 109	3	21.800	2.263	0.533	0.119	7	0.01697	58.401
EBJ3122F	3968	AP 109	3	21.127	1.966	0.750	0.118	7	0.01687	58.401
EBJ3123F	3968	AP 109	3	21.046			0.118	7	0.01690	58.401
EBJ3125F	3968	AP 109	3	20.568			0.119	7	0.01705	58.401
EBJ3126F	3968	AP 109	3	20.253			0.119	7	0.01704	58.401
EBJ3127F	3968	AP 109	3	20.589			0.118	7	0.01690	58.401

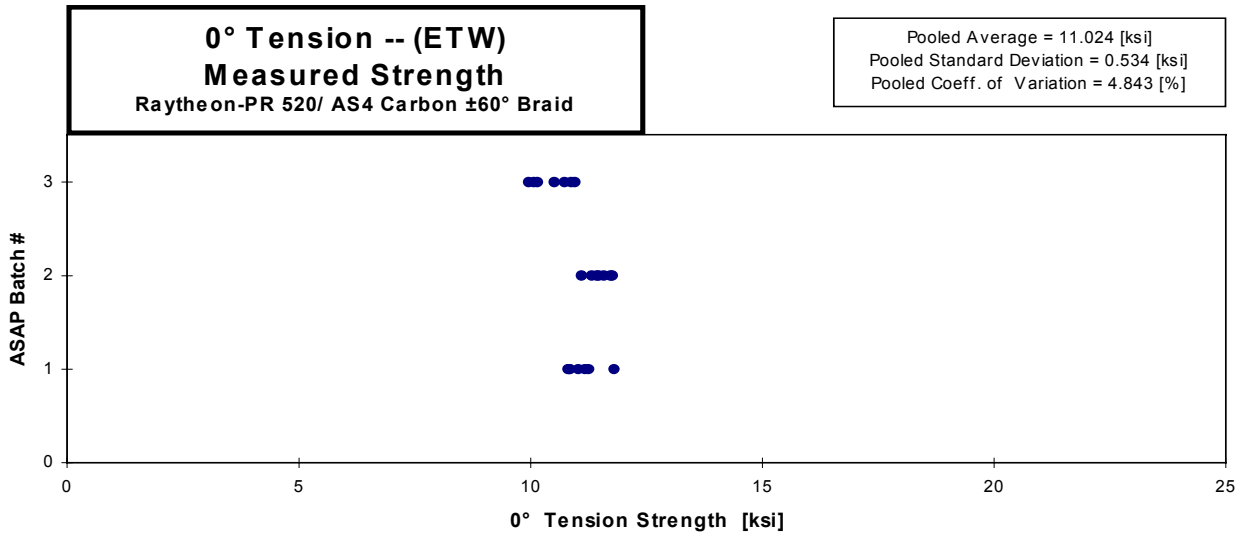
Average	**20.694**	**1.964**	**0.687**	**0.01692**	**58.058**
Standard Dev.	**0.828**	**0.160**	**0.112**		
Coeff. of Var. [%]	**3.999**	**8.125**	**16.248**		
Min.	**19.342**	**1.788**	**0.533**	**0.0168**	**57.162**
Max.	**21.995**	**2.263**	**0.806**	**0.0170**	**58.611**
Number of Spec.	**18**	**6**	**6**		

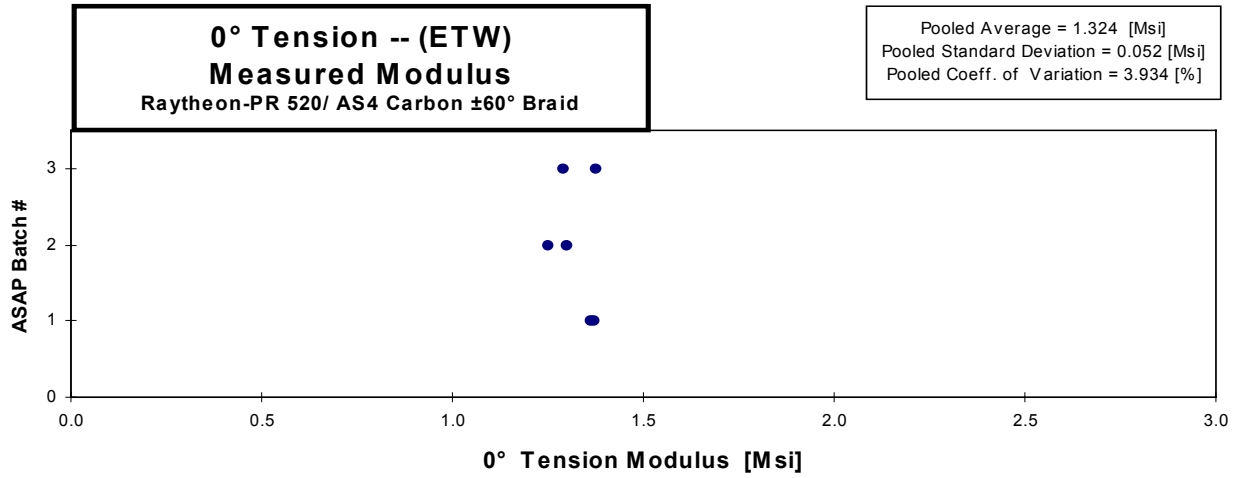




0° Tension -- (ETW)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

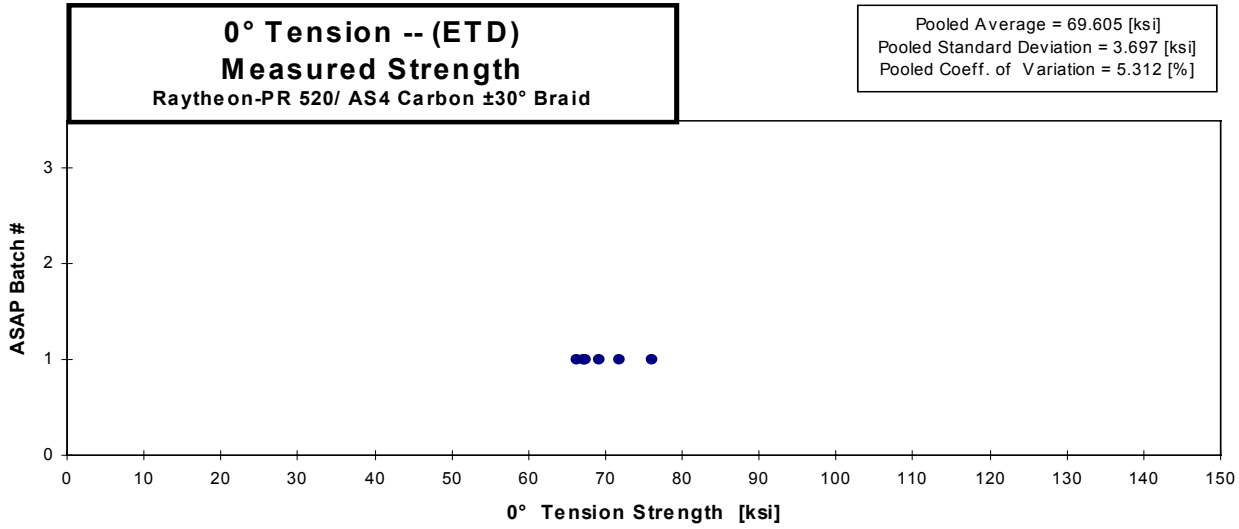
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECJ1111F	4383	AP 110	1	11.787	1.370	0.292	0.115	6	0.01909	59.485
ECJ1112F	4383	AP 110	1	11.261	1.364	0.254	0.113	6	0.01888	59.485
ECJ1113F	4383	AP 110	1	10.826			0.113	6	0.01884	59.485
ECJ1114F	4383	AP 110	1	10.855			0.113	6	0.01878	59.485
ECJ1115F	4383	AP 110	1	10.853			0.112	6	0.01861	59.485
ECJ1116F	4383	AP 110	1	11.038			0.112	6	0.01871	59.485
ECJ1117F	4383	AP 110	1	11.167			0.113	6	0.01877	59.485
ECJ2111F	4383	AP 109	2	11.779	1.249	0.280	0.114	6	0.01896	61.447
ECJ2112F	4383	AP 109	2	11.333	1.297	0.282	0.114	6	0.01901	61.447
ECJ2113F	4383	AP 109	2	11.591			0.113	6	0.01880	61.447
ECJ2114F	4383	AP 109	2	11.458			0.114	6	0.01899	61.447
ECJ2115F	4383	AP 109	2	11.103			0.114	6	0.01894	61.447
ECJ2116F	4383	AP 109	2	11.721			0.113	6	0.01880	61.447
ECJ2117F	4383	AP 109	2	11.434			0.113	6	0.01878	61.447
ECJ3111F	3968	AP 109	3	10.529	1.374	0.295	0.114	6	0.01898	61.439
ECJ3112F	3968	AP 109	3	10.156			0.116	6	0.01928	61.439
ECJ3113F	3968	AP 109	3	10.725			0.113	6	0.01885	61.439
ECJ3114F	3968	AP 109	3	9.971			0.115	6	0.01915	61.439
ECJ3115F	3968	AP 109	3	10.865	1.291	0.257	0.114	6	0.01896	61.439
ECJ3116F	3968	AP 109	3	10.083			0.115	6	0.01917	61.439
ECJ3117F	3968	AP 109	3	10.973			0.113	6	0.01879	61.439
			Average	**11.024**	**1.324**	**0.277**			**0.01891**	**60.790**
			Standard Dev.	**0.534**	**0.052**	**0.018**				
			Coeff. of Var. [%]	**4.843**	**3.934**	**6.344**				
			Min.	**9.971**	**1.249**	**0.254**			**0.0186**	**59.485**
			Max.	**11.787**	**1.374**	**0.295**			**0.0193**	**61.447**
			Number of Spec.	**21**	**6**	**6**				

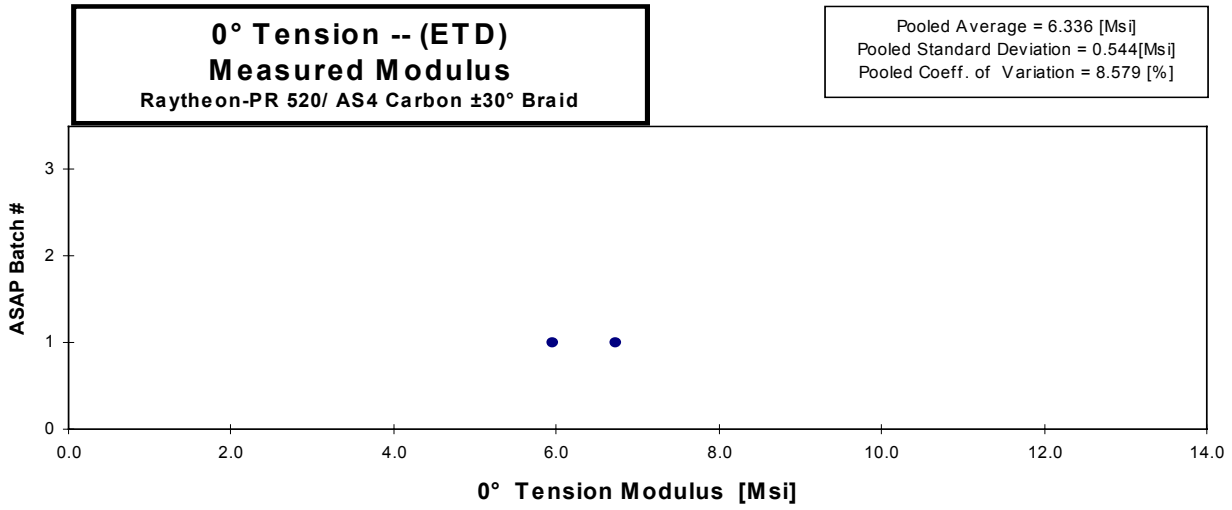




0° Tension -- (ETD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±30° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECU1211G	4383	AP 110	1	67.337	5.952	1.441	0.113	6	0.01891	59.568
ECU1212G	4383	AP 110	1	75.973	6.720	1.486	0.114	6	0.01897	59.568
ECU1213G	4383	AP 110	1	71.861			0.114	6	0.01897	59.568
ECU1214G	4383	AP 110	1	69.041			0.114	6	0.01903	59.568
ECU1215G	4383	AP 110	1	67.201			0.114	6	0.01895	59.568
ECU1216G	4383	AP 110	1	66.219			0.113	6	0.01890	59.568
			Average	**69.605**	**6.336**	**1.463**			**0.01895**	**59.568**
			Standard Dev.	**3.697**	**0.544**	**0.031**				
			Coeff. of Var. [%]	**5.312**	**8.579**	**2.150**				
			Min.	**66.219**	**5.952**	**1.441**			**0.0189**	**59.568**
			Max.	**75.973**	**6.720**	**1.486**			**0.0190**	**59.568**
			Number of Spec.	**6**	**2**	**2**				



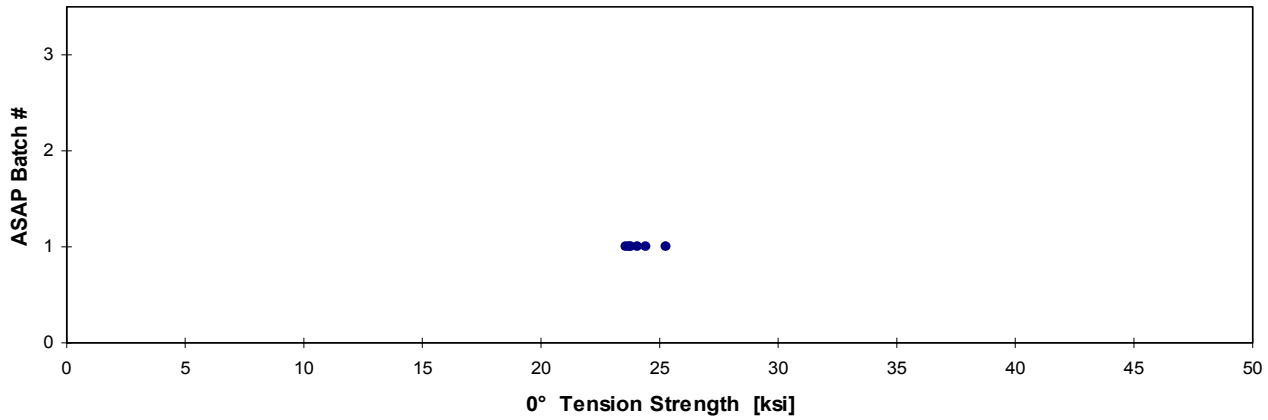


0° Tension -- (ETD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBJ1211G	4383	AP 110	1	23.571	1.974	0.753	0.118	7	0.01686	57.712
EBJ1212G	4383	AP 110	1	23.713	1.902	0.760	0.120	7	0.01710	57.712
EBJ1213G	4383	AP 110	1	23.770			0.120	7	0.01709	57.712
EBJ1214G	4383	AP 110	1	24.090			0.119	7	0.01706	57.712
EBJ1215G	4383	AP 110	1	24.468			0.120	7	0.01709	57.712
EBJ1216G	4383	AP 110	1	25.296			0.119	7	0.01700	57.712
			Average	**24.151**	**1.938**	**0.756**			**0.01703**	**57.712**
			Standard Dev.	**0.646**	**0.050**	**0.005**				
			Coeff. of Var. [%]	**2.677**	**2.599**	**0.682**				
			Min.	**23.571**	**1.902**	**0.753**			**0.0169**	**57.712**
			Max.	**25.296**	**1.974**	**0.760**			**0.0171**	**57.712**
			Number of Spec.	**6**	**2**	**2**				

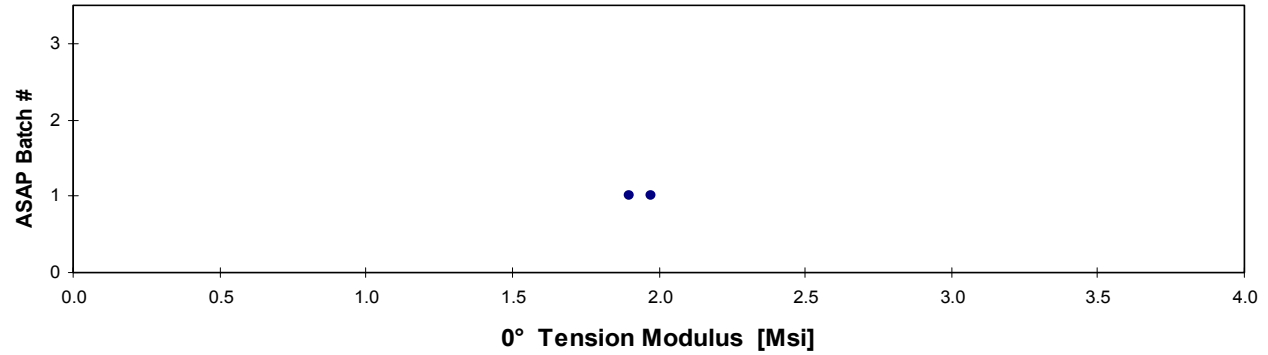
0° Tension -- (ETD)
Measured Strength
Raytheon-PR 520/ AS4 Carbon ±45° Braid

Pooled Average = 24.151 [ksi]
Pooled Standard Deviation = 0.646 [ksi]
Pooled Coeff. of Variation = 2.677 [%]



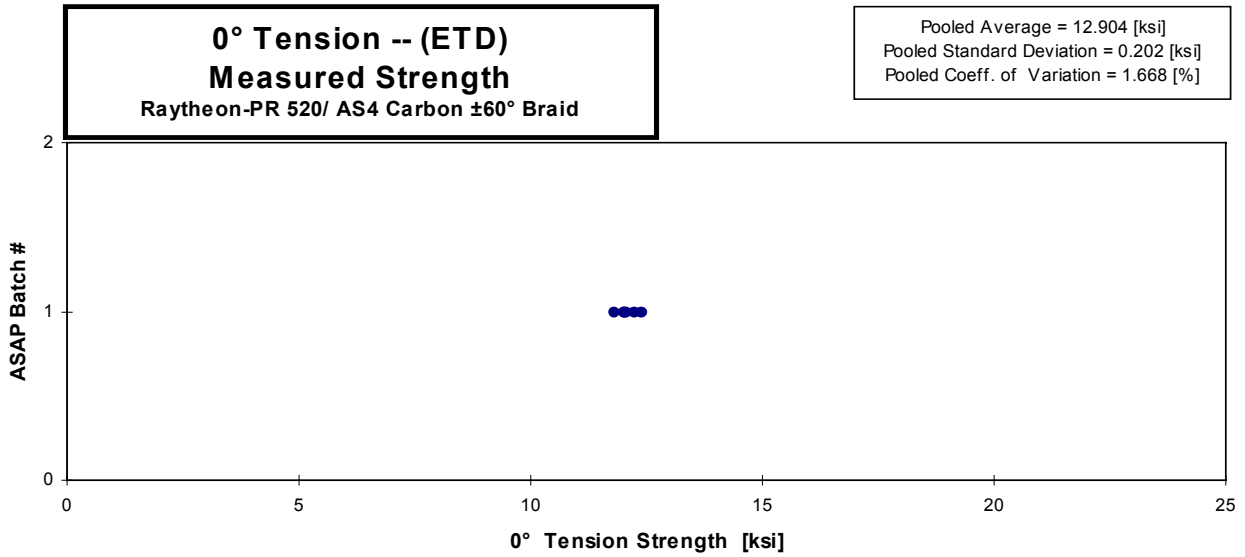
0° Tension -- (ETD)
Measured Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

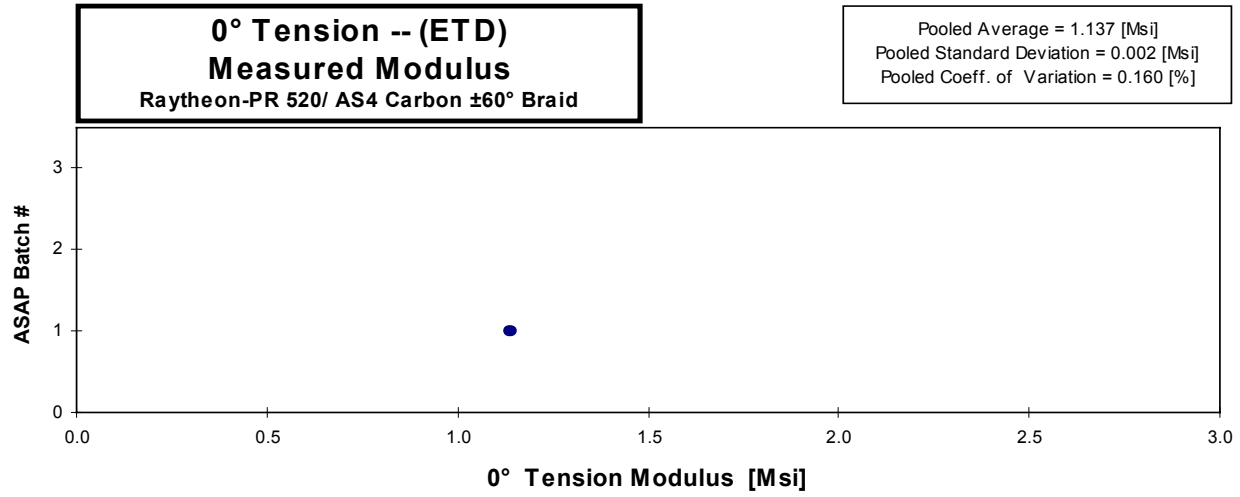
Pooled Average = 1.938 [Msi]
Pooled Standard Deviation =0.050 [Msi]
Pooled Coeff. of Variation = 2.599 [%]



0° Tension -- (ETD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

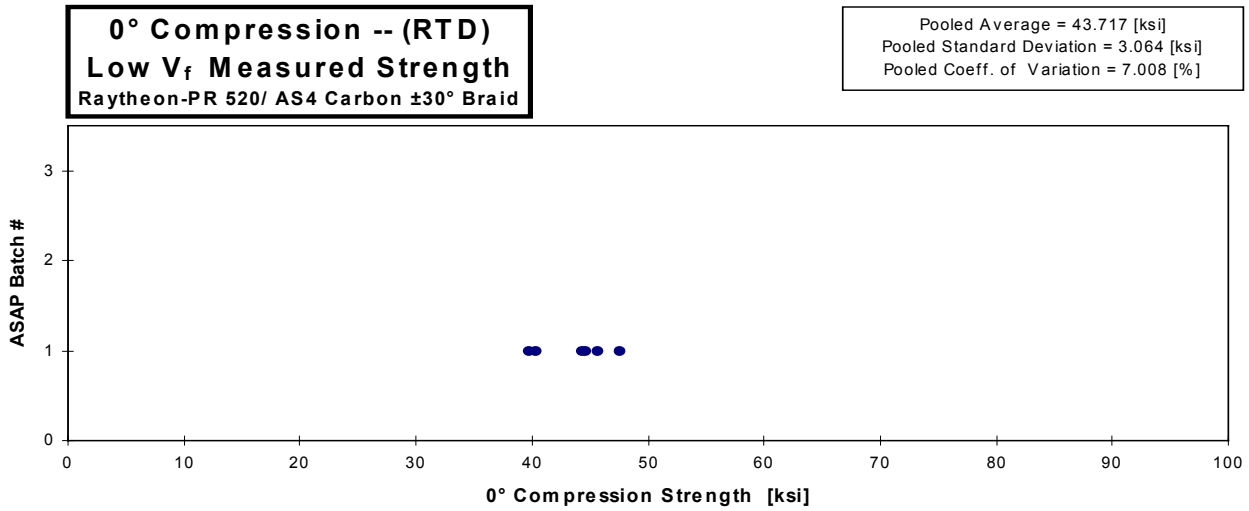
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECJ1211G	4383	AP 110	1	12.074	1.136	0.245	0.114	6	0.01895	62.638
ECJ1212G	4383	AP 110	1	12.034	1.139	0.207	0.113	6	0.01887	62.638
ECJ1213G	4383	AP 110	1	12.032			0.113	6	0.01876	62.638
ECJ1214G	4383	AP 110	1	11.795			0.112	6	0.01873	62.638
ECJ1215G	4383	AP 110	1	12.381			0.112	6	0.01873	62.638
ECJ1216G	4383	AP 110	1	12.248			0.112	6	0.01872	62.638
			Average	**12.094**	**1.137**	**0.226**			**0.01879**	**62.638**
			Standard Dev.	**0.202**	**0.002**	**0.027**				
			Coeff. of Var. [%]	**1.668**	**0.160**	**11.889**				
			Min.	**11.795**	**1.136**	**0.207**			**0.0187**	**62.638**
			Max.	**12.381**	**1.139**	**0.245**			**0.0190**	**62.638**
			Number of Spec.	**6**	**2**	**2**				

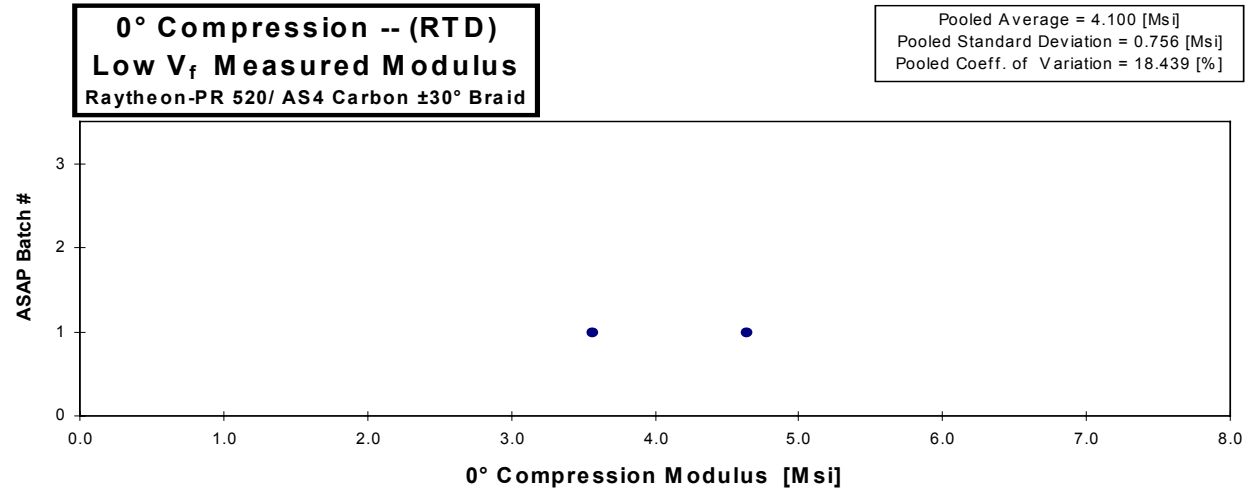




0° Compression -- (RTD)
Low V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±30° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECRX2L1A	4383	AP 110	1	45.586	4.634	0.114	5	0.02270	51.325
ECRX2L2A	4383	AP 110	1	39.765	3.565	0.113	5	0.02256	51.325
ECRX2L3A	4383	AP 110	1	40.347		0.112	5	0.02249	51.325
ECRX2L4A	4383	AP 110	1	44.367		0.113	5	0.02255	51.325
ECRX2L5A	4383	AP 110	1	44.619		0.113	5	0.02254	51.325
ECRX2L6A	4383	AP 110	1	47.620		0.111	5	0.02222	51.325
			Average	**43.717**	**4.100**			**0.02251**	**51.325**
			Standard Dev.	**3.064**	**0.756**				
			Coeff. of Var. [%]	**7.008**	**18.439**				
			Min.	**39.765**	**3.565**			**0.0222**	**51.325**
			Max.	**47.620**	**4.634**			**0.0227**	**51.325**
			Number of Spec.	**6**	**2**				

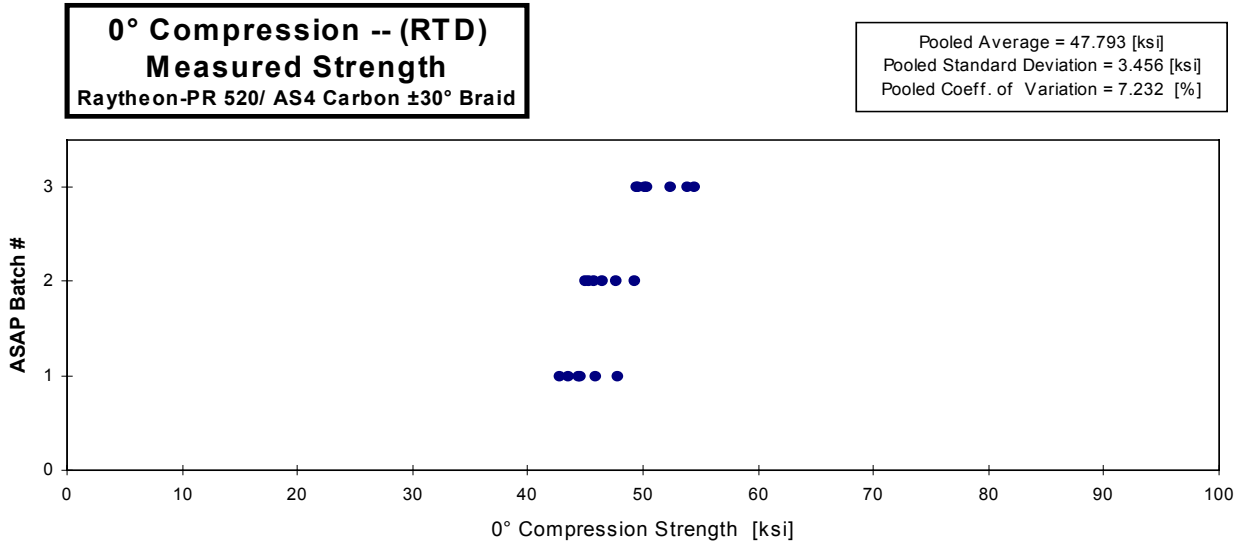


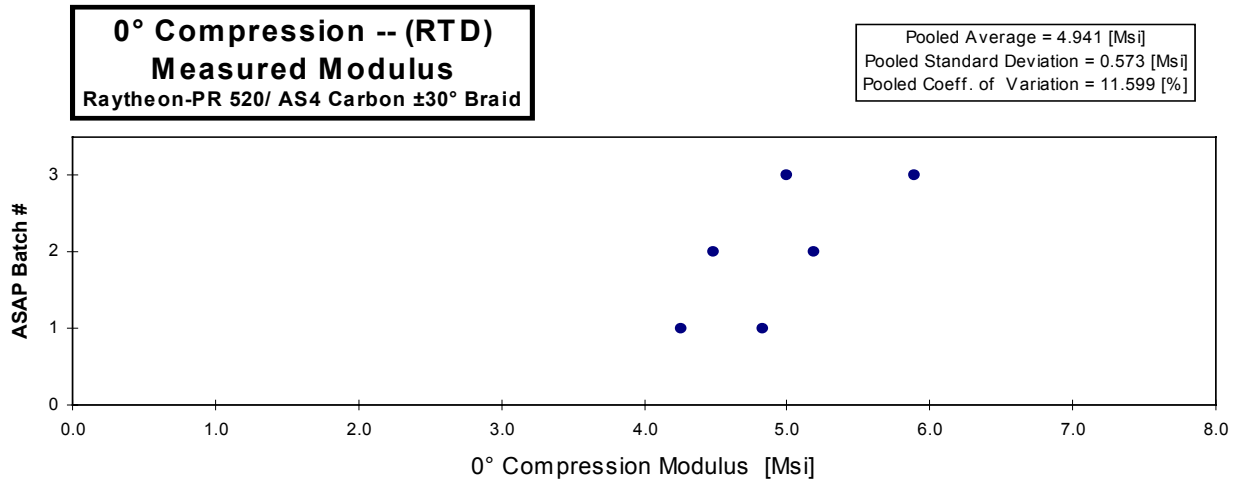


0° Compression-- (RTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±30° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECR1119A	4383	AP 110	1	42.697	4.261	0.113	6	0.01887	59.557
ECR111AA	4383	AP 110	1	44.516	4.832	0.114	6	0.01892	59.557
ECR111BA	4383	AP 110	1	45.786		0.113	6	0.01885	59.557
ECR111CA	4383	AP 110	1	44.415		0.113	6	0.01891	59.557
ECR111DA	4383	AP 110	1	43.470		0.114	6	0.01893	59.557
ECR111EA	4383	AP 110	1	47.821		0.113	6	0.01884	59.557
ECR211AA	4383	AP 109	2	45.219	4.479	0.113	6	0.01882	60.498
ECR211BA	4383	AP 109	2	45.644	5.186	0.113	6	0.01886	60.498
ECR211CA	4383	AP 109	2	46.481		0.113	6	0.01888	60.498
ECR211DA	4383	AP 109	2	47.581		0.113	6	0.01883	60.498
ECR211EA	4383	AP 109	2	44.948		0.113	6	0.01885	60.498
ECR211FA	4383	AP 109	2	49.253		0.112	6	0.01872	60.498
ECR311AA	3968	AP 109	3	52.362	5.885	0.113	6	0.01885	60.814
ECR311BA	3968	AP 109	3	49.480	5.001	0.113	6	0.01879	60.814
ECR311CA	3968	AP 109	3	53.911		0.113	6	0.01882	60.814
ECR311DA	3968	AP 109	3	50.263		0.114	6	0.01906	60.814
ECR311EA	3968	AP 109	3	54.493		0.114	6	0.01896	60.814
ECR311FA	3968	AP 109	3	49.532		0.113	6	0.01886	60.814
ECR311GA	3968	AP 109	3	50.199		0.113	6	0.01879	60.814

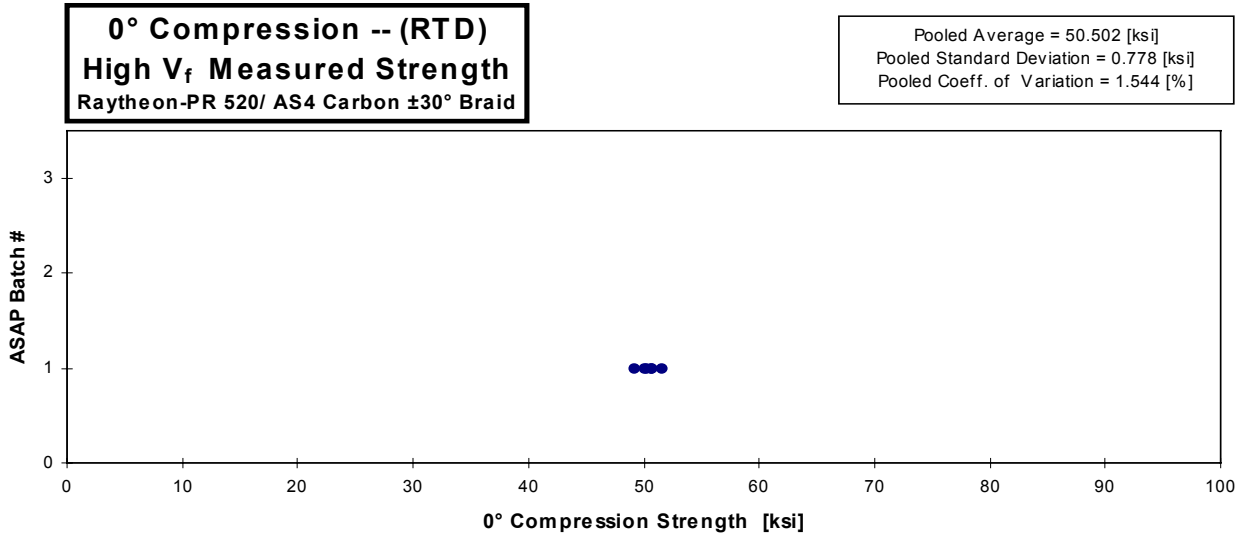
Average	**47.793**	**4.941**	**0.01886**	**60.317**
Standard Dev.	**3.456**	**0.573**		
Coeff. of Var. [%]	**7.232**	**11.599**		
Min.	**42.697**	**4.261**	**0.0187**	**59.557**
Max.	**54.493**	**5.885**	**0.0191**	**60.814**
Number of Spec.	**19**	**6**		

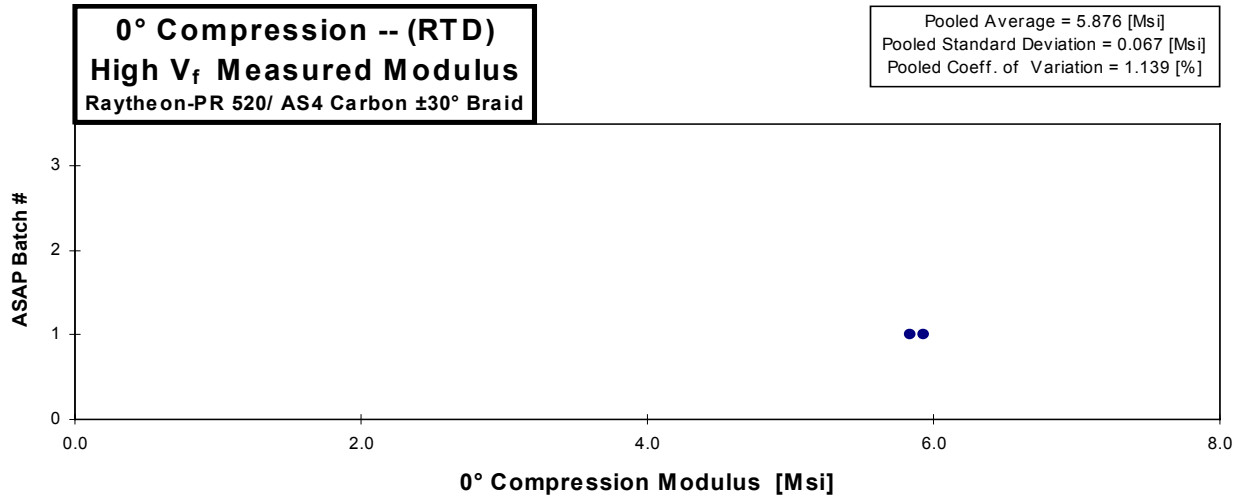




0° Compression -- (RTD)
High V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±30° Braid

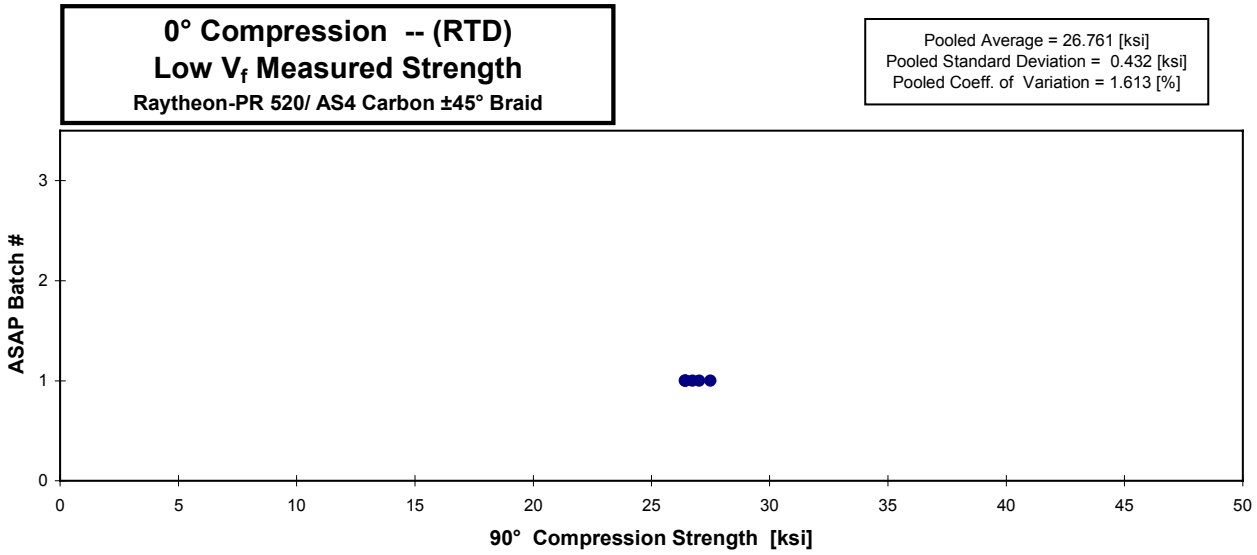
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECRX2G1A	4383	AP 110	1	49.209	5.924	0.122	7	0.01746	66.604
ECRX2G2A	4383	AP 110	1	50.071		0.122	7	0.01739	66.604
ECRX2G3A	4383	AP 110	1	51.561		0.122	7	0.01742	66.604
ECRX2G4A	4383	AP 110	1	50.681		0.121	7	0.01726	66.604
ECRX2G5A	4383	AP 110	1	50.635		0.121	7	0.01734	66.604
ECRX2G9A	4383	AP 110	1	50.256	5.829	0.122	7	0.01744	66.604
			Average	**50.402**	**5.876**			**0.01738**	**66.604**
			Standard Dev.	**0.778**	**0.067**				
			Coeff. of Var. [%]	**1.544**	**1.139**				
			Min.	**49.209**	**5.829**			**0.0173**	**66.604**
			Max.	**51.561**	**5.924**			**0.0175**	**66.604**
			Number of Spec.	**6**	**2**				

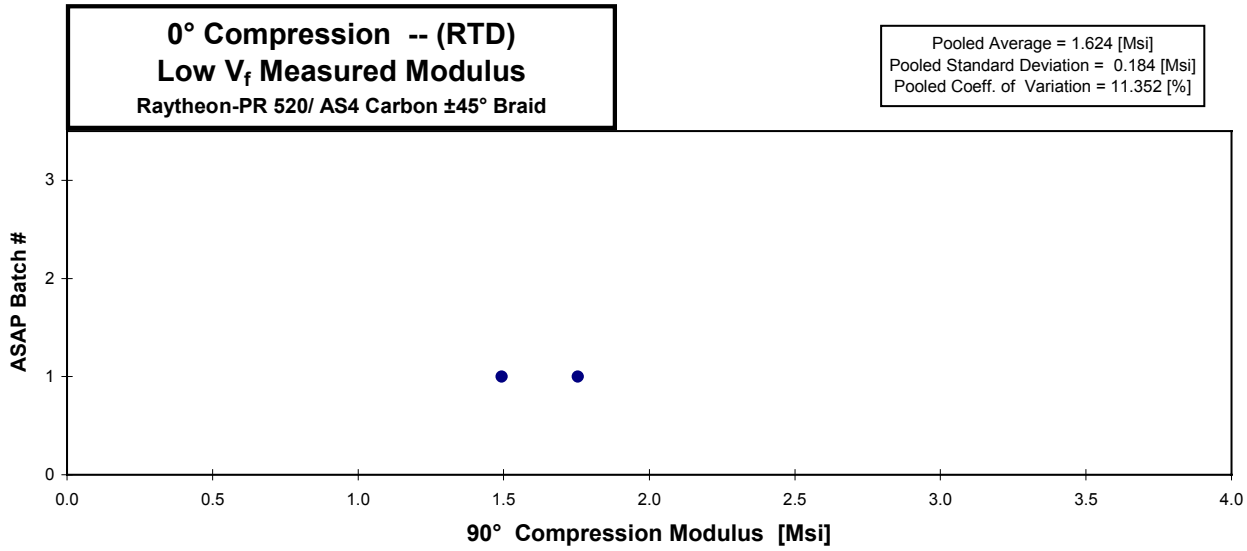




0° Compression -- (RTD)
Low V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBRX1L1A	4383	AP 110	1	27.493	1.494	0.118	6	0.01975	49.472
EBRX1L2A	4383	AP 110	1	26.438	1.755	0.118	6	0.01971	49.472
EBRX1L3A	4383	AP 110	1	26.738		0.118	6	0.01973	49.472
EBRX1L4A	4383	AP 110	1	27.032		0.119	6	0.01975	49.472
EBRX1L5A	4383	AP 110	1	26.438		0.118	6	0.01971	49.472
EBRX1L6A	4383	AP 110	1	26.425		0.118	6	0.01970	49.472
			Average	**26.761**	**1.624**			**0.01973**	**49.472**
			Standard Dev.	**0.432**	**0.184**				
			Coeff. of Var. [%]	**1.613**	**11.352**				
			Min.	**26.425**	**1.494**			**0.0197**	**49.472**
			Max.	**27.493**	**1.755**			**0.0198**	**49.472**
			Number of Spec.	**6**	**2**				

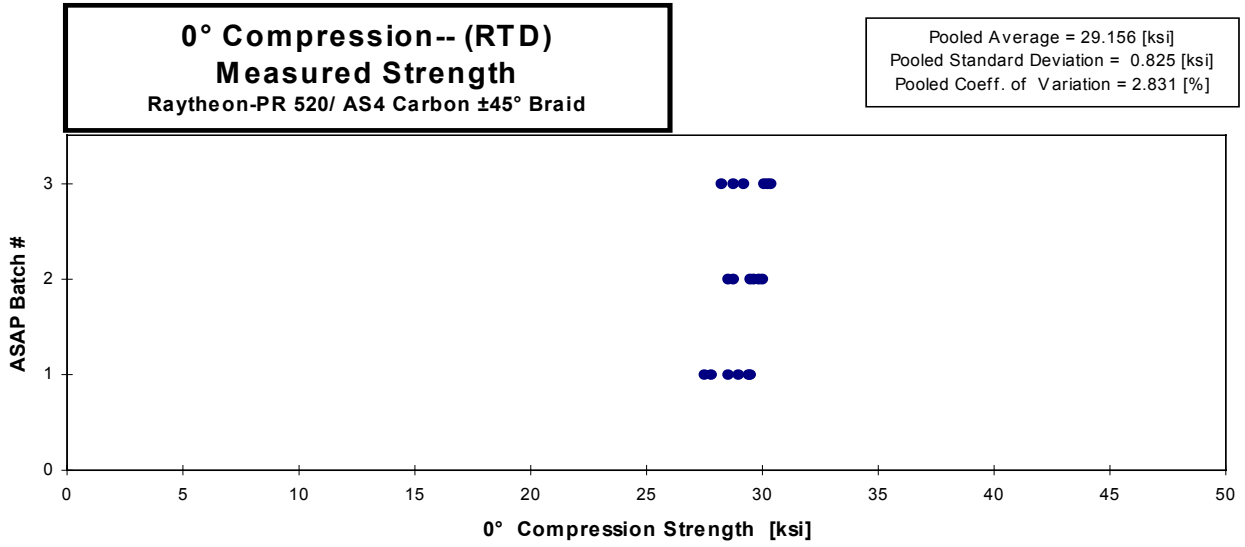


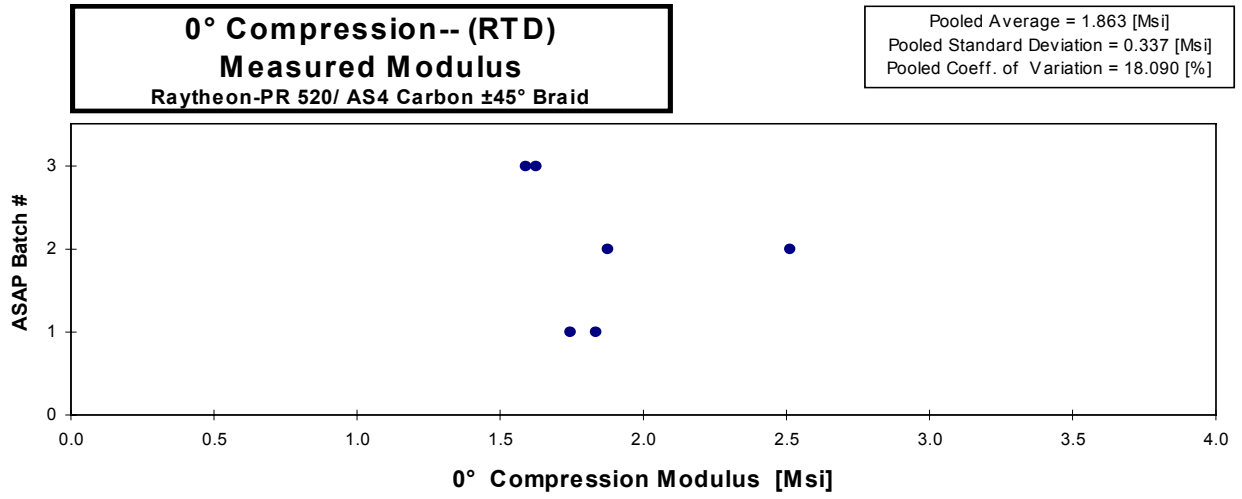


0° Compression-- (RTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBP1119A	4383	AP 110	1	27.811	1.836	0.120	7	0.01718	56.572
EBP111AA	4383	AP 110	1	27.522	1.746	0.123	7	0.01750	56.572
EBP111BA	4383	AP 110	1	29.440		0.120	7	0.01710	56.572
EBP111CA	4383	AP 110	1	29.521		0.119	7	0.01705	56.572
EBP111DA	4383	AP 110	1	28.552		0.120	7	0.01708	56.572
EBP111EA	4383	AP 110	1	28.967		0.119	7	0.01705	56.572
EBP2119A	4383	AP 109	2	29.830	2.511	0.118	7	0.01689	58.973
EBP211AA	4383	AP 109	2	29.467	1.873	0.117	7	0.01676	58.973
EBP211BA	4383	AP 109	2	28.727		0.119	7	0.01702	58.973
EBP211CA	4383	AP 109	2	30.020		0.119	7	0.01695	58.973
EBP211DA	4383	AP 109	2	28.560		0.118	7	0.01683	58.973
EBP211EA	4383	AP 109	2	29.620		0.119	7	0.01697	58.973
EBP3119A	3968	AP 109	3	28.213	1.588	0.119	7	0.01700	59.055
EBP311AA	3968	AP 109	3	30.045	1.623	0.119	7	0.01698	59.055
EBP311BA	3968	AP 109	3	30.346		0.117	7	0.01674	59.055
EBP311CA	3968	AP 109	3	30.235		0.119	7	0.01700	59.055
EBP311DA	3968	AP 109	3	28.742		0.119	7	0.01703	59.055
EBP311EA	3968	AP 109	3	29.194		0.119	7	0.01695	59.055

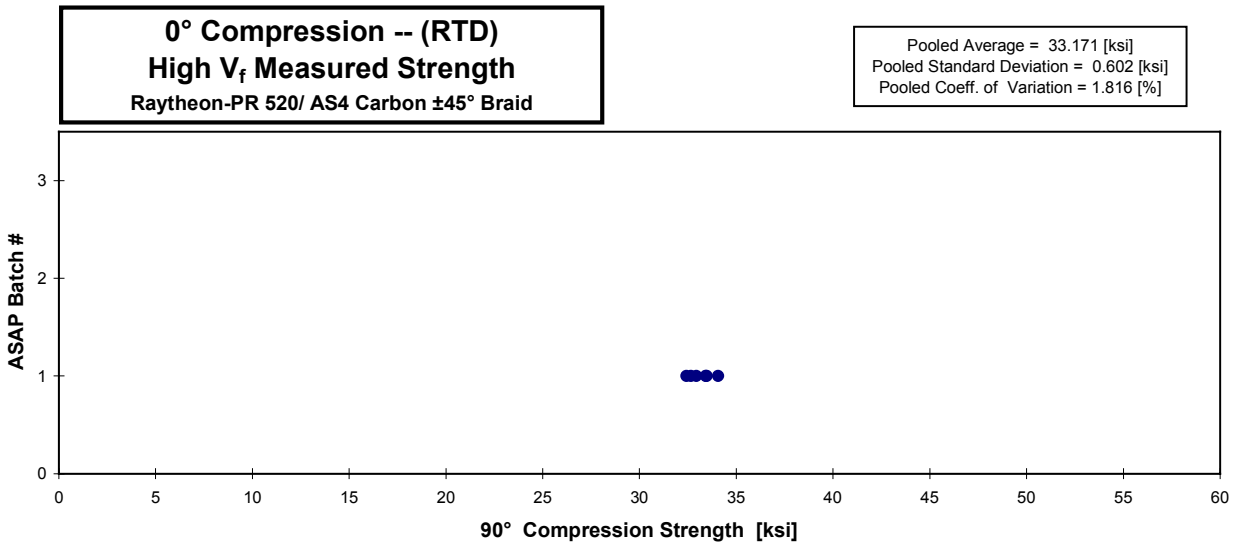
Average	**29.156**	**1.863**	**0.01700**	**58.200**
Standard Dev.	**0.825**	**0.337**		
Coeff. of Var. [%]	**2.831**	**18.090**		
Min.	**27.522**	**1.588**	**0.0167**	**56.572**
Max.	**30.346**	**2.511**	**0.0175**	**59.055**
Number of Spec.	**18**	**6**		

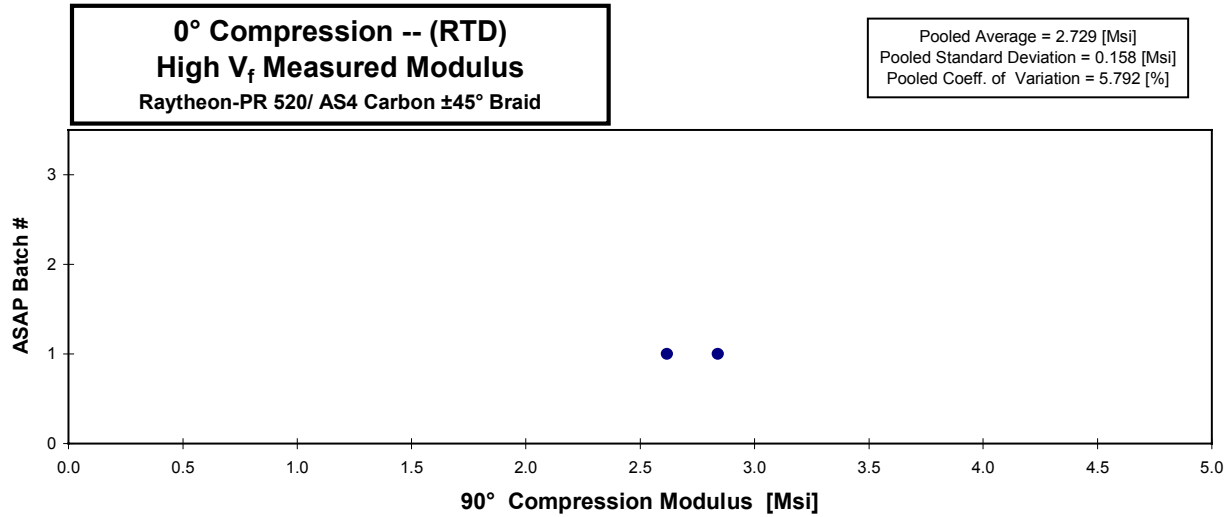




0° Compression -- (RTD)
High V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

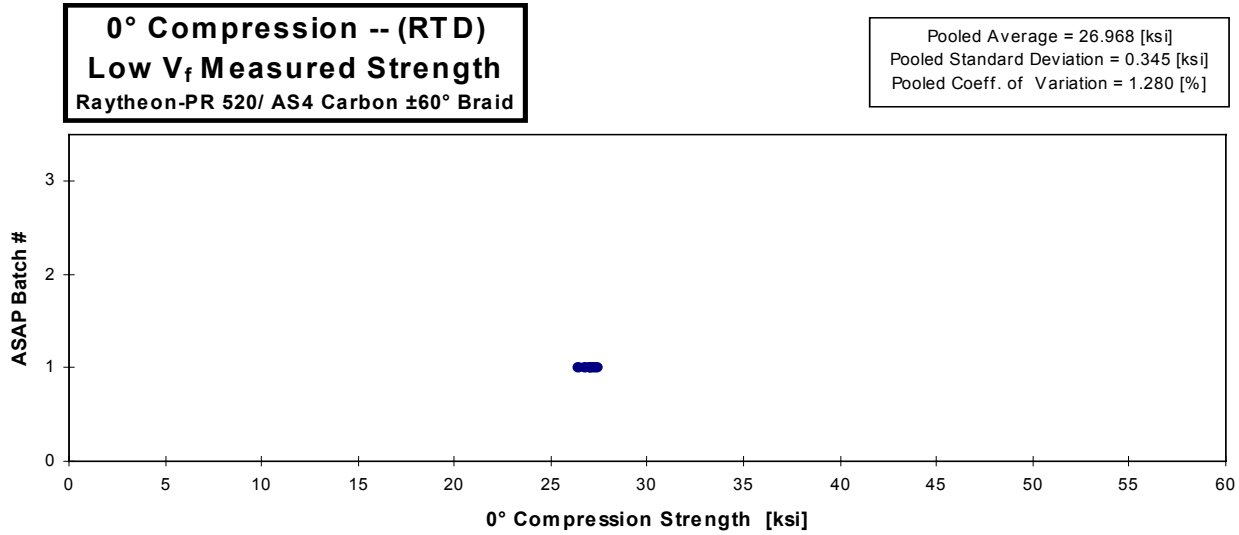
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBRX1G1	4383	AP 110	1	34.064	2.617	0.122	8	0.01519	64.434
EBRX1G2	4383	AP 110	1	33.433	2.840	0.122	8	0.01521	64.434
EBRX1G3	4383	AP 110	1	33.485		0.121	8	0.01513	64.434
EBRX1G4	4383	AP 110	1	32.659		0.121	8	0.01518	64.434
EBRX1G5	4383	AP 110	1	32.946		0.121	8	0.01511	64.434
EBRX1G6	4383	AP 110	1	32.439		0.120	8	0.01498	64.434
			Average	**33.171**	**2.729**			**0.01513**	**64.434**
			Standard Dev.	**0.602**	**0.158**				
			Coeff. of Var. [%]	**1.816**	**5.792**				
			Min.	**32.439**	**2.617**			**0.0150**	**64.434**
			Max.	**34.064**	**2.840**			**0.0152**	**64.434**
			Number of Spec.	**6**	**2**				

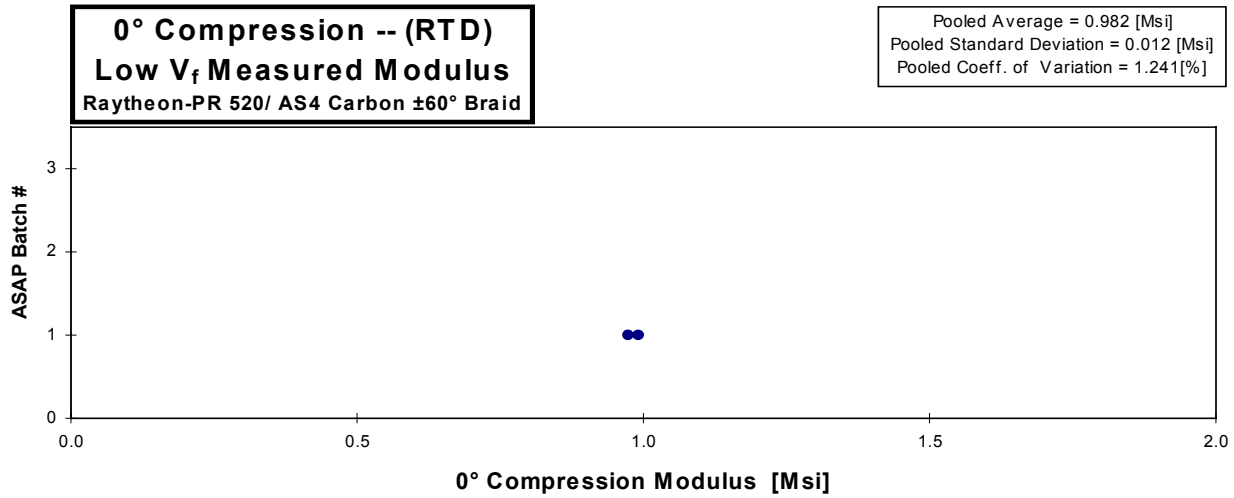




0° Compression -- (RTD)
Low V_f - Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

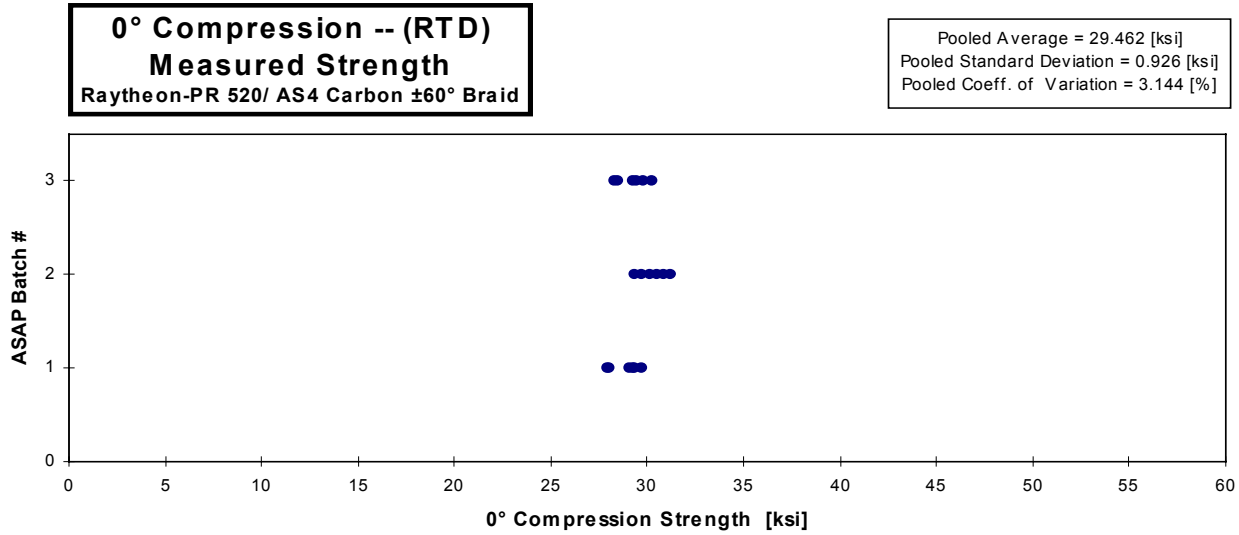
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECPX1L1A	4383	AP 110	1	27.350	0.991	0.113	5	0.02259	50.038
ECPX1L2A	4383	AP 110	1	26.788	0.973	0.113	5	0.02253	50.038
ECPX1L3A	4383	AP 110	1	27.027		0.113	5	0.02251	50.038
ECPX1L4A	4383	AP 110	1	27.007		0.113	5	0.02252	50.038
ECPX1L5A	4383	AP 110	1	26.389		0.113	5	0.02258	50.038
ECPX1L6A	4383	AP 110	1	27.246		0.112	5	0.02248	50.038
			Average	**26.968**	**0.982**			**0.02253**	**50.038**
			Standard Dev.	**0.345**	**0.012**				
			Coeff. of Var. [%]	**1.280**	**1.241**				
			Min.	**26.389**	**0.973**			**0.0225**	**50.038**
			Max.	**27.350**	**0.991**			**0.0226**	**50.038**
			Number of Spec.	**6**	**2**				

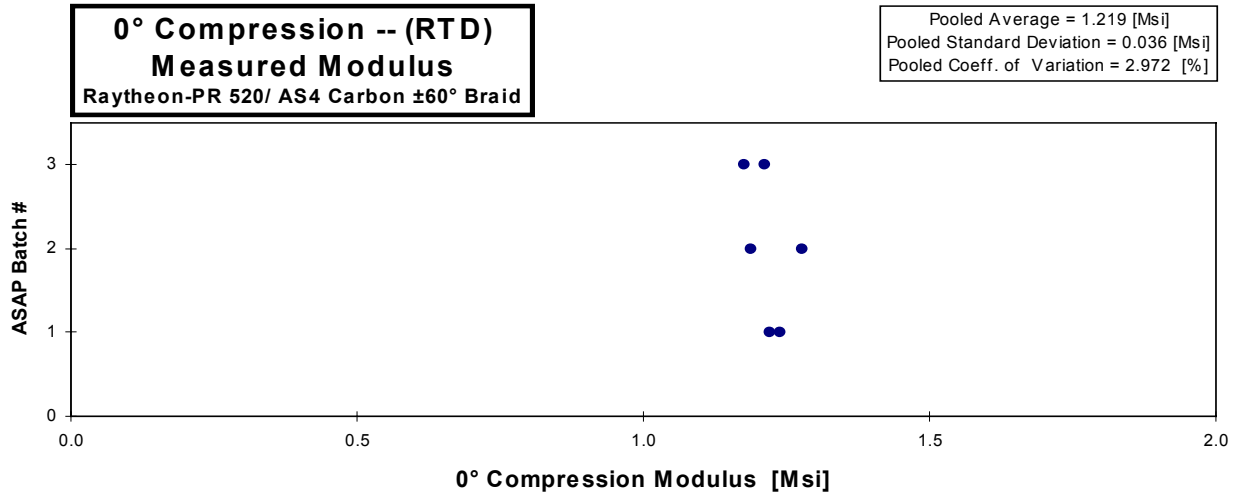




0° Compression -- (RTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

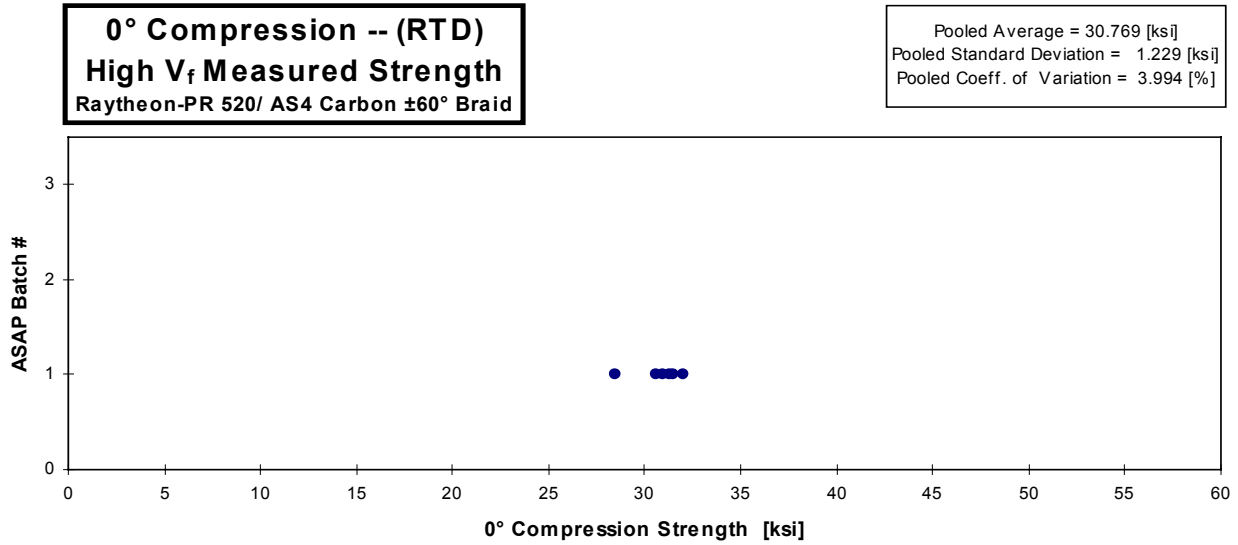
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECP111AA	4383	AP 110	1	29.651	1.238	0.114	6	0.01896	58.953
ECP111BA	4383	AP 110	1	27.975	1.219	0.114	6	0.01894	58.953
ECP111CA	4383	AP 110	1	29.054		0.113	6	0.01883	58.953
ECP111DA	4383	AP 110	1	27.926		0.113	6	0.01886	58.953
ECP111EA	4383	AP 110	1	29.330		0.113	6	0.01883	58.953
ECP111FA	4383	AP 110	1	29.292		0.114	6	0.01893	58.953
ECP211AA	4383	AP 109	2	29.651	1.187	0.112	6	0.01866	60.168
ECP211BA	4383	AP 109	2	29.329	1.277	0.112	6	0.01870	60.168
ECP211CA	4383	AP 109	2	30.827		0.113	6	0.01878	60.168
ECP211DA	4383	AP 109	2	30.176		0.113	6	0.01877	60.168
ECP211EA	4383	AP 109	2	30.526		0.112	6	0.01873	60.168
ECP211FA	4383	AP 109	2	31.175		0.111	6	0.01854	60.168
ECP311AA	3968	AP 109	3	28.417	1.213	0.113	6	0.01885	57.317
ECP311BA	3968	AP 109	3	29.278	1.177	0.113	6	0.01885	57.317
ECP311CA	3968	AP 109	3	28.259		0.114	6	0.01899	57.317
ECP311DA	3968	AP 109	3	29.749		0.113	6	0.01880	57.317
ECP311EA	3968	AP 109	3	29.451		0.114	6	0.01898	57.317
ECP311FA	3968	AP 109	3	30.248		0.114	6	0.01897	57.317
			Average	**29.462**	**1.219**			**0.01883**	**58.813**
			Standard Dev.	**0.926**	**0.036**				
			Coeff. of Var. [%]	**3.144**	**2.972**				
			Min.	**27.926**	**1.177**			**0.0185**	**57.317**
			Max.	**31.175**	**1.277**			**0.0190**	**60.168**
			Number of Spec.	**18**	**6**				

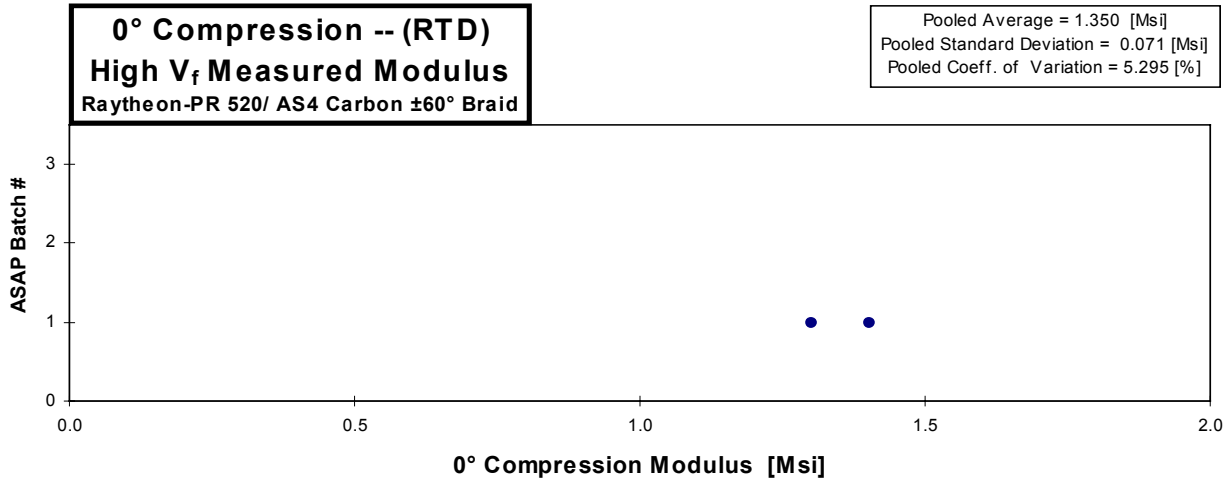




0° Compression -- (RTD)
High V_f - Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECPX1G1A	4383	AP 110	1	30.910	1.401	0.119	7	0.01694	69.346
ECPX1G2A	4383	AP 110	1	30.553	1.300	0.118	7	0.01691	69.346
ECPX1G3A	4383	AP 110	1	31.965		0.119	7	0.01697	69.346
ECPX1G4A	4383	AP 110	1	31.300		0.118	7	0.01690	69.346
ECPX1G5A	4383	AP 110	1	31.425		0.118	7	0.01686	69.346
ECPX1G6A	4383	AP 110	1	28.458		0.118	7	0.01689	69.346
			Average	**30.769**	**1.350**			**0.01691**	**69.346**
			Standard Dev.	**1.229**	**0.071**				
			Coeff. of Var. [%]	**3.994**	**5.295**				
			Min.	**28.458**	**1.300**			**0.0169**	**69.346**
			Max.	**31.965**	**1.401**			**0.0170**	**69.346**
			Number of Spec.	**6**	**2**				



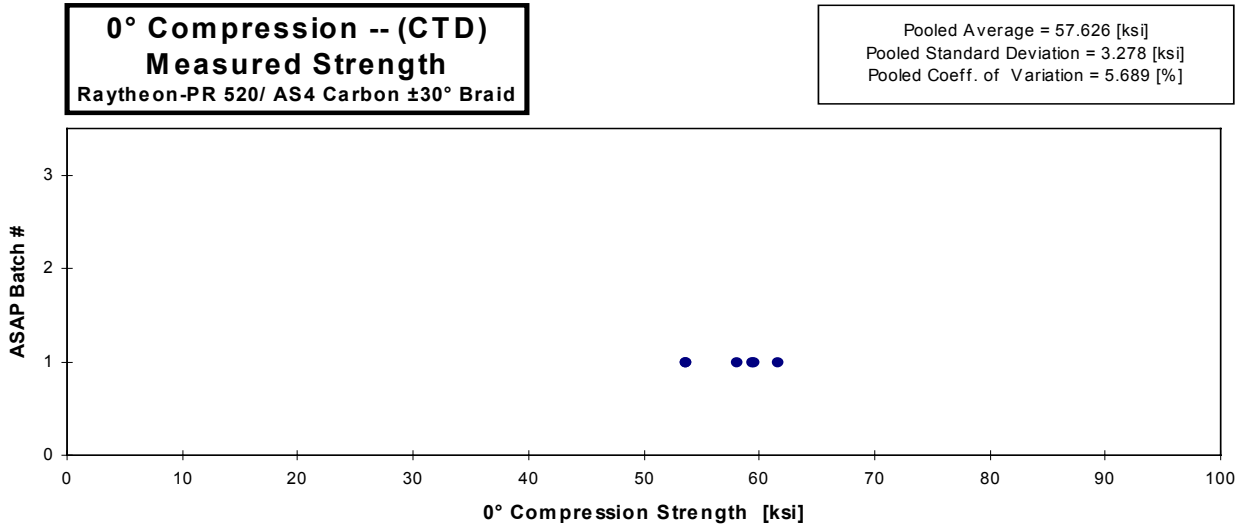


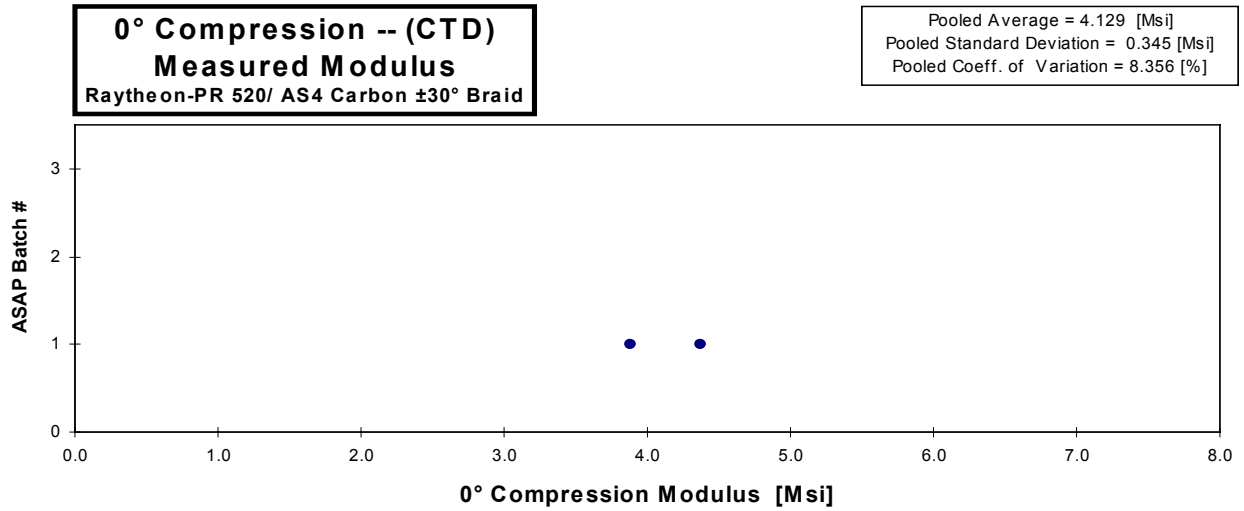
0° Compression -- (CTD) Strength & Modulus

Raytheon-PR 520/ AS4 Carbon ±30° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECR111FB	4383	AP 110	1	53.656	3.885	0.114	6	0.01892	59.557
ECR111GB	4383	AP 110	1	61.586	4.373	0.114	6	0.01895	59.557
ECR111HB	4383	AP 110	1	53.667		0.114	6	0.01893	59.557
ECR111IB	4383	AP 110	1	59.371		0.113	6	0.01890	59.557
ECR111JB	4383	AP 110	1	59.478		0.114	6	0.01892	59.557
ECR111KB	4383	AP 110	1	57.997		0.113	6	0.01890	59.557

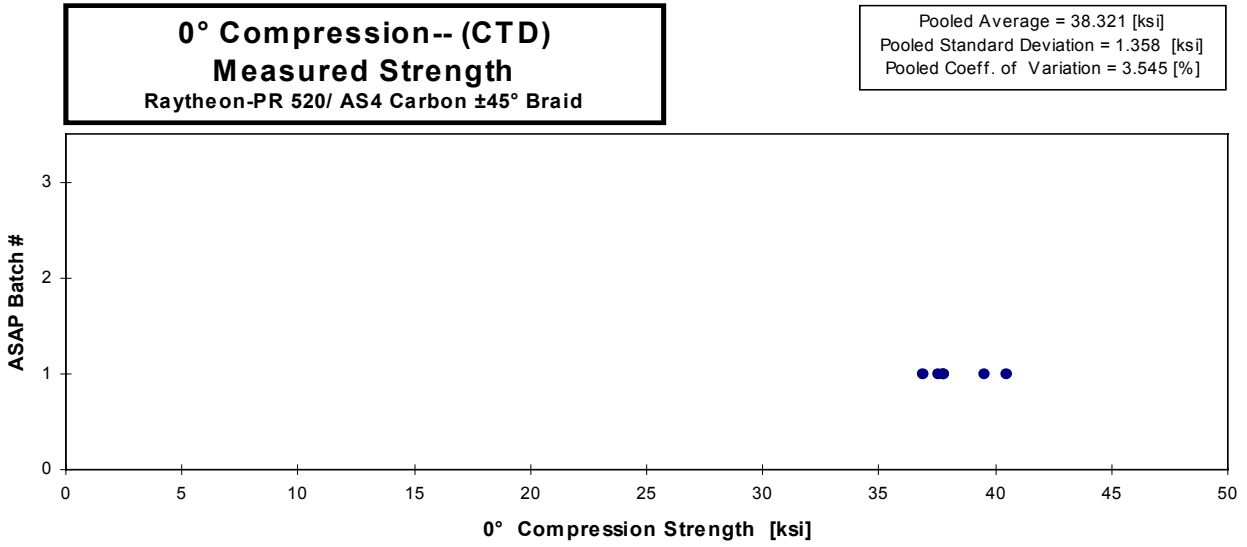
Average	**57.626**	**4.129**	**0.01892**	**59.557**
Standard Dev.	**3.278**	**0.345**		
Coeff. of Var. [%]	**5.689**	**8.356**		
Min.	**53.656**	**3.885**	**0.0189**	**59.557**
Max.	**61.586**	**4.373**	**0.0190**	**59.557**
Number of Spec.	**6**	**2**		

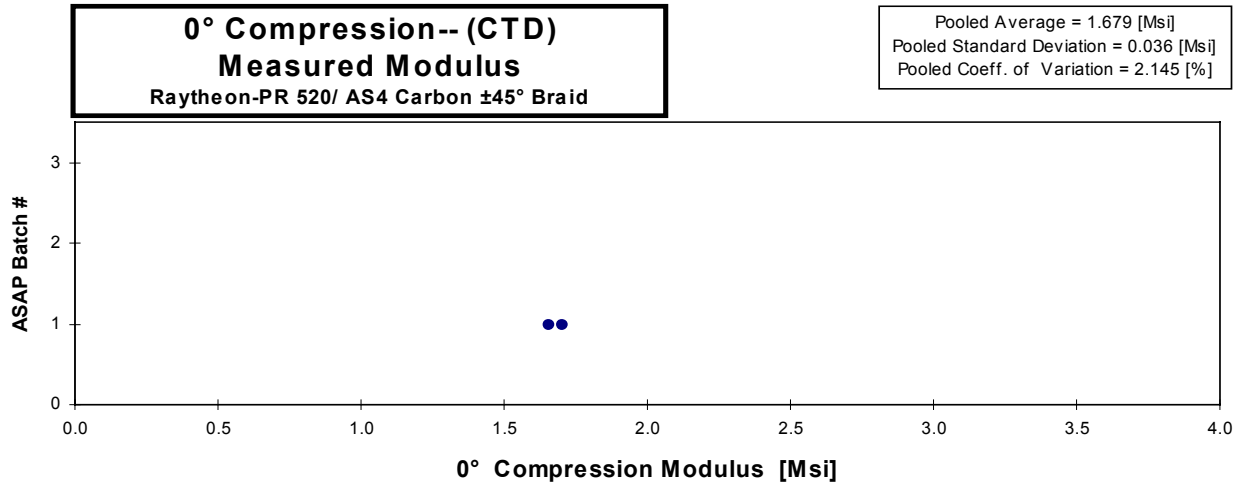




0° Compression-- (CTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

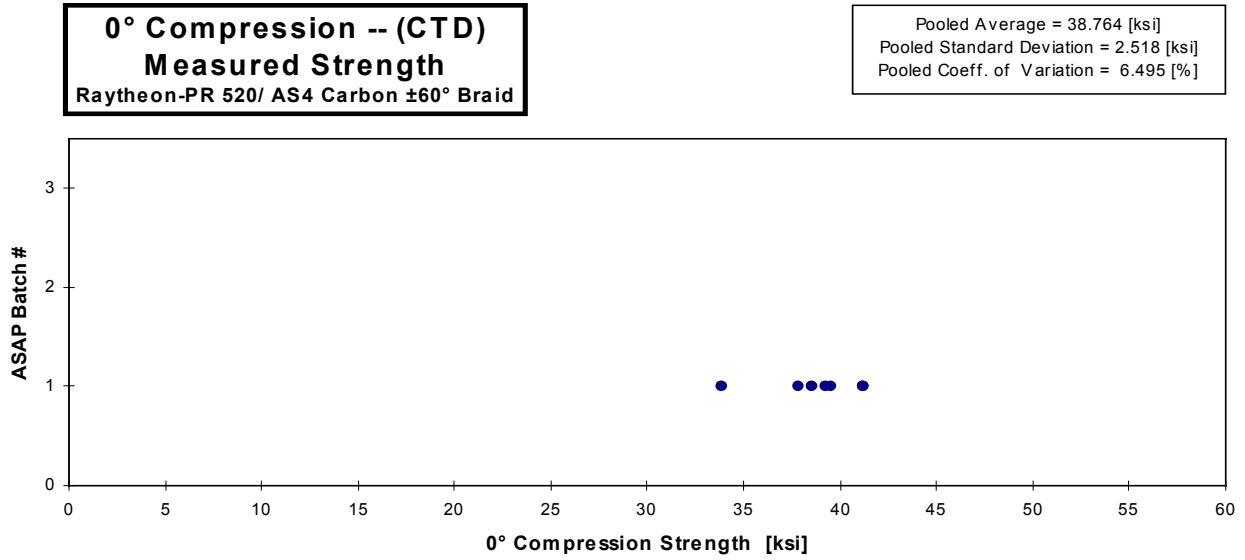
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBP1121B	4383	AP 110	1	37.564	1.653	0.118	7	0.01691	56.572
EBP1122B	4383	AP 110	1	37.744	1.704	0.120	7	0.01714	56.572
EBP1123B	4383	AP 110	1	36.900		0.120	7	0.01711	56.572
EBP1124B	4383	AP 110	1	37.757		0.120	7	0.01712	56.572
EBP1125B	4383	AP 110	1	40.465		0.117	7	0.01673	56.572
EBP1126B	4383	AP 110	1	39.497		0.118	7	0.01692	56.572
			Average	**38.321**	**1.679**			**0.01699**	**56.572**
			Standard Dev.	**1.358**	**0.036**				
			Coeff. of Var. [%]	**3.545**	**2.145**				
			Min.	**36.900**	**1.653**			**0.0167**	**56.572**
			Max.	**40.465**	**1.704**			**0.0171**	**56.572**
			Number of Spec.	**6**	**2**				

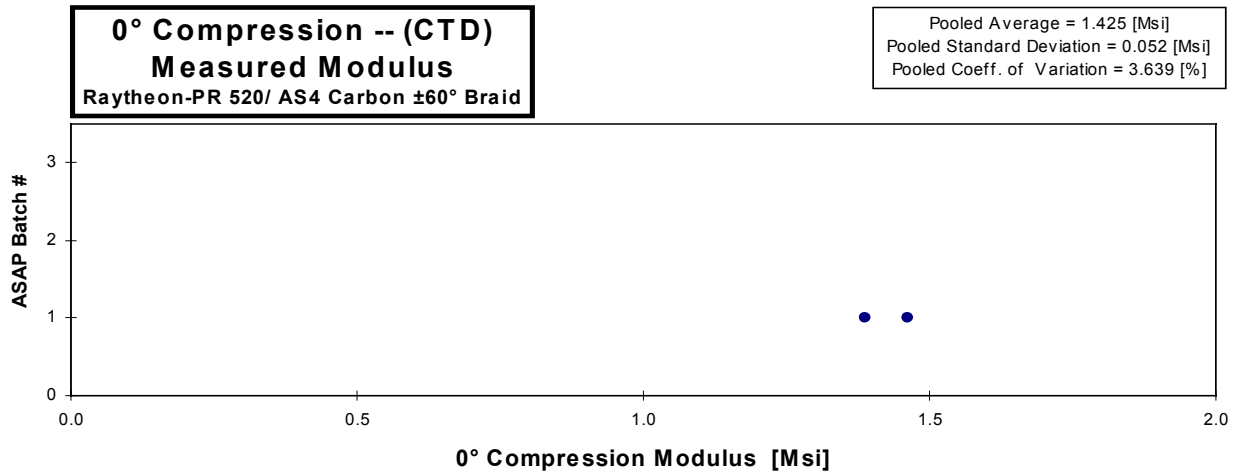




0° Compression -- (CTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

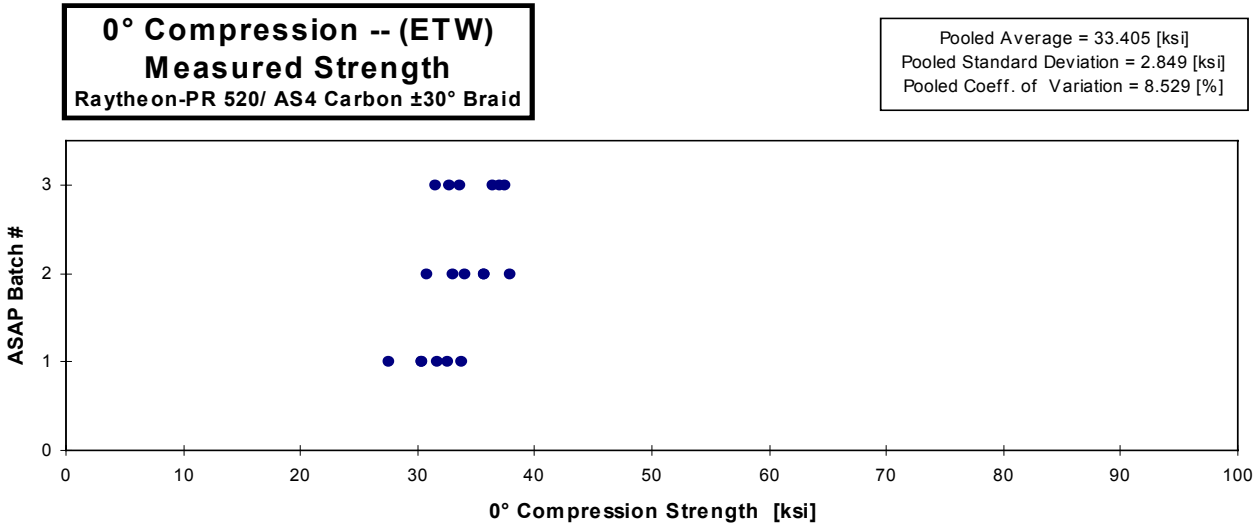
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECP1121B	4383	AP 110	1	41.218	1.387	0.113	6	0.01875	58.953
ECP1123B	4383	AP 110	1	33.817		0.113	6	0.01883	58.953
ECP1124B	4383	AP 110	1	37.834		0.114	6	0.01900	58.953
ECP1125B	4383	AP 110	1	38.556		0.115	6	0.01918	58.953
ECP1126B	4383	AP 110	1	39.249		0.112	6	0.01873	59.953
ECP1127B	4383	AP 110	1	39.488		0.112	6	0.01872	58.953
ECP1128B	4383	AP 110	1	41.188	1.461	0.115	6	0.01922	58.953
			Average	**38.764**	**1.424**			**0.01892**	**59.096**
			Standard Dev.	**2.518**	**0.052**				
			Coeff. of Var. [%]	**6.495**	**3.639**				
			Min.	**33.817**	**1.387**			**0.0187**	**58.953**
			Max.	**41.218**	**1.461**			**0.0192**	**59.953**
			Number of Spec.	**7**	**2**				

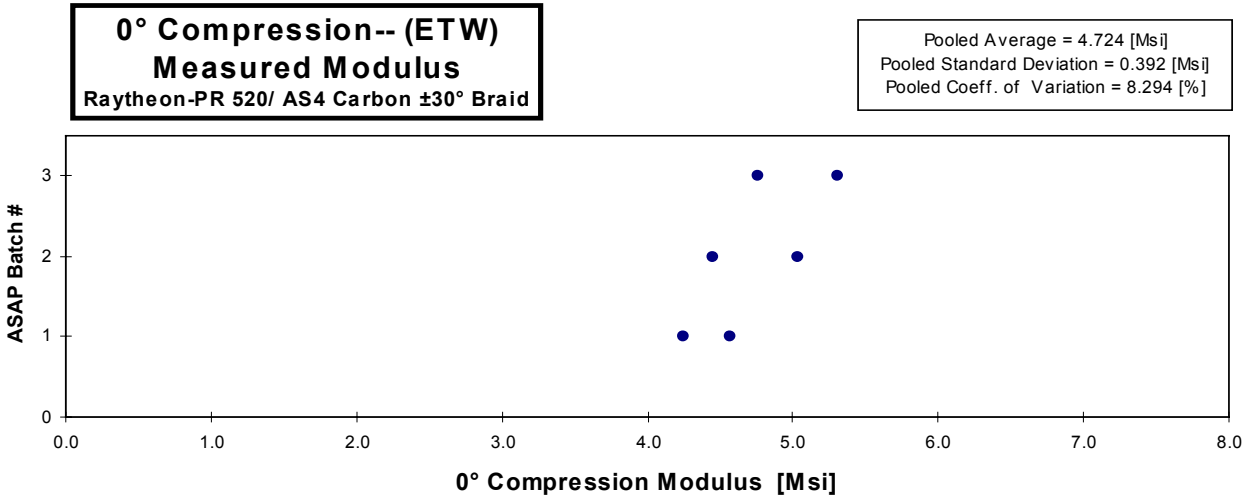




0° Compression -- (ETW)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±30° Braid

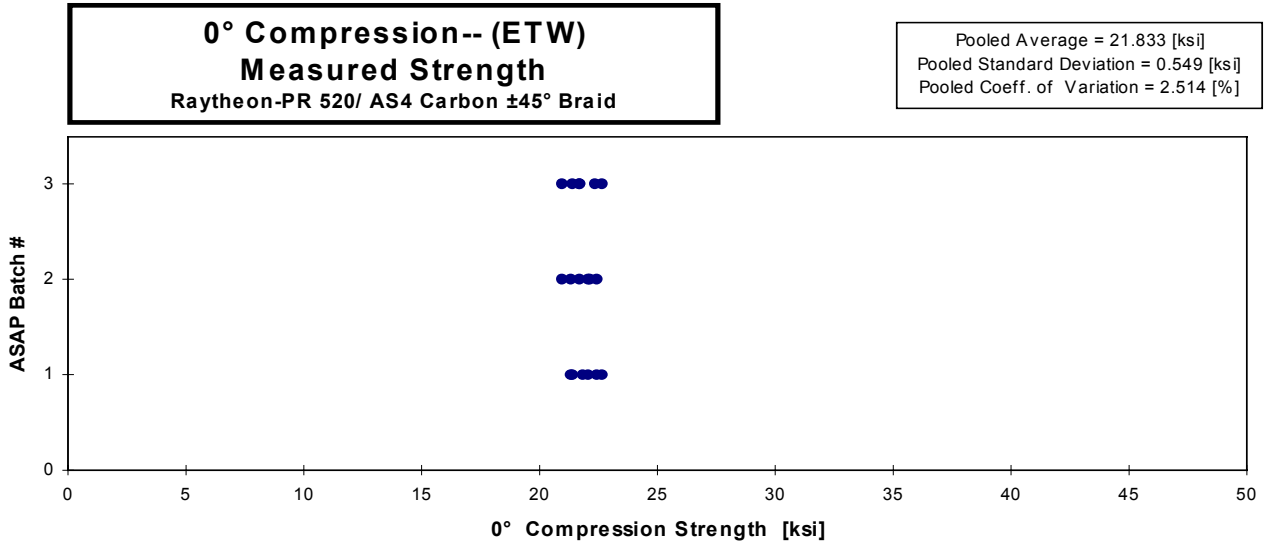
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECR1111F	4383	AP 110	1	27.465	4.561	0.114	6	0.01895	59.557
ECR1112F	4383	AP 110	1	30.281	4.243	0.113	6	0.01875	59.557
ECR1113F	4383	AP 110	1	31.606		0.114	6	0.01893	59.557
ECR1114F	4383	AP 110	1	30.393		0.113	6	0.01886	59.557
ECR1115F	4383	AP 110	1	33.655		0.113	6	0.01889	59.557
ECR1116F	4383	AP 110	1	32.522		0.113	6	0.01888	59.557
ECR2112F	4383	AP 109	2	30.732	4.443	0.112	6	0.01869	60.498
ECR2113F	4383	AP 109	2	37.883		0.114	6	0.01892	60.498
ECR2114F	4383	AP 109	2	35.694		0.113	6	0.01880	60.498
ECR2115F	4383	AP 109	2	33.952		0.113	6	0.01889	61.498
ECR2116F	4383	AP 109	2	32.935		0.114	6	0.01893	60.498
ECR2117F	4383	AP 109	2	35.678	5.035	0.113	6	0.01878	60.498
ECR3111F	3968	AP 109	3	36.355	4.763	0.113	6	0.01878	60.814
ECR3112F	3968	AP 109	3	36.963	5.300	0.114	6	0.01899	60.814
ECR3113F	3968	AP 109	3	33.629		0.113	6	0.01875	60.814
ECR3114F	3968	AP 109	3	32.639		0.114	6	0.01893	60.814
ECR3115F	3968	AP 109	3	31.500		0.113	6	0.01881	60.814
ECR3116F	3968	AP 109	3	37.412		0.114	6	0.01894	60.814
			Average	**33.405**	**4.724**			**0.01886**	**60.345**
			Standard Dev.	**2.849**	**0.392**				
			Coeff. of Var. [%]	**8.529**	**8.294**				
			Min.	**27.465**	**4.243**			**0.0187**	**59.557**
			Max.	**37.883**	**5.300**			**0.0190**	**61.498**
			Number of Spec.	**18**	**6**				

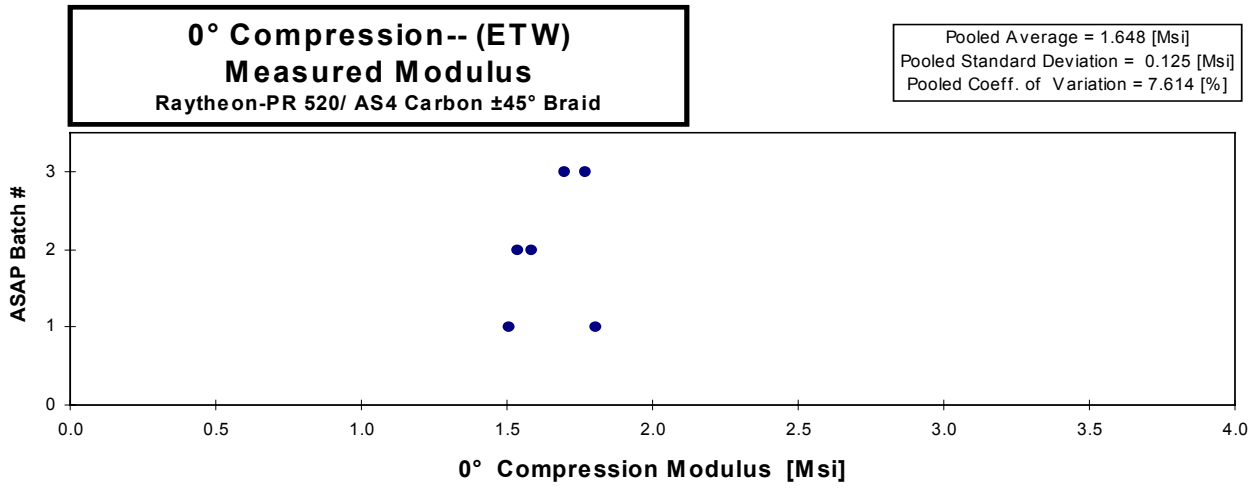




0° Compression-- (ETW)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

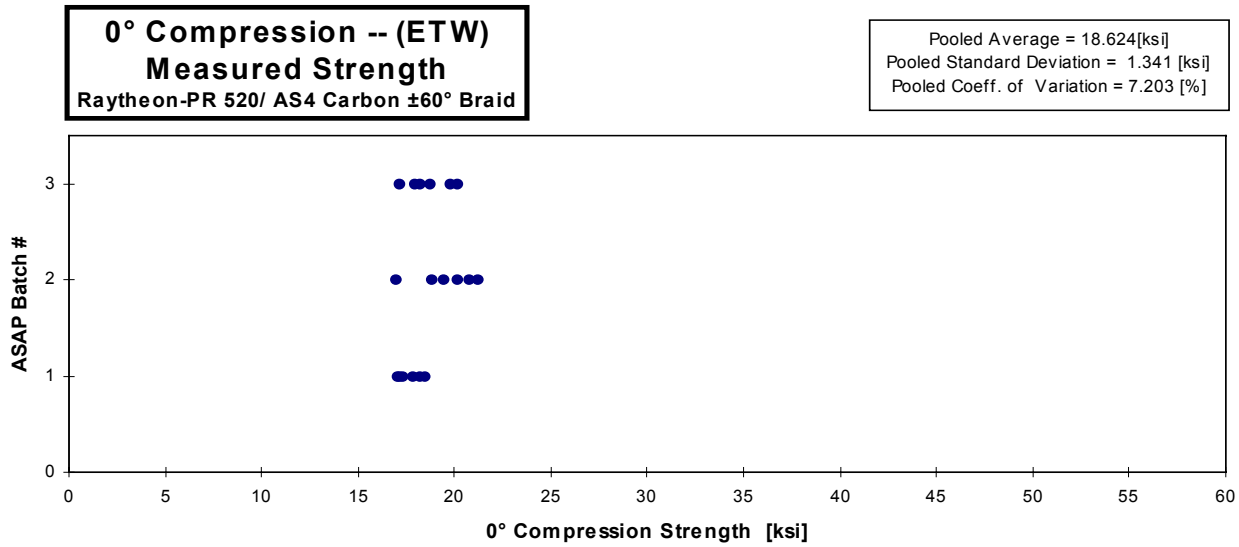
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBP1111F	4383	AP 110	1	22.437	1.803	0.120	7	0.01708	56.572
EBP1112F	4383	AP 110	1	21.372	1.506	0.120	7	0.01715	56.572
EBP1113F	4383	AP 110	1	22.620		0.119	7	0.01703	56.572
EBP1114F	4383	AP 110	1	21.856		0.118	7	0.01682	56.572
EBP1115F	4383	AP 110	1	21.320		0.121	7	0.01721	56.572
EBP1116F	4383	AP 110	1	22.090		0.119	7	0.01696	56.572
EBP2111F	4383	AP 109	2	20.964	1.582	0.118	7	0.01686	58.973
EBP2112F	4383	AP 109	2	21.307	1.533	0.119	7	0.01693	58.973
EBP2113F	4383	AP 109	2	21.662		0.118	7	0.01690	58.973
EBP2114F	4383	AP 109	2	22.045		0.119	7	0.01699	58.973
EBP2115F	4383	AP 109	2	22.416		0.118	7	0.01688	58.973
EBP2116F	4383	AP 109	2	22.119		0.118	7	0.01689	58.973
EBP3111F	3968	AP 109	3	22.675	1.768	0.119	7	0.01693	59.055
EBP3112F	3968	AP 109	3	22.383	1.695	0.118	7	0.01685	59.055
EBP3113F	3968	AP 109	3	21.692		0.119	7	0.01697	59.055
EBP3114F	3968	AP 109	3	21.391		0.119	7	0.01695	59.055
EBP3115F	3968	AP 109	3	20.924		0.120	7	0.01710	59.055
EBP3116F	3968	AP 109	3	21.714		0.119	7	0.01701	59.055
			Average	**21.833**	**1.648**			**0.01697**	**58.200**
			Standard Dev.	**0.549**	**0.125**				
			Coeff. of Var. [%]	**2.514**	**7.614**				
			Min.	**20.924**	**1.506**			**0.0168**	**56.572**
			Max.	**22.675**	**1.803**			**0.0172**	**59.055**
			Number of Spec.	**18**	**6**				

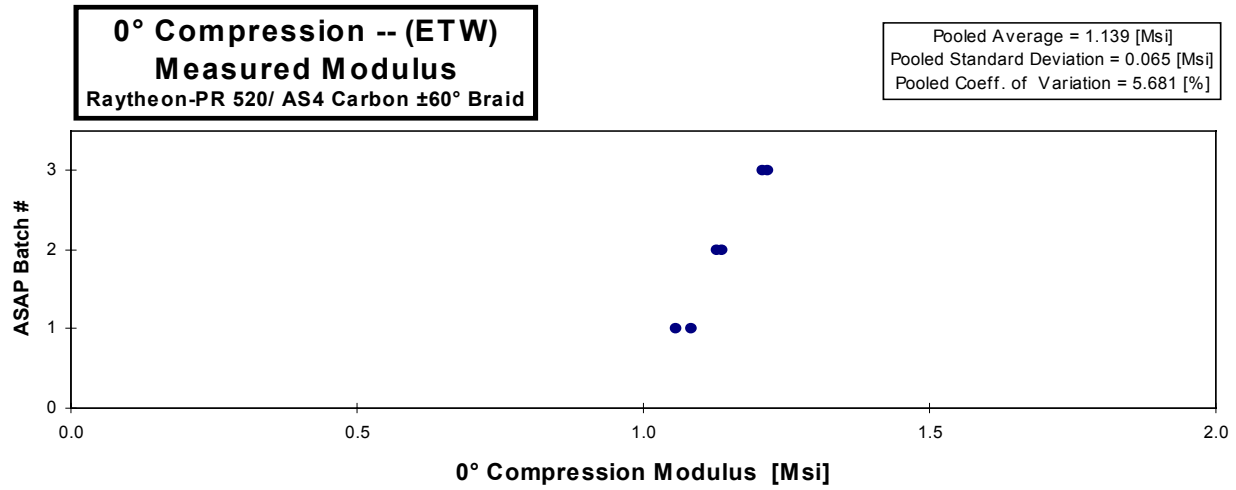




0° Compression -- (ETW)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

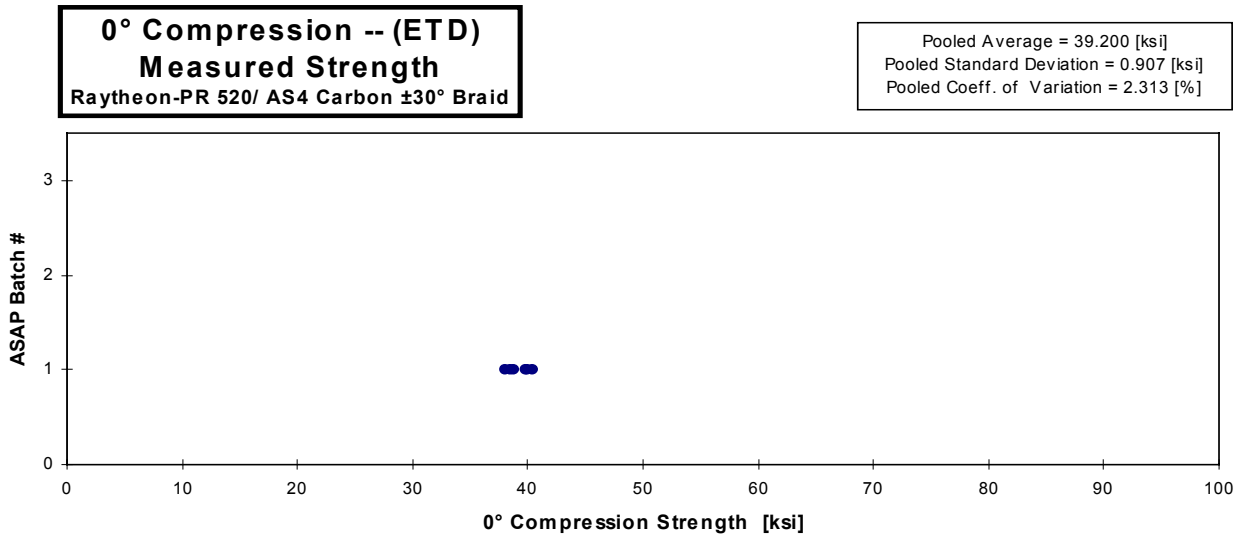
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECP1111F	4383	AP 110	1	17.878	1.083	0.115	6	0.01908	58.953
ECP1112F	4383	AP 110	1	18.429	1.058	0.114	6	0.01899	58.953
ECP1113F	4383	AP 110	1	17.148		0.115	6	0.01920	58.953
ECP1114F	4383	AP 110	1	18.188		0.113	6	0.01886	58.953
ECP1115F	4383	AP 110	1	17.288		0.112	6	0.01872	58.953
ECP1116F	4383	AP 110	1	17.013		0.113	6	0.01888	58.953
ECP2111F	4383	AP 109	2	20.107	1.127	0.115	6	0.01909	60.168
ECP2112F	4383	AP 109	2	20.746	1.138	0.112	6	0.01865	60.168
ECP2113F	4383	AP 109	2	21.179		0.112	6	0.01874	60.168
ECP2114F	4383	AP 109	2	18.834		0.113	6	0.01884	60.168
ECP2115F	4383	AP 109	2	19.412		0.112	6	0.01873	60.168
ECP2116F	4383	AP 109	2	16.978		0.111	6	0.01857	60.168
ECP3111F	3968	AP 109	3	18.748	1.217	0.113	6	0.01886	57.317
ECP3112F	3968	AP 109	3	19.828	1.209	0.113	6	0.01877	57.317
ECP3113F	3968	AP 109	3	18.160		0.114	6	0.01893	57.317
ECP3114F	3968	AP 109	3	20.170		0.114	6	0.01896	57.317
ECP3115F	3968	AP 109	3	17.161		0.112	6	0.01866	57.317
ECP3116F	3968	AP 109	3	17.968		0.112	6	0.01866	57.317
			Average	**18.624**	**1.139**			**0.01884**	**58.813**
			Standard Dev.	**1.341**	**0.065**				
			Coeff. of Var. [%]	**7.203**	**5.681**				
			Min.	**16.978**	**1.058**			**0.0186**	**57.317**
			Max.	**21.179**	**1.217**			**0.0192**	**60.168**
			Number of Spec.	**18**	**6**				

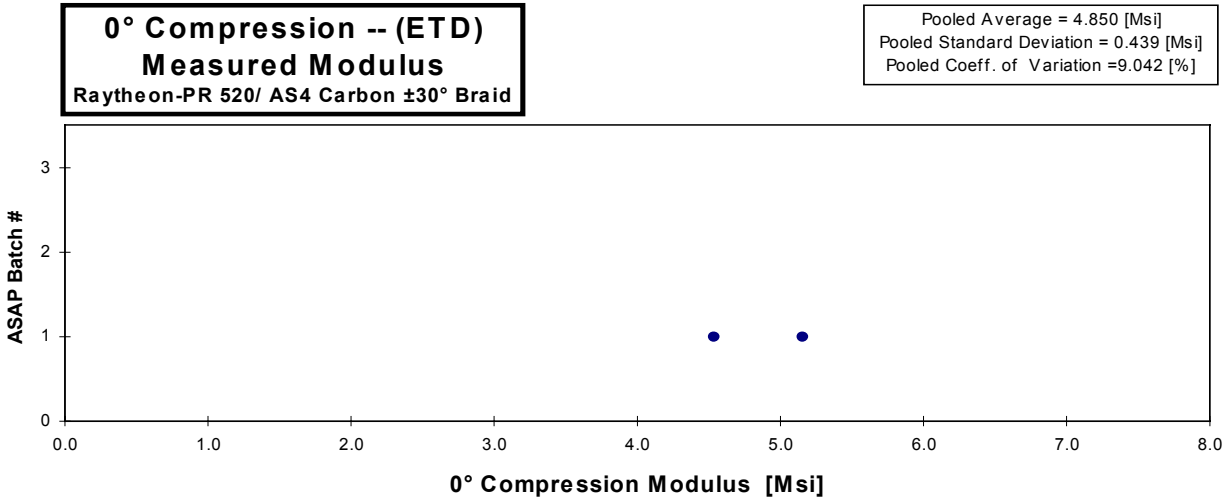




0° Compression -- (ETD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±30° Braid

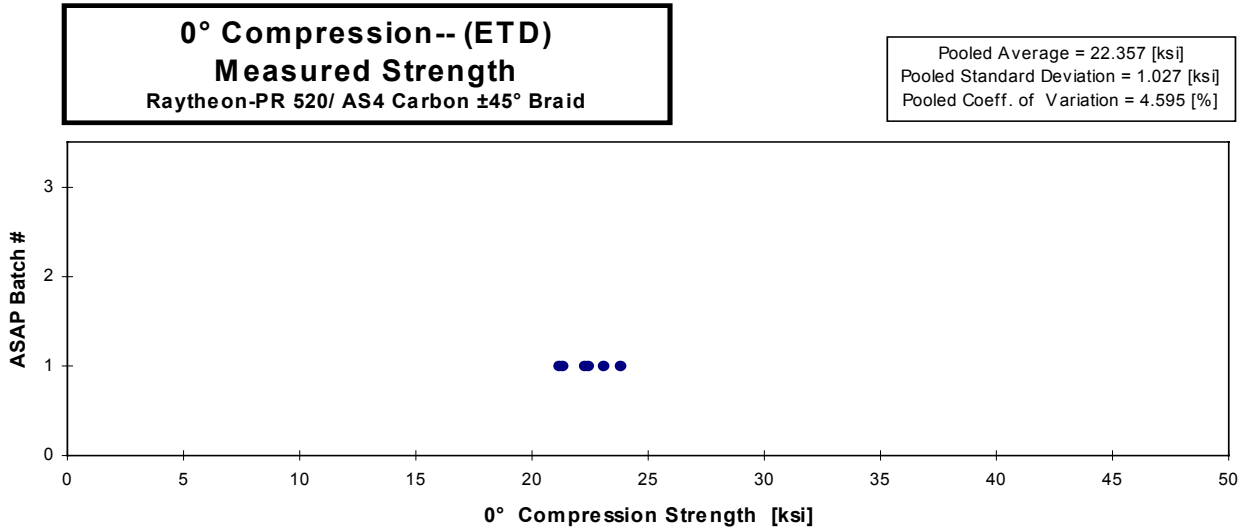
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECR111LG	4383	AP 110	1	38.009	5.160	0.113	6	0.01887	59.557
ECR111MG	4383	AP 110	1	39.734	4.540	0.113	6	0.01887	59.557
ECR111NG	4383	AP 110	1	40.314		0.113	6	0.01885	59.557
ECR111OG	4383	AP 110	1	39.877		0.114	6	0.01893	59.557
ECR111PG	4383	AP 110	1	38.456		0.113	6	0.01886	59.557
ECR111QG	4383	AP 110	1	38.807		0.113	6	0.01889	59.557
			Average	**39.200**	**4.850**			**0.01888**	**59.557**
			Standard Dev.	**0.907**	**0.439**				
			Coeff. of Var. [%]	**2.313**	**9.042**				
			Min.	**38.009**	**4.540**			**0.0189**	**59.557**
			Max.	**40.314**	**5.160**			**0.0189**	**59.557**
			Number of Spec.	**6**	**2**				

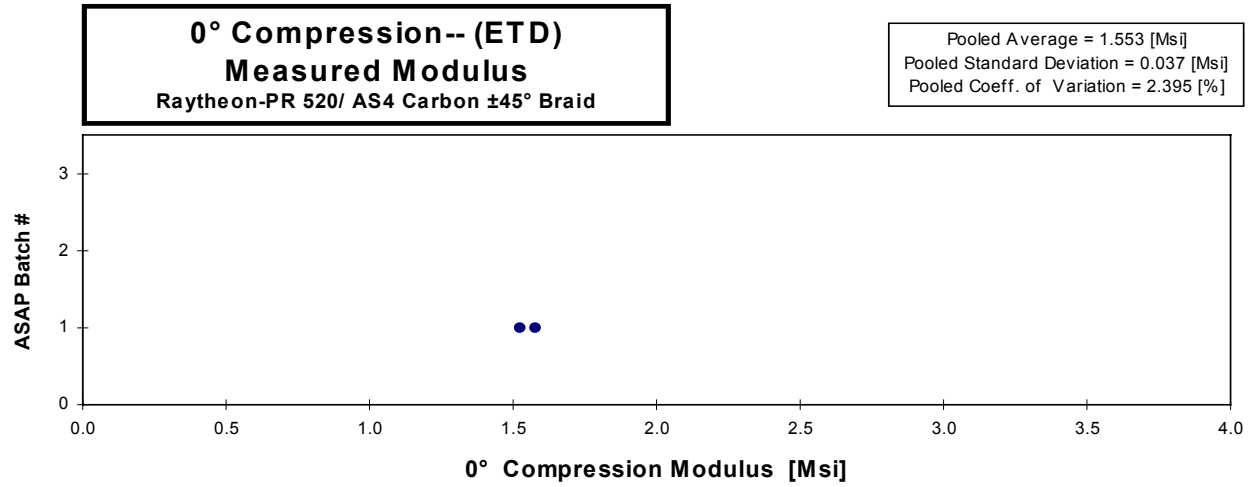




0° Compression-- (ETD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

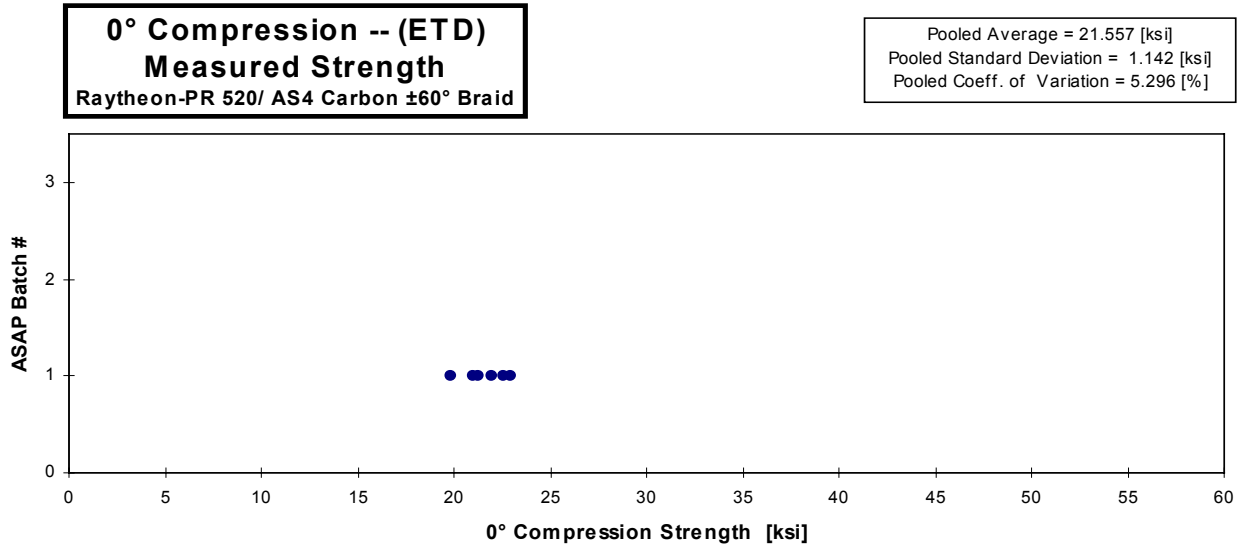
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBP1128G	4383	AP 110	1	23.109		0.118	7	0.01688	56.572
EBP1129G	4383	AP 110	1	21.198		0.119	7	0.01697	56.572
EBP112AG	4383	AP 110	1	22.298	1.527	0.120	7	0.01709	56.572
EBP112BG	4383	AP 110	1	23.849	1.579	0.119	7	0.01702	56.572
EBP112CG	4383	AP 110	1	22.397		0.120	7	0.01712	56.572
EBP112DG	4383	AP 110	1	21.292		0.119	7	0.01703	56.572
			Average	**22.357**	**1.553**			**0.01702**	**56.572**
			Standard Dev.	**1.027**	**0.037**				
			Coeff. of Var. [%]	**4.595**	**2.395**				
			Min.	**21.198**	**1.527**			**0.0169**	**56.572**
			Max.	**23.849**	**1.579**			**0.0171**	**56.572**
			Number of Spec.	**6**	**2**				

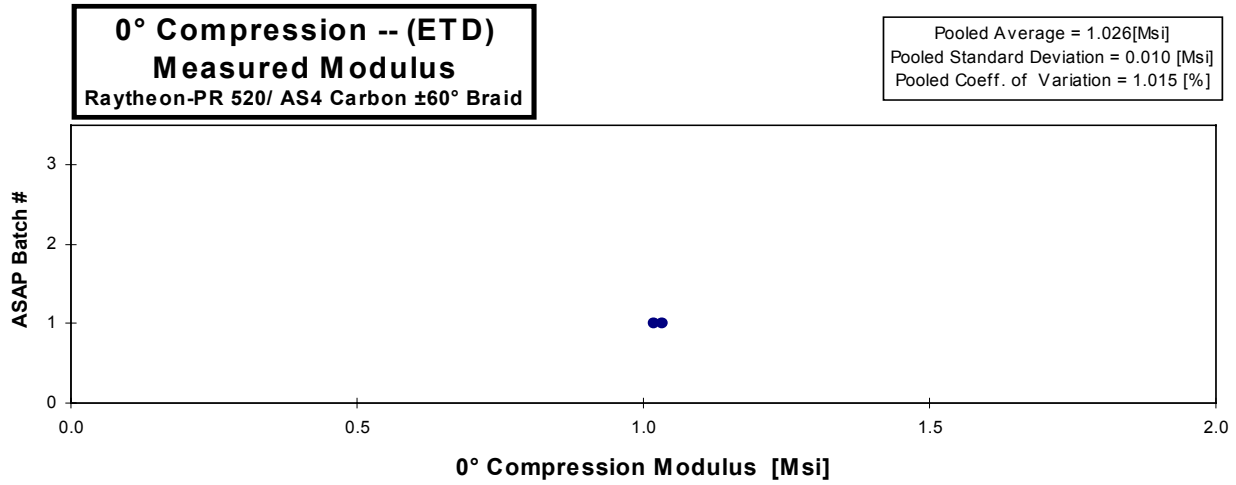




0° Compression -- (ETD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

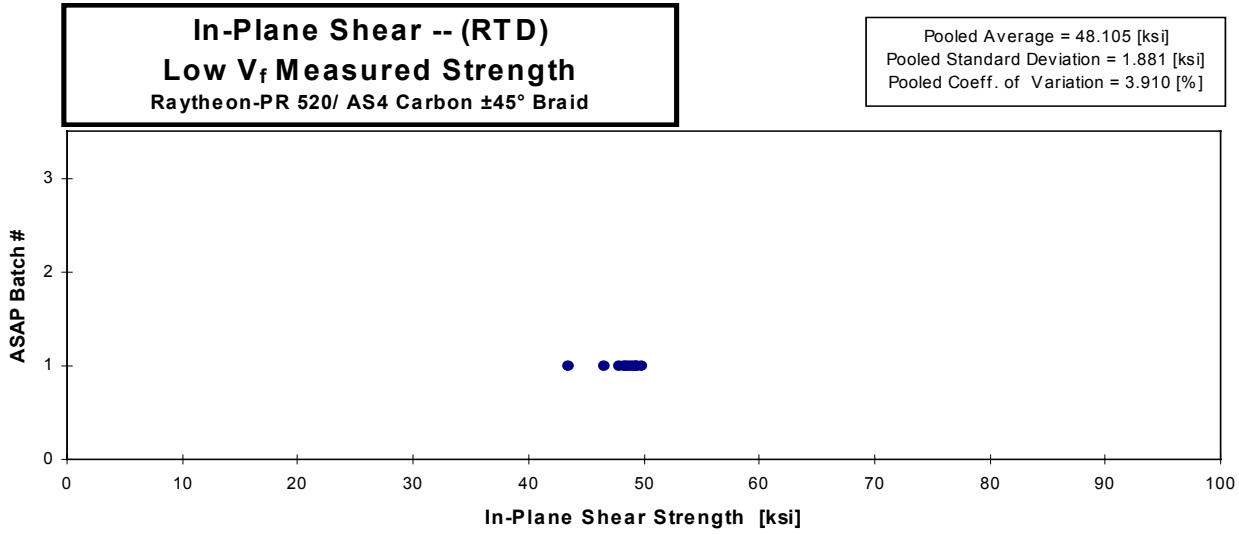
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECP1129G	4383	AP 110	1	20.974	1.018	0.113	6	0.01880	58.953
ECP112AG	4383	AP 110	1	21.215	1.033	0.124	6	0.02060	58.953
ECP112BG	4383	AP 110	1	22.529		0.112	6	0.01872	58.953
ECP112CG	4383	AP 110	1	21.935		0.115	6	0.01918	58.953
ECP112DG	4383	AP 110	1	22.907		0.112	6	0.01874	58.953
ECP112EG	4383	AP 110	1	19.783		0.124	6	0.02070	58.953
			Average	**21.557**	**1.026**			**0.01946**	**58.953**
			Standard Dev.	**1.142**	**0.010**				
			Coeff. of Var. [%]	**5.296**	**1.015**				
			Min.	**19.783**	**1.018**			**0.0187**	**58.953**
			Max.	**22.907**	**1.033**			**0.0207**	**58.953**
			Number of Spec.	**6**	**2**				

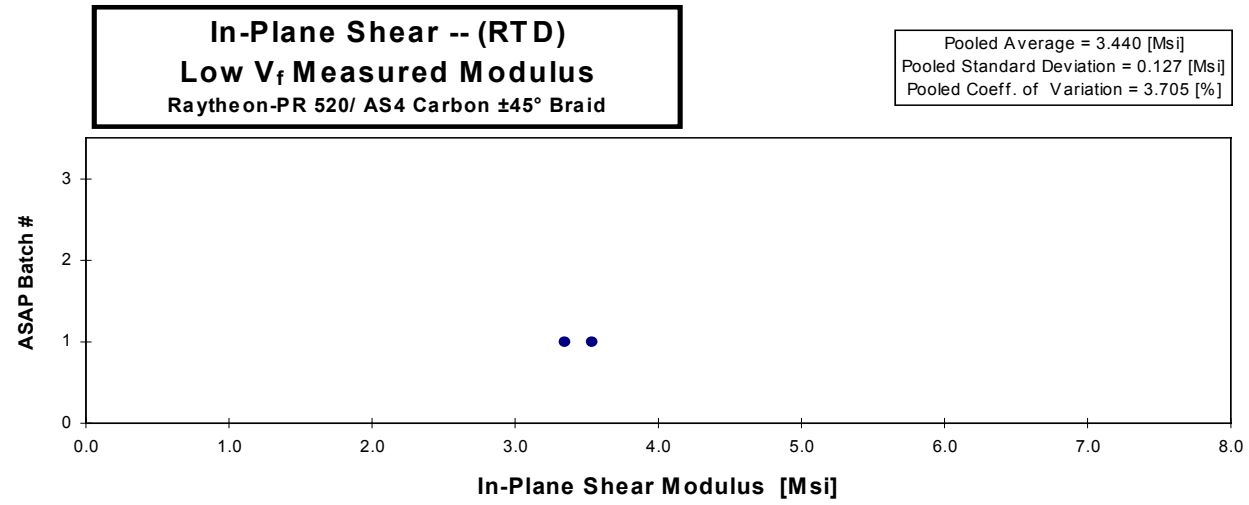




In-Plane Shear -- (RTD)
Low V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBTX1L1A	4383	AP 110	1	43.441		0.118	6	0.01964	49.472
EBTX1L2A	4383	AP 110	1	49.055		0.117	6	0.01942	49.472
EBTX1L3A	4383	AP 110	1	49.404		0.117	6	0.01947	49.472
EBTX1L4A	4383	AP 110	1	48.700		0.118	6	0.01961	49.472
EBTX1L5A	4383	AP 110	1	46.597		0.119	6	0.01981	49.472
EBTX1L6A	4383	AP 110	1	49.373		0.118	6	0.01970	49.472
EBTX1L7A	4383	AP 110	1	47.865		0.118	6	0.01973	49.472
EBTX1L8A	4383	AP 110	1	49.849		0.119	6	0.01978	49.472
EBTX1L9A	4383	AP 110	1	48.368		0.119	6	0.01980	49.472
EBTX1LAA	4383	AP 110	1	48.399		0.117	6	0.01949	49.472
EBNX1L1A	4383	AP 110	1		3.350	0.118	6	0.01974	49.472
EBNX1L2A	4383	AP 110	1		3.530	0.118	6	0.01972	49.472
			Average	**48.105**	**3.440**			**0.01966**	**49.472**
			Standard Dev.	**1.881**	**0.127**				
			Coeff. of Var. [%]	**3.910**	**3.705**				
			Min.	**43.441**	**3.350**			**0.0194**	**49.472**
			Max.	**49.849**	**3.530**			**0.0198**	**49.472**
			Number of Spec.	**10**	**2**				

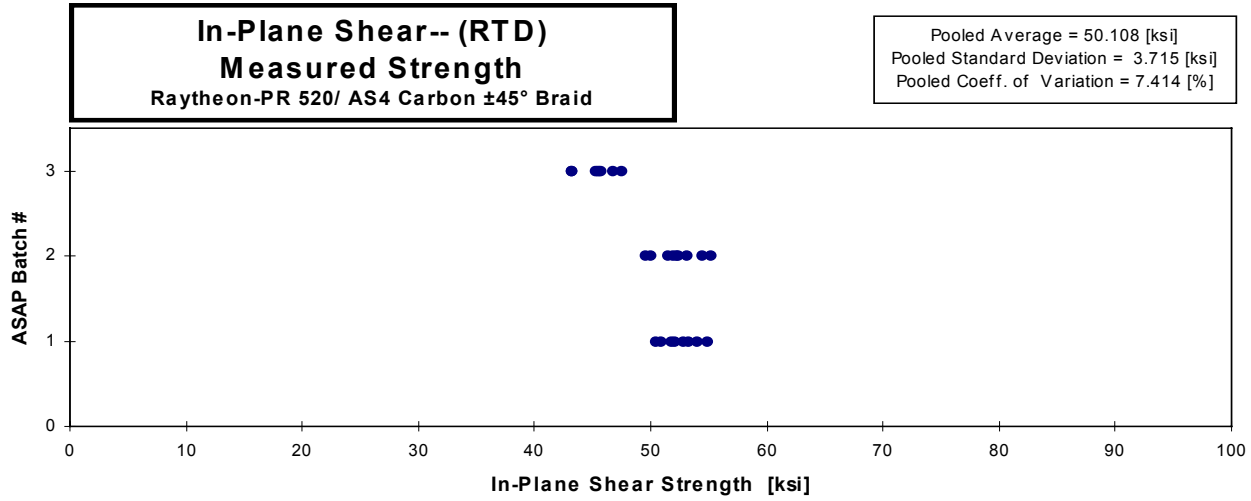


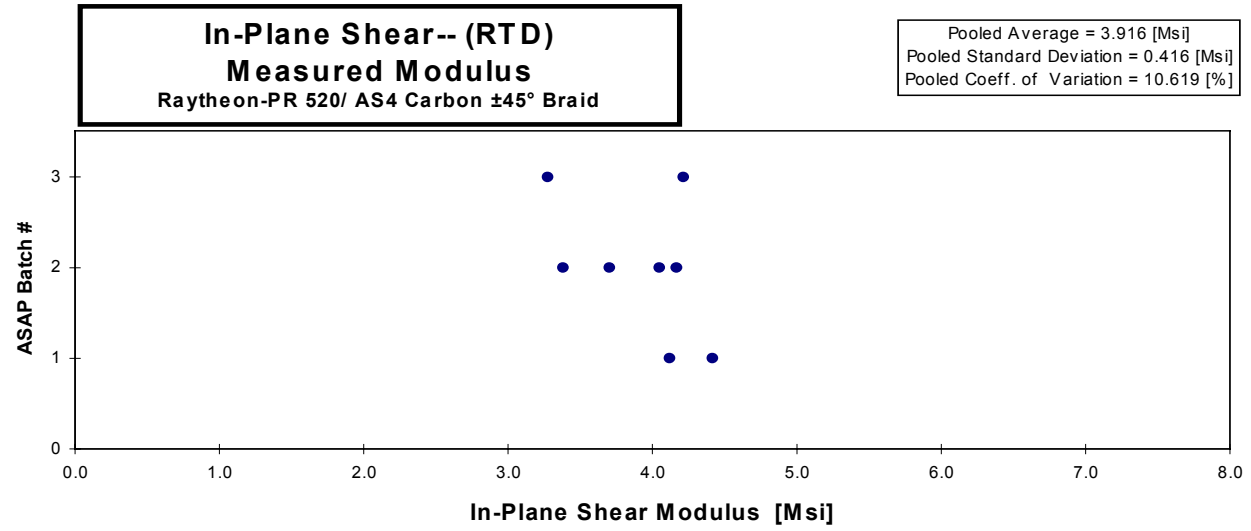


In-Plane Shear-- (RTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBT1231A	4383	AP 110	1	51.702		0.119	7	0.01707	58.648
EBT1232A	4383	AP 110	1	50.417		0.119	7	0.01696	58.648
EBT1233A	4383	AP 110	1	54.055		0.119	7	0.01695	58.648
EBT1234A	4383	AP 110	1	50.948		0.118	7	0.01693	58.648
EBT1235A	4383	AP 110	1	52.801		0.119	7	0.01698	58.648
EBT1236A	4383	AP 110	1	52.004		0.119	7	0.01693	58.648
EBT1237A	4388	AP 110	1	54.883		0.118	7	0.01690	58.648
EBT1238A	4383	AP 110	1	53.237		0.118	7	0.01689	58.648
EBN1129A	4383	AP 110	1		4.124	0.119	7	0.01700	57.638
EBN112AA	4383	AP 110	1		4.421	0.118	7	0.01689	57.638
EBT2131A	4383	AP 109	2	50.048		0.120	7	0.01709	59.857
EBT2132A	4383	AP 109	2	53.051		0.119	7	0.01705	59.857
EBT2133A	4383	AP 109	2	51.964		0.120	7	0.01709	59.857
EBT2134A	4383	AP 109	2	49.486		0.120	7	0.01708	59.857
EBT2135A	4383	AP 109	2	51.441		0.119	7	0.01705	59.857
EBT2136A	4383	AP 109	2	55.134		0.120	7	0.01708	59.857
EBT2137A	4383	AP 109	2	52.421		0.119	7	0.01697	59.857
EBT2138A	4383	AP 109	2	54.451		0.120	7	0.01713	59.857
EBT2139A	4383	AP 109	2	52.238		0.120	7	0.01717	59.857
EBN2117A	4383	AP 109	2		3.376	0.118	7	0.01691	59.857
EBN2118A	4383	AP 109	2		3.698	0.119	7	0.01697	59.857
EBN2119A	4383	AP 109	2		4.052	0.119	7	0.01699	60.857
EBN211AA	4383	AP 109	2		4.161	0.119	7	0.01694	61.857
EBT3122A	3968	AP 109	3	43.132		0.119	7	0.01695	57.915
EBT3123A	3968	AP 109	3	45.448		0.118	7	0.01693	57.915
EBT3124A	3968	AP 109	3	43.233		0.119	7	0.01694	57.915
EBT3125A	3968	AP 109	3	47.472		0.119	7	0.01701	57.915
EBT3126A	3968	AP 109	3	45.553		0.119	7	0.01698	57.915
EBT3127A	3968	AP 109	3	45.685		0.119	7	0.01699	57.915
EBT3128A	3968	AP 109	3	46.706		0.119	7	0.01694	57.915
EBT3129A	3968	AP 109	3	45.202		0.119	7	0.01695	57.915
EBN311AA	3968	AP 109	3		4.214	0.119	7	0.01698	57.915
EBN32J2A	3968	AP 109	3		3.279	0.119	7	0.01695	57.915

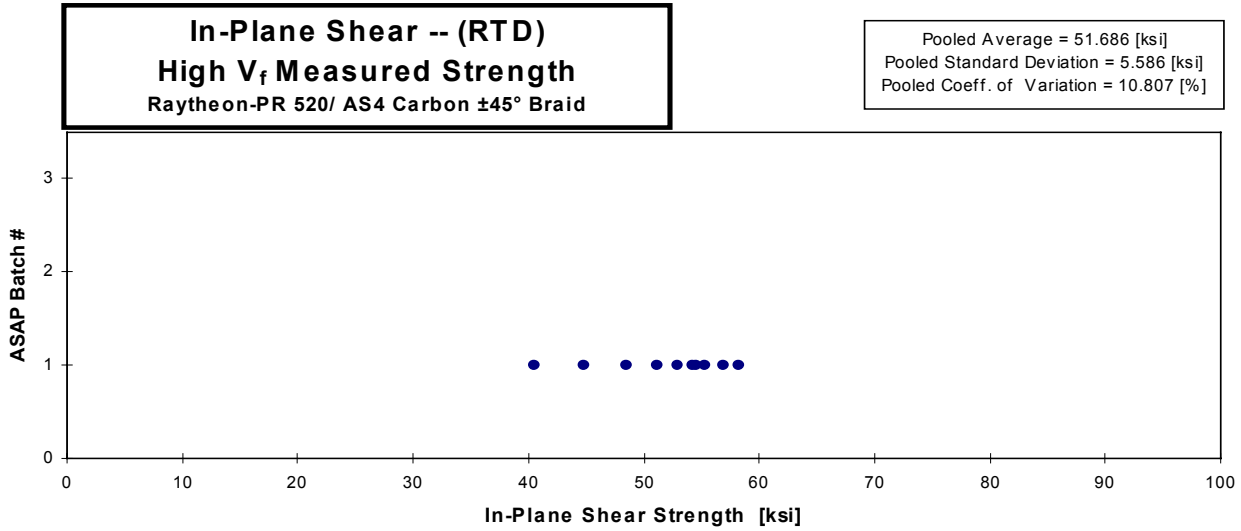
Average	**50.108**	**3.916**	**0.01699**	**58.932**
Standard Dev.	**3.715**	**0.416**		
Coeff. of Var. [%]	**7.414**	**10.619**		
Min.	**43.132**	**3.279**	**0.0169**	**57.638**
Max.	**55.134**	**4.421**	**0.0172**	**61.857**
Number of Spec.	**25**	**8**		

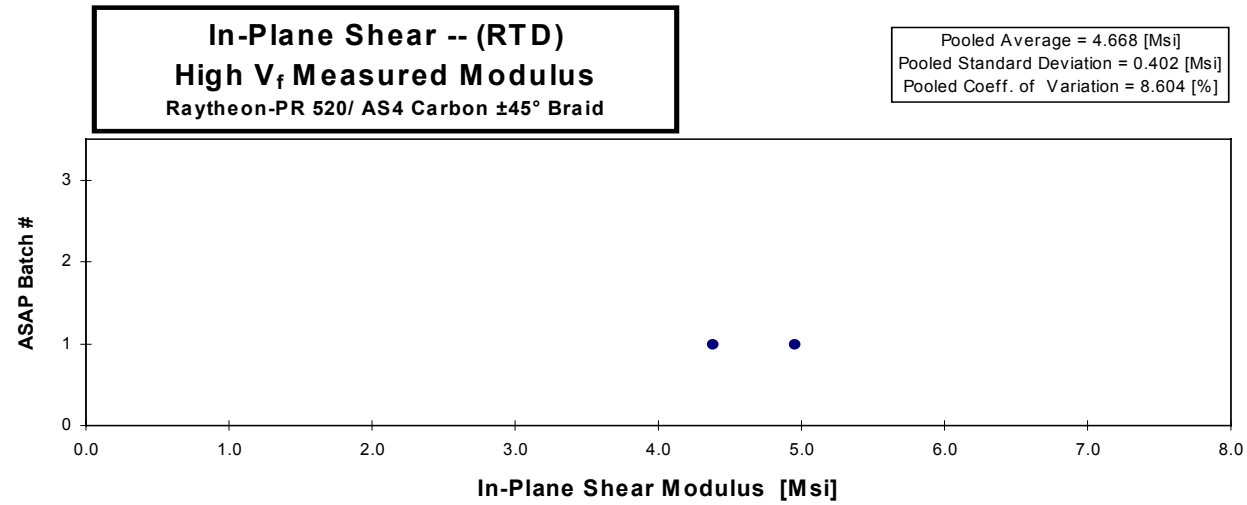




In-Plane Shear -- (RTD)
High V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBTX1G1A	4383	AP 110	1	52.933		0.120	8	0.01499	64.434
EBTX1G2A	4383	AP 110	1	58.130		0.120	8	0.01499	64.434
EBTX1G3A	4383	AP 110	1	54.253		0.119	8	0.01487	64.434
EBTX1G4A	4383	AP 110	1	54.534		0.120	8	0.01501	64.434
EBTX1G5A	4383	AP 110	1	40.504		0.120	8	0.01500	64.434
EBTX1G6A	4383	AP 110	1	51.177		0.119	8	0.01493	64.434
EBTX1G7A	4383	AP 110	1	56.845		0.119	8	0.01491	64.434
EBTX1G8A	4383	AP 110	1	55.244		0.120	8	0.01494	64.434
EBTX1G9A	4383	AP 110	1	48.505		0.120	8	0.01497	64.434
EBTX1GAA	4383	AP 110	1	44.733		0.119	8	0.01488	64.434
EBNX1G1A	4383	AP 110	1		4.952	0.120	8	0.01499	64.434
EBNX1G2A	4383	AP 110	1		4.384	0.120	8	0.01500	64.434
			Average	**51.686**	**4.668**			**0.01496**	**64.434**
			Standard Dev.	**5.586**	**0.402**				
			Coeff. of Var. [%]	**10.807**	**8.604**				
			Min.	**40.504**	**4.384**			**0.0149**	**64.434**
			Max.	**58.130**	**4.952**			**0.0150**	**64.434**
			Number of Spec.	**10**	**2**				



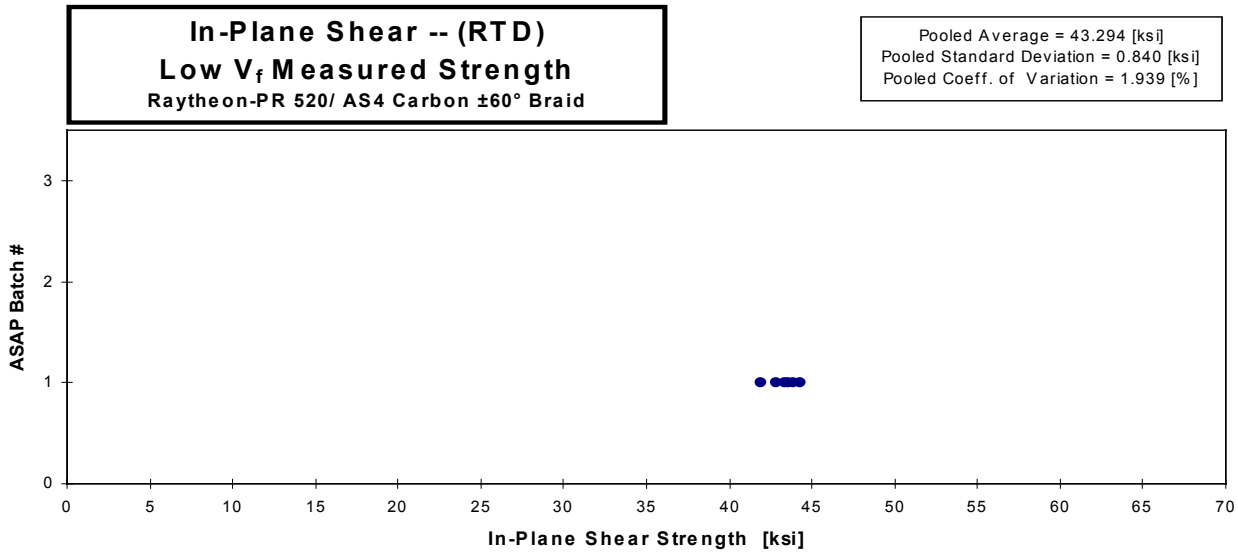


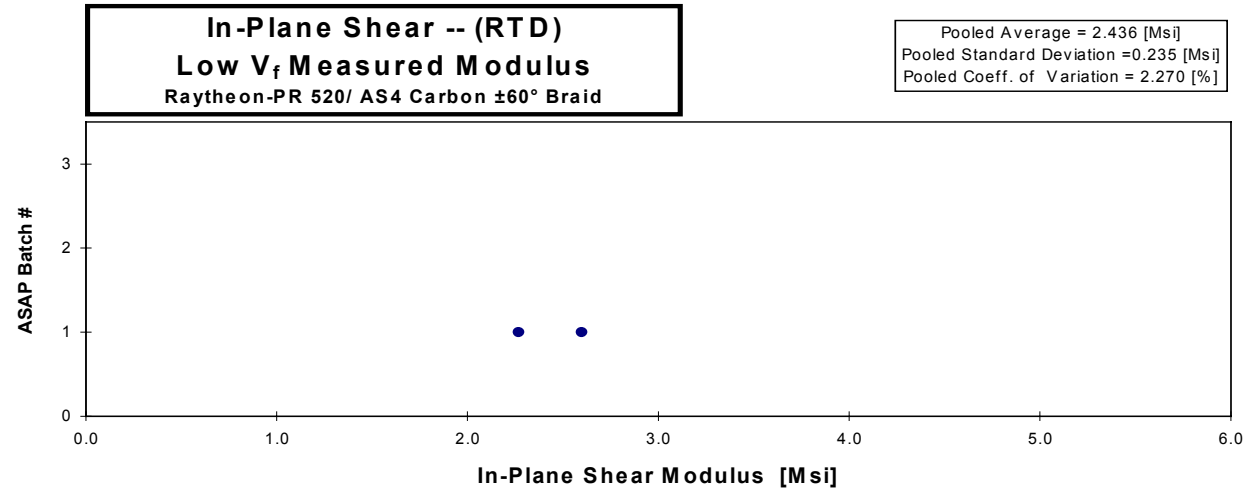
In-Plane Shear -- (RTD)
Low V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECTX1L1A*	4383	AP 110	1	46.274		0.113	5	0.02264	50.038
ECTX1L2A*	4383	AP 110	1	49.216		0.113	5	0.02252	50.038
ECTX1L3A*	4383	AP 110	1	50.414		0.112	5	0.02232	50.038
ECTX1L4A*	4383	AP 110	1	49.611		0.112	5	0.02243	50.038
ECTX1L5A*	4383	AP 110	1	51.794		0.112	5	0.02248	50.038
ECTX1L6A*	4383	AP 110	1	51.508		0.112	5	0.02249	50.038
ECTX1L7A*	4383	AP 110	1	49.884		0.112	5	0.02235	50.038
ECTX1L8A*	4383	AP 110	1	46.563		0.112	5	0.02247	50.038
ECNX1L1A*	4383	AP 110	1		2.513	0.113	5	0.02270	50.038
ECNX1L2A*	4383	AP 110	1		2.491	0.113	5	0.02261	50.038
ECNX2L1A*	4383	AP 110	1		3.266	0.111	5	0.02221	51.038
ECNX2L2A*	4383	AP 110	1		3.252	0.112	5	0.02239	52.038
ECTX2L1A	4383	AP 110	1	43.532		0.121	5	0.02427	51.325
ECTX2L2A	4383	AP 110	1	41.870		0.122	5	0.02433	51.325
ECTX2L3A	4383	AP 110	1	42.867		0.121	5	0.02421	51.325
ECTX2L4A	4383	AP 110	1	43.848		0.122	5	0.02431	51.325
ECTX2L5A	4383	AP 110	1	44.265		0.122	5	0.02437	51.325
ECTX2L6A	4383	AP 110	1	43.383		0.121	5	0.02416	51.325
ECNX2LAA	4383	AP 110	1		2.270	0.110	5	0.02209	51.325
ECNX2LBA	4383	AP 110	1		2.602	0.110	5	0.02199	51.325

*Specimens cut with fibers oriented ±30° to the lenghwise axis are reported but not included in totals

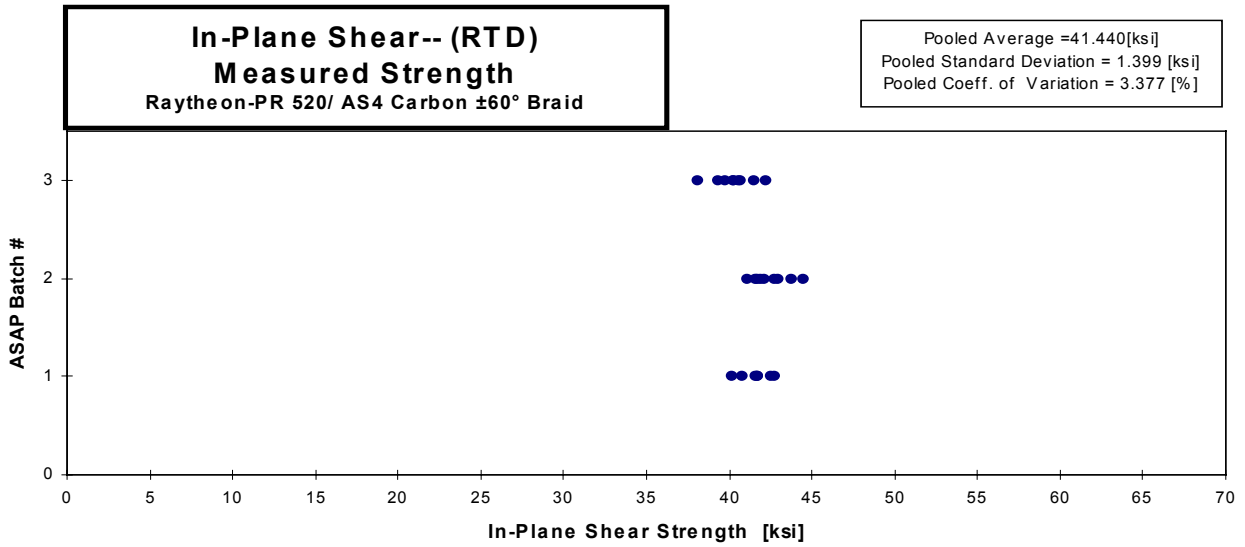
Average	**43.294**	**2.436**	**0.02297**	**50.703**
Standard Dev.	**0.840**	**0.235**		
Coeff. of Var. [%]	**1.939**	**9.635**		
Min.	**41.870**	**2.270**	**0.0220**	**50.038**
Max.	**44.265**	**2.602**	**0.0244**	**52.038**
Number of Spec.	**6**	**2**		

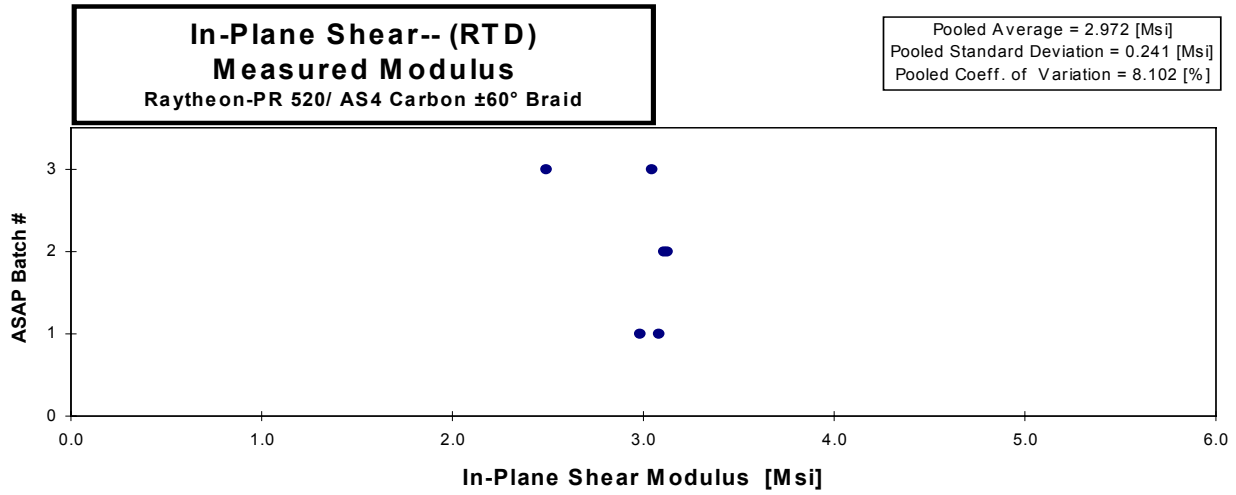




In-Plane Shear-- (RTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECT1131A	4383	AP 110	1	41.606		0.113	6	0.01876	60.387
ECT1132A	4383	AP 110	1	42.688		0.112	6	0.01868	60.387
ECT1133A	4383	AP 110	1	42.477		0.113	6	0.01875	60.387
ECT1134A	4383	AP 110	1	40.185		0.113	6	0.01888	60.387
ECT1135A	4383	AP 110	1	40.800		0.112	6	0.01873	60.387
ECT1136A	4383	AP 110	1	41.695		0.114	6	0.01903	60.387
ECT1137A	4383	AP 110	1	41.711		0.113	6	0.01889	60.387
ECN1117A	4383	AP 110	1		2.980	0.112	6	0.01873	60.387
ECN111AA	4383	AP 110	1		3.077	0.113	6	0.01875	60.387
ECT21X2A	4383	AP 109	2	42.099		0.112	6	0.01865	57.821
ECT21X3A	4383	AP 109	2	42.738		0.113	6	0.01882	57.821
ECT21X4A	4383	AP 109	2	41.069		0.113	6	0.01882	57.821
ECT21X5A	4383	AP 109	2	41.846		0.112	6	0.01867	57.821
ECT21X6A	4383	AP 109	2	42.909		0.112	6	0.01860	57.821
ECT21X7A	4383	AP 109	2	43.733		0.112	6	0.01874	57.821
ECT21X8A	4383	AP 109	2	44.463		0.113	6	0.01880	57.821
ECT21X9A	4383	AP 109	2	41.660		0.113	6	0.01876	57.821
ECT21XAA	4383	AP 109	2	41.587		0.113	6	0.01886	57.821
ECN2119A	4383	AP 109	2		3.106	0.113	6	0.01877	57.821
ECN211AA	4383	AP 109	2		3.129	0.113	6	0.01885	57.821
ECT31X1A	3968	AP 109	3	40.711		0.115	6	0.01913	60.938
ECT31X2A	3968	AP 109	3	41.523		0.114	6	0.01900	60.938
ECT31X3A	3968	AP 109	3	40.579		0.115	6	0.01910	60.938
ECT31X4A	3968	AP 109	3	40.276		0.114	6	0.01895	60.938
ECT31X5A	3968	AP 109	3	40.253		0.114	6	0.01903	60.938
ECT31X6A	3968	AP 109	3	42.221		0.113	6	0.01886	60.938
ECT31X7A	3968	AP 109	3	39.720		0.113	6	0.01890	60.938
ECT31X8A	3968	AP 109	3	38.106		0.113	6	0.01880	60.938
ECT31X9A	3968	AP 109	3	39.334		0.112	6	0.01866	60.938
ECN3119A	3968	AP 109	3		2.492	0.113	6	0.01891	60.938
ECN311AA	3968	AP 109	3		3.048	0.114	6	0.01895	60.938
			Average	**41.440**	**2.972**			**0.01883**	**59.672**
			Standard Dev.	**1.399**	**0.241**				
			Coeff. of Var. [%]	**3.377**	**8.102**				
			Min.	**38.106**	**2.492**			**0.0186**	**57.821**
			Max.	**44.463**	**3.129**			**0.0191**	**60.938**
			Number of Spec.	**25**	**6**				



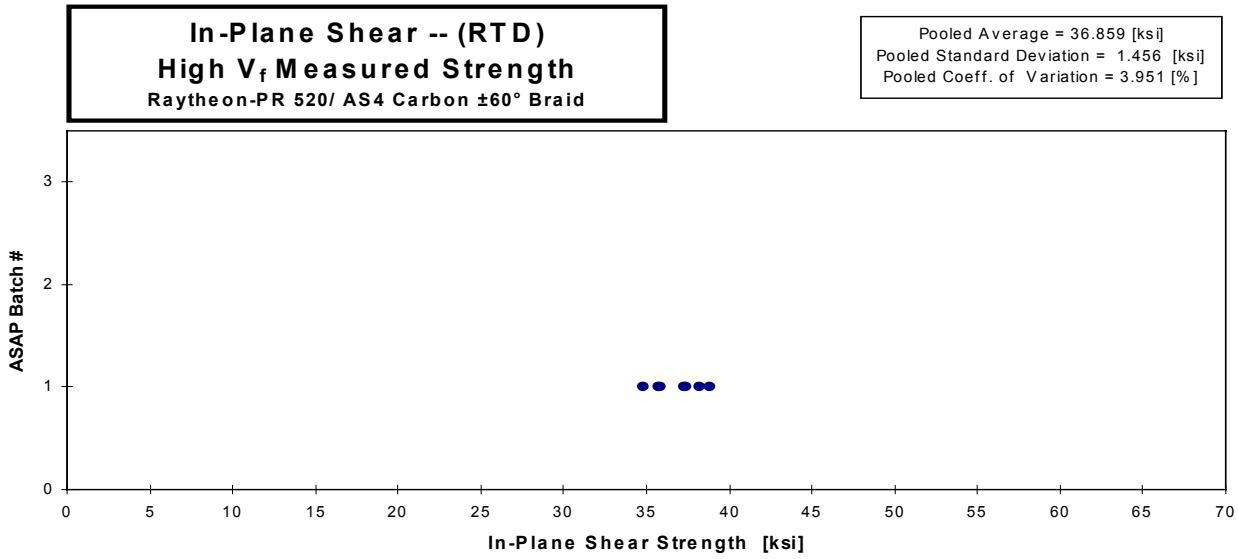


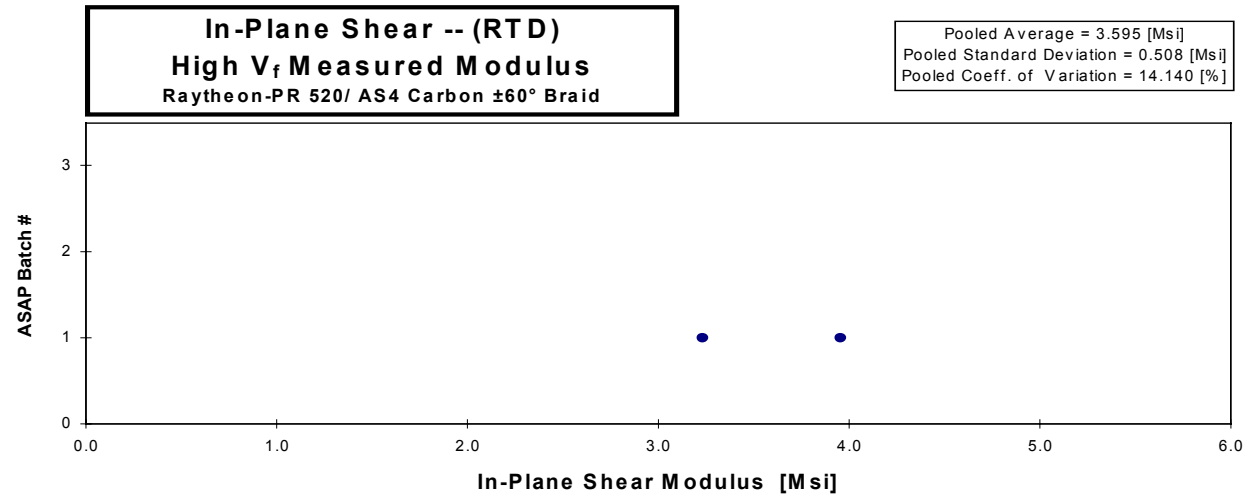
In-Plane Shear -- (RTD)
High V_f Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECTX1G1A*	4383	AP 110	1	50.759		0.118	7	0.01688	69.346
ECTX1G2A*	4383	AP 110	1	46.653		0.119	7	0.01693	69.346
ECTX1G4A*	4383	AP 110	1	52.771		0.118	7	0.01685	69.346
ECTX1G5A*	4383	AP 110	1	50.410		0.118	7	0.01679	69.346
ECTX1G6A*	4383	AP 110	1	52.643		0.117	7	0.01672	69.346
ECNX1G1A*	4383	AP 110	1		3.527	0.119	7	0.01704	69.346
ECNX1G2A*	4383	AP 110	1		3.664	0.119	7	0.01694	69.346
ECNX2G1A*	4383	AP 110	1		3.760	0.119	7	0.01707	70.346
ECNX2G2A*	4383	AP 110	1		3.974	0.120	7	0.01719	71.346
ECTX2G1A	4383	AP 110	1	34.788		0.110	7	0.01573	66.604
ECTX2G2A	4383	AP 110	1	37.320		0.110	7	0.01565	66.604
ECTX2G3A	4383	AP 110	1	35.747		0.109	7	0.01557	66.604
ECTX2G4A	4383	AP 110	1	35.833		0.109	7	0.01562	66.604
ECTX2G5A	4383	AP 110	1	37.270		0.109	7	0.01562	66.604
ECTX2G6A	4383	AP 110	1	38.218		0.109	7	0.01558	66.604
ECTX2G7A	4383	AP 110	1	38.839		0.110	7	0.01566	66.604
ECNX2GAA	4383	AP 110	1		3.955	0.123	7	0.01754	66.604
ECNX2GBA	4383	AP 110	1		3.236	0.122	7	0.01738	66.604

*Specimens cut with fibers oriented ±30° to the lenghwise axis are reported but not included in totals

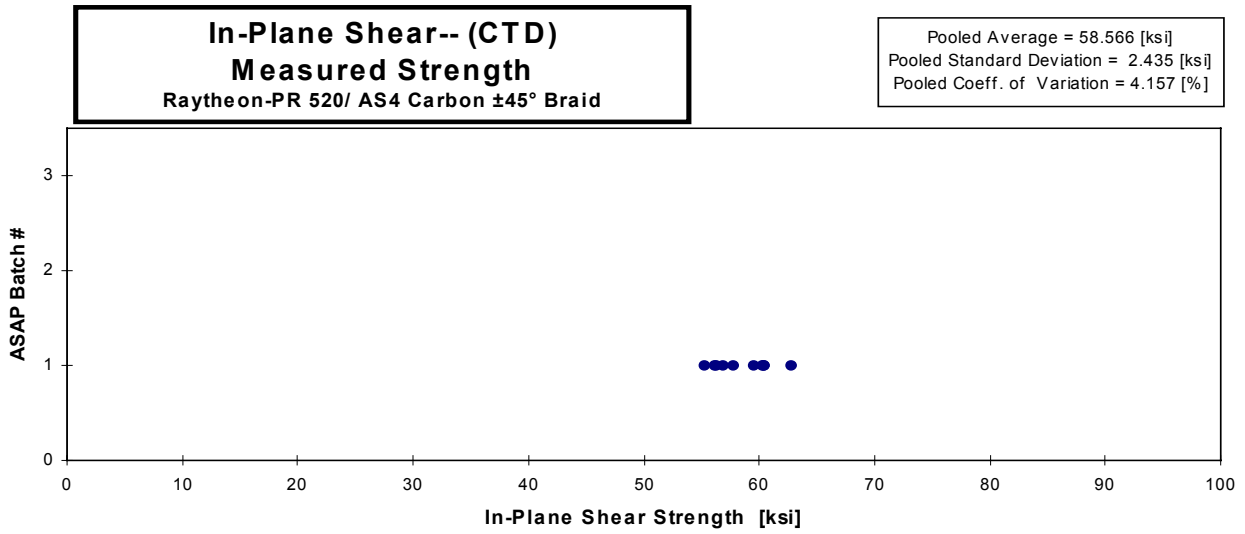
Average	**36.859**	**3.595**	**0.01649**	**68.142**
Standard Dev.	**1.456**	**0.508**		
Coeff. of Var. [%]	**3.951**	**14.140**		
Min.	**34.788**	**3.236**	**0.0156**	**66.604**
Max.	**38.839**	**3.955**	**0.0175**	**71.346**
Number of Spec.	**7**	**2**		

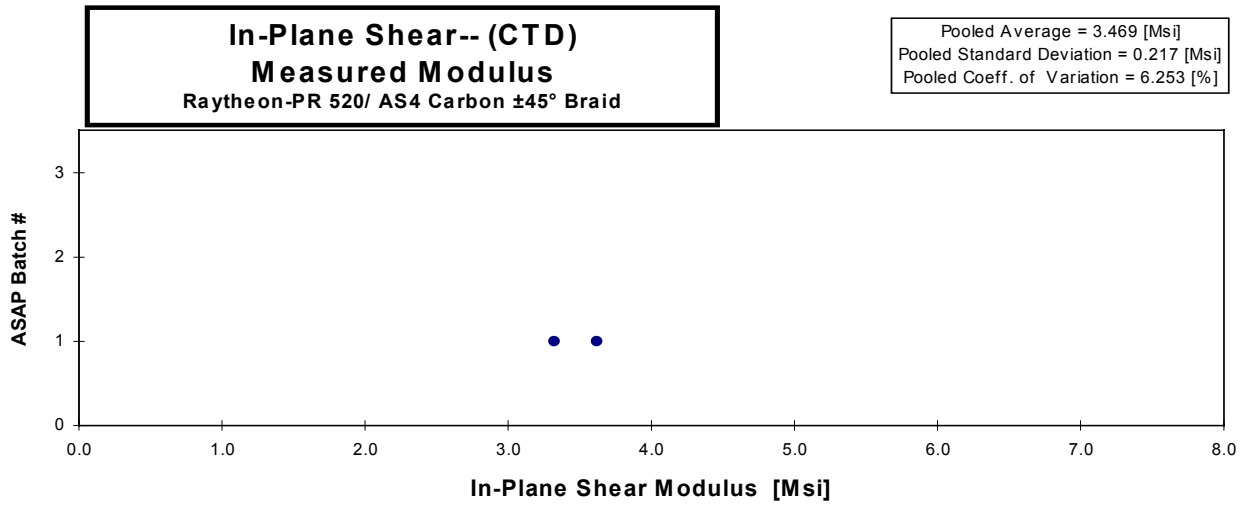




In-Plane Shear-- (CTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

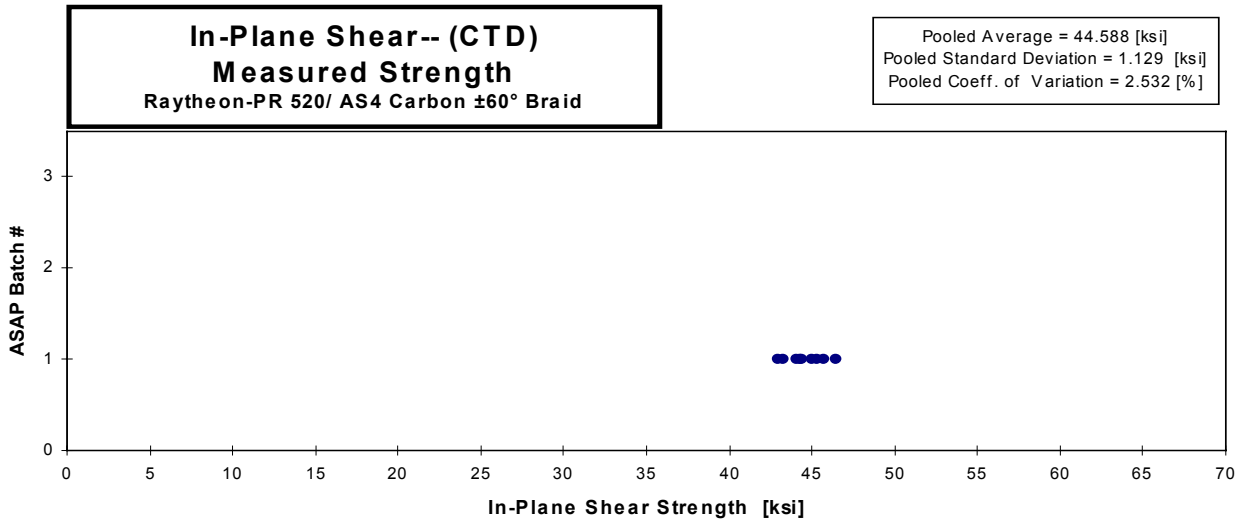
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBT12X1B	4383	AP 110	1	56.270		0.118	7	0.01686	58.648
EBT12X2B	4383	AP 110	1	57.796		0.118	7	0.01689	58.648
EBT12X3B	4383	AP 110	1	56.859		0.118	7	0.01688	58.648
EBT12X4B	4383	AP 110	1	56.135		0.119	7	0.01702	58.648
EBT12X5B	4383	AP 110	1	60.405		0.119	7	0.01705	58.648
EBT12X6B	4383	AP 110	1	62.727		0.118	7	0.01692	58.648
EBT12X7B	4383	AP 110	1	60.341		0.118	7	0.01690	58.648
EBT12X8B	4383	AP 110	1	59.525		0.119	7	0.01705	58.648
EBT12X9B	4383	AP 110	1	60.320		0.119	7	0.01698	58.648
EBT12XAB	4383	AP 110	1	55.277		0.119	7	0.01696	58.648
EBN1111B	4383	AP 110	1		3.316	0.118	7	0.01690	57.638
EBN1112B	4383	AP 110	1		3.623	0.119	7	0.01697	57.638
			Average	**58.566**	**3.469**			**0.01695**	**58.480**
			Standard Dev.	**2.435**	**0.217**				
			Coeff. of Var. [%]	**4.157**	**6.253**				
			Min.	**55.277**	**3.316**			**0.0169**	**57.638**
			Max.	**62.727**	**3.623**			**0.0171**	**58.648**
			Number of Spec.	**10**	**2**				

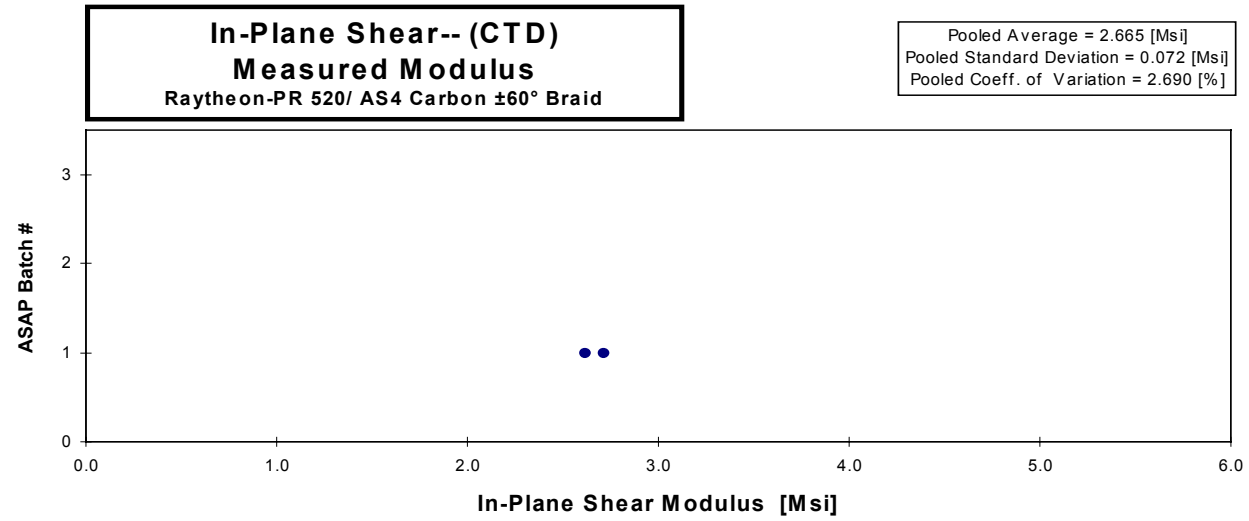




In-Plane Shear-- (CTD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

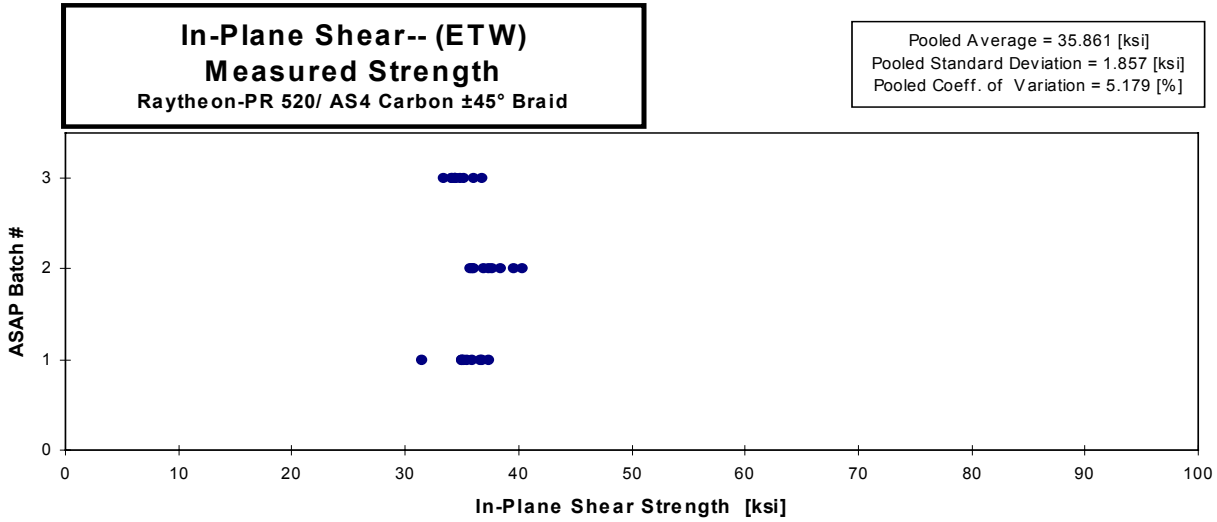
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECT12X1B	4383	AP 110	1	43.256		0.113	6	0.01878	58.726
ECT12X2B	4383	AP 110	1	45.678		0.111	6	0.01856	58.726
ECT12X3B	4383	AP 110	1	46.436		0.110	6	0.01835	58.726
ECT12X4B	4383	AP 110	1	44.959		0.110	6	0.01840	58.726
ECT12X5B	4383	AP 110	1	44.281		0.110	6	0.01833	58.726
ECT12X6B	4383	AP 110	1	45.331		0.111	6	0.01851	58.726
ECT12X7B	4383	AP 110	1	42.947		0.110	6	0.01830	58.726
ECT12X8B	4383	AP 110	1	44.346		0.111	6	0.01858	58.726
ECT12X9B	4383	AP 110	1	44.059		0.111	6	0.01845	58.726
ECN1118B	4383	AP 110	1		2.716	0.112	6	0.01863	60.387
ECN1119B	4383	AP 110	1		2.614	0.112	6	0.01861	60.387
			Average	**44.588**	**2.665**			**0.01850**	**59.028**
			Standard Dev.	**1.129**	**0.072**				
			Coeff. of Var. [%]	**2.532**	**2.690**				
			Min.	**42.947**	**2.614**			**0.0183**	**58.726**
			Max.	**46.436**	**2.716**			**0.0188**	**60.387**
			Number of Spec.	**9**	**2**				

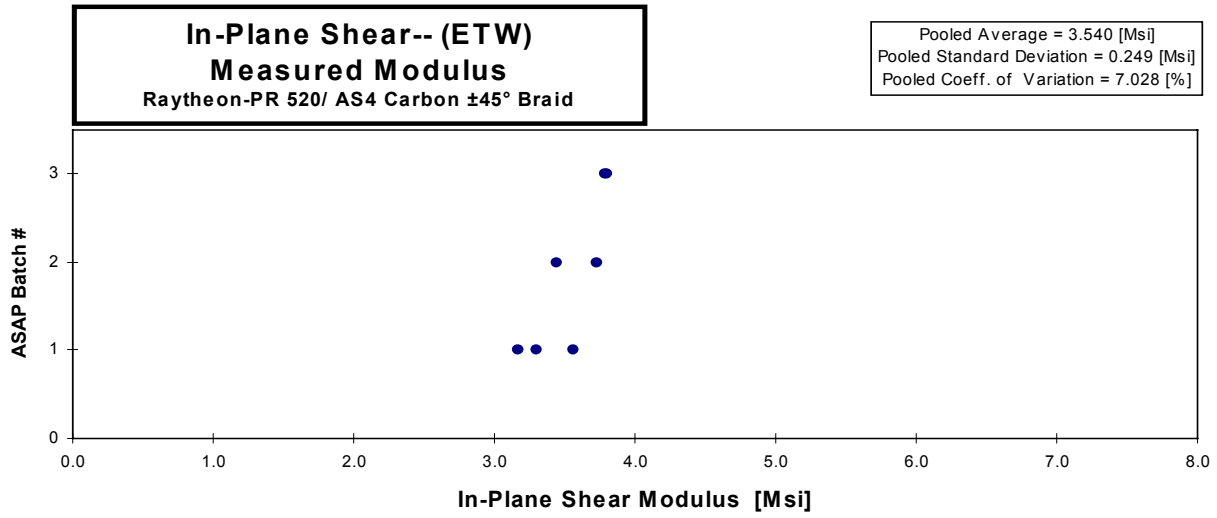




In-Plane Shear-- (ETW)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

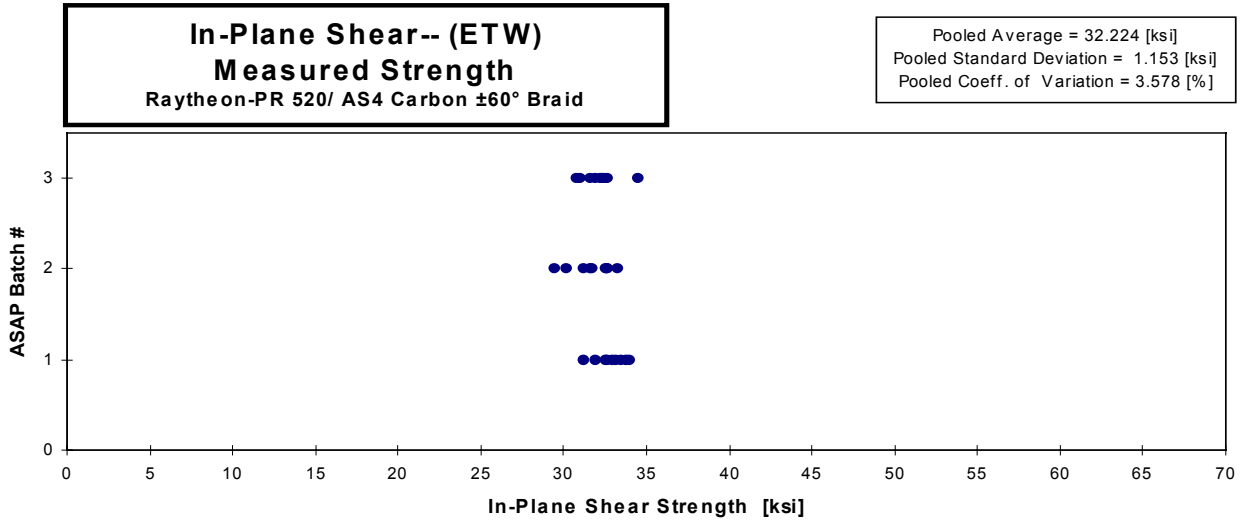
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBT1211F	4383	AP 110	1	35.886		0.120	7	0.01715	58.648
EBT1212F	4383	AP 110	1	35.161		0.119	7	0.01696	58.648
EBT1213F	4383	AP 110	1	37.310		0.120	7	0.01717	58.648
EBT1214F	4383	AP 110	1	35.421		0.120	7	0.01709	58.648
EBT1215F	4383	AP 110	1	34.941		0.121	7	0.01728	58.648
EBT1216F	4383	AP 110	1	36.563		0.119	7	0.01707	58.648
EBT1217F	4383	AP 110	1	35.035		0.120	7	0.01714	58.648
EBT1218F	4383	AP 110	1	31.526		0.119	7	0.01706	58.648
EBT1219F	4383	AP 110	1	36.820		0.121	7	0.01724	58.648
EBN1121F	4383	AP 110	1		3.565	0.118	7	0.01681	57.638
EBN1122F	4383	AP 110	1		3.294	0.119	7	0.01701	57.638
EBN1123F	4383	AP 110	1		3.172	0.120	7	0.01710	57.638
EBT2121F	4383	AP 109	2	39.598		0.119	7	0.01695	59.857
EBT2122F	4383	AP 109	2	38.432		0.118	7	0.01691	59.857
EBT2123F	4383	AP 109	2	37.729		0.119	7	0.01695	59.857
EBT2124F	4383	AP 109	2	35.987		0.119	7	0.01694	59.857
EBT2125F	4383	AP 109	2	35.706		0.119	7	0.01694	59.857
EBT2126F	4383	AP 109	2	40.375		0.118	7	0.01693	59.857
EBT2127F	4383	AP 109	2	37.310		0.119	7	0.01702	59.857
EBT2128F	4383	AP 109	2	35.930		0.119	7	0.01697	59.857
EBT2129F	4383	AP 109	2	36.886		0.119	7	0.01693	59.857
EBN2111F	4383	AP 109	2		3.722	0.118	7	0.01693	59.857
EBN2112F	4383	AP 109	2		3.435	0.119	7	0.01695	59.857
EBT3121F	3968	AP 109	3	33.415		0.119	7	0.01698	57.915
EBT3131F	3968	AP 109	3	34.389		0.119	7	0.01704	57.915
EBT3132F	3968	AP 109	3	34.061		0.119	7	0.01699	57.915
EBT3133F	3968	AP 109	3	36.733		0.119	7	0.01699	57.915
EBT3134F	3968	AP 109	3	35.113		0.118	7	0.01686	57.915
EBT3135F	3968	AP 109	3	34.818		0.119	7	0.01701	57.915
EBT3136F	3968	AP 109	3	36.000		0.117	7	0.01678	57.915
EBT3137F	3968	AP 109	3	34.482		0.118	7	0.01686	57.915
EBT3138F	3968	AP 109	3	34.346		0.118	7	0.01692	57.915
EBT3139F	3968	AP 109	3	34.137		0.118	7	0.01687	57.915
EBN3111F	3968	AP 109	3		3.802	0.118	7	0.01689	57.915
EBN3112F	3968	AP 109	3		3.789	0.119	7	0.01696	57.915
			Average	**35.861**	**3.540**			**0.01699**	**58.690**
			Standard Dev.	**1.857**	**0.249**				
			Coeff. of Var. [%]	**5.179**	**7.028**				
			Min.	**31.526**	**3.172**			**0.0168**	**57.638**
			Max.	**40.375**	**3.802**			**0.0173**	**59.857**
			Number of Spec.	**28**	**7**				

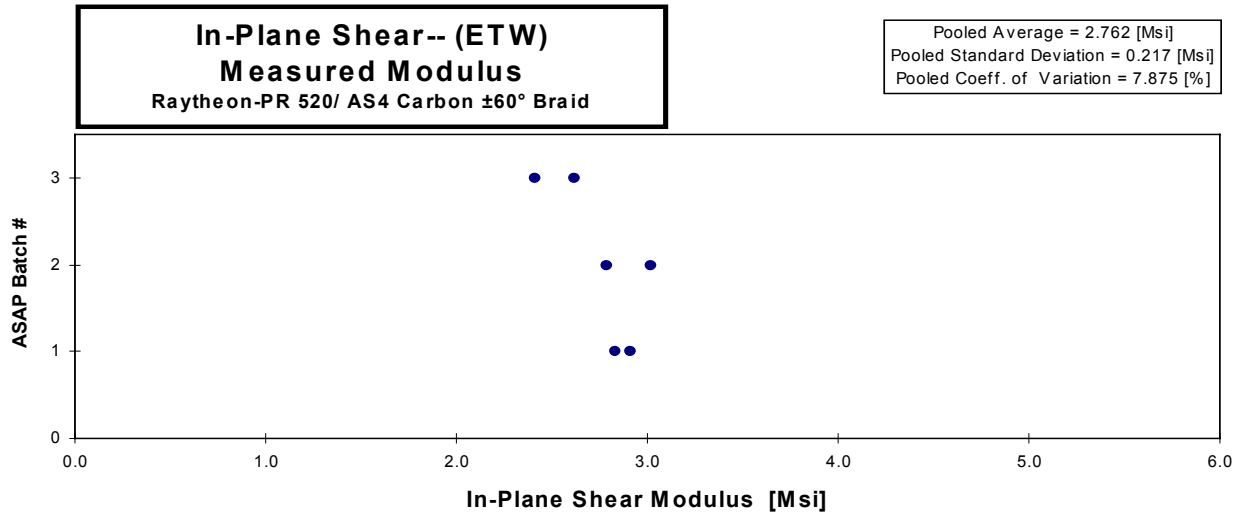




In-Plane Shear-- (ETW)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

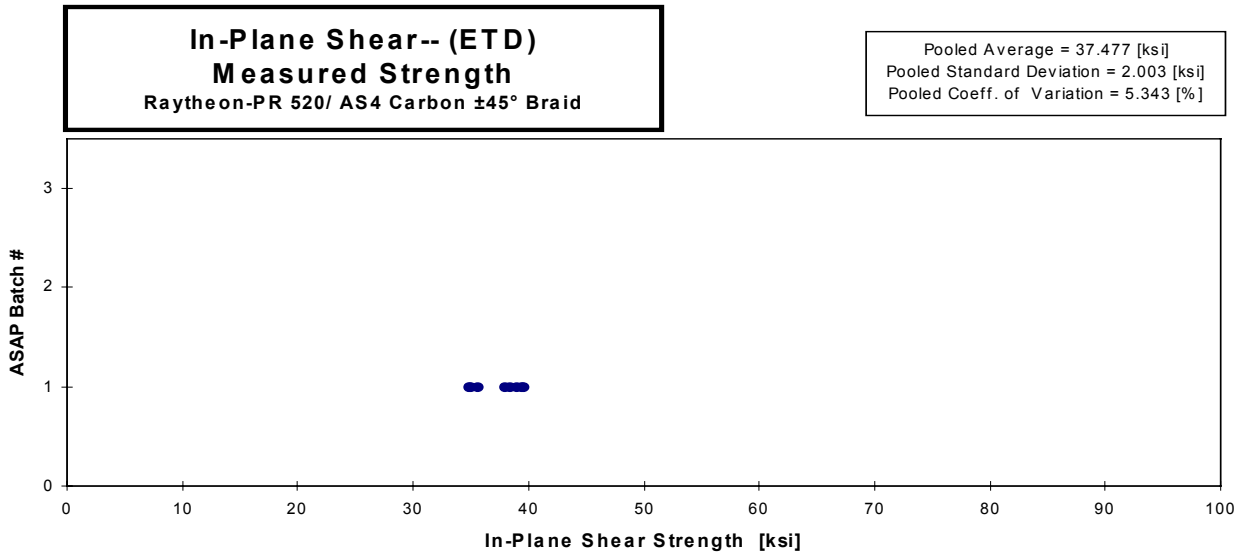
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECT1122F	4383	AP 110	1	33.942		0.112	6	0.01865	60.387
ECT1123F	4383	AP 110	1	32.649		0.112	6	0.01859	60.387
ECT1125F	4383	AP 110	1	31.232		0.111	6	0.01846	60.387
ECT1127F	4383	AP 110	1	32.508		0.110	6	0.01837	60.387
ECT1128F	4383	AP 110	1	33.503		0.110	6	0.01838	60.387
ECT1129F	4383	AP 110	1	32.943		0.112	6	0.01867	60.387
ECT112AF	4383	AP 110	1	31.919		0.112	6	0.01874	60.387
ECT112BF	4383	AP 110	1	33.096		0.114	6	0.01892	60.387
ECT112CF	4383	AP 110	1	33.731		0.112	6	0.01869	60.387
ECN1111F	4383	AP 110	1		2.826	0.115	6	0.01922	60.387
ECN1112F	4383	AP 110	1		2.913	0.114	6	0.01905	60.387
ECT2121F	4383	AP 109	2	32.636		0.114	6	0.01896	57.821
ECT2122F	4383	AP 109	2	31.741		0.113	6	0.01888	57.821
ECT2123F	4383	AP 109	2	32.479		0.113	6	0.01879	57.821
ECT2124F	4383	AP 109	2	29.423		0.115	6	0.01919	57.821
ECT2125F	4383	AP 109	2	31.158		0.114	6	0.01904	57.821
ECT2126F	4383	AP 109	2	30.123		0.115	6	0.01910	57.821
ECT2127F	4383	AP 109	2	32.666		0.112	6	0.01868	57.821
ECT2128F	4383	AP 109	2	33.299		0.113	6	0.01879	57.821
ECT2129F	4383	AP 109	2	31.650		0.114	6	0.01892	57.821
ECN2111F	4383	AP 109	2		2.784	0.115	6	0.01918	57.821
EVN2112F	4383	AP 109	2		3.018	0.114	6	0.01908	57.821
ECT3121F	3968	AP 109	3	31.896		0.113	6	0.01885	60.938
ECT3122F	3968	AP 109	3	31.609		0.112	6	0.01865	60.938
ECT3123F	3968	AP 109	3	32.231		0.114	6	0.01898	60.938
ECT3124F	3968	AP 109	3	32.367		0.113	6	0.01876	60.938
ECT3125F	3968	AP 109	3	30.751		0.114	6	0.01893	60.938
ECT3126F	3968	AP 109	3	32.615		0.112	6	0.01871	60.938
ECT3127F	3968	AP 109	3	30.960		0.115	6	0.01916	60.938
ECT3128F	3968	AP 109	3	32.433		0.112	6	0.01870	60.938
ECT3129F	3968	AP 109	3	34.477		0.111	6	0.01858	60.938
ECN3111F	3968	AP 109	3		2.413	0.114	6	0.01894	60.938
ECN3113F	3968	AP 109	3		2.616	0.113	6	0.01889	60.938
			Average	**32.224**	**2.762**			**0.01883**	**59.715**
			Standard Dev.	**1.153**	**0.217**				
			Coeff. of Var. [%]	**3.578**	**7.875**				
			Min.	**29.423**	**2.413**			**0.0184**	**57.821**
			Max.	**34.477**	**3.018**			**0.0192**	**60.938**
			Number of Spec.	**27**	**6**				

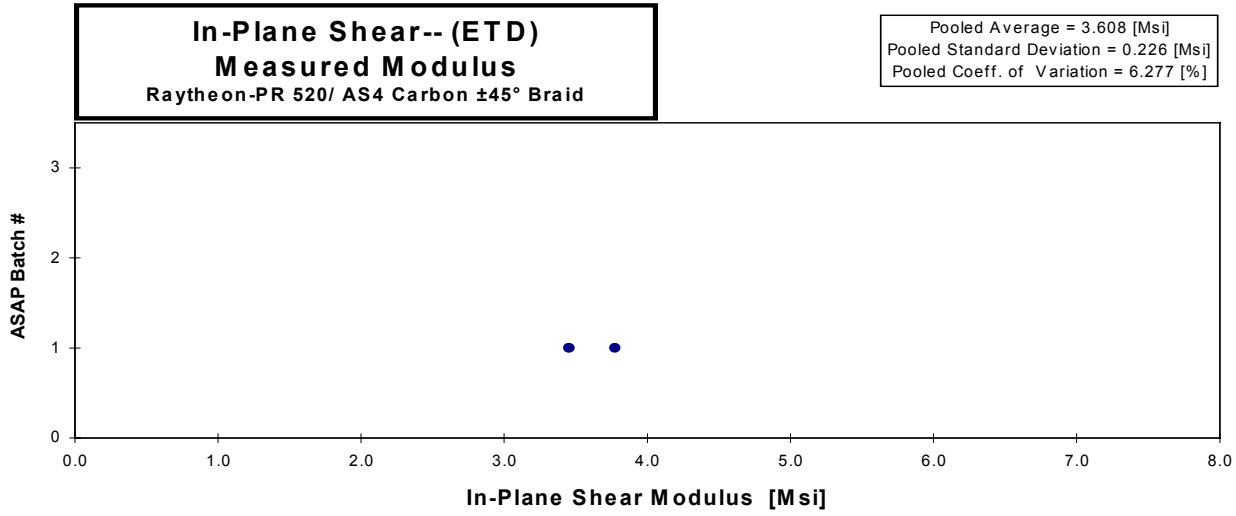




In-Plane Shear-- (ETD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±45° Braid

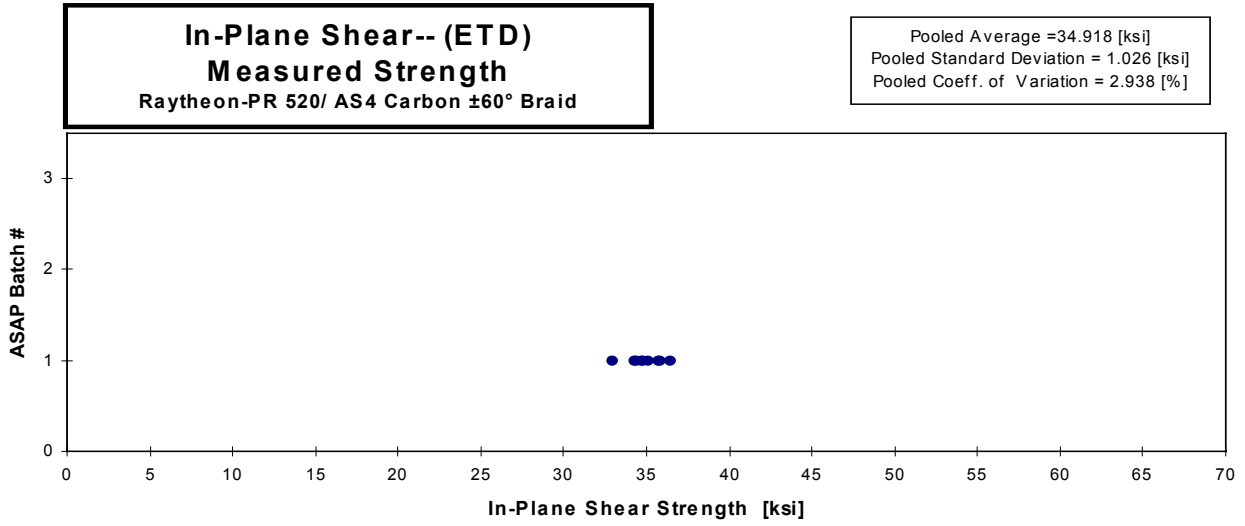
Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBT1221G	4383	AP 110	1	38.980		0.119	7	0.01695	58.648
EBT1222G	4383	AP 110	1	39.409		0.119	7	0.01698	58.648
EBT1223G	4383	AP 110	1	35.073		0.119	7	0.01702	58.648
EBT1224G	4383	AP 110	1	35.580		0.118	7	0.01692	58.648
EBT1225G	4383	AP 110	1	34.789		0.119	7	0.01693	58.648
EBT1226G	4383	AP 110	1	38.023		0.118	7	0.01687	58.648
EBT1227G	4383	AP 110	1	39.552		0.119	7	0.01696	58.648
EBT1228G	4383	AP 110	1	38.411		0.118	7	0.01681	58.648
EBN1115G	4383	AP 110	1		3.768	0.119	7	0.01695	57.638
EBN1116G	4383	AP 110	1		3.448	0.119	7	0.01696	57.638
			Average	**37.477**	**3.608**			**0.01694**	**58.446**
			Standard Dev.	**2.003**	**0.226**				
			Coeff. of Var. [%]	**5.343**	**6.277**				
			Min.	**34.789**	**3.448**			**0.0168**	**57.638**
			Max.	**39.552**	**3.768**			**0.0170**	**58.648**
			Number of Spec.	**8**	**2**				

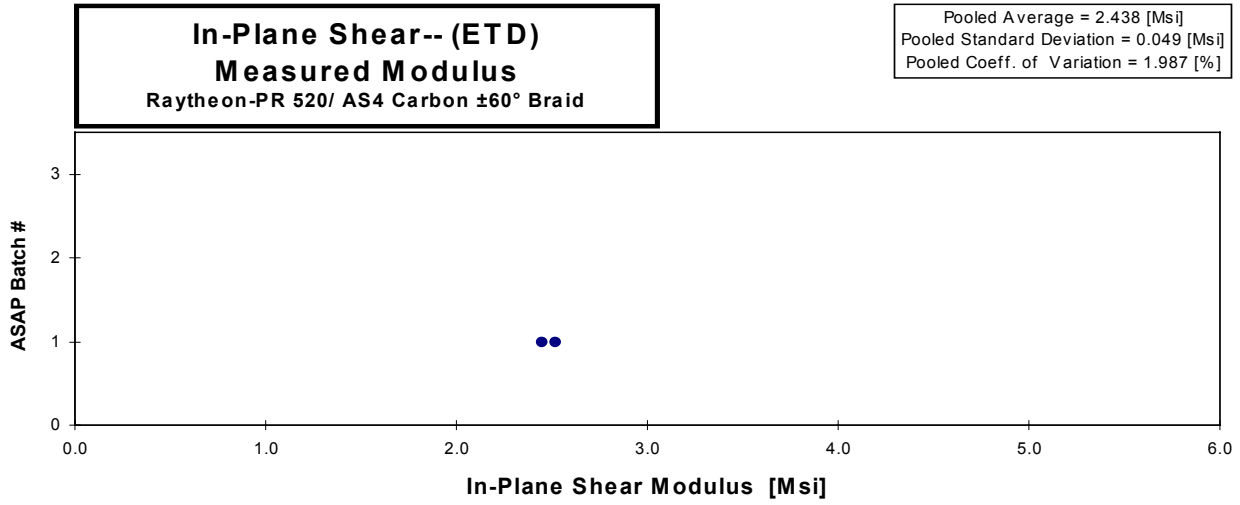




In-Plane Shear-- (ETD)
Strength & Modulus
Raytheon-PR 520/ AS4 Carbon ±60° Braid

Specimen Number	Resin Batch#	Fiber Batch#	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
ECT1211G	4383	AP 110	1	32.972		0.114	6	0.01902	58.726
ECT1212G	4383	AP 110	1	35.118		0.112	6	0.01865	58.726
ECT1213G	4383	AP 110	1	34.795		0.112	6	0.01873	58.726
ECT1214G	4383	AP 110	1	34.406		0.111	6	0.01858	58.726
ECT1215G	4383	AP 110	1	35.863		0.112	6	0.01866	58.726
ECT1216G	4383	AP 110	1	35.728		0.110	6	0.01837	58.726
ECT1217G	4383	AP 110	1	36.428		0.111	6	0.01855	58.726
ECT1218G	4383	AP 110	1	34.694		0.113	6	0.01879	58.726
ECT1219G	4383	AP 110	1	34.258		0.112	6	0.01870	58.726
ECN111BG	4383	AP 110	1		2.448	0.113	6	0.01891	60.387
ECN111CG	4383	AP 110	1		2.518	0.113	6	0.01891	60.387
			Average	**34.918**	**2.483**			**0.01872**	**59.028**
			Standard Dev.	**1.026**	**0.049**				
			Coeff. of Var. [%]	**2.938**	**1.987**				
			Min.	**32.972**	**2.448**			**0.0184**	**58.726**
			Max.	**36.428**	**2.518**			**0.0190**	**60.387**
			Number of Spec.	**9**	**2**				

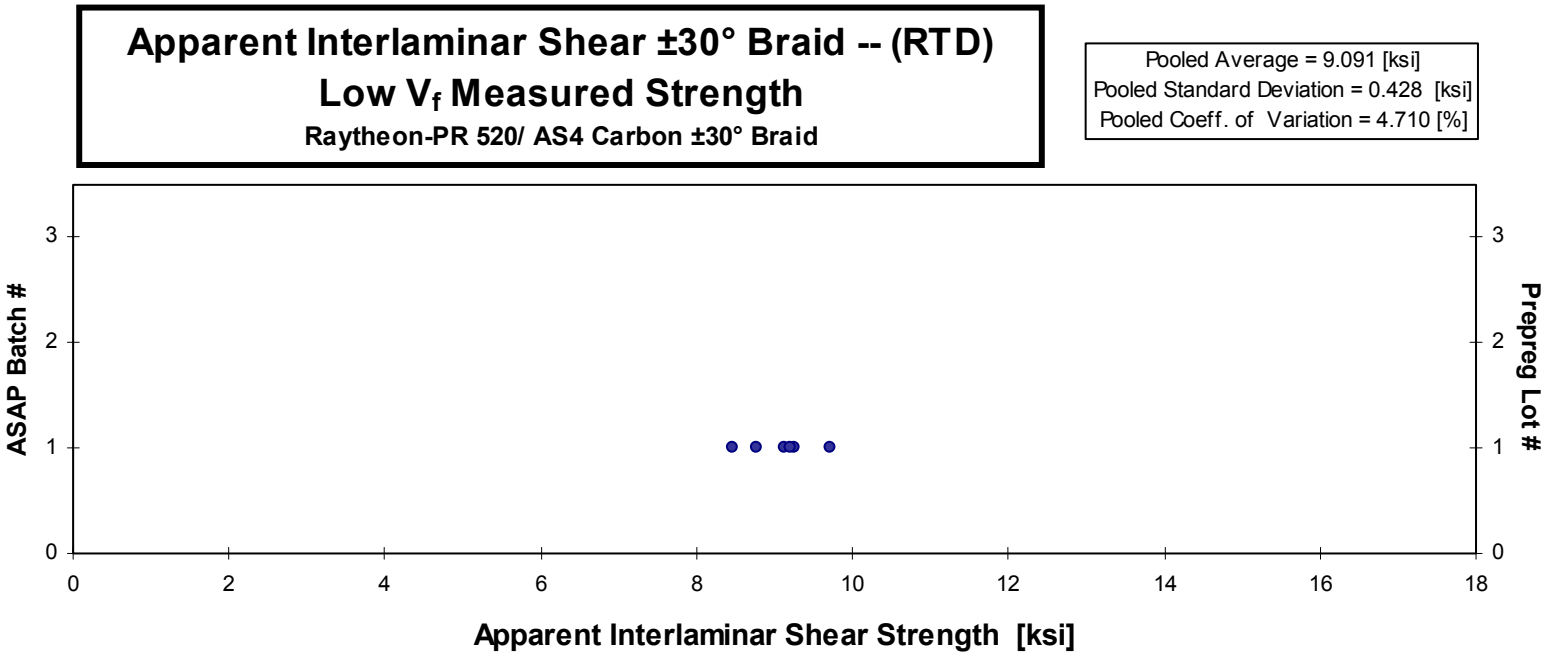




Apparent Interlaminar Shear ±30° Braid -- (RTD)
Low V_f Strength
Raytheon-PR 520/ AS4 Carbon ±30° Braid

Specimen Number	Resin Batch #	Fiber Batch #	ASAP Batch #	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV %
ECBX2L1A	4383	AP 110	1	8.472	0.111	5	0.02217	51.325
ECBX2L2A	4383	AP 110	1	9.262	0.110	5	0.02205	51.325
ECBX2L3A	4383	AP 110	1	9.130	0.110	5	0.02206	51.325
ECBX2L4A	4383	AP 110	1	9.192	0.110	5	0.02206	51.325
ECBX2L5A	4383	AP 110	1	8.773	0.110	5	0.02208	51.325
ECBX2L6A	4383	AP 110	1	9.716	0.110	5	0.02204	51.325

Average	**9.091**	**0.0221**	**51.325**
Standard Dev.	**0.428**		
Coeff. of Var. [%]	**4.710**		
Min.	**8.472**	**0.0220**	**51.325**
Max.	**9.716**	**0.0222**	**51.325**
Number of Spec.	**6**		

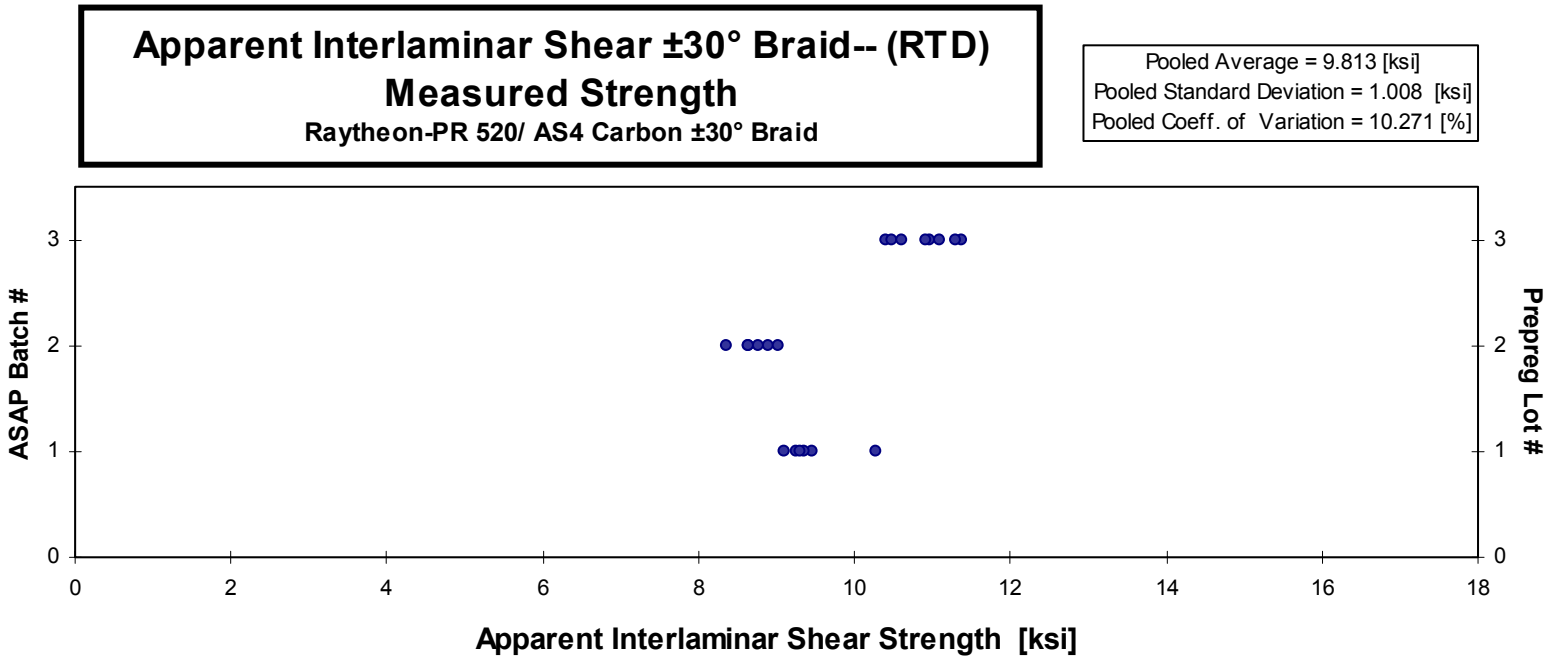


Apparent Interlaminar Shear ±30° Braid -- (RTD) Strength

Raytheon-PR 520/ AS4 Carbon ±30° Braid

Specimen Number	Resin Batch #	Fiber Batch #	ASAP Batch #	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV %
ECB11U1A	4383	AP 110	1	9.455	0.114	6	0.01895	60.309
ECB11U2A	4383	AP 110	1	9.256	0.114	6	0.01893	60.309
ECB11U3A	4383	AP 110	1	9.349	0.114	6	0.01892	60.309
ECB11U4A	4383	AP 110	1	9.302	0.113	6	0.01891	60.309
ECB11U5A	4383	AP 110	1	10.281	0.114	6	0.01907	60.309
ECB11U6A	4383	AP 110	1	9.106	0.114	6	0.01893	60.309
ECB21J1A	4383	AP 109	2	8.887	0.114	6	0.01903	61.447
ECB21J2A	4383	AP 109	2	8.652	0.115	6	0.01915	61.447
ECB21J3A	4383	AP 109	2	8.651	0.114	6	0.01908	61.447
ECB21J4A	4383	AP 109	2	9.036	0.115	6	0.01912	61.447
ECB21J6A	4383	AP 109	2	8.765	0.115	6	0.01913	61.447
ECB21J7A	4383	AP 109	2	8.356	0.115	6	0.01920	61.447
ECB3123A	3968	AP 109	3	10.412	0.113	6	0.01879	59.919
ECB3124A	3968	AP 109	3	10.972	0.112	6	0.01864	59.919
ECB3125A	3968	AP 109	3	11.365	0.113	6	0.01880	59.919
ECB3126A	3968	AP 109	3	11.301	0.112	6	0.01872	59.919
ECB3127A	3968	AP 109	3	10.486	0.112	6	0.01874	59.919
ECB3128A	3968	AP 109	3	11.104	0.112	6	0.01867	59.919
ECB3129A	3968	AP 109	3	10.905	0.113	6	0.01877	59.919
ECB312AA	3968	AP 109	3	10.617	0.112	6	0.01873	59.919

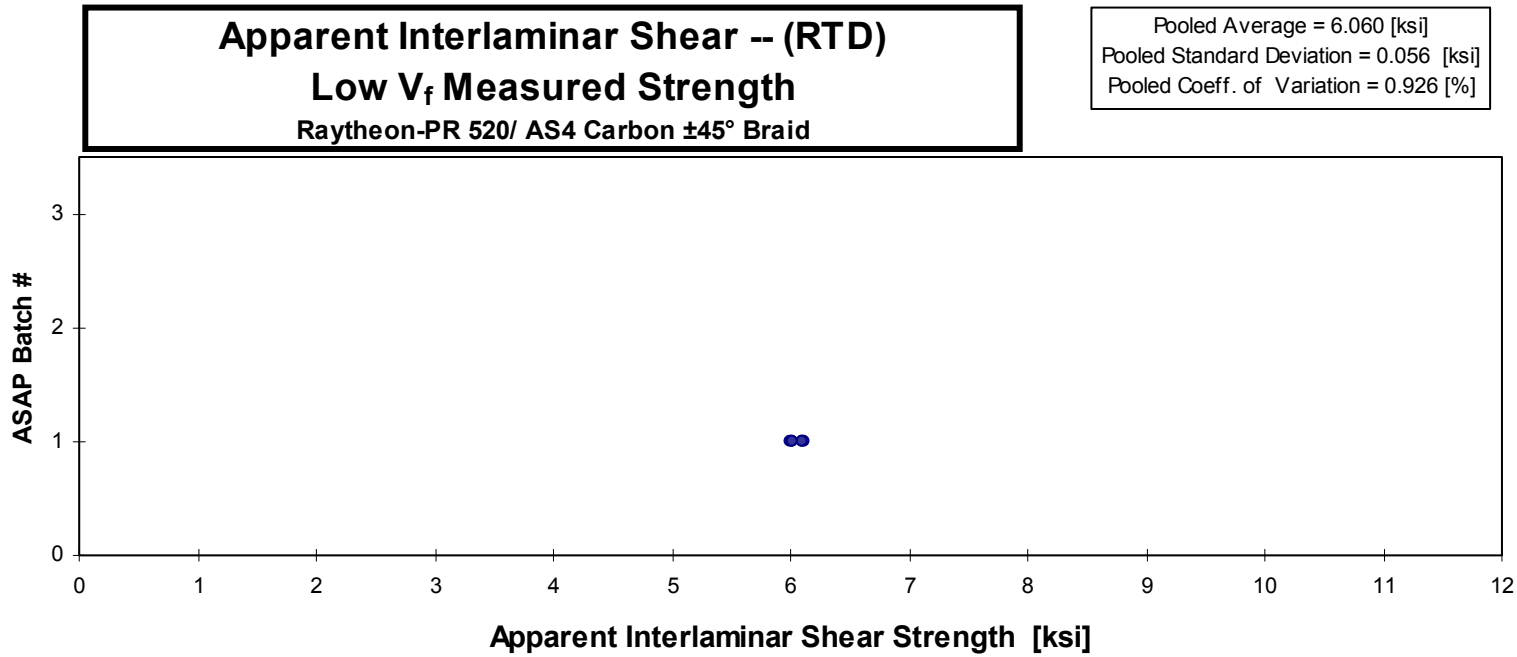
Average	**9.813**	**0.0189**	**60.494**
Standard Dev.	**1.008**		
Coeff. of Var. [%]	**10.271**		
Min.	**8.356**	**0.0186**	**59.919**
Max.	**11.365**	**0.0192**	**61.447**
Number of Spec.	**20**		



Apparent Interlaminar Shear -- (RTD)
Low V_f Strength
Raytheon-PR 520/ AS4 Carbon ±45° Braid

Specimen Number	Resin Batch #	Fiber Batch #	ASAP Batch #	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBQX1L1A	4383	AP 110	1	6.096	0.118	6	0.01966	49.472
EBQX1L2A	4383	AP 110	1	5.997	0.119	6	0.01977	49.472
EBQX1L3A	4383	AP 110	1	6.018	0.118	6	0.01973	49.472
EBQX1L4A	4383	AP 110	1	6.126	0.119	6	0.01982	49.472
EBQX1L5A	4383	AP 110	1	6.108	0.118	6	0.01973	49.472
EBQX1L6A	4383	AP 110	1	6.014	0.119	6	0.01976	49.472

Average	**6.060**	**0.0197**	**49.472**
Standard Dev.	**0.056**		
Coeff. of Var. [%]	**0.926**		
Min.	**5.997**	**0.0197**	**49.472**
Max.	**6.126**	**0.0198**	**49.472**
Number of Spec.	**6**		

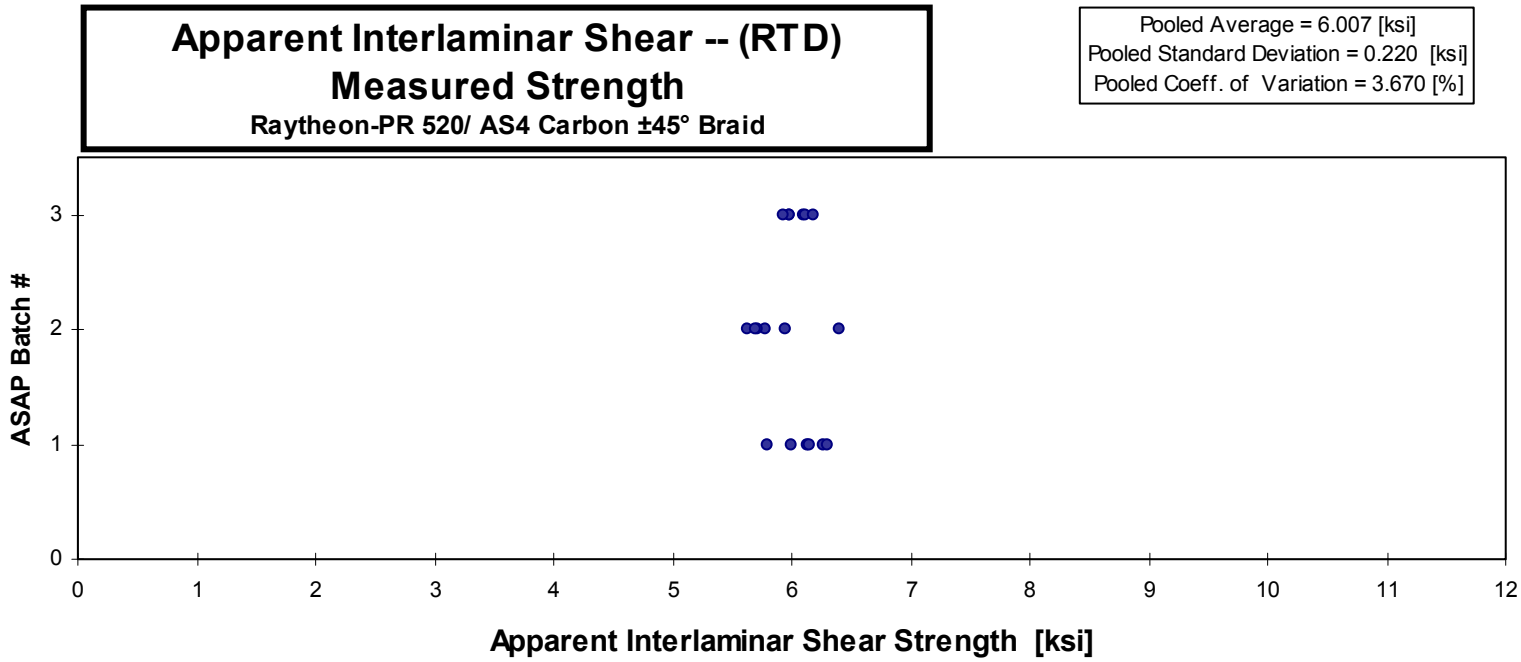


Apparent Interlaminar Shear -- (RTD) Strength

Raytheon-PR 520/ AS4 Carbon ±45° Braid

Specimen Number	Resin Batch #	Fiber Batch #	ASAP Batch #	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBQ1125A	4383	AP 110	1	6.132	0.119	7	0.01701	57.638
EBQ1126A	4383	AP 110	1	6.272	0.120	7	0.01717	57.638
EBQ1127A	4383	AP 110	1	6.003	0.119	7	0.01697	57.638
EBQ1128A	4383	AP 110	1	5.801	0.126	7	0.01803	57.638
EBQ1129A	4383	AP 110	1	6.296	0.119	7	0.01704	57.638
EBQ112AA	4383	AP 110	1	6.143	0.119	7	0.01702	57.638
EBQ2121A	4383	AP 109	2	5.629	0.119	7	0.01701	58.973
EBQ2122A	4383	AP 109	2	5.941	0.119	7	0.01705	58.973
EBQ2123A	4383	AP 109	2	5.779	0.119	7	0.01705	58.973
EBQ2124A	4383	AP 109	2	6.405	0.119	7	0.01696	58.973
EBQ2125A	4383	AP 109	2	5.718	0.120	7	0.01716	58.973
EBQ2126A	4383	AP 109	2	5.703	0.118	7	0.01692	58.973
EBQ3121A	4383	AP 109	3	5.990	0.119	7	0.01696	59.055
EBQ3122A	4383	AP 109	3	6.100	0.119	7	0.01695	59.055
EBQ3123A	4383	AP 109	3	5.979	0.120	7	0.01713	59.055
EBQ3124A	4383	AP 109	3	6.124	0.118	7	0.01689	59.055
EBQ3125A	4383	AP 109	3	5.930	0.119	7	0.01695	59.055
EBQ3126A	4383	AP 109	3	6.188	0.118	7	0.01690	59.055

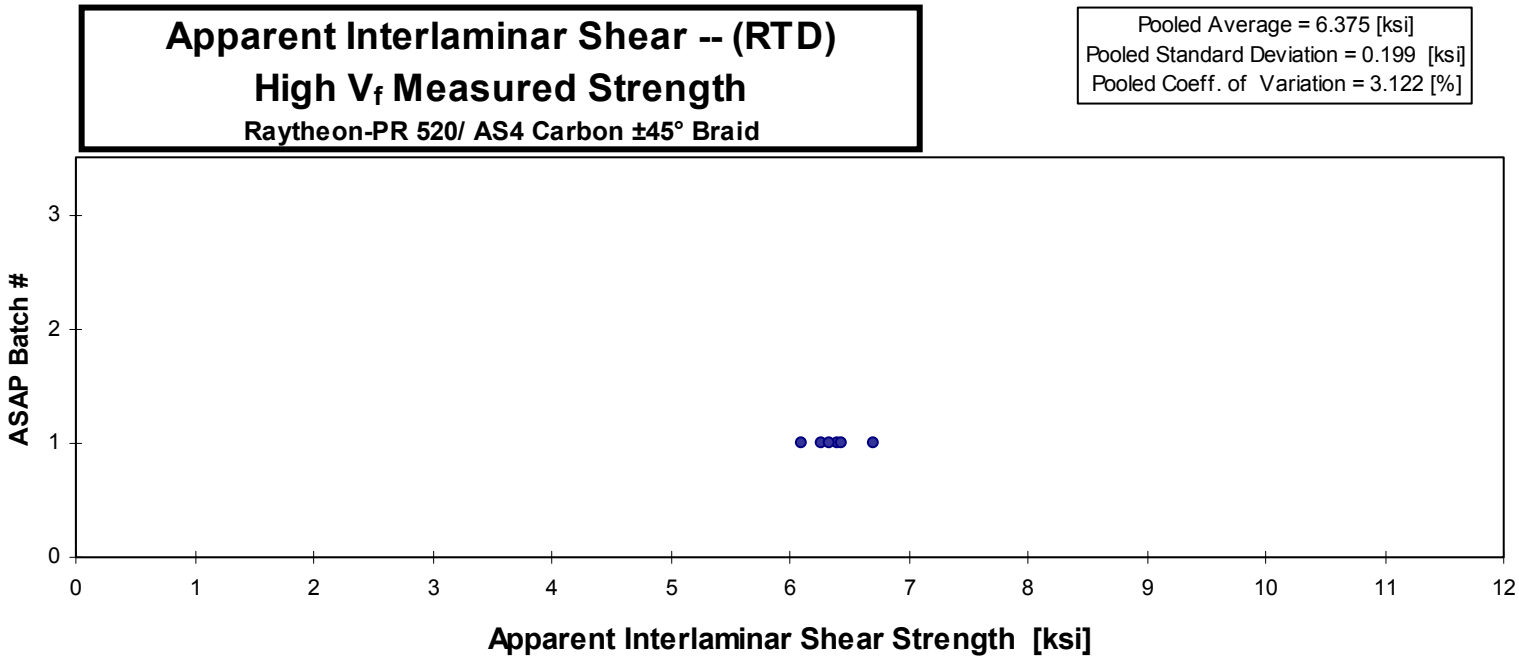
Average	**6.007**	**0.0171**	**58.555**
Standard Dev.	**0.220**		
Coeff. of Var. [%]	**3.670**		
Min.	**5.629**	**0.0169**	**57.638**
Max.	**6.405**	**0.0180**	**59.055**
Number of Spec.	**18**		



Apparent Interlaminar Shear -- (RTD)
High V_f Strength
Raytheon-PR 520/ AS4 Carbon ±45° Braid

Specimen Number	Resin Batch #	Fiber Batch #	ASAP Batch #	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV (%)
EBQX1G1A	4383	AP 110	1	6.276	0.122	8	0.01524	64.434
EBQX1G2A	4383	AP 110	1	6.402	0.121	8	0.01518	64.434
EBQX1G3A	4383	AP 110	1	6.436	0.122	8	0.01521	64.434
EBQX1G4A	4383	AP 110	1	6.330	0.121	8	0.01514	64.434
EBQX1G5A	4383	AP 110	1	6.104	0.122	8	0.01524	64.434
EBQX1G6A	4383	AP 110	1	6.704	0.122	8	0.01524	64.434

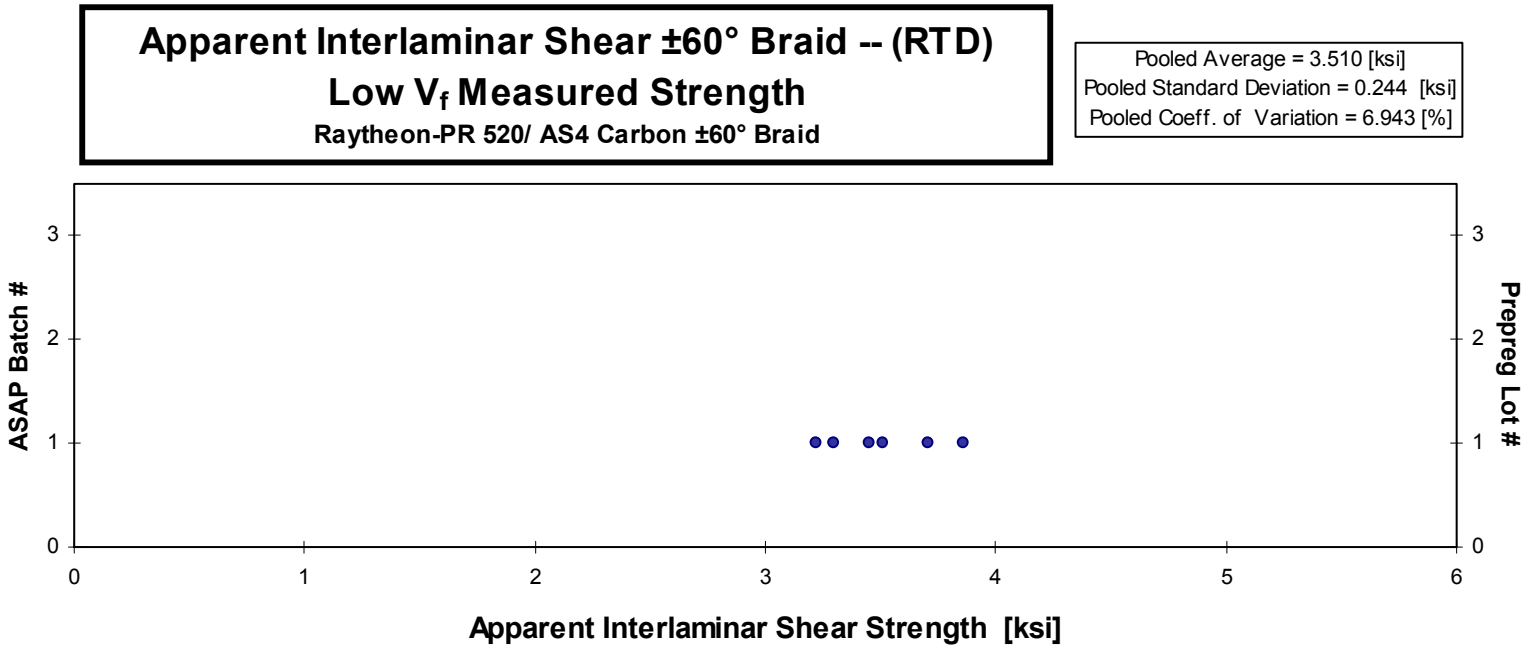
Average	**6.375**	**0.0152**	**64.434**
Standard Dev.	**0.199**		
Coeff. of Var. [%]	**3.122**		
Min.	**6.104**	**0.0151**	**64.434**
Max.	**6.704**	**0.0152**	**64.434**
Number of Spec.	**6**		



Apparent Interlaminar Shear ±60° Braid -- (RTD)
Low V_f Strength
Raytheon-PR 520/ AS4 Carbon ±60° Braid

Specimen Number	Resin Batch #	Fiber Batch #	ASAP Batch #	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV %
ECAX1L1A	4383	AP 110	1	3.862	0.112	5	0.02247	50.038
ECAX1L2A	4383	AP 110	1	3.711	0.112	5	0.02237	50.038
ECAX1L4A	4383	AP 110	1	3.297	0.115	5	0.02293	50.038
ECAX1L5A	4383	AP 110	1	3.453	0.111	5	0.02213	50.038
ECAX1L6A	4383	AP 110	1	3.514	0.112	5	0.02249	50.038
ECAX1L7A	4383	AP 110	1	3.220	0.112	5	0.02245	50.038

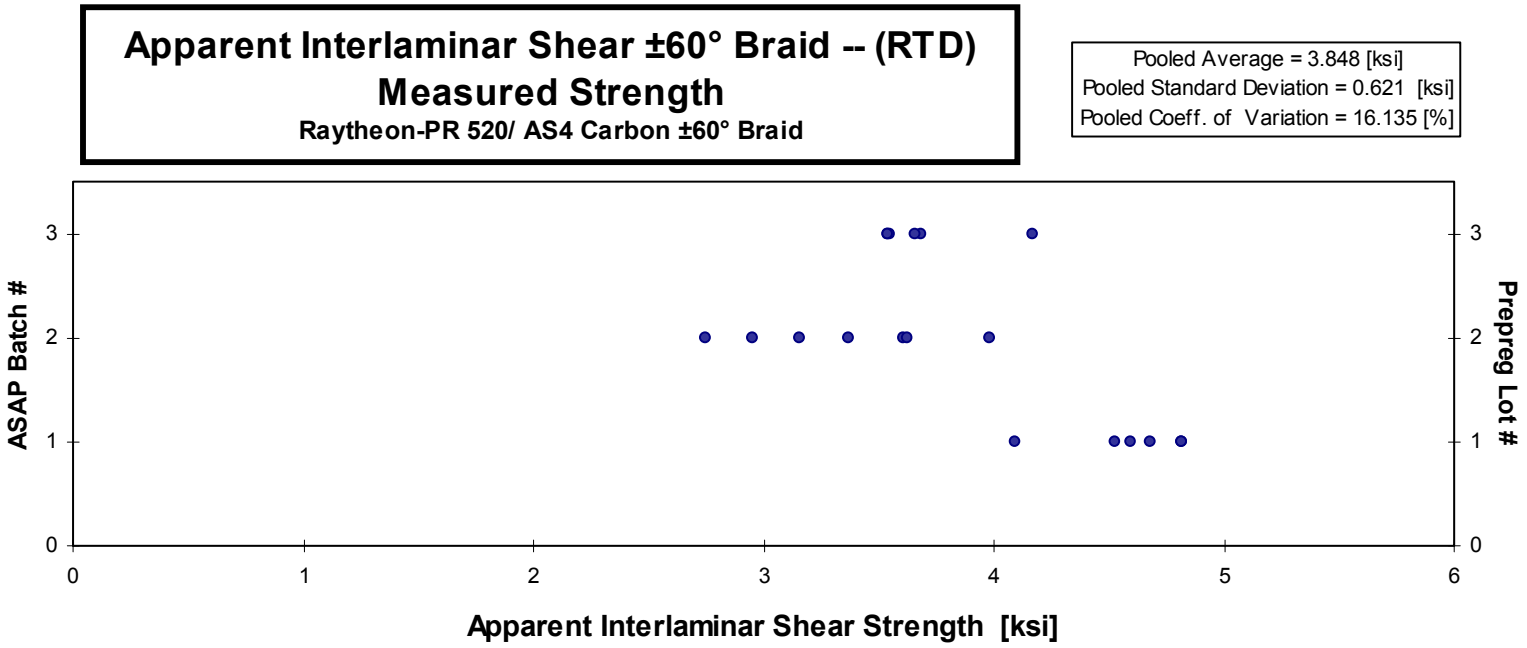
Average	**3.510**	**0.0225**	**50.038**
Standard Dev.	**0.244**		
Coeff. of Var. [%]	**6.943**		
Min.	**3.220**	**0.0221**	**50.038**
Max.	**3.862**	**0.0229**	**50.038**
Number of Spec.	**6**		



Apparent Interlaminar Shear ±60° Braid -- (RTD) Strength

Raytheon-PR 520/ AS4 Carbon ±60° Braid

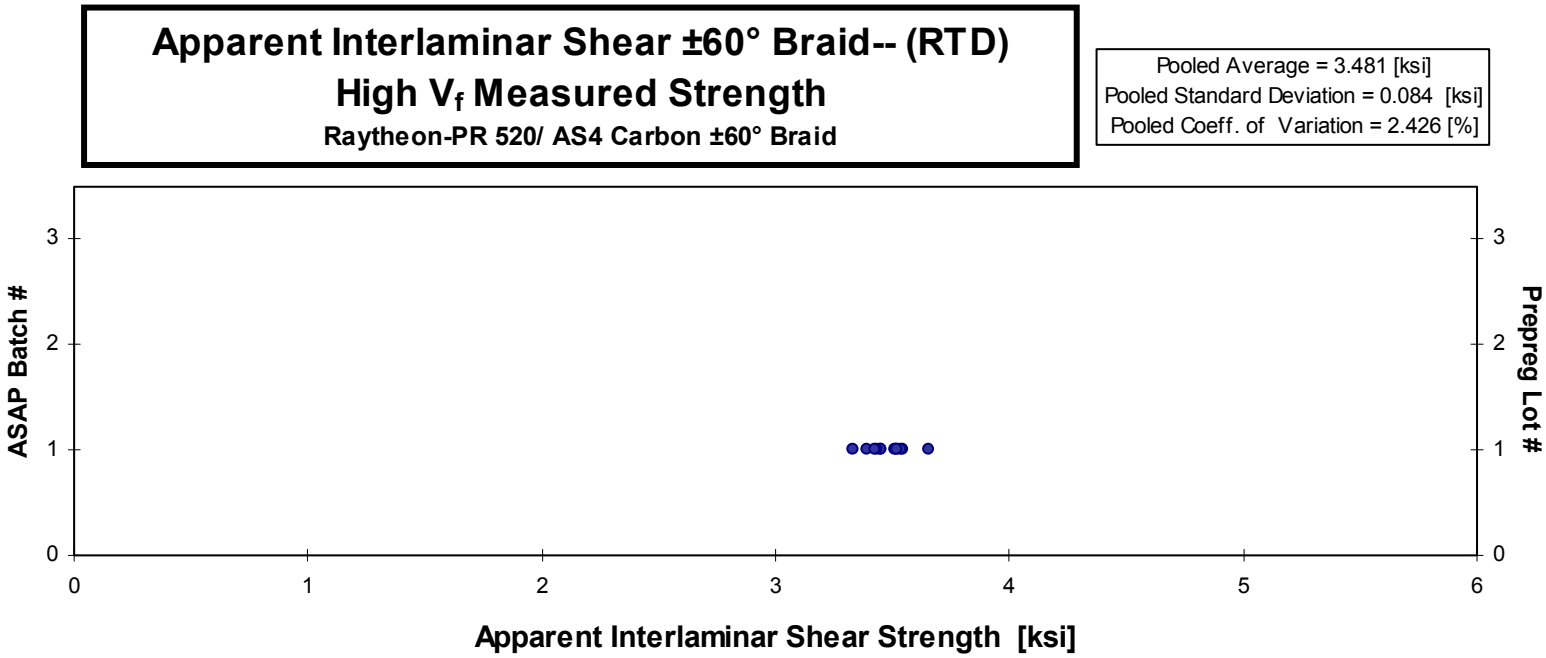
Specimen Number	Resin Batch #	Fiber Batch #	ASAP Batch #	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV %
ECA1124A	4383	AP 110	1	4.821	0.113	6	0.01891	60.309
ECA1125A	4383	AP 110	1	4.524	0.114	6	0.01893	60.309
ECA1126A	4383	AP 110	1	4.094	0.114	6	0.01906	60.309
ECA1127A	4383	AP 110	1	4.594	0.113	6	0.01886	60.309
ECA1129A	4383	AP 110	1	4.680	0.115	6	0.01910	60.309
ECA112AA	4383	AP 110	1	4.814	0.113	6	0.01880	60.309
ECA2122A	4383	AP 109	2	2.748	0.116	6	0.01928	58.517
ECA2123A	4383	AP 109	2	3.370	0.115	6	0.01918	58.517
ECA2126A	4383	AP 109	2	3.987	0.115	6	0.01919	58.517
ECA2127A	4383	AP 109	2	3.157	0.116	6	0.01927	58.517
ECA2128A	4383	AP 109	2	2.949	0.115	6	0.01916	58.517
ECA2129A	4383	AP 109	2	3.609	0.115	6	0.01918	58.517
ECA212AA	4383	AP 109	2	3.629	0.116	6	0.01927	58.517
ECA31P1A	3968	AP 109	3	3.542	0.114	6	0.01905	57.317
ECA31P2A	3968	AP 109	3	4.172	0.112	6	0.01873	57.317
ECA31P3A	3968	AP 109	3	3.687	0.113	6	0.01887	57.317
ECA31P4A	3968	AP 109	3	3.548	0.113	6	0.01890	57.317
ECA31P5A	3968	AP 109	3	3.659	0.114	6	0.01897	57.317
ECA31P6A	3968	AP 109	3	3.537	0.114	6	0.01899	57.317
			Average	**3.848**			**0.0190**	**58.704**
			Standard Dev.	**0.621**				
			Coeff. of Var. [%]	**16.135**				
			Min.	**2.748**			**0.0187**	**57.317**
			Max.	**4.821**			**0.0193**	**60.309**
			Number of Spec.	**19**				



Apparent Interlaminar Shear ±60° Braid -- (RTD)
High V_f Strength
Raytheon-PR 520/ AS4 Carbon ±60° Braid

Specimen Number	Resin Batch #	Fiber Batch #	ASAP Batch #	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	FV %
ECAX1G1A	4383	AP 110	1	3.451	0.118	7	0.01679	69.346
ECAX1G2A	4383	AP 110	1	3.542	0.118	7	0.01685	69.346
ECAX1G3A	4383	AP 110	1	3.658	0.118	7	0.01693	69.346
ECAX1G4A	4383	AP 110	1	3.507	0.118	7	0.01686	69.346
ECAX1G5A	4383	AP 110	1	3.519	0.117	7	0.01674	69.346
ECAX1G6A	4383	AP 110	1	3.393	0.118	7	0.01679	69.346
ECAX2G1A	4383	AP 110	1	3.448	0.124	7	0.01765	66.604
ECAX2G2A	4383	AP 110	1	3.534	0.124	7	0.01769	66.604
ECAX2G3A	4383	AP 110	1	3.438	0.124	7	0.01766	66.604
ECAX2G4A	4383	AP 110	1	3.429	0.123	7	0.01764	66.604
ECAX2G5A	4383	AP 110	1	3.331	0.124	7	0.01764	66.604
ECAX2G6A	4383	AP 110	1	3.519	0.123	7	0.01763	66.604

Average	**3.481**	**0.0172**	**67.975**
Standard Dev.	**0.084**		
Coeff. of Var. [%]	**2.426**		
Min.	**3.331**	**0.0167**	**66.604**
Max.	**3.658**	**0.0177**	**69.346**
Number of Spec.	**12**		

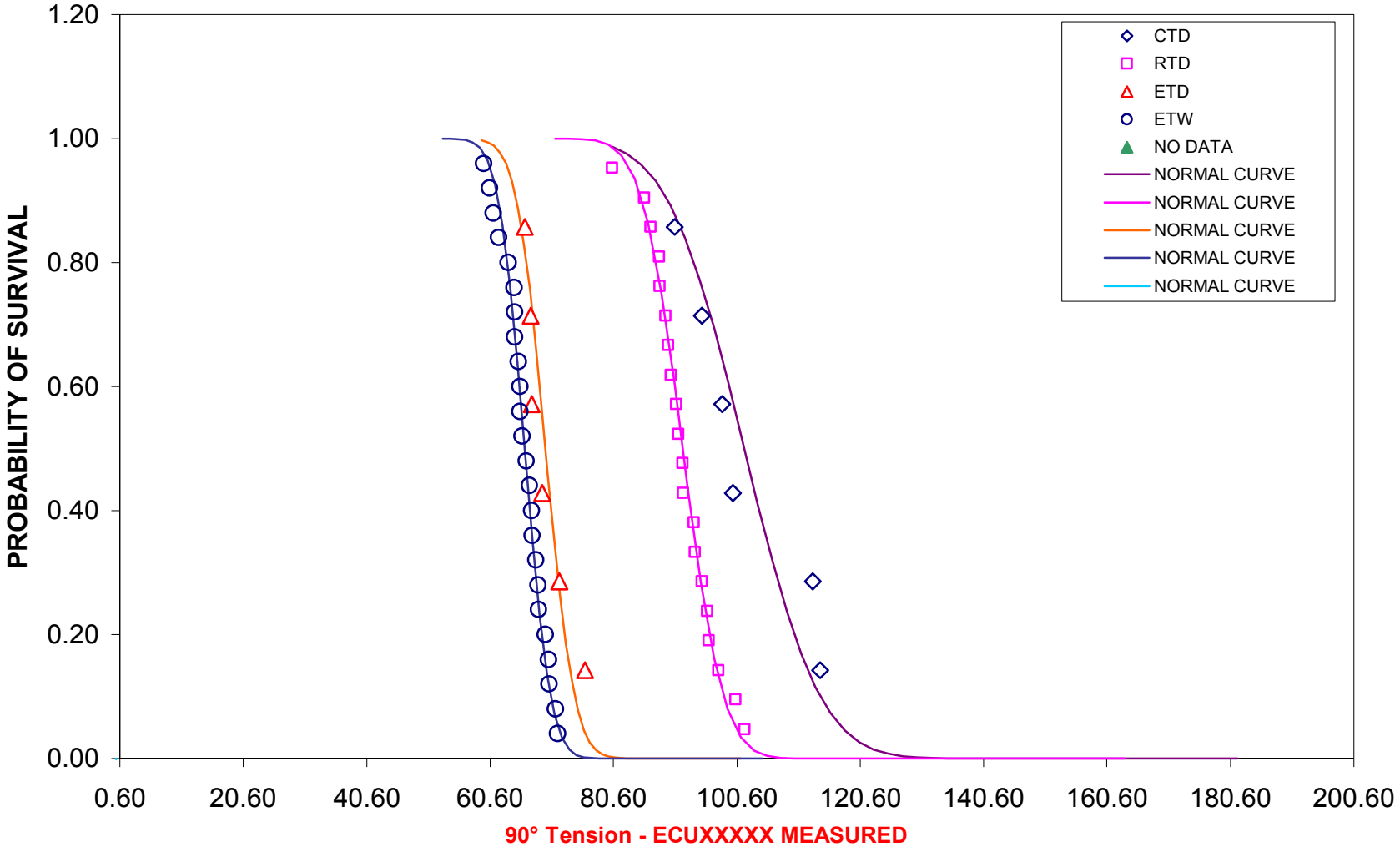


3.3 Statistical Results

3.3.1 Plot By Condition

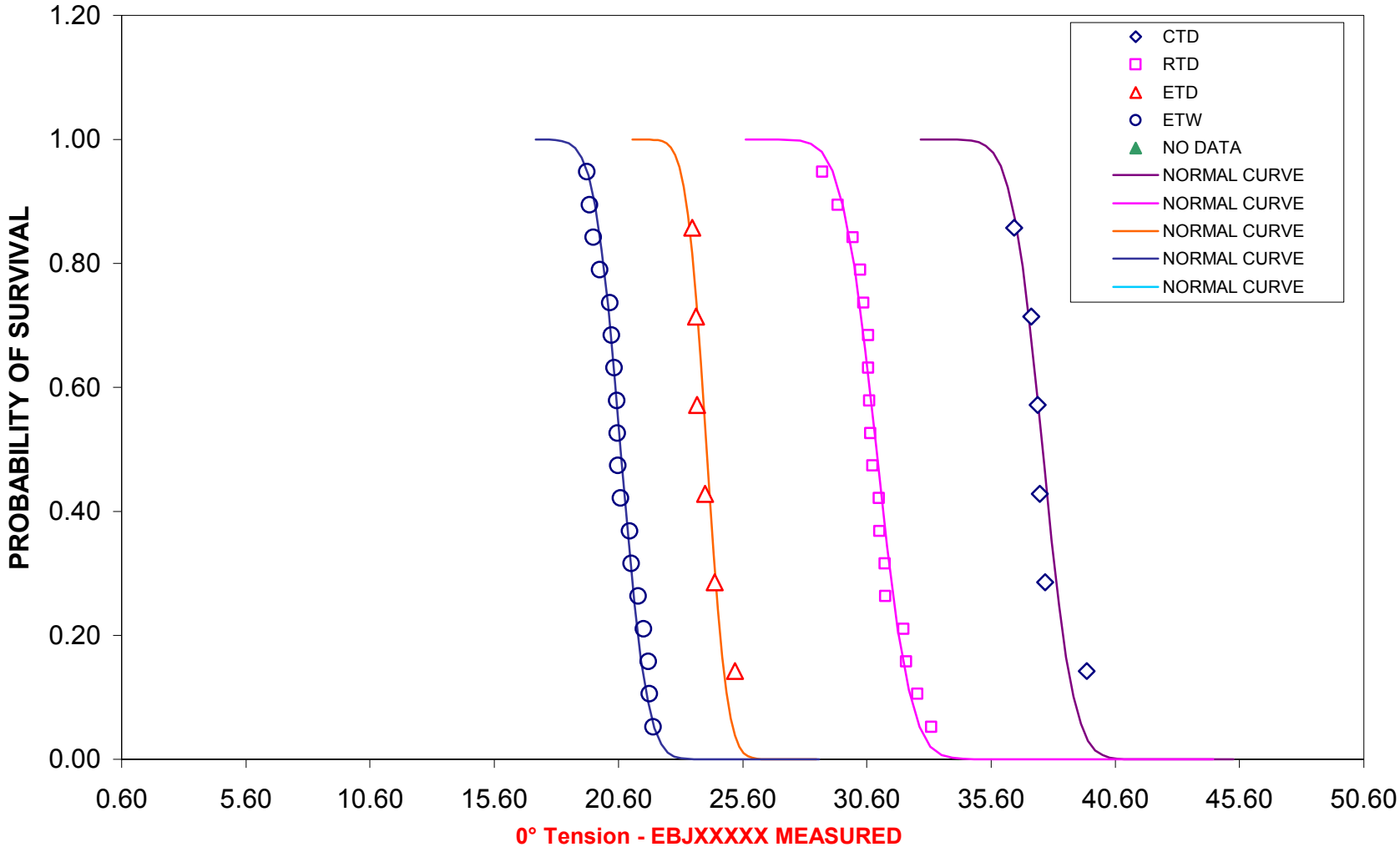
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

PR 520/ AS4 Carbon ±60°
RAYTHEON



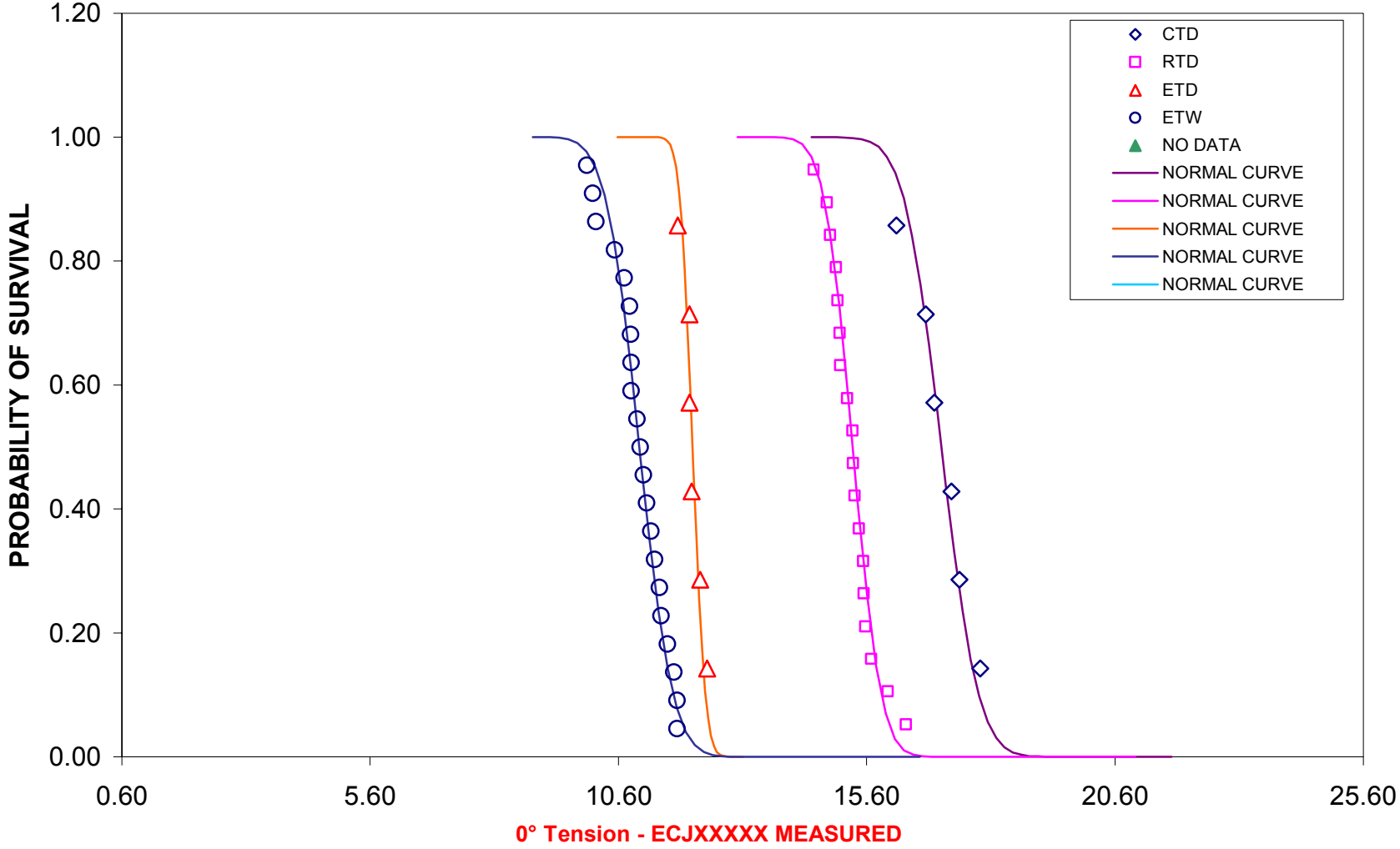
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

PR 520/ AS4 Carbon ±45°
RAYTHEON



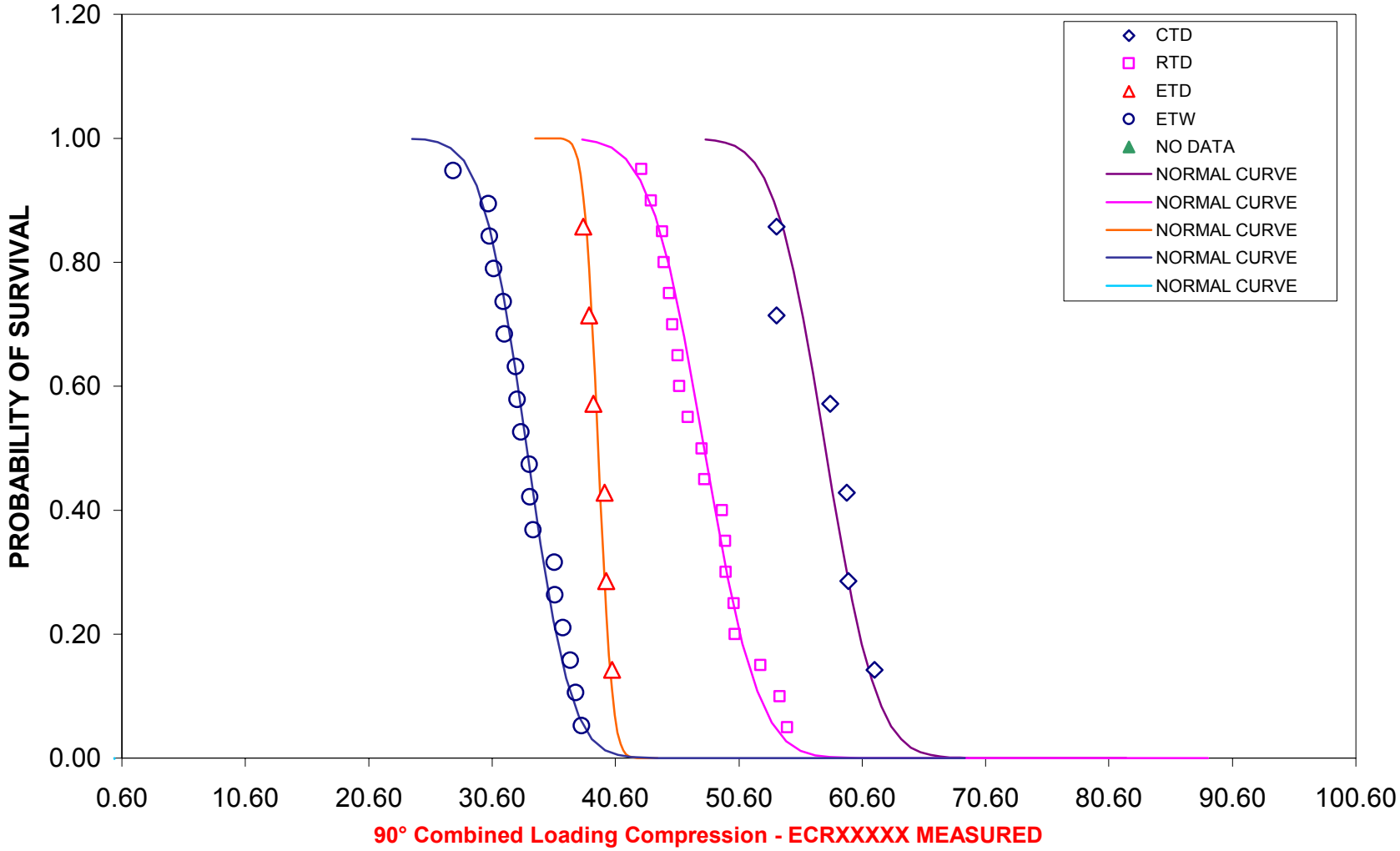
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

PR 520/ AS4 Carbon ±60°
RAYTHEON



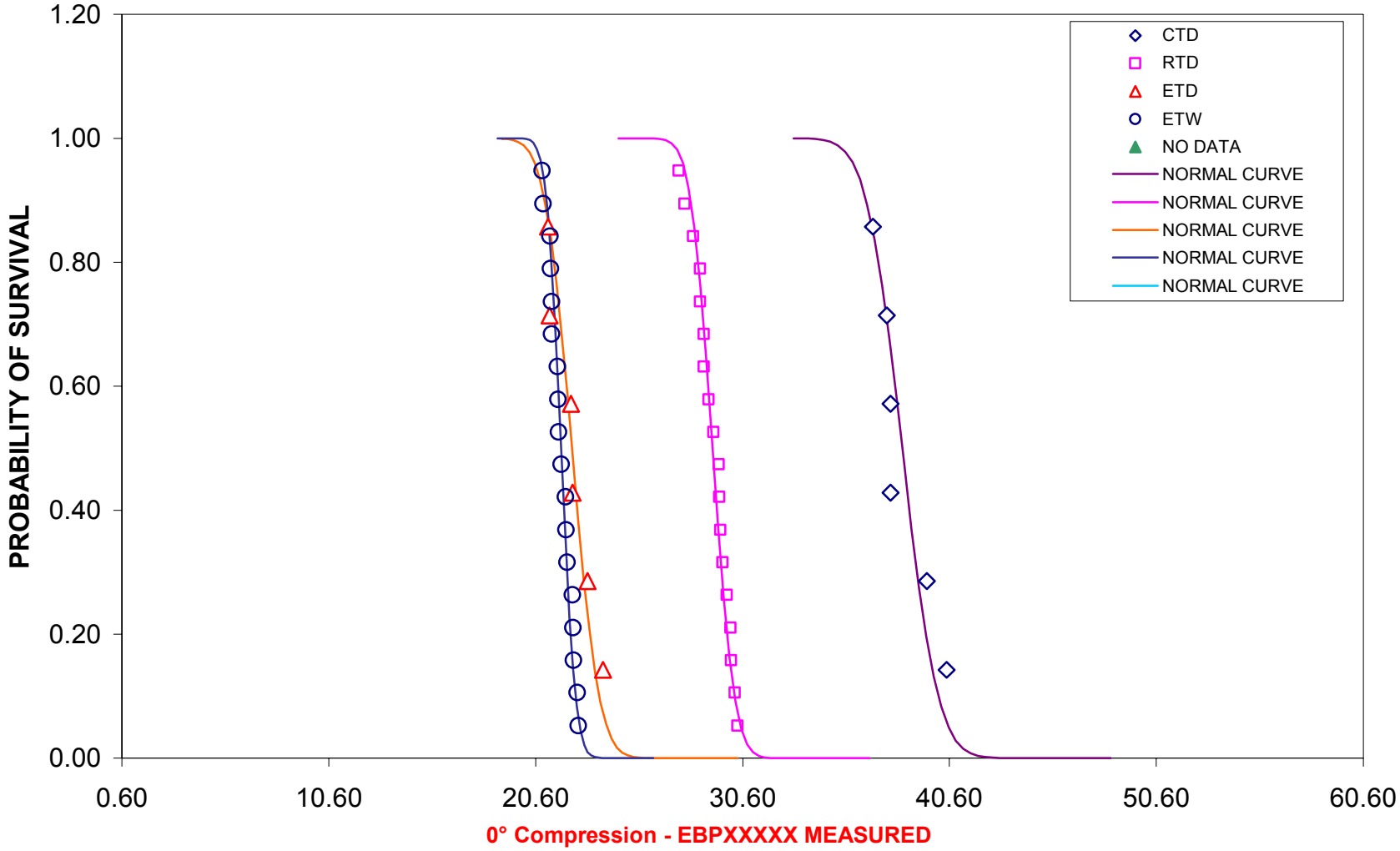
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

PR 520/ AS4 Carbon ±60°
RAYTHEON



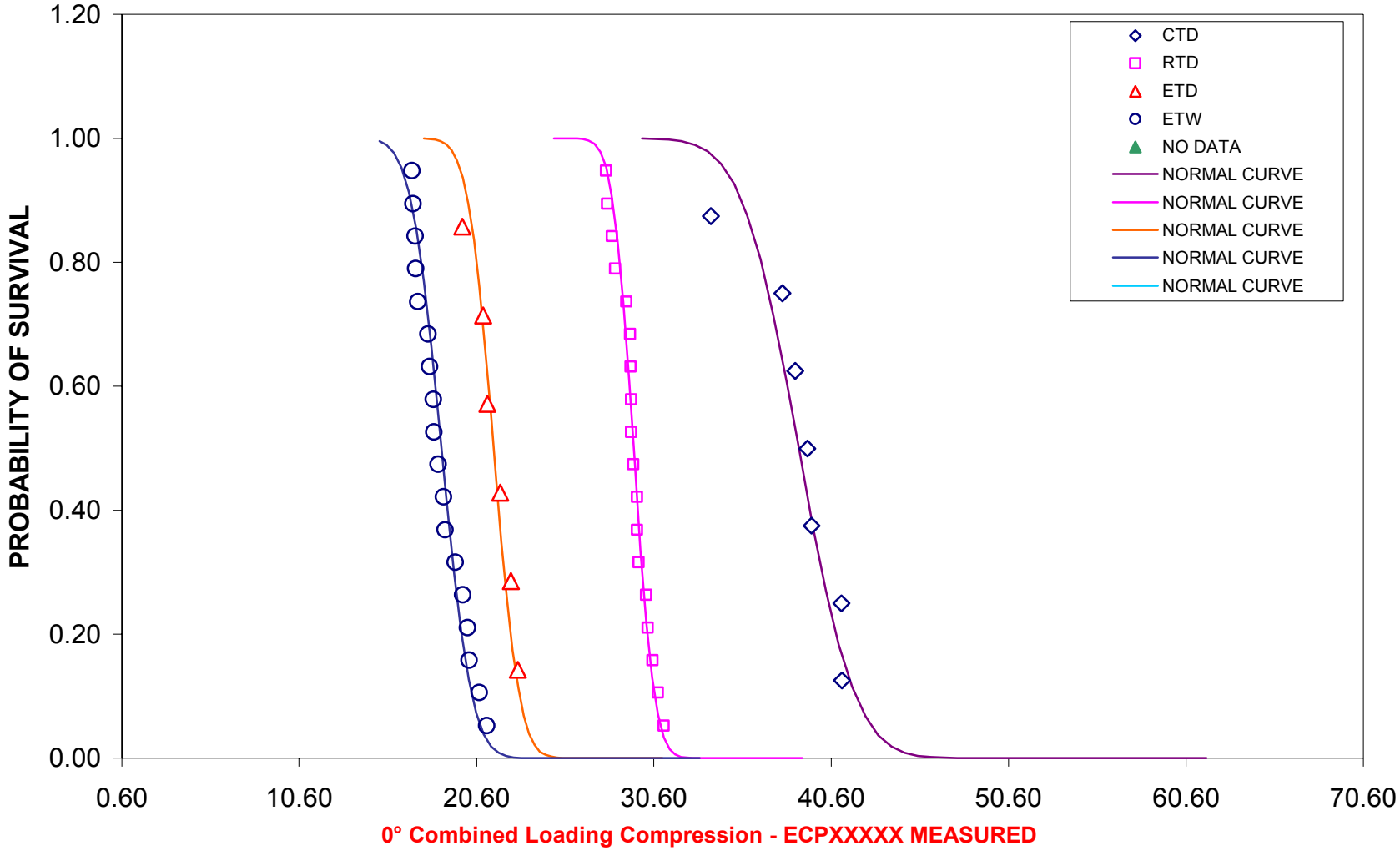
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

PR 520/ AS4 Carbon ±45°
RAYTHEON



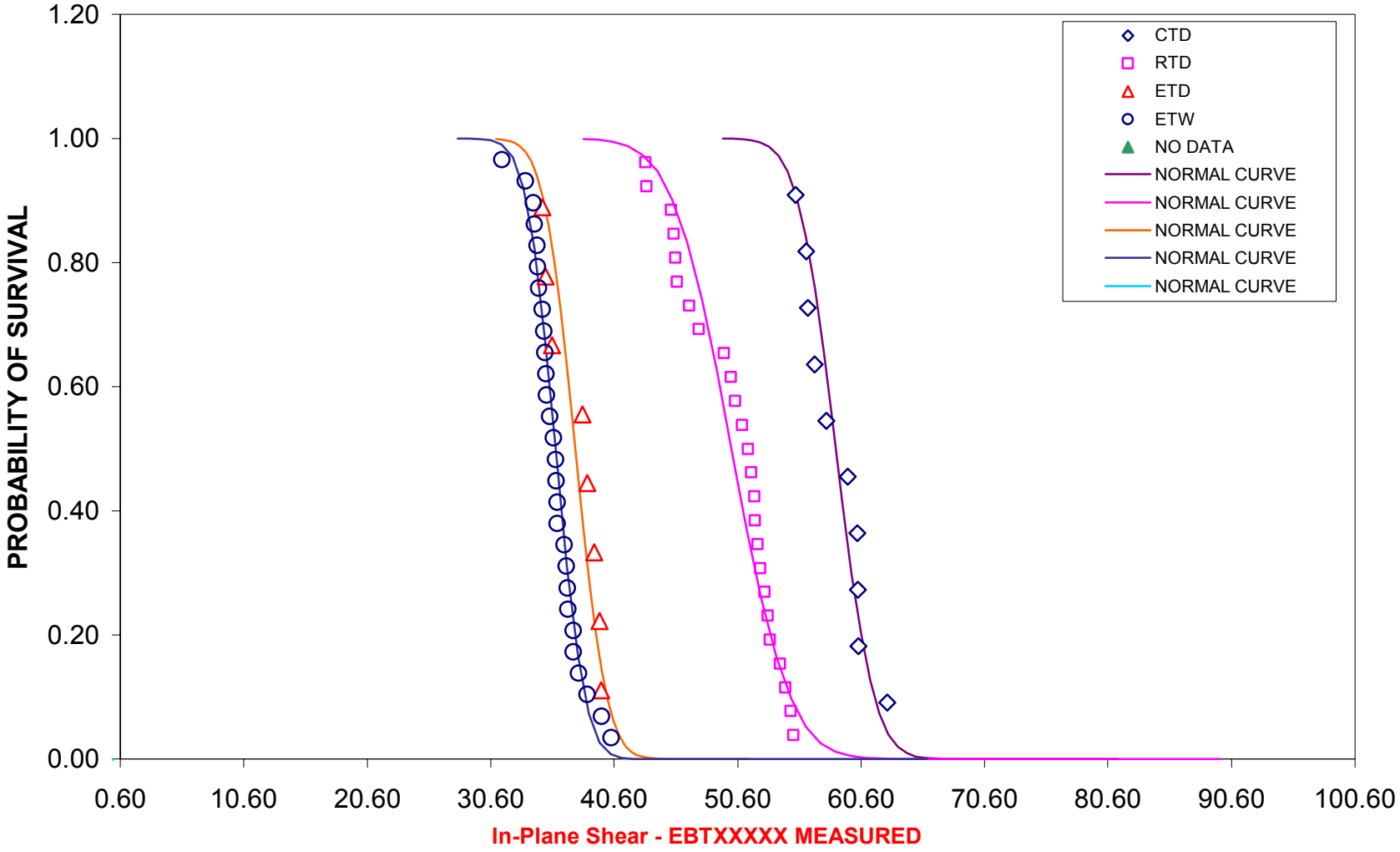
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

PR 520/ AS4 Carbon ±60°
RAYTHEON



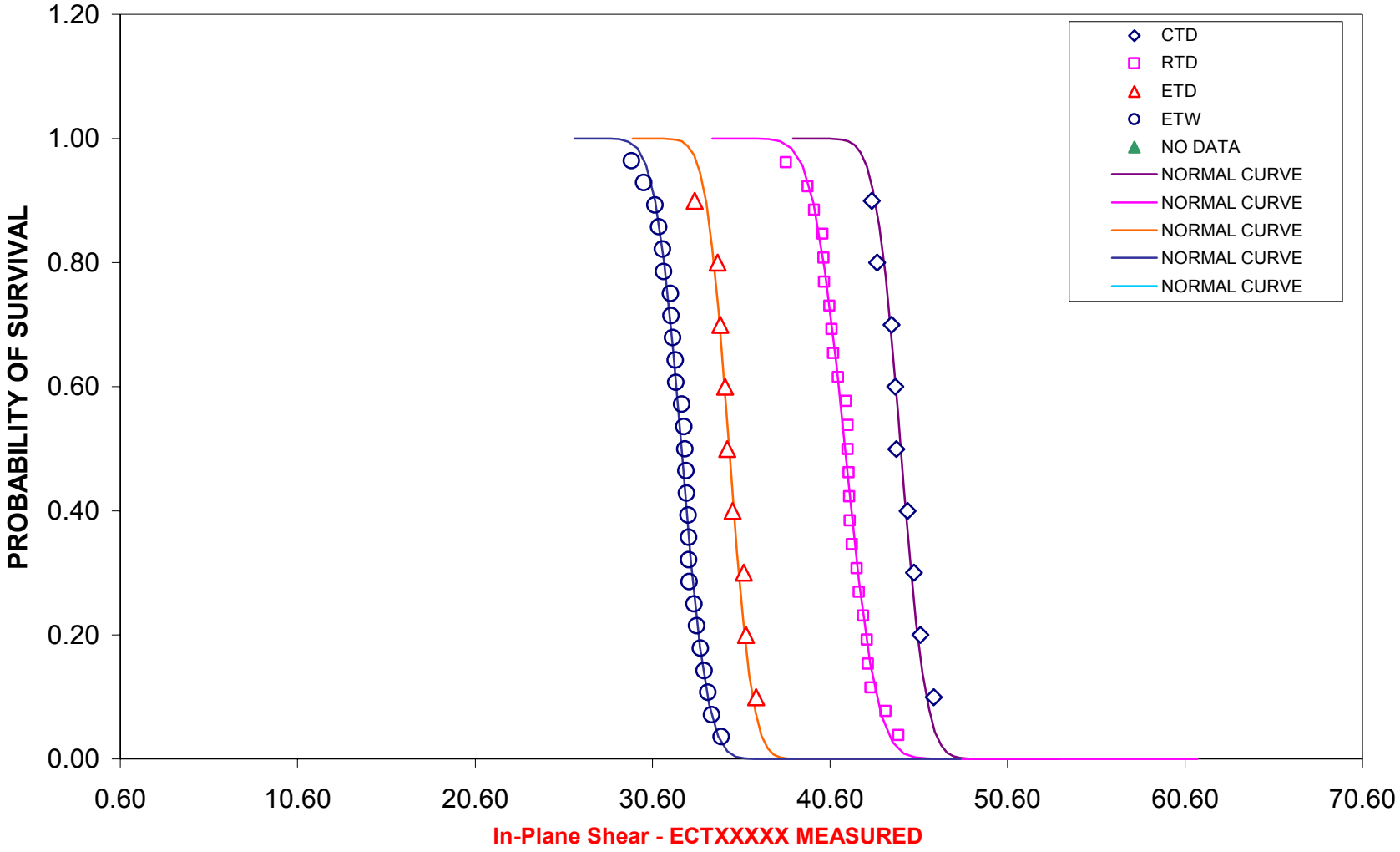
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

PR 520/ AS4 Carbon ±45°
RAYTHEON

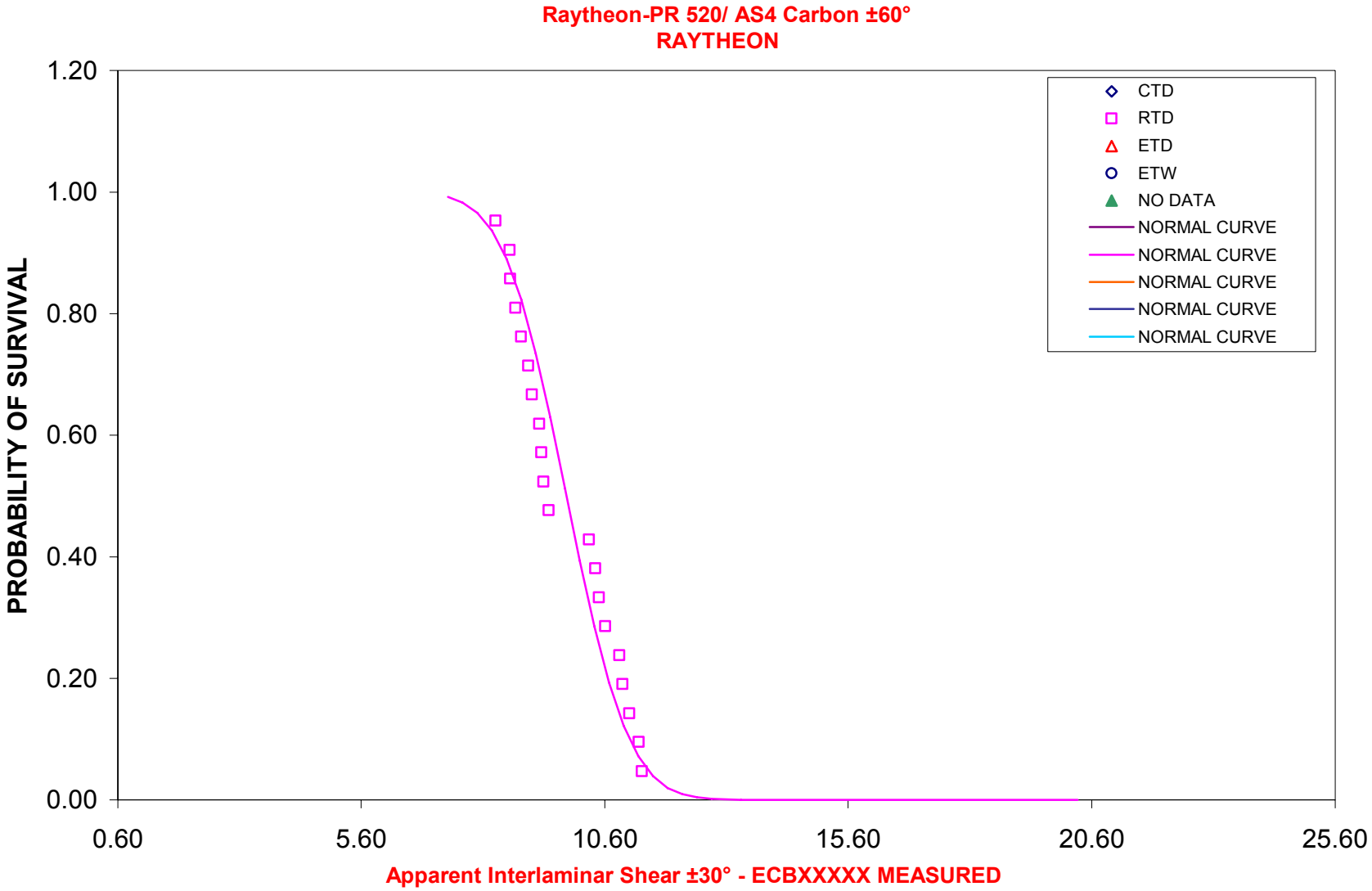


DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

PR 520/ AS4 Carbon ±60°
RAYTHEON

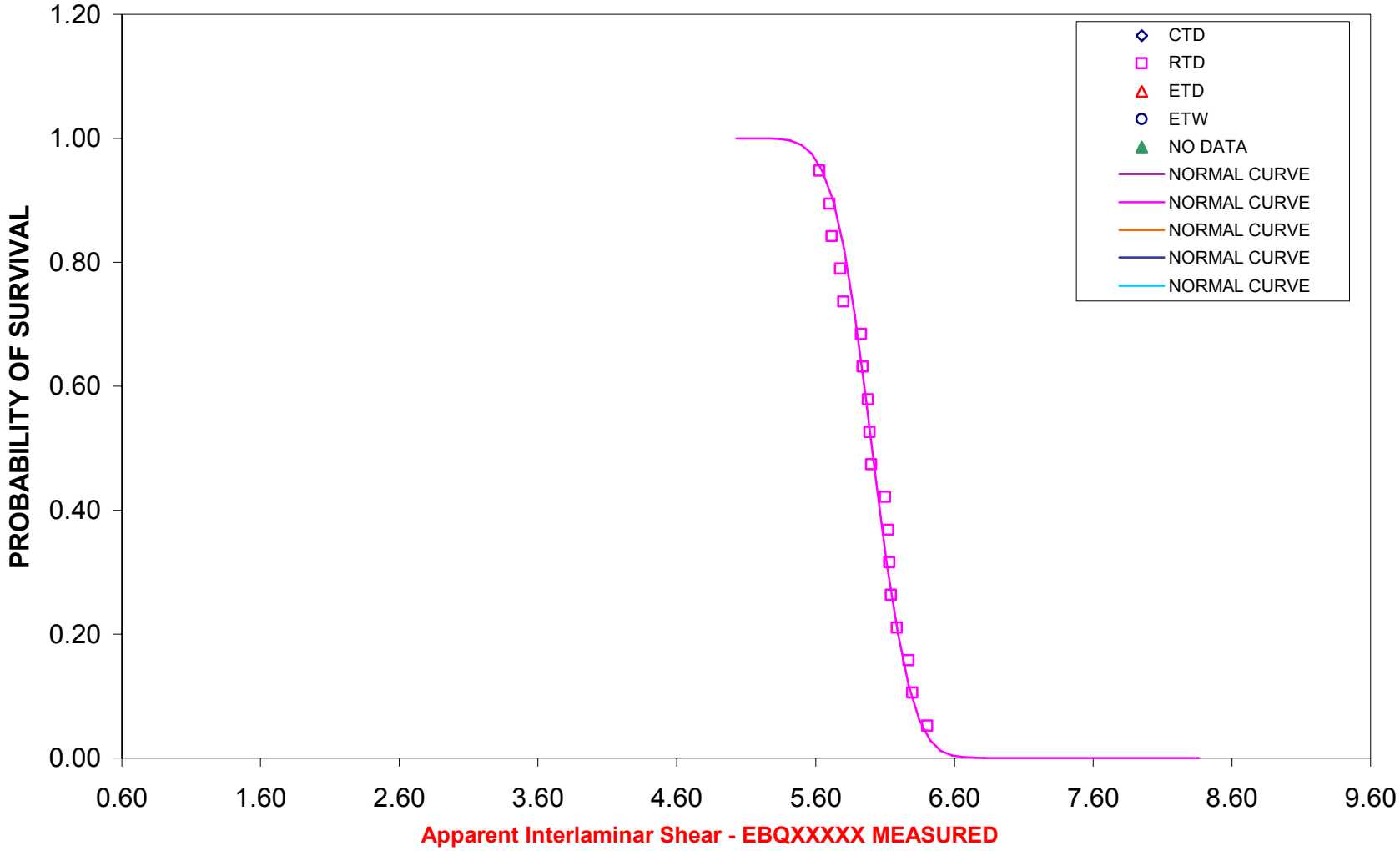


DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS



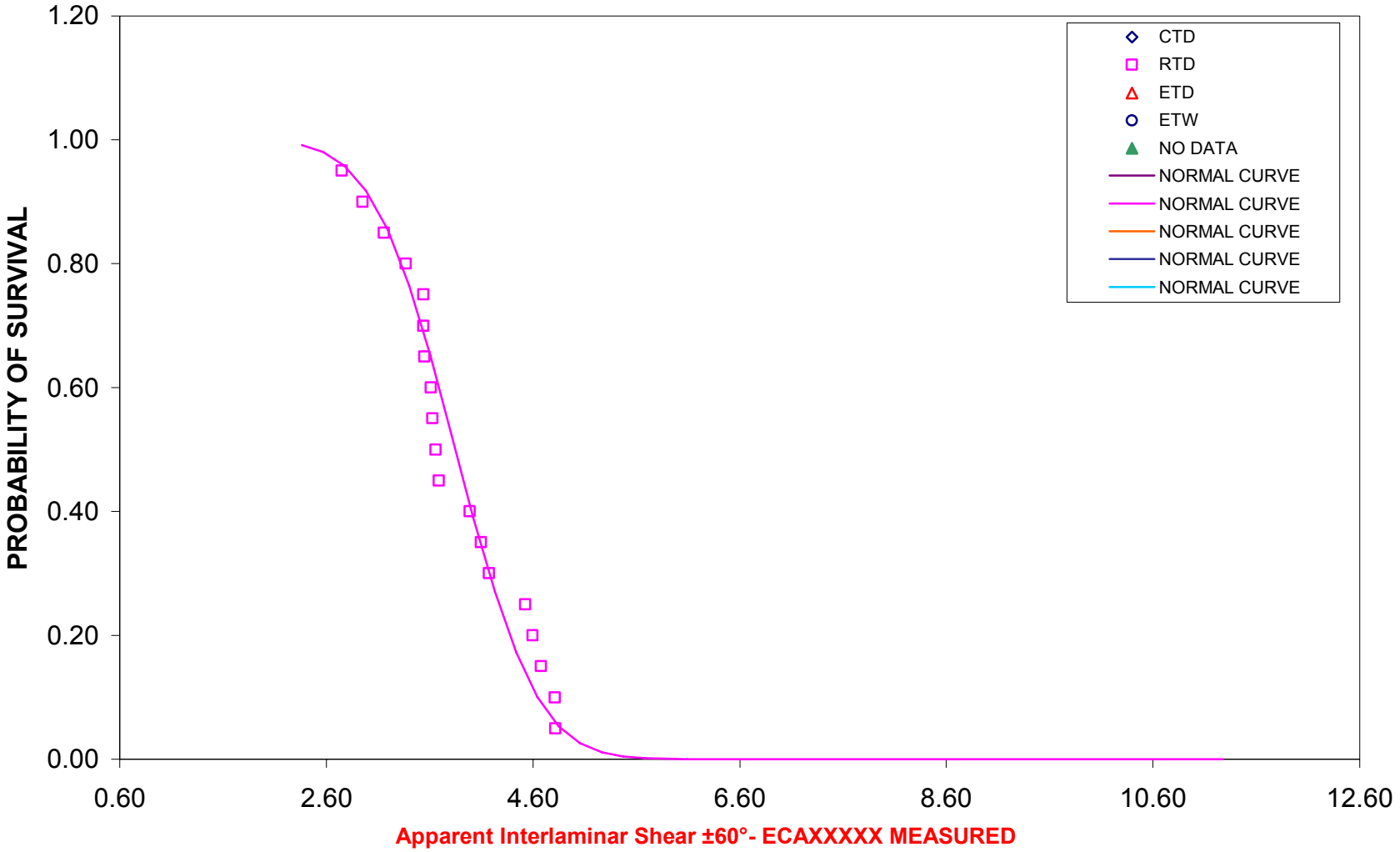
DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

PR 520/ AS4 Carbon ±45°
RAYTHEON



DISTRIBUTION OF GROUPED DATA FOR DIFFERENT TEST CONDITIONS

Raytheon-PR 520/ AS4 Carbon ±60°
RAYTHEON



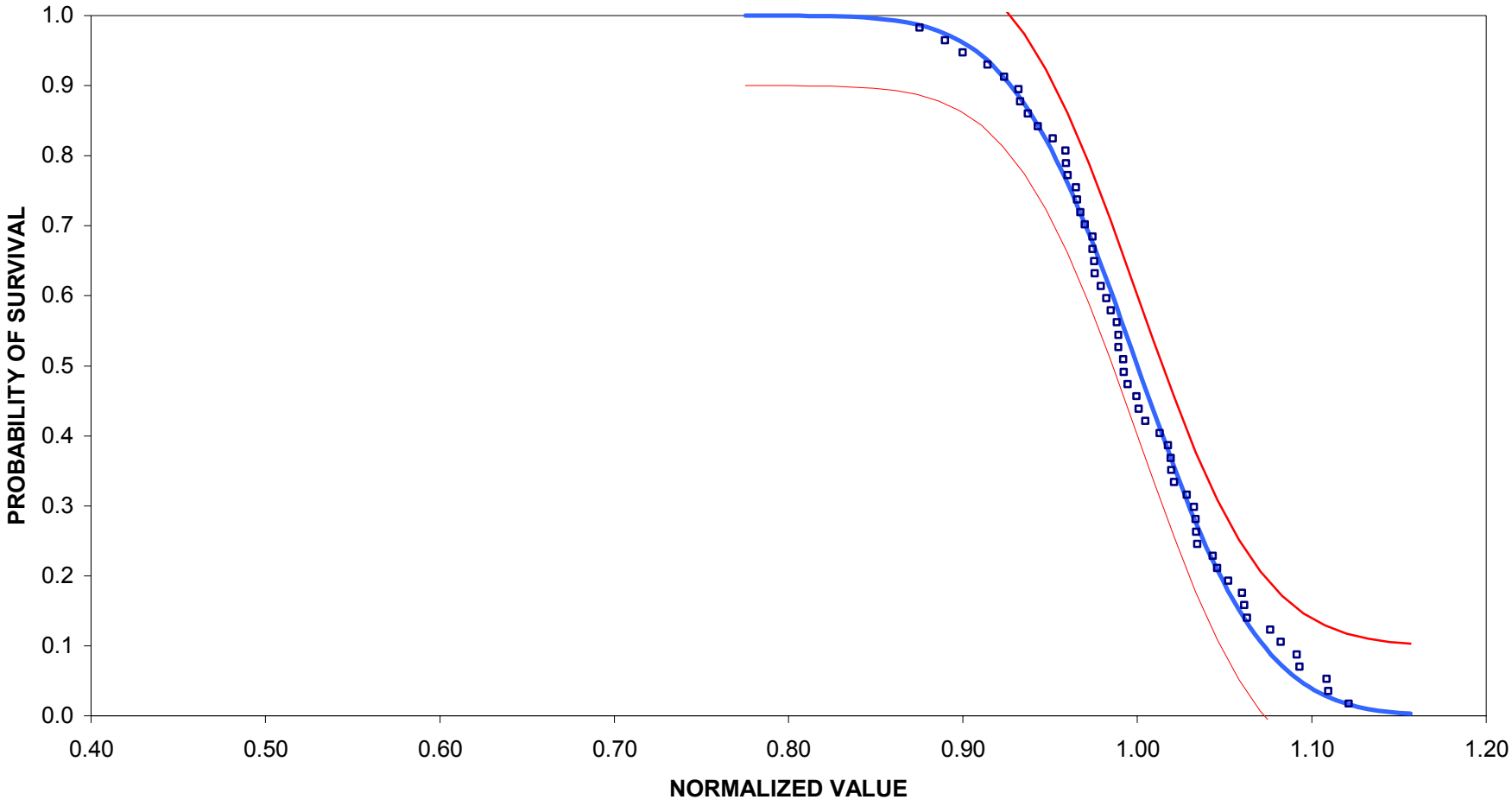
3.3.2 Plot of Pooled Data

DISTRIBUTION OF POOLED DATA

PR 520/ AS4 Carbon ±60°

RAYTHEON

90° Tension - ECUXXXXX MEASURED

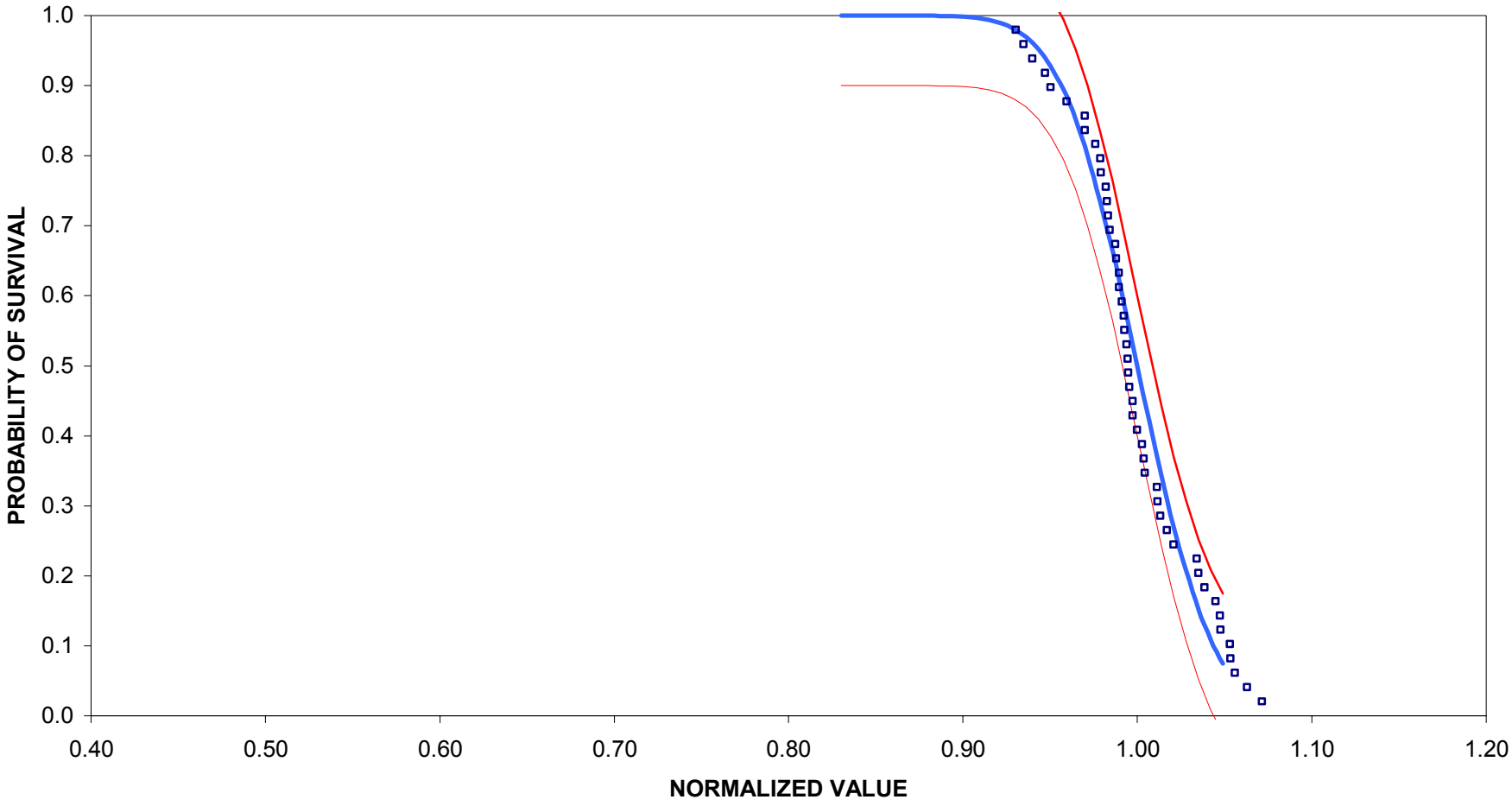


DISTRIBUTION OF POOLED DATA

PR 520/ AS4 Carbon ±45°

RAYTHEON

0° Tension - EBJXXXXX MEASURED

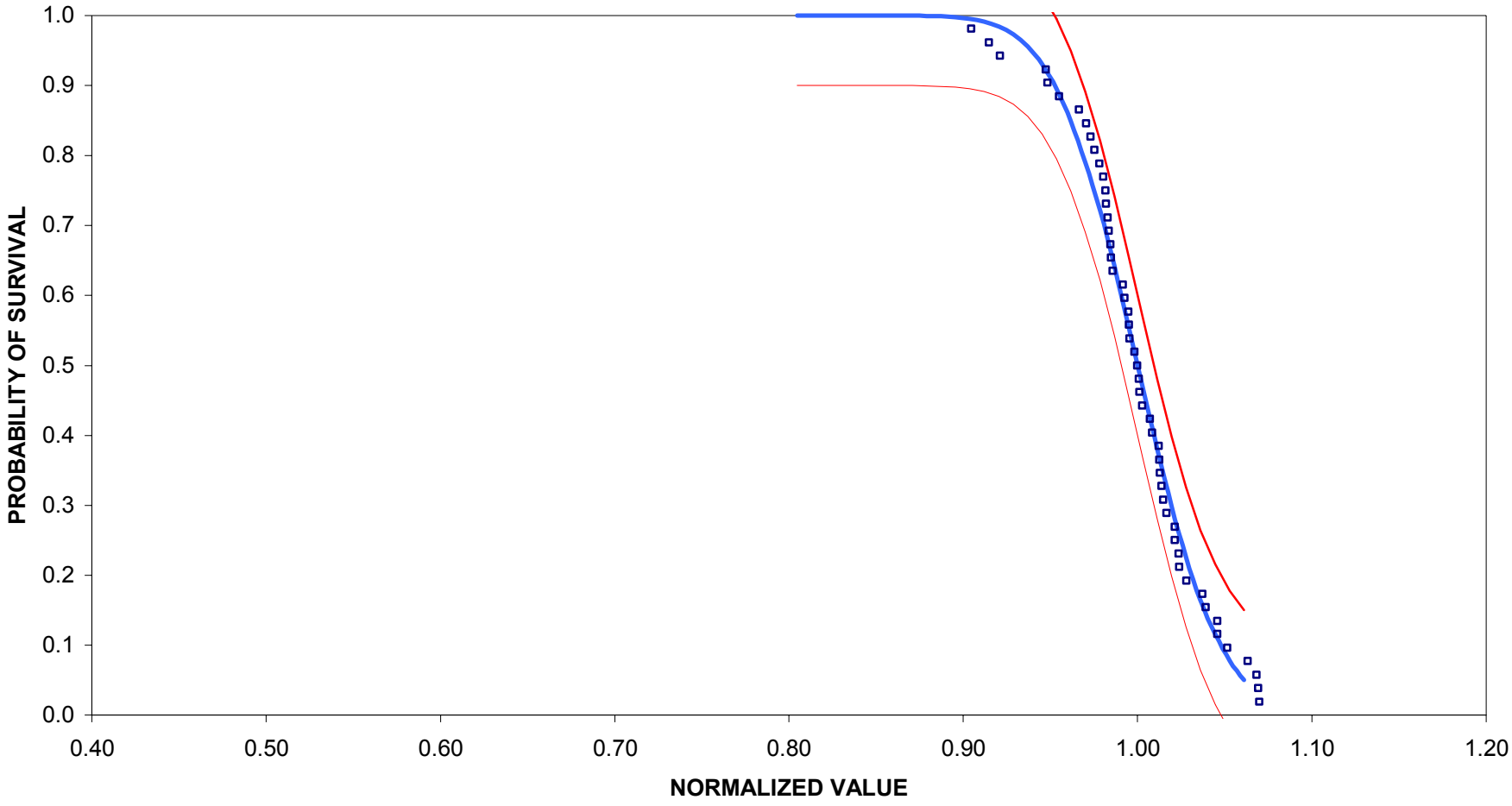


DISTRIBUTION OF POOLED DATA

PR 520/ AS4 Carbon ±60°

RAYTHEON

0° Tension - ECJXXXXX MEASURED

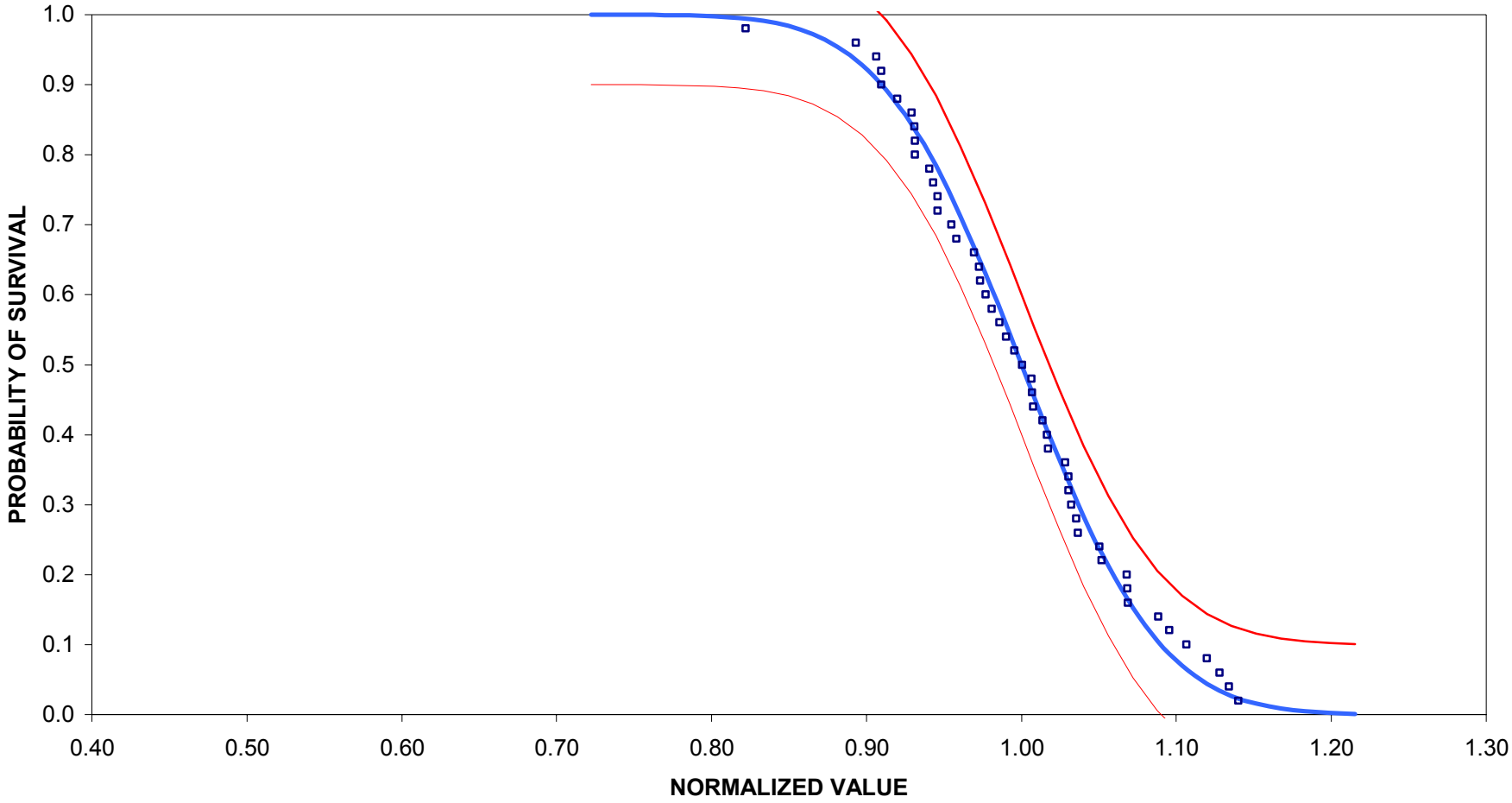


DISTRIBUTION OF POOLED DATA

PR 520/ AS4 Carbon ±60°

RAYTHEON

90° Combined Loading Compression - ECRXXXXX MEASURED

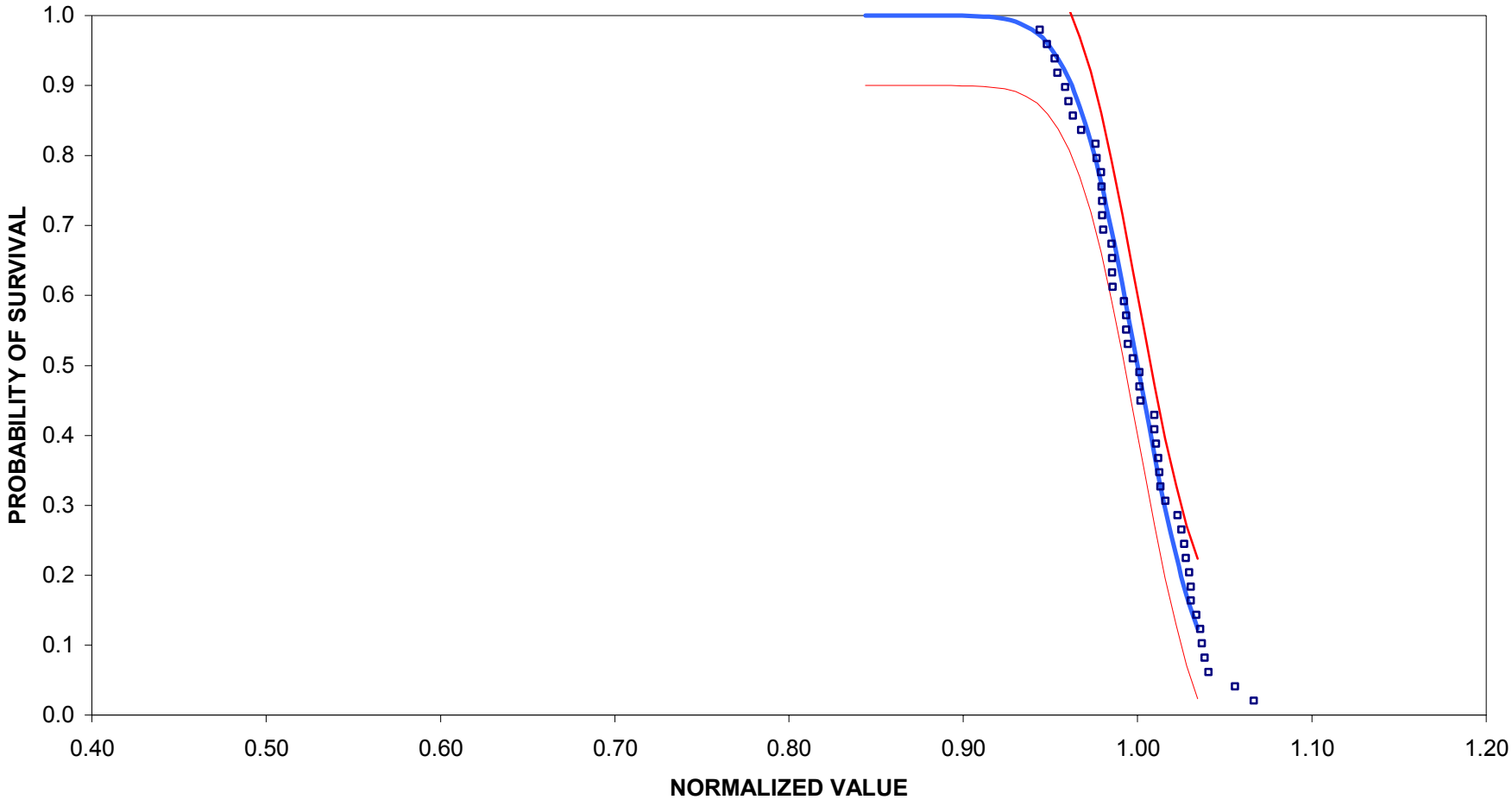


DISTRIBUTION OF POOLED DATA

PR 520/ AS4 Carbon ±45°

RAYTHEON

0° Compression - EBPXXXXX MEASURED

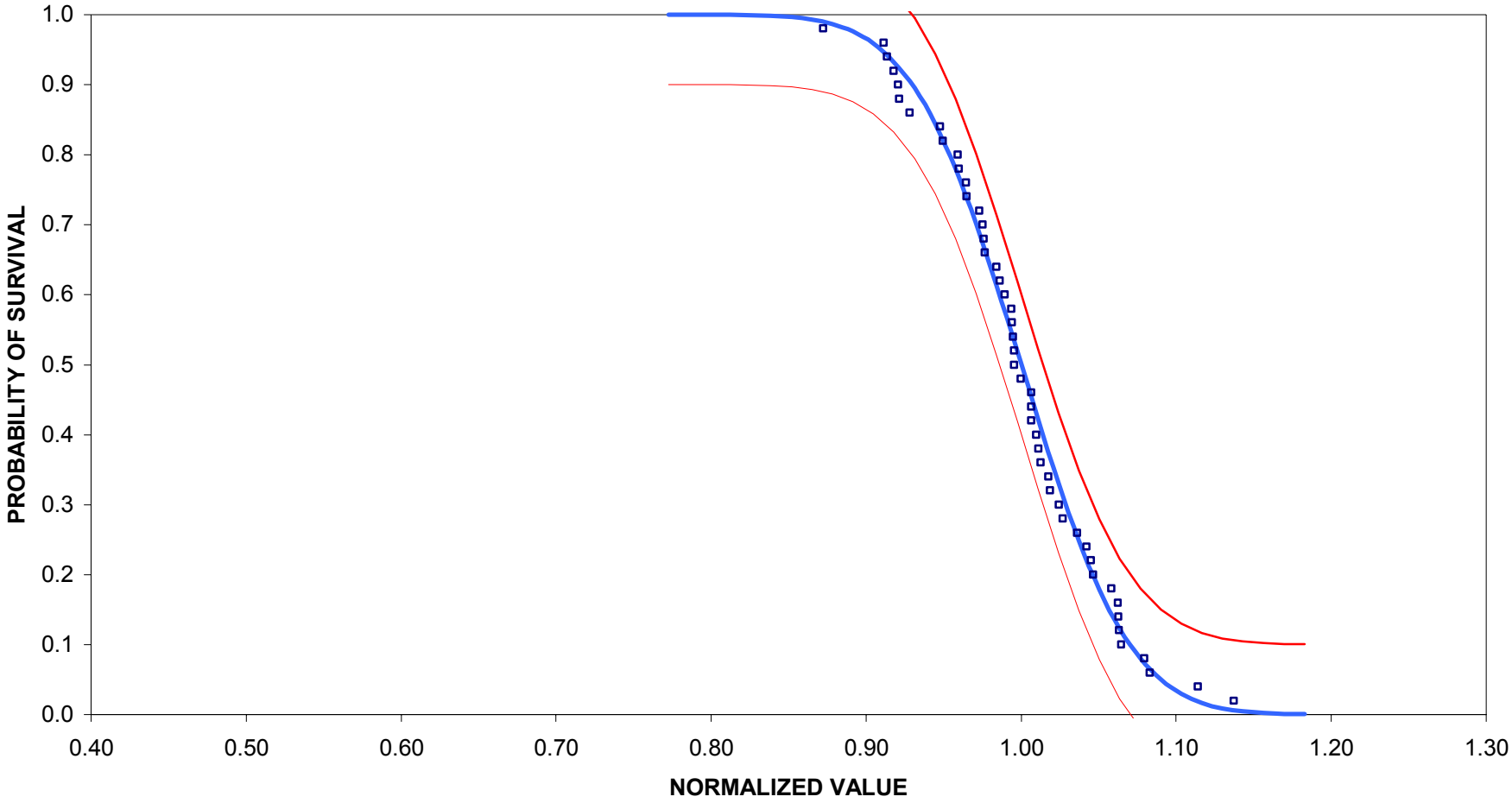


DISTRIBUTION OF POOLED DATA

PR 520/ AS4 Carbon ±60°

RAYTHEON

0° Combined Loading Compression - ECPXXXXX MEASURED

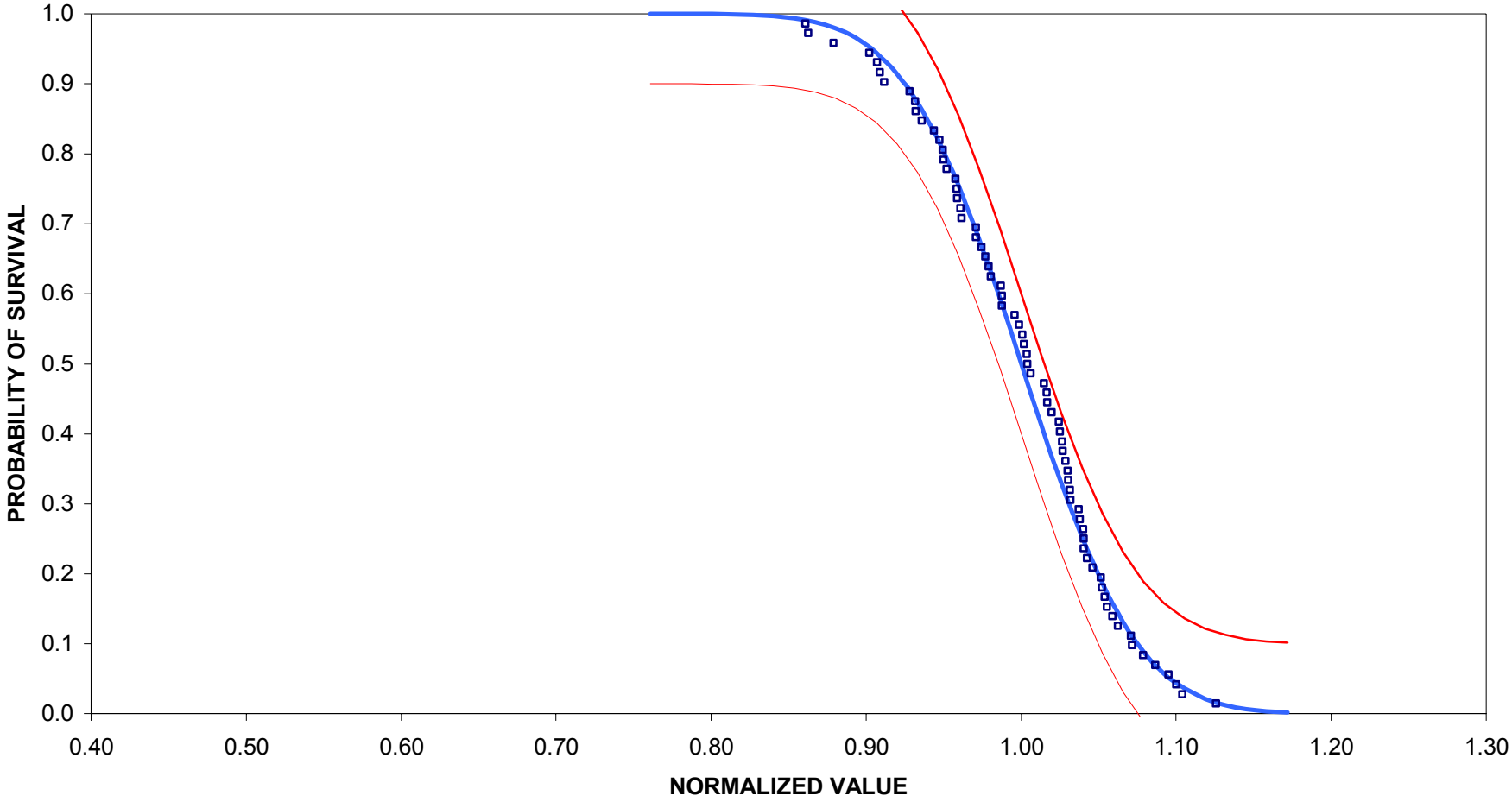


DISTRIBUTION OF POOLED DATA

PR 520/ AS4 Carbon ±45°

RAYTHEON

In-Plane Shear - EBTXXXXX MEASURED

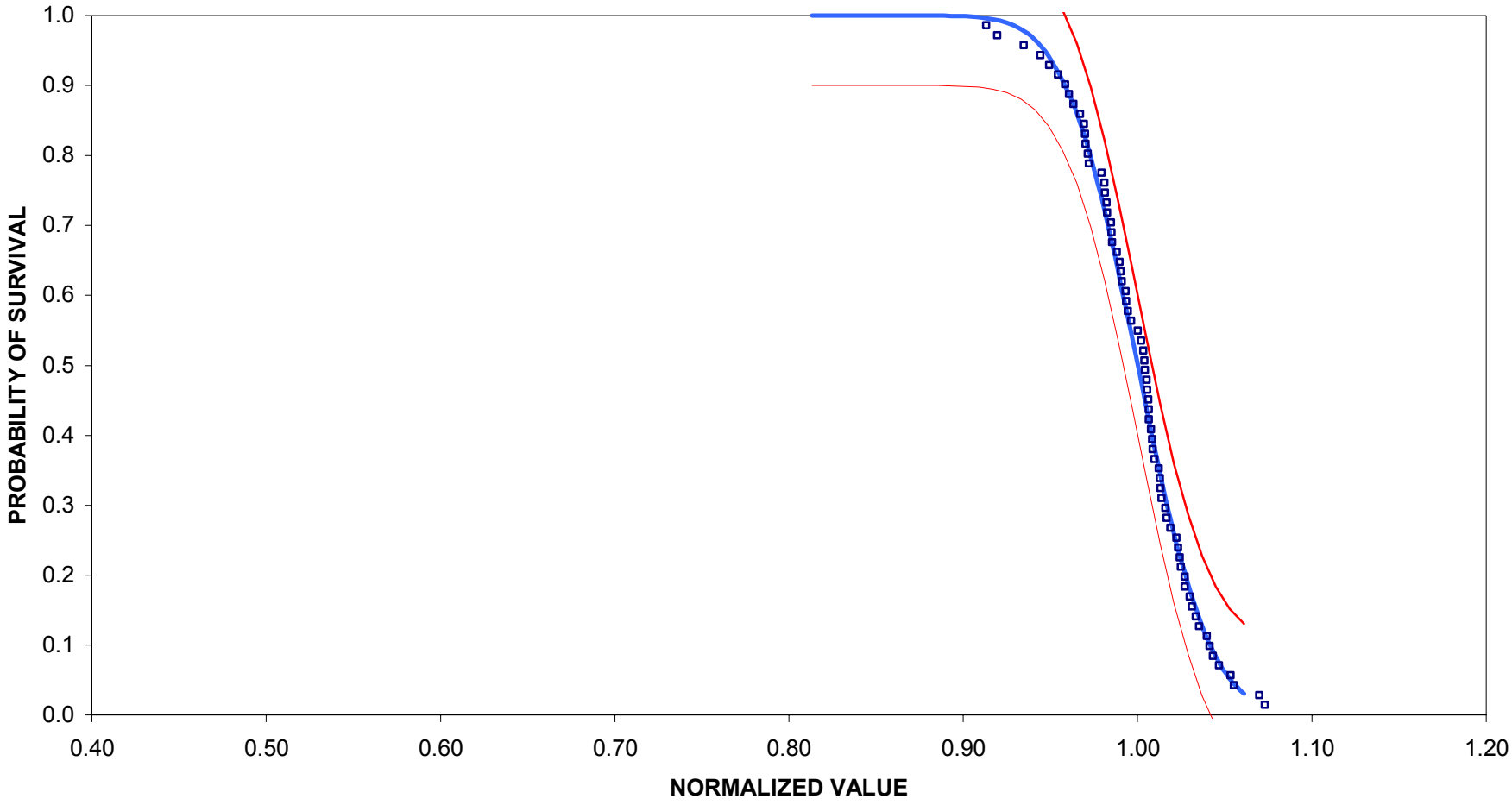


DISTRIBUTION OF POOLED DATA

PR 520/ AS4 Carbon ±60°

RAYTHEON

In-Plane Shear - ECTXXXXX MEASURED

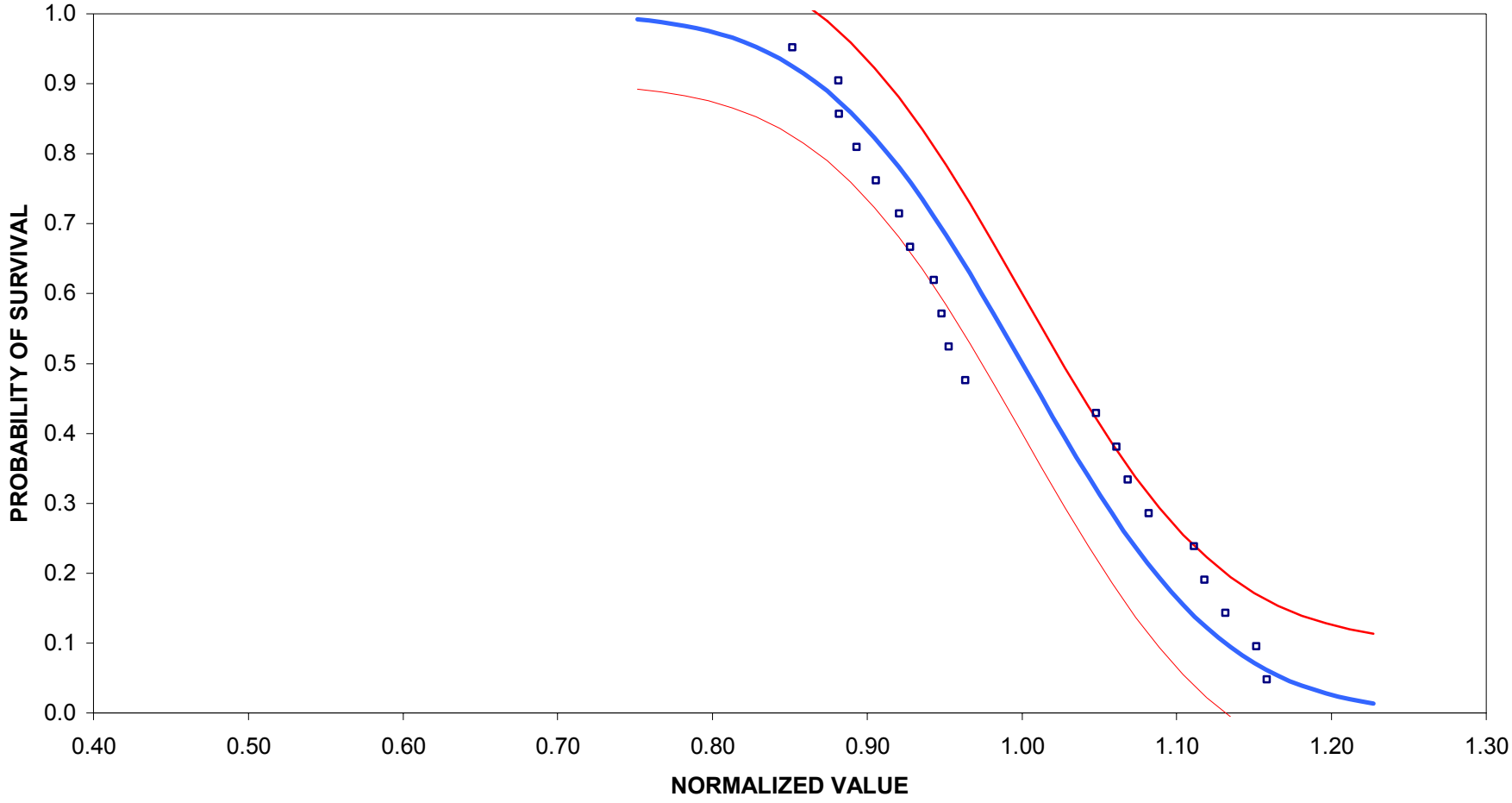


DISTRIBUTION OF POOLED DATA

Raytheon-PR 520/ AS4 Carbon ±60°

RAYTHEON

Apparent Interlaminar Shear ±30° - ECBXXXXX MEASURED

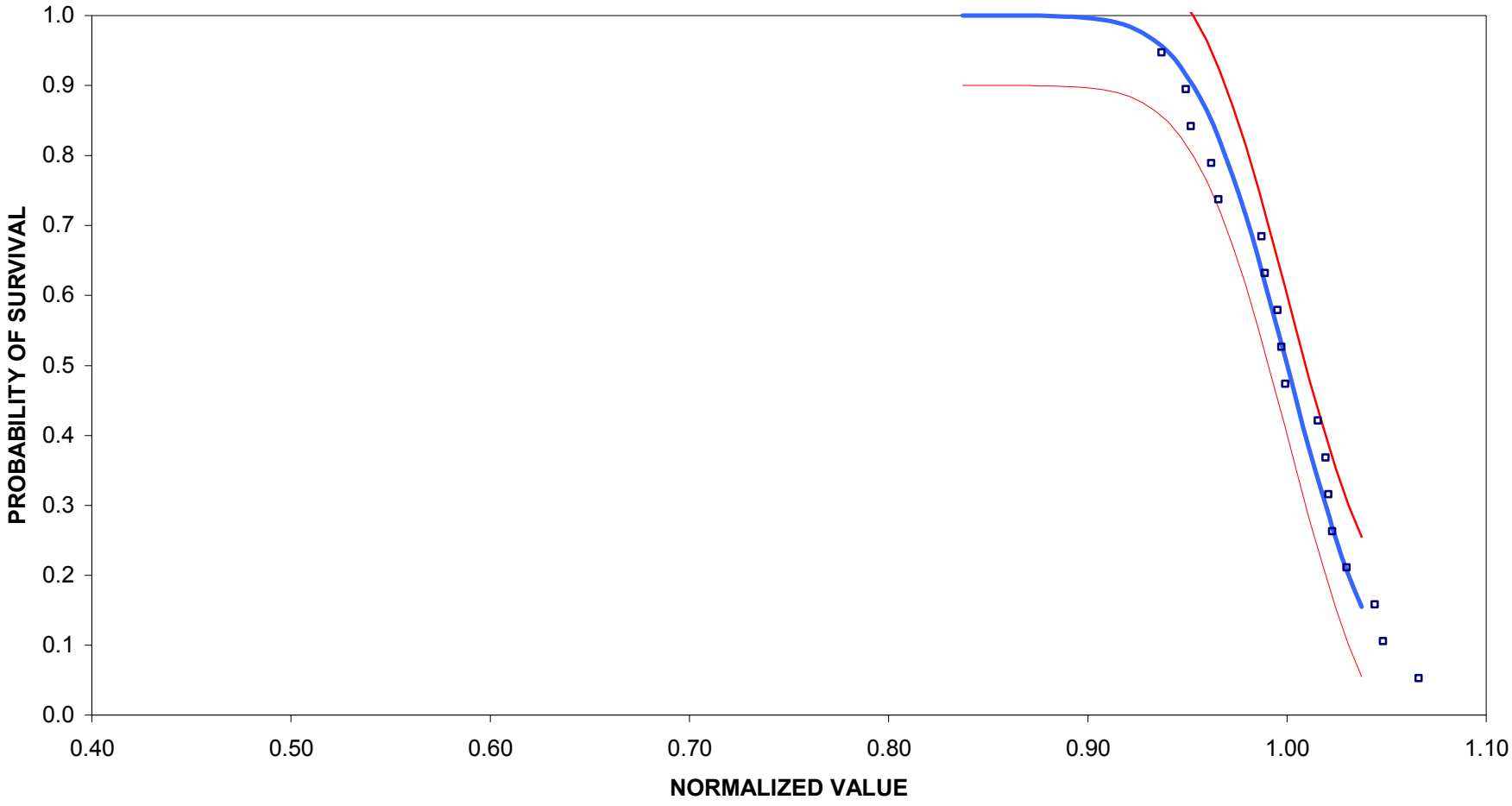


DISTRIBUTION OF POOLED DATA

PR 520/ AS4 Carbon ±45°

RAYTHEON

Apparent Interlaminar Shear - EBQXXXXX MEASURED

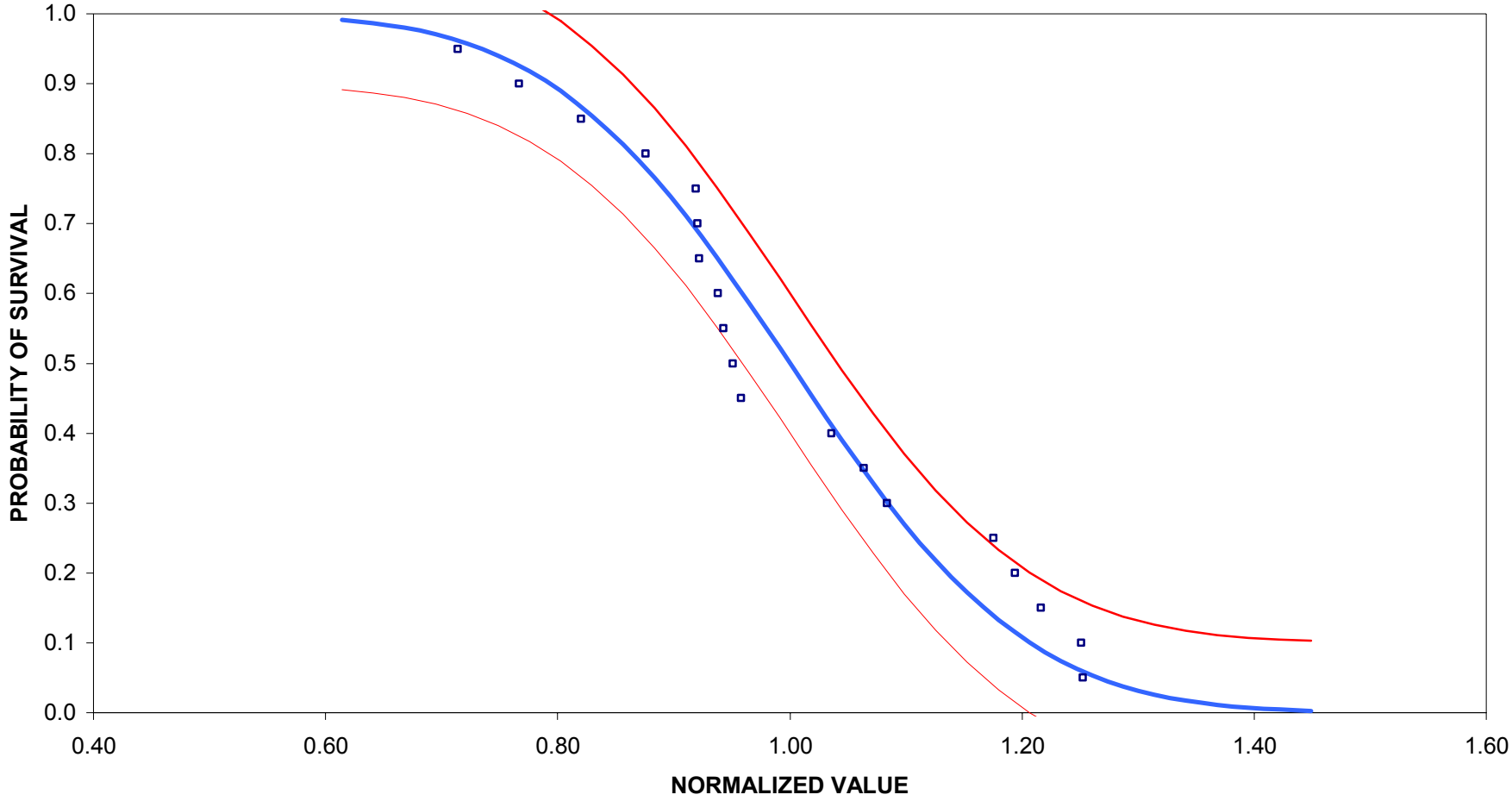


DISTRIBUTION OF POOLED DATA

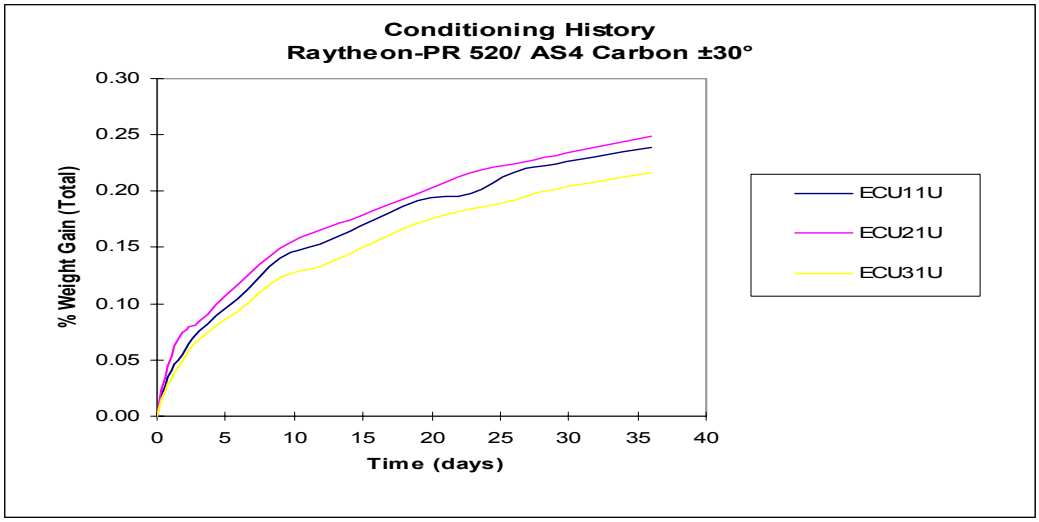
Raytheon-PR 520/ AS4 Carbon ±60°

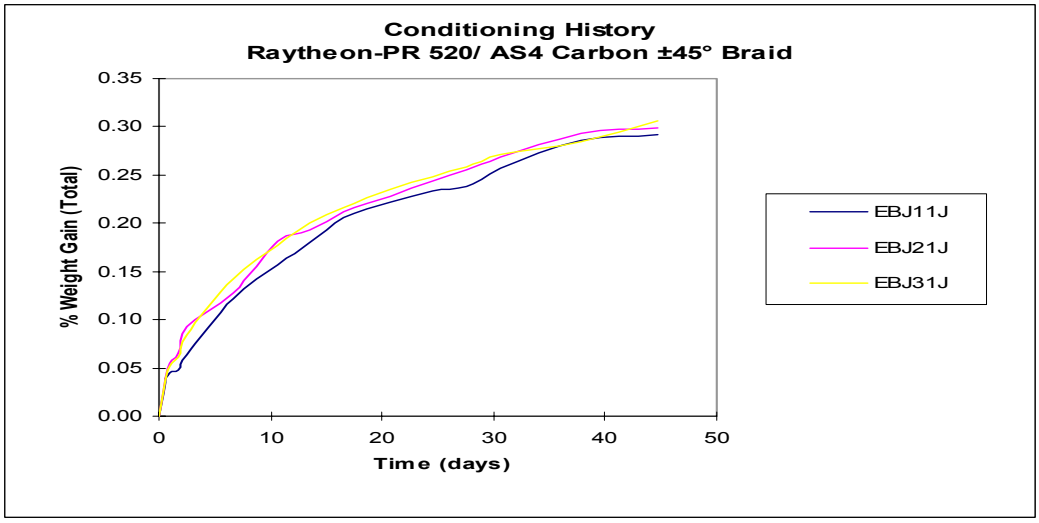
RAYTHEON

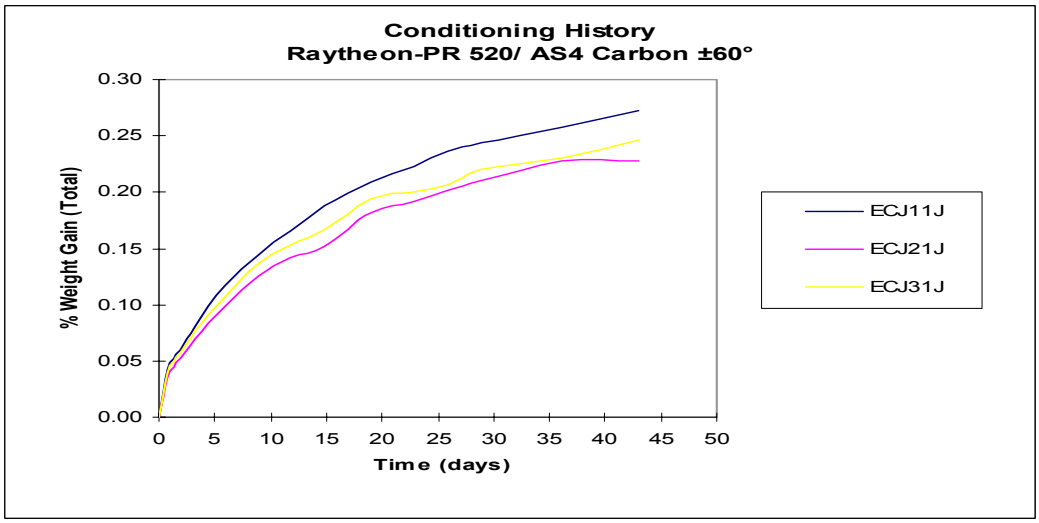
Apparent Interlaminar Shear ±60°- ECAXXXXX MEASURED

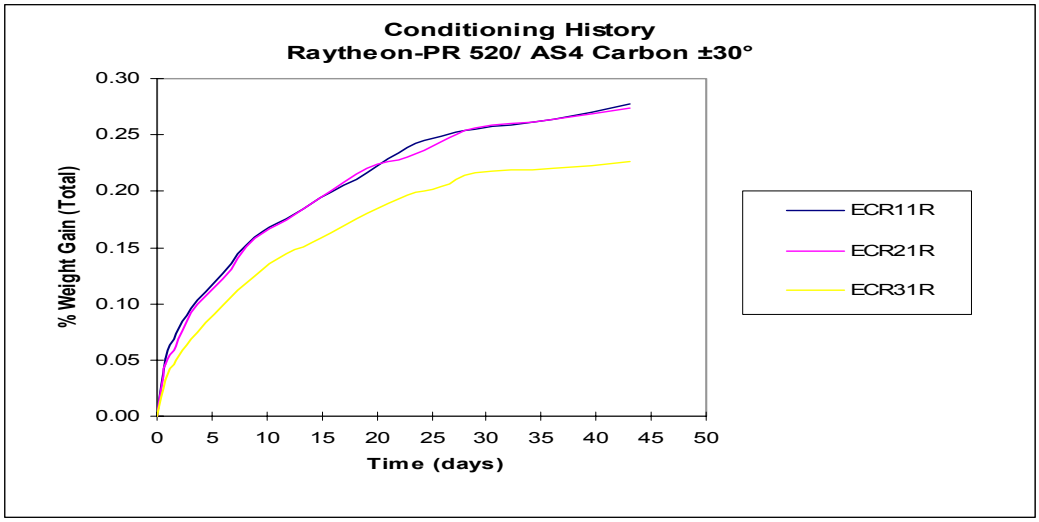


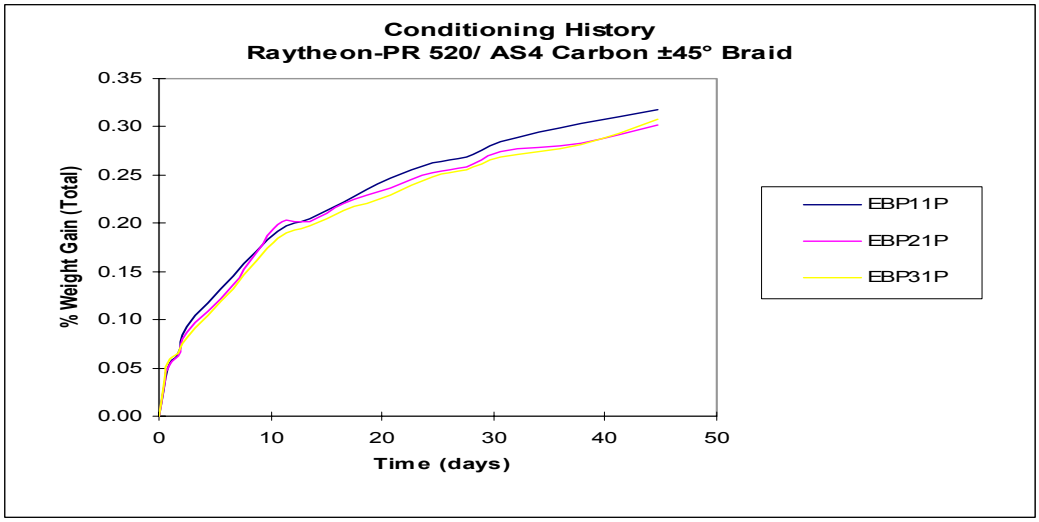
3.4 Moisture Conditioning History Charts

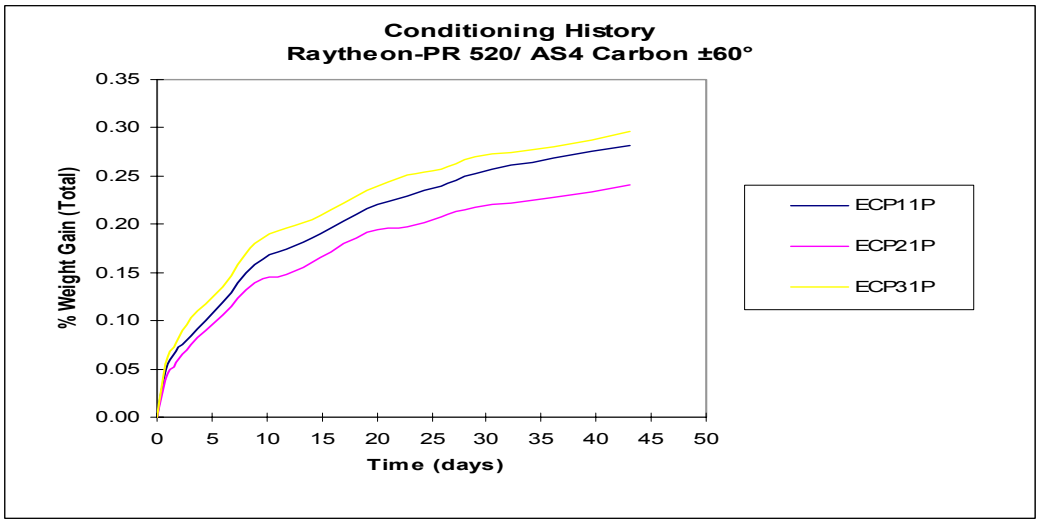


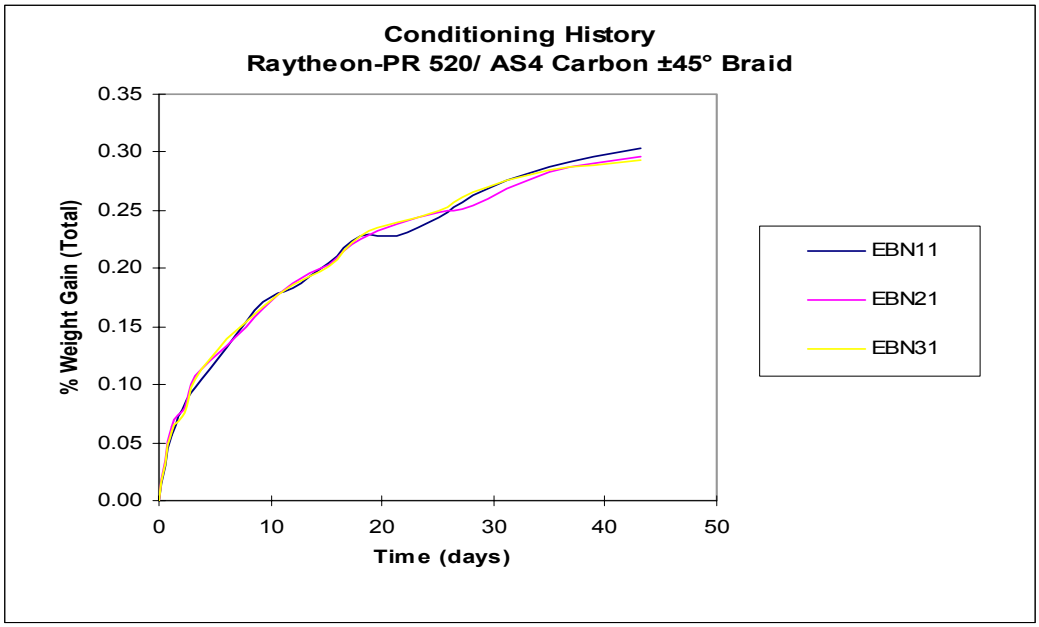


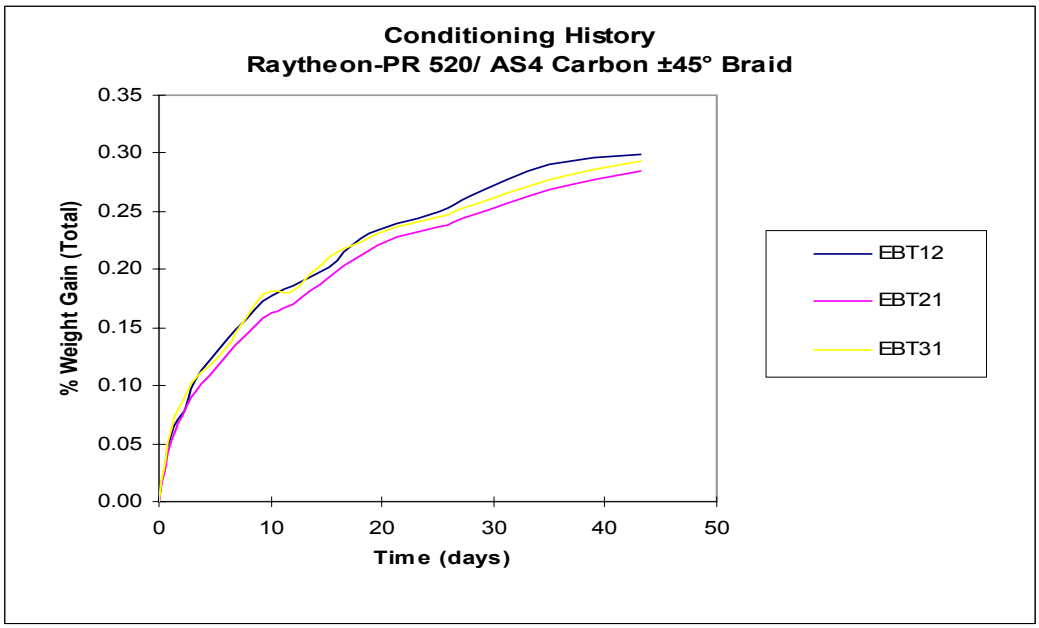


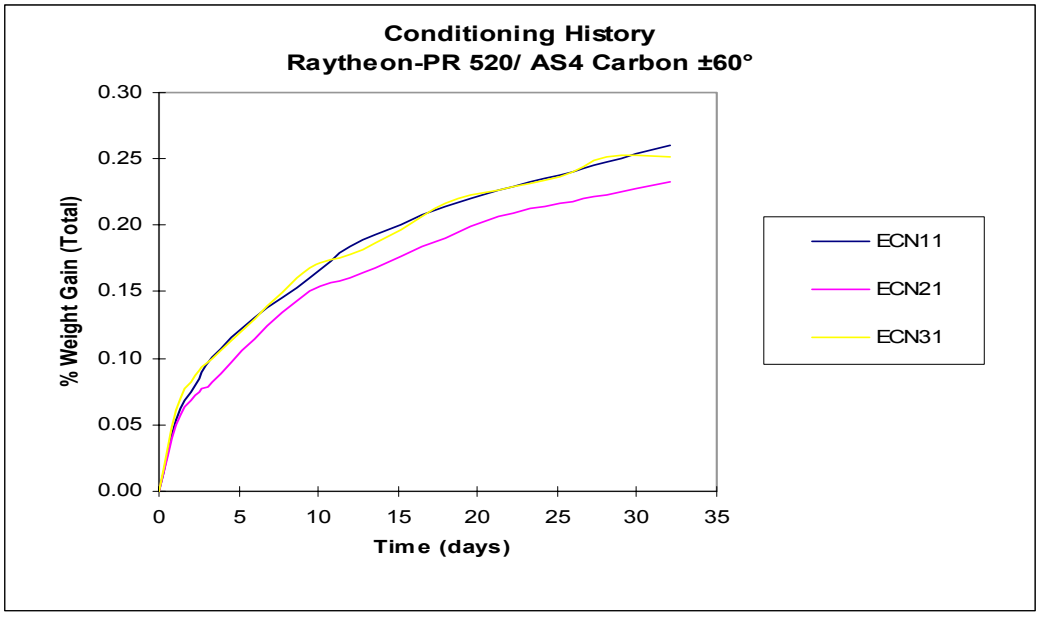


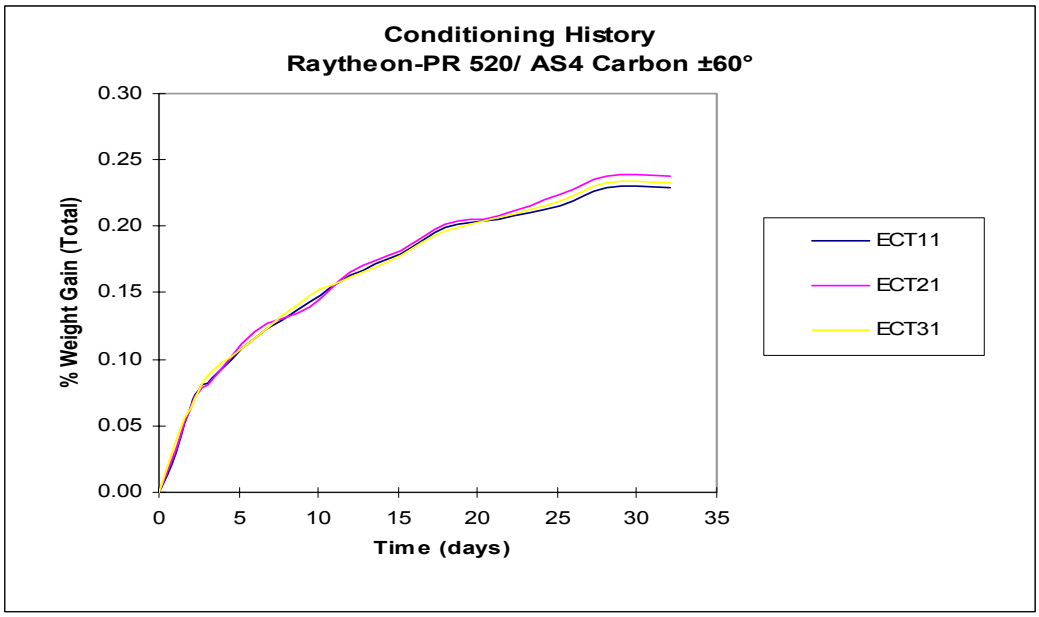


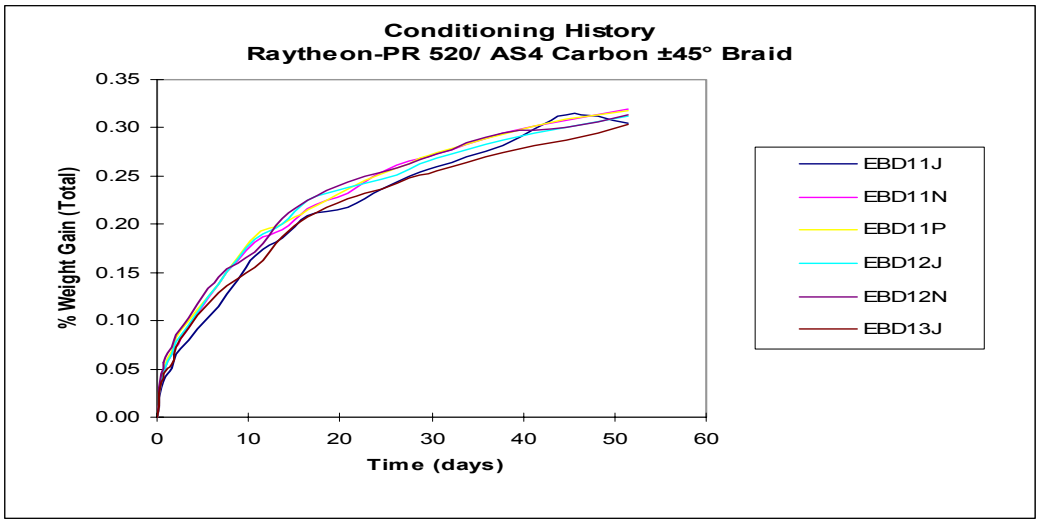


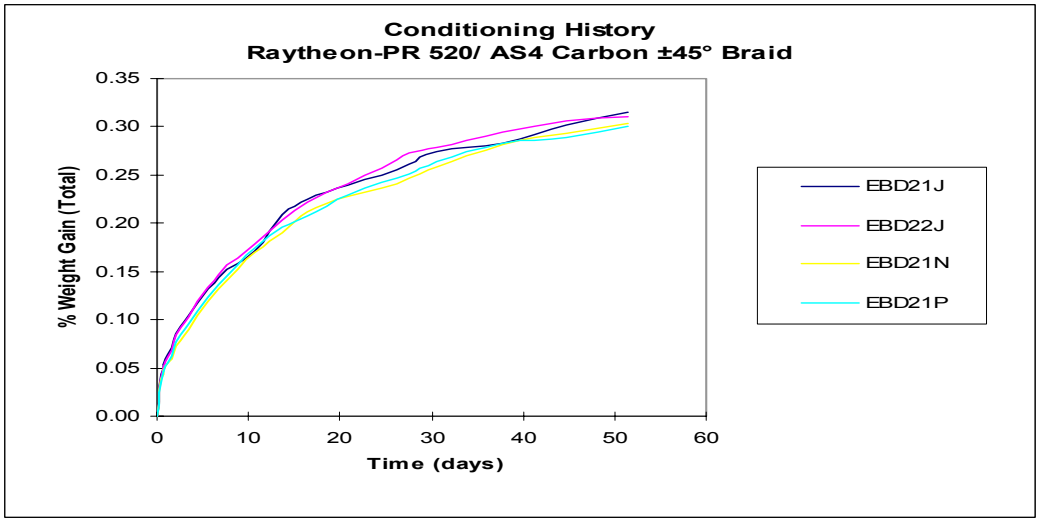


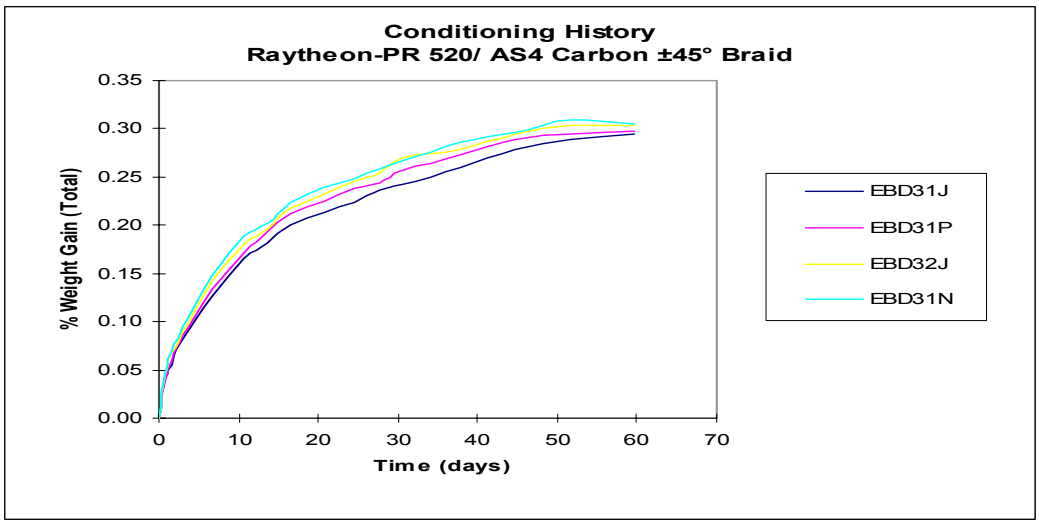


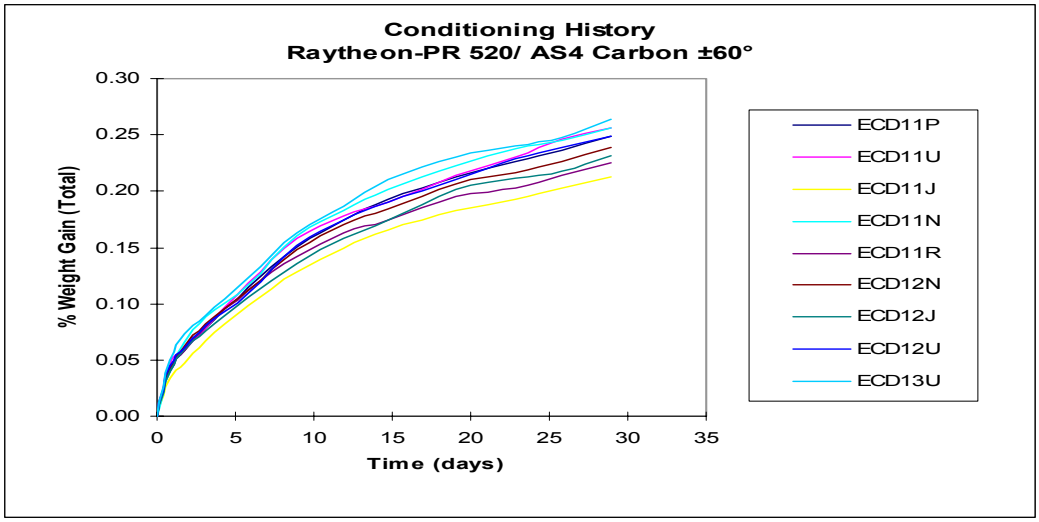


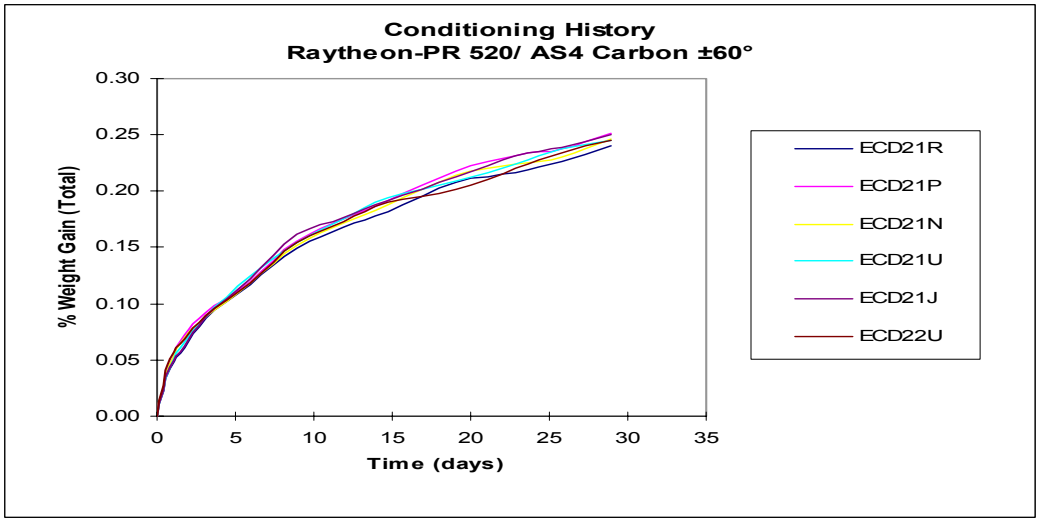


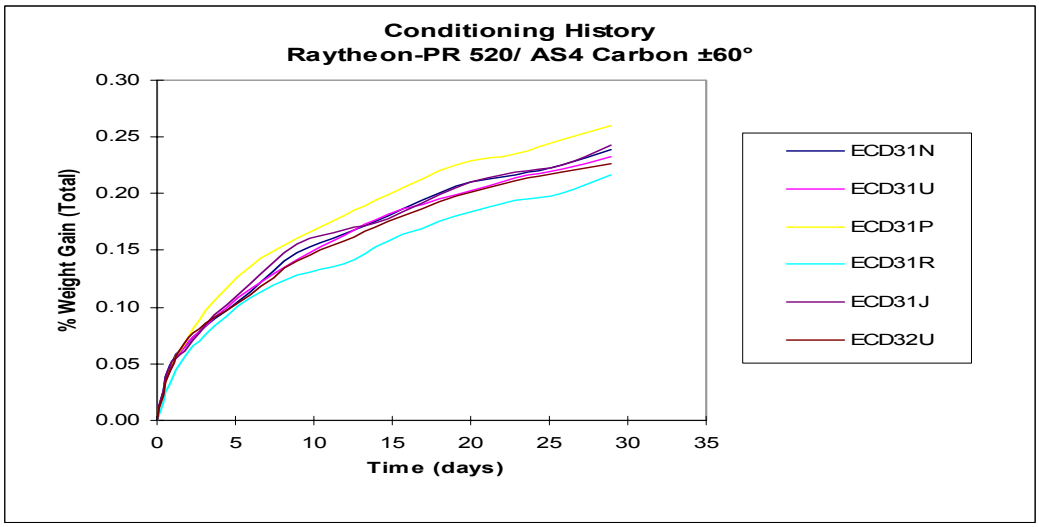












3.5 Physical Test Results

Physical Test Summary
Raytheon-PR 520/ AS4 Carbon ±45° Braid

	Composite Density [g/cc]	Resin Content [wt%]	Fiber Volume [vol%]	Void Content [vol%]
0° Tension (EBJXXXXX)				
No. of Specimens	7	7	7	7
Mean	1.549	32.609	58.035	1.550
Standard Deviation	0.003	1.185	1.037	0.475
In-Plane Shear (EBNXXXXX)				
No. of Specimens	4	4	4	4
Mean	1.549	32.051	58.515	1.767
Standard Deviation	0.006	0.913	0.992	0.211
0° Combined Loading Compression (EBPXXXXX)				
No. of Specimens	3	3	3	3
Mean	1.547	32.329	58.200	1.785
Standard Deviation	0.001	1.594	1.410	0.536
Overall No. of Specimens	**14**	**14**	**14**	**14**
Overall Mean	**1.549**	**32.389**	**58.207**	**1.663**
Overall Std. Deviation	**0.004**	**1.137**	**1.037**	**0.415**

Physical Test Summary
Raytheon-PR 520/ AS4 Carbon ±60°

	Composite Density [g/cc]	Resin Content [wt%]	Fiber Volume [vol%]	Void Content [vol%]
0° Tension (ECJXXXXX)				
No. of Specimens	4	4	4	4
Mean	1.569	29.764	61.252	1.393
Standard Deviation	0.002	1.418	1.306	0.441
90° Tension (ECUXXXXX)				
No. of Specimens	7	7	7	7
Mean	1.560	31.642	59.294	1.204
Standard Deviation	0.005	0.982	0.823	0.568
In-Plane Shear (ECNXXXXX)				
No. of Specimens	4	4	4	4
Mean	1.555	31.220	59.468	1.683
Standard Deviation	0.003	1.635	1.446	0.601
0° Combined Loading Compression (ECPXXXXX)				
No. of Specimens	3	3	3	3
Mean	1.562	32.254	58.813	0.896
Standard Deviation	0.007	1.357	1.431	0.117
90° Combined Loading Compression (ECRXXXXX)				
No. of Specimens	3	3	3	3
Mean	1.567	30.773	60.290	1.142
Standard Deviation	0.006	0.477	0.654	0.228
Overall No. of Specimens	**21**	**21**	**21**	**21**
Overall Mean	**1.562**	**31.167**	**59.774**	**1.278**
Overall Std. Deviation	**0.006**	**1.368**	**1.317**	**0.499**

COMPANY : RAYTHEON
MATERIAL SYSTEM : Raytheon-PR 520/ AS4 Carbon ±45°
PROJECT : 990414C1

DMA Results -- Onset Storage Modulus

DRY

As Fabricated		
Sample #	**Tg [°C]**	**Tg [°F]**
EBD11J1A	149.92	301.85
EBD12J1A	149.57	301.23
EBD13J1A	149.50	301.09
EBD11N1A	146.88	296.38
EBD12N1A	151.71	305.08
EBD11P1A	149.11	300.40
EBD21J1A	152.98	307.37
EBD22J1A	148.76	299.77
EBD21N1A	151.56	304.81
EBD21P1A	152.24	306.04
EBD31J1A	148.98	300.16
EBD32J1A	150.80	303.44
EBD31N1A	151.21	304.17
EBD31P1A	152.17	305.90
Average [°F]		**302.69**
Standard Dev. [°F]		**3.06**
Coeff. Of Var. [%]		**1.01**

WET

Moisture Equilibrium at 85% RH		
Sample #	**Tg [°C]**	**Tg [°F]**
EBD11J4F	137.68	279.82
EBD12J4F	138.47	281.25
EBD13J4F	139.76	283.58
EBD11N4F	133.34	272.01
EBD12N4F	140.20	284.35
EBD11P4F	139.74	283.54
EBD21J4F	138.73	281.72
EBD22J4F	137.50	279.50
EBD21N4F	134.83	274.69
EBD21P4F	137.27	279.09
EBD31J4F	141.00	285.80
EBD32J4F	139.30	282.73
EBD31N4F	139.22	282.60
EBD31P4F	140.54	284.96
Average [°F]		**281.12**
Standard Dev. [°F]		**3.89**
Coeff. Of Var. [%]		**1.38**

DMA Results - Peak Tan Delta

DRY

As Fabricated		
Sample #	**Tg [°C]**	**Tg [°F]**
EBD11J1A	162.10	323.78
EBD12J1A	162.67	324.81
EBD13J1A	161.70	323.06
EBD11N1A	160.93	321.68
EBD12N1A	164.45	328.01
EBD11P1A	161.96	323.52
EBD21J1A	164.59	328.26
EBD22J1A	161.88	323.38
EBD21N1A	162.42	324.35
EBD21P1A	162.55	324.58
EBD31J1A	163.48	326.26
EBD32J1A	162.88	325.18
EBD31N1A	163.62	326.51
EBD31P1A	165.00	329.00
Average [°F]		**325.17**
Standard Dev. [°F]		**2.16**
Coeff. Of Var. [%]		**0.67**

WET

Moisture Equilibrium at 85% RH		
Sample #	**Tg [°C]**	**Tg [°F]**
EBD11J4F	158.63	317.53
EBD12J4F	161.05	321.89
EBD13J4F	160.96	321.73
EBD11N4F	160.39	320.71
EBD12N4F	162.97	325.35
EBD11P4F	161.76	323.16
EBD21J4F	159.87	319.77
EBD22J4F	161.05	321.88
EBD21N4F	159.38	318.88
EBD21P4F	159.29	318.72
EBD31J4F	160.49	320.89
EBD32J4F	158.84	317.91
EBD31N4F	159.36	318.85
EBD31P4F	160.07	320.13
Average [°F]		**320.53**
Standard Dev. [°F]		**2.17**
Coeff. Of Var. [%]		**0.68**

COMPANY : RAYTHEON
MATERIAL SYSTEM : Raytheon-PR 520/ AS4 Carbon ±60°
PROJECT : 990414C1

DMA Results -- Onset Storage Modulus

DRY

As Fabricated		
Sample #	Tg [°C]	Tg [°F]
ECD11J2A	148.90	300.02
ECD12J1A	153.32	307.97
ECD11N1A	151.67	305.00
ECD12N1A	151.83	305.30
ECD11P1A	148.55	299.39
ECD11R1A	147.67	297.81
ECD11U1A	154.90	310.83
ECD12U1A	152.98	307.36
ECD13U2A	150.96	303.73
ECD21J1A	151.20	304.17
ECD21N1A	149.35	300.83
ECD21P1A	151.20	304.17
ECD21R1A	151.54	304.76
ECD21U1A	148.43	299.17
ECD22U1A	153.52	308.33
ECD31J1A	152.30	306.13
ECD31N1A	152.59	306.67
ECD31P1A	152.29	306.13
ECD31R1A	152.86	307.14
ECD31U1A	153.38	308.08
ECD32U1A	152.27	306.09
Average [°F]		304.72
Standard Dev. [°F]		3.47
Coeff. Of Var. [%]		1.14

WET

Moisture Equilibrium at 85% RH		
Sample #	Tg [°C]	Tg [°F]
ECD11J4F	147.33	297.20
ECD12J4F	137.85	280.13
ECD11N4F	137.53	279.55
ECD12N4F	137.03	278.65
ECD11P4F	139.84	283.71
ECD11R4F	139.93	283.88
ECD11U4F	146.50	295.71
ECD12U4F	138.73	281.71
ECD13U5F	138.02	280.44
ECD21J4F	135.50	275.89
ECD21N4F	141.83	287.29
ECD21P4F	136.62	277.92
ECD21R4F	137.16	278.89
ECD21U4F	135.52	275.93
ECD22U4F	138.44	281.18
ECD31J4F	140.64	285.15
ECD31N4F	135.75	276.35
ECD31P4F	140.28	284.51
ECD31R4F	136.00	276.79
ECD31U4F	143.49	290.28
ECD32U4F	137.53	279.55
Average [°F]		282.41
Standard Dev. [°F]		6.02
Coeff. Of Var. [%]		2.13

DMA Results - Peak Tan Delta

DRY

As Fabricated		
Sample #	Tg [°C]	Tg [°F]
ECD11J2A	165.21	329.37
ECD12J1A	167.00	332.60
ECD11N1A	166.85	332.34
ECD12N1A	167.13	332.83
ECD11P1A	162.90	325.22
ECD11R1A	161.77	323.18
ECD11U1A	167.50	333.51
ECD12U1A	164.15	327.46
ECD13U2A	166.81	332.26
ECD21J1A	165.74	330.33
ECD21N1A	167.40	333.31
ECD21P1A	166.35	331.44
ECD21R1A	166.09	330.97
ECD21U1A	165.70	330.25
ECD22U1A	167.34	333.22
ECD31J1A	166.39	331.49
ECD31N1A	167.15	332.88
ECD31P1A	168.04	334.47
ECD31R1A	166.84	332.31
ECD31U1A	171.40	340.53
ECD32U1A	166.62	331.92
Average [°F]		331.52
Standard Dev. [°F]		3.47
Coeff. Of Var. [%]		1.05

WET

Moisture Equilibrium at 85% RH		
Sample #	Tg [°C]	Tg [°F]
ECD11J4F	165.48	329.86
ECD12J4F	162.01	323.63
ECD11N4F	163.17	325.71
ECD12N4F	162.23	324.01
ECD11P4F	161.53	322.75
ECD11R4F	159.67	319.40
ECD11U4F	161.33	322.40
ECD12U4F	165.27	329.49
ECD13U5F	162.18	323.93
ECD21J4F	156.06	312.91
ECD21N4F	161.74	323.12
ECD21P4F	161.50	322.71
ECD21R4F	161.44	322.58
ECD21U4F	160.23	320.41
ECD22U4F	161.38	322.48
ECD31J4F	157.05	314.70
ECD31N4F	160.86	321.56
ECD31P4F	161.71	323.08
ECD31R4F	161.56	322.81
ECD31U4F	157.90	316.21
ECD32U4F	161.70	323.07
Average [°F]		322.23
Standard Dev. [°F]		4.04
Coeff. Of Var. [%]		1.25

COMPANY : RAYTHEON
MATERIAL SYSTEM : Raytheon-PR 520/ AS4 Carbon
PROJECT : 990414C1

DMA Results -- Onset Storage Modulus

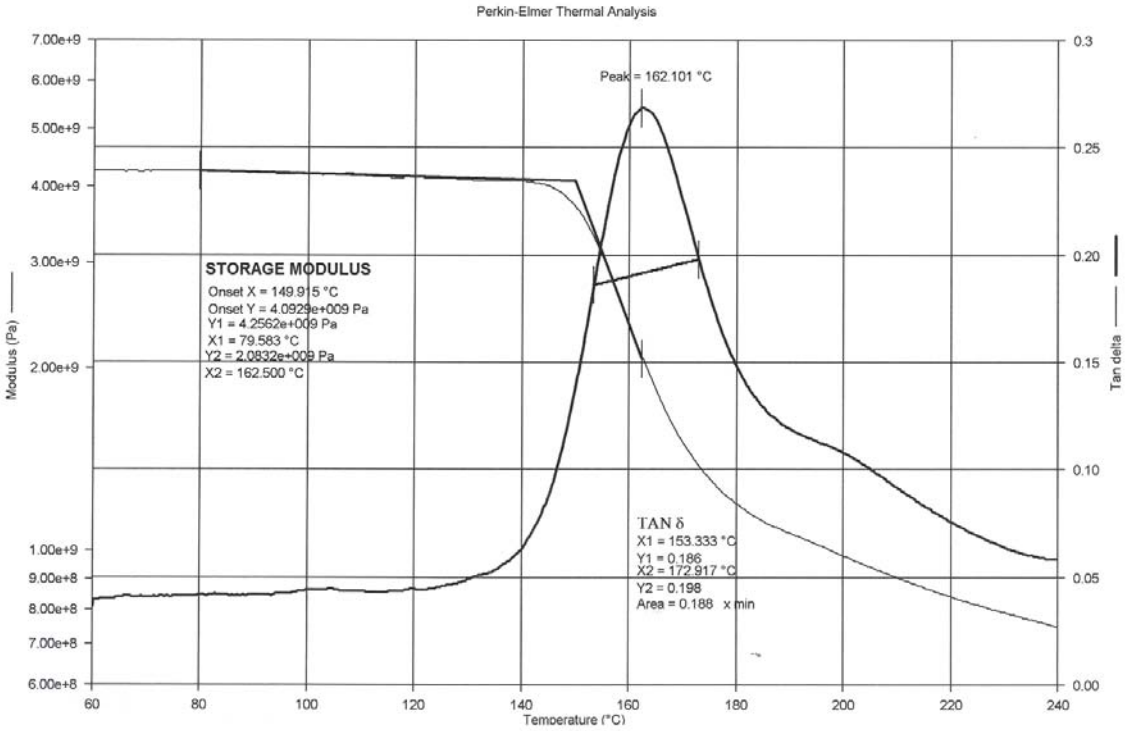
DRY

Sample #	As Fabricated Tg [°C]	Tg [°F]
ECDX1L1A	156.53	313.75
ECDX1G1A	150.63	303.14
ECDX2L1A	157.14	314.85
ECDX2G1A	153.30	307.93
EBDX1L1A	153.25	307.85
EBDX1G2A	152.43	306.38
	Average [°F]	**308.98**
	Standard Dev. [°F]	**4.48**
	Coeff. Of Var. [%]	**1.45**

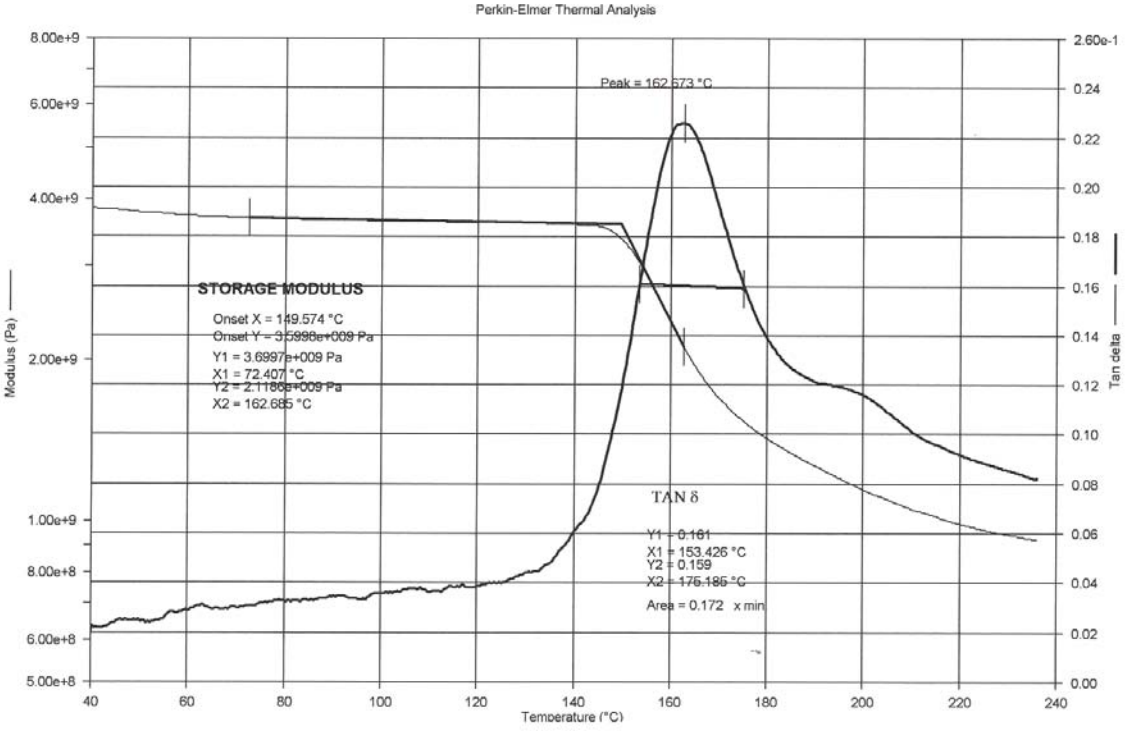
DMA Results -- Peak Tan Delta

DRY

Sample #	As Fabricated Tg [°C]	Tg [°F]
ECDX1L1A	167.64	333.76
ECDX1G1A	162.87	325.17
ECDX2L1A	166.26	331.27
ECDX2G1A	164.58	328.25
EBDX1L1A	164.85	328.74
EBDX1G2A	163.51	326.31
	Average [°F]	**328.92**
	Standard Dev. [°F]	**3.17**
	Coeff. Of Var. [%]	**0.96**



EBD11J1A



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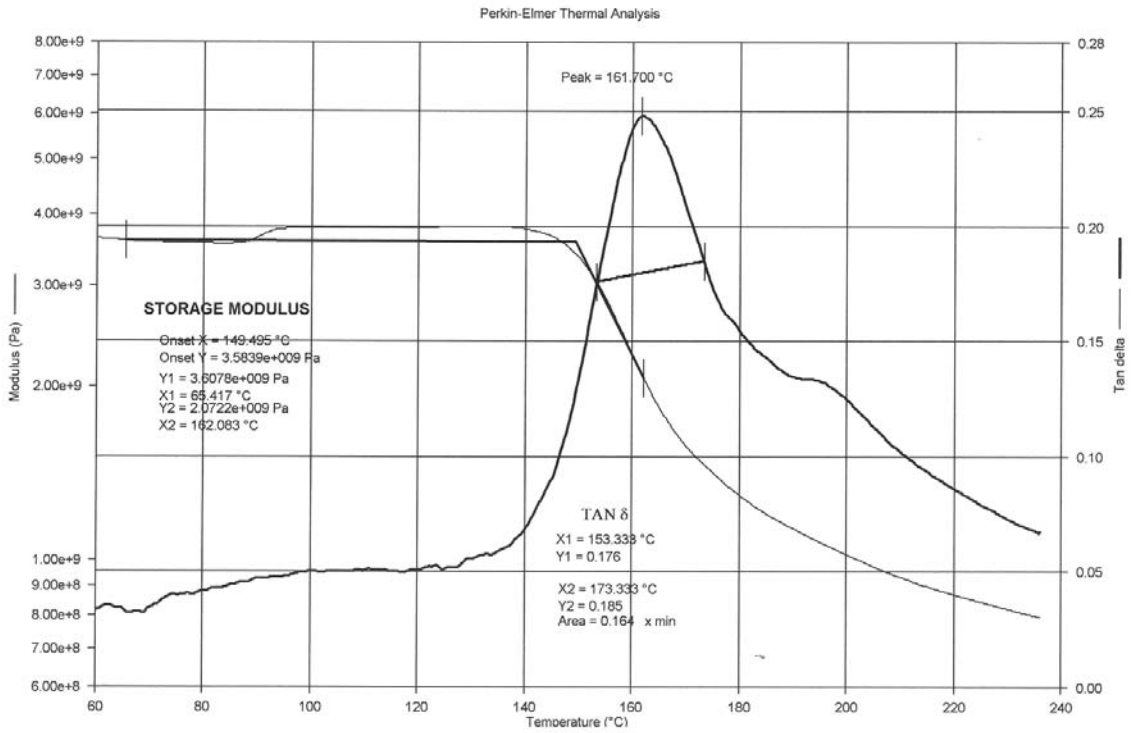

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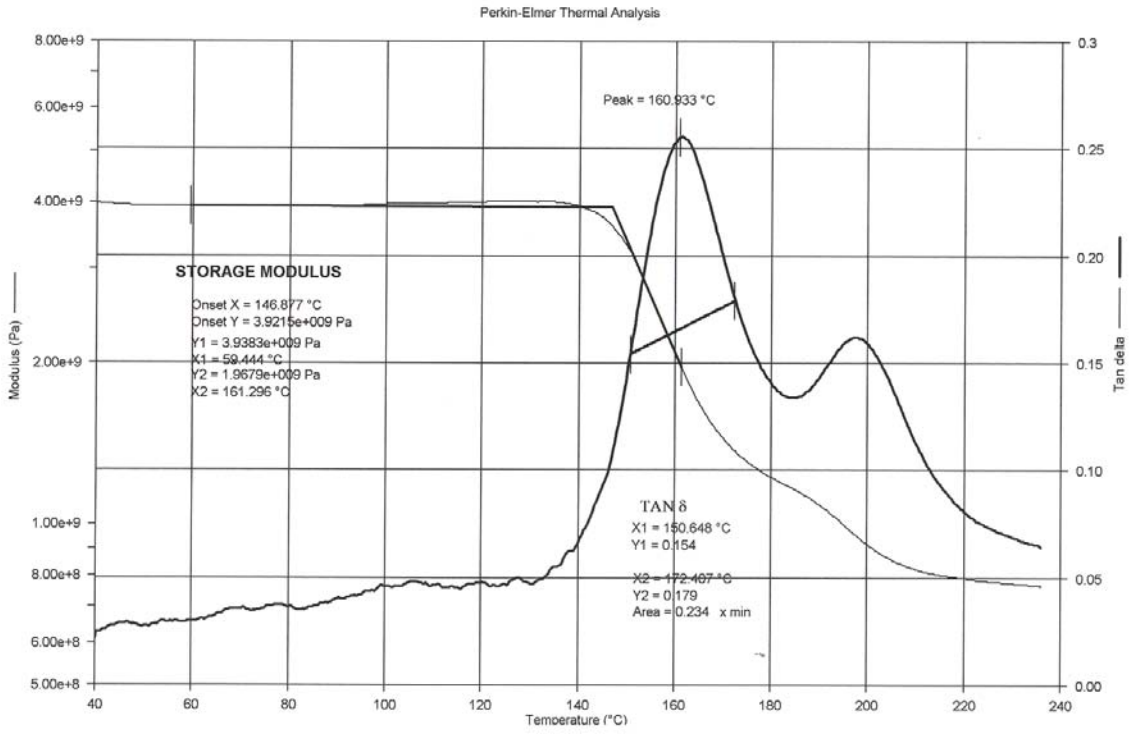

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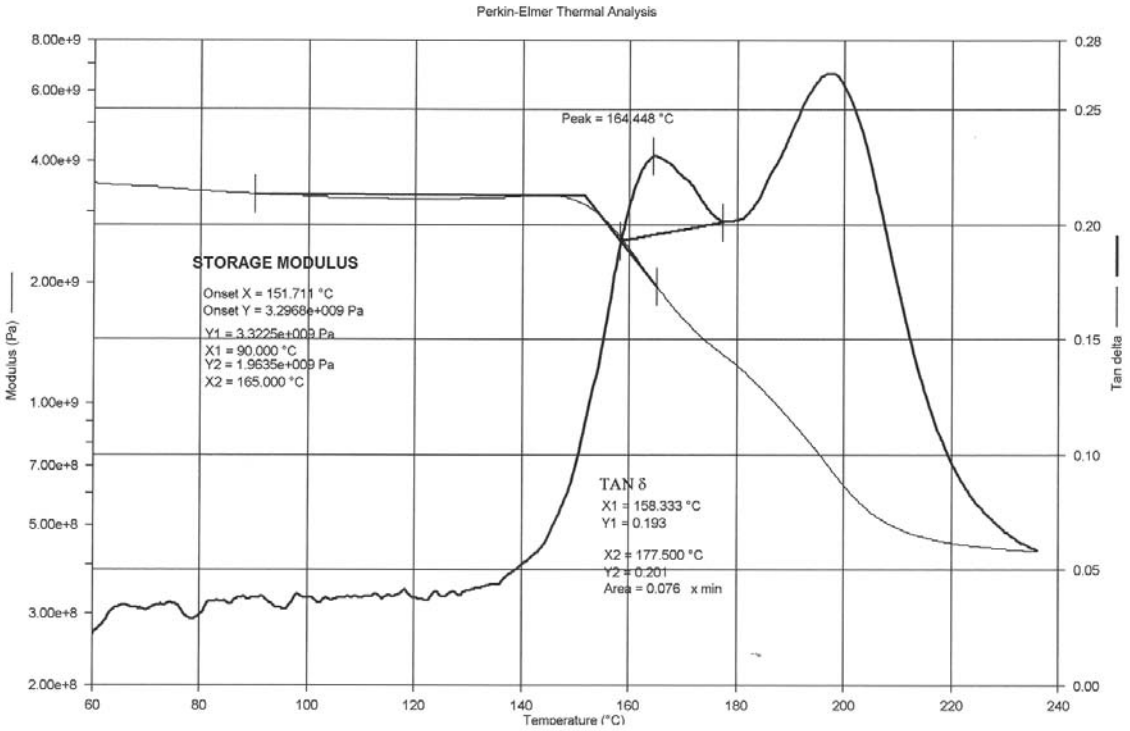

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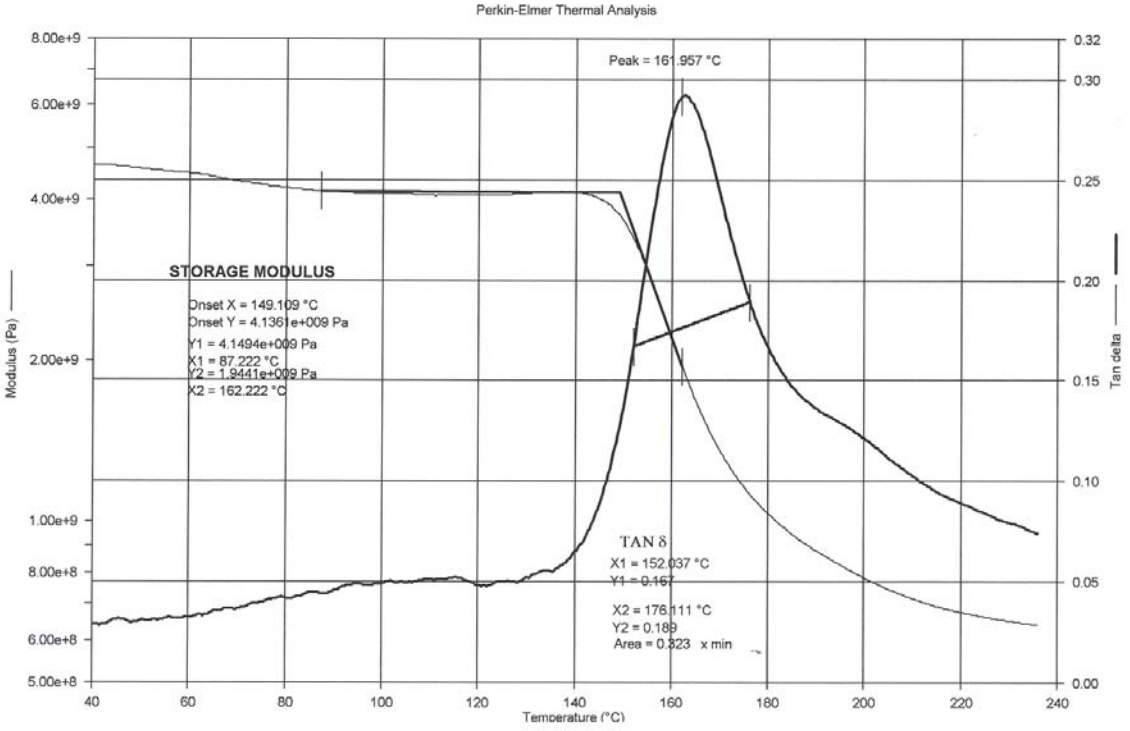

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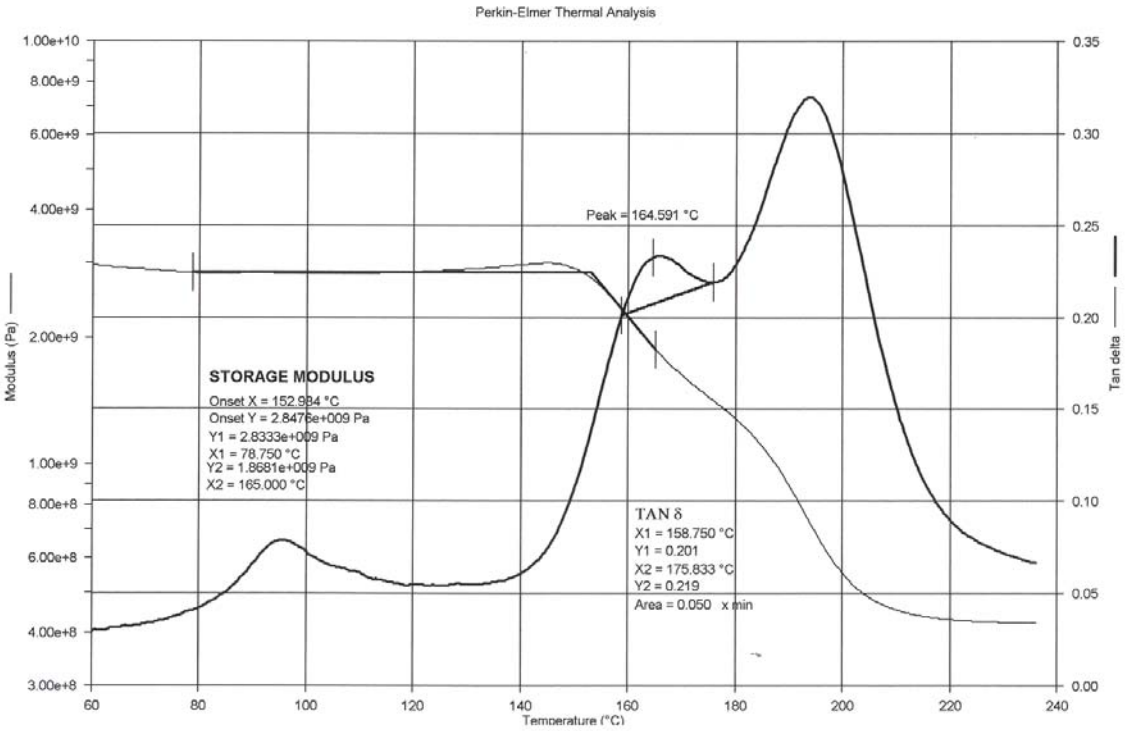

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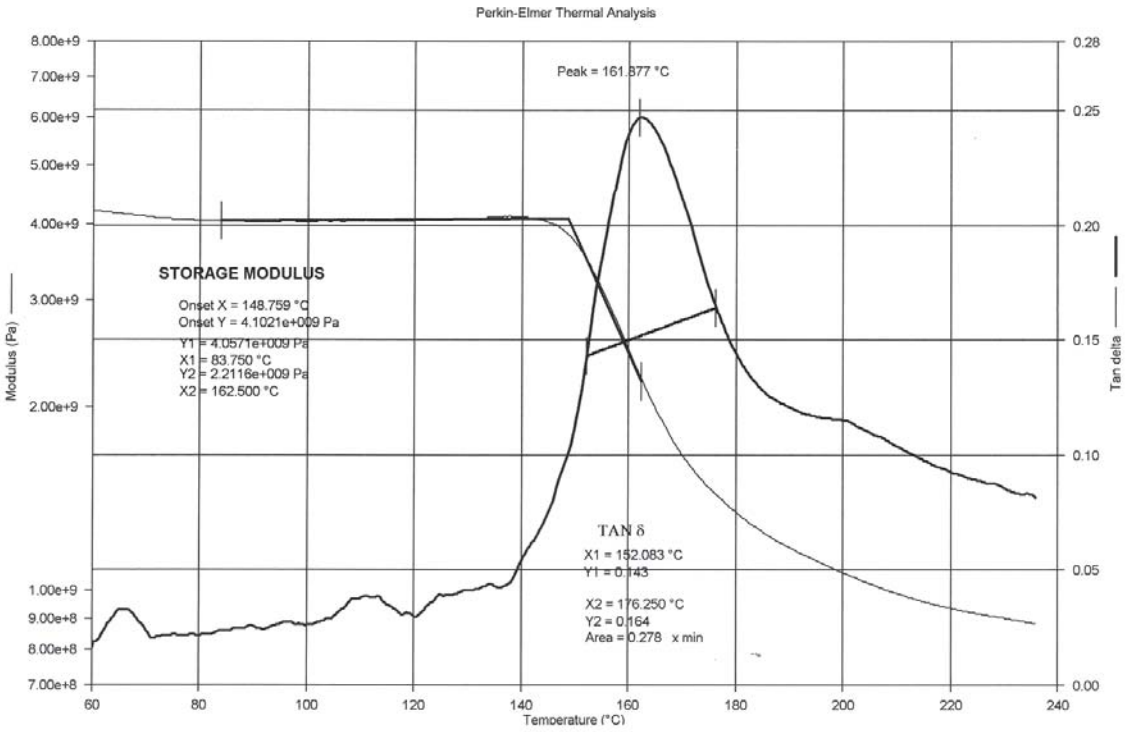

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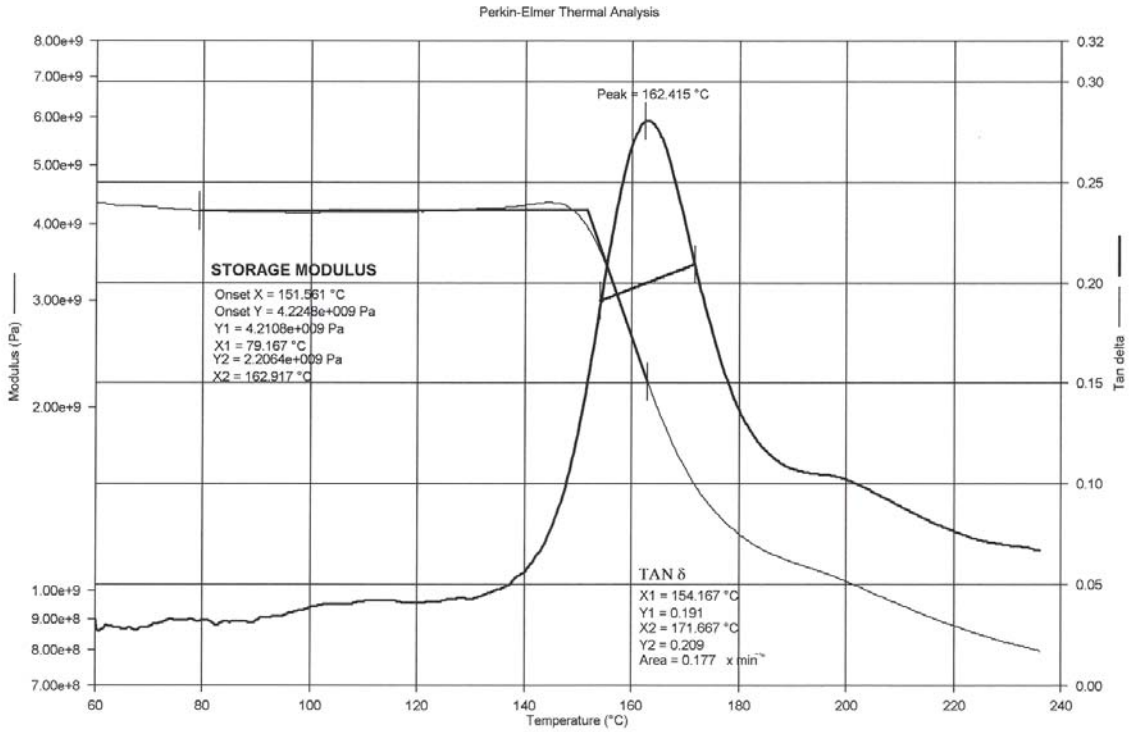

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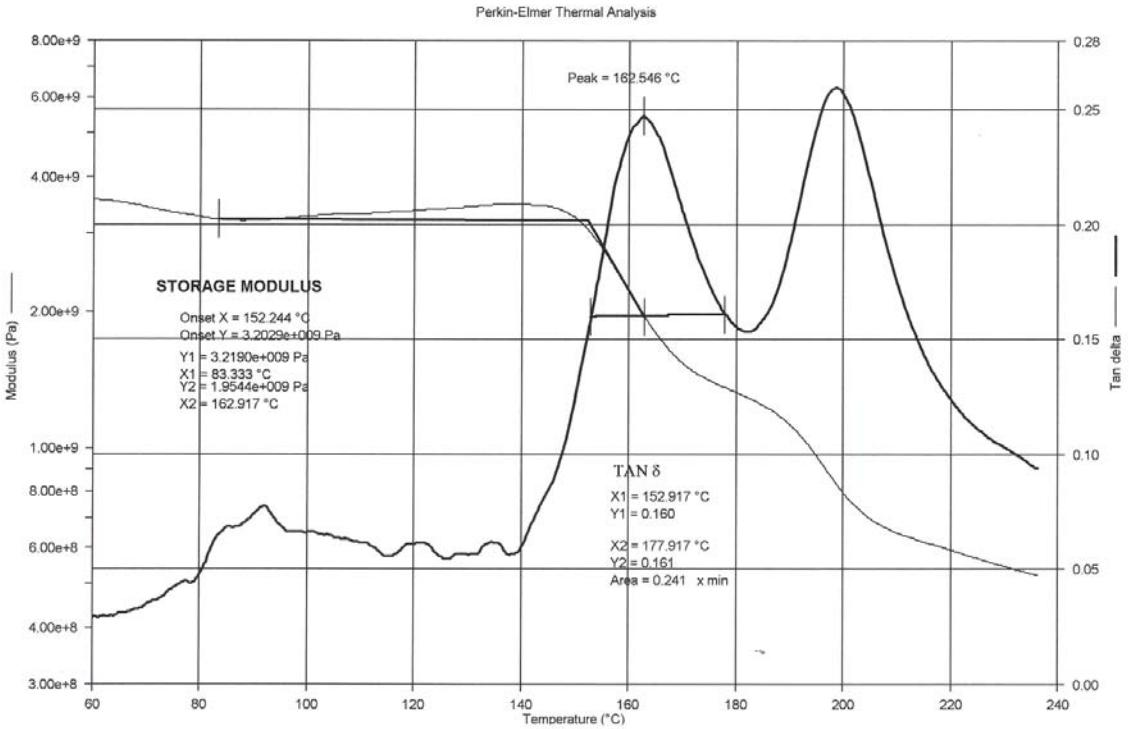

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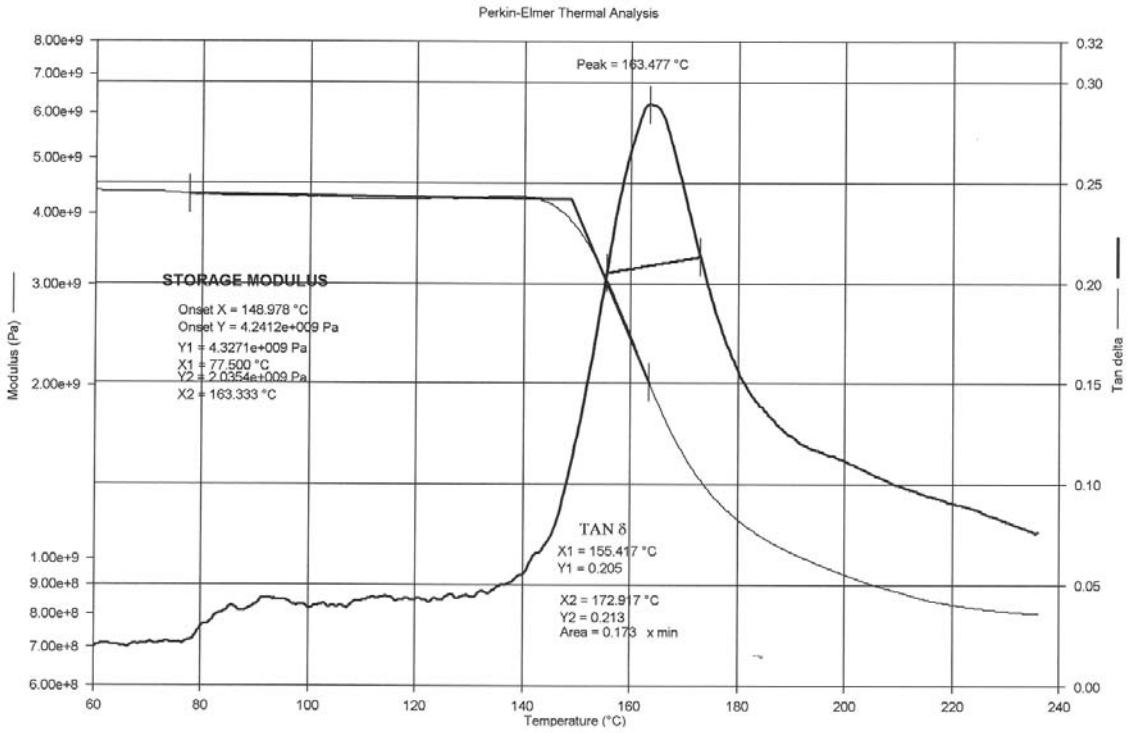

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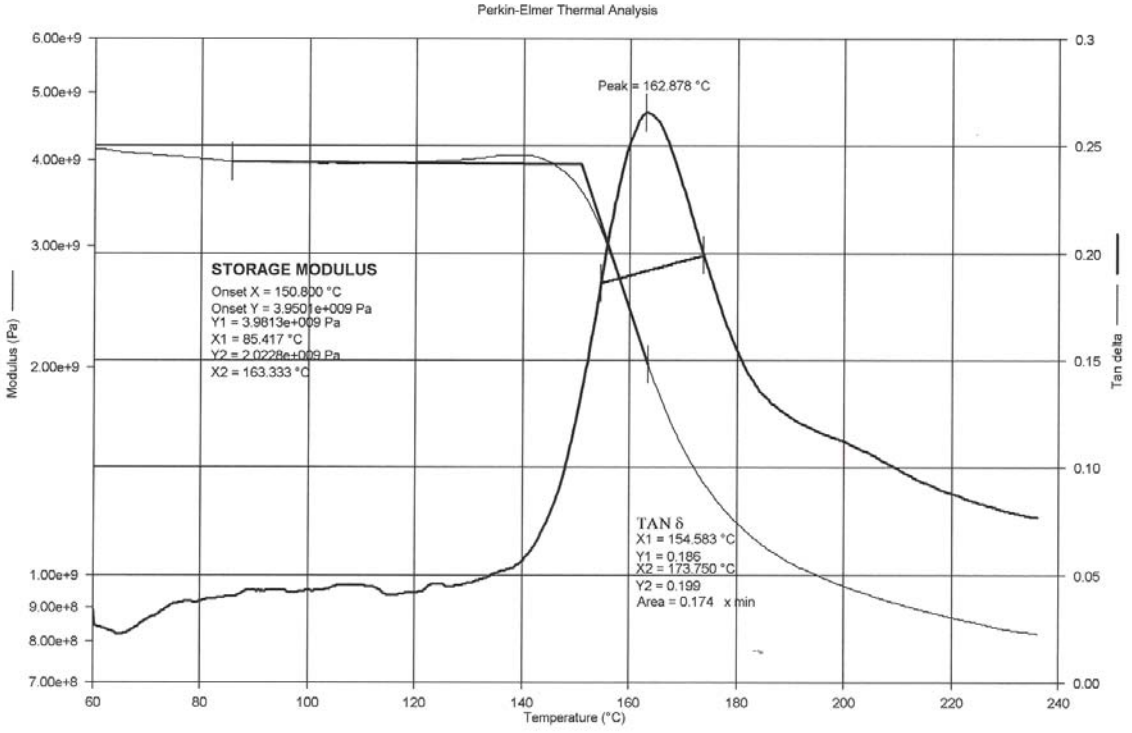

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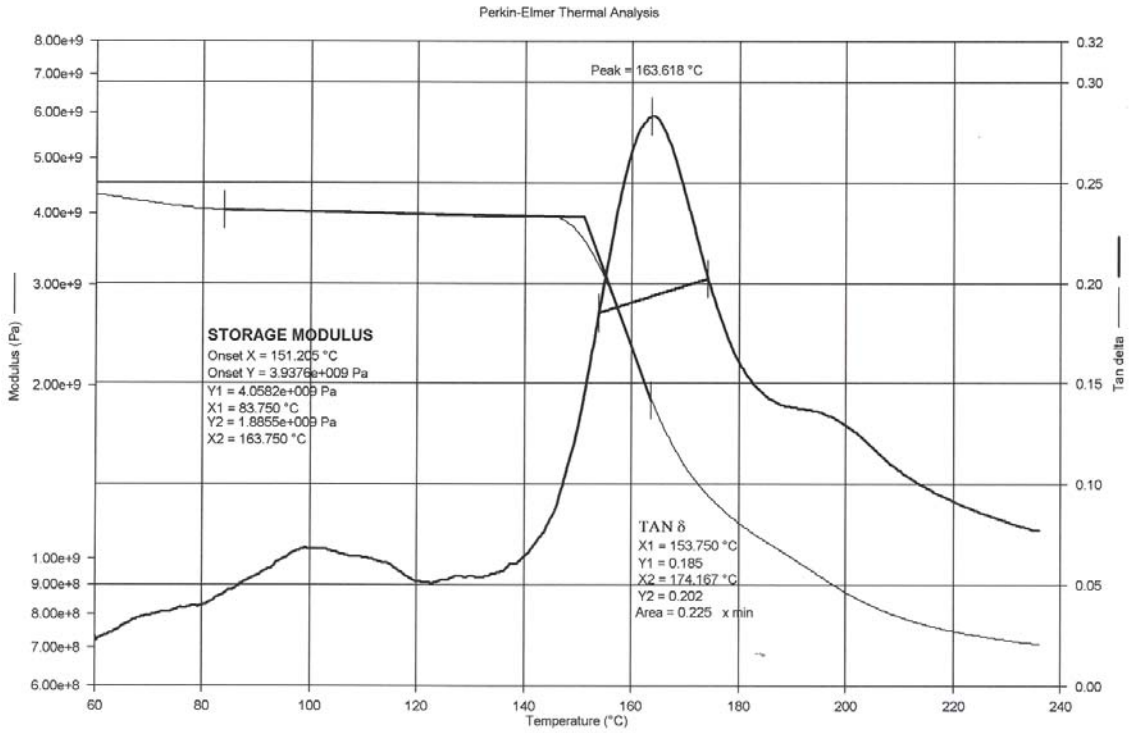

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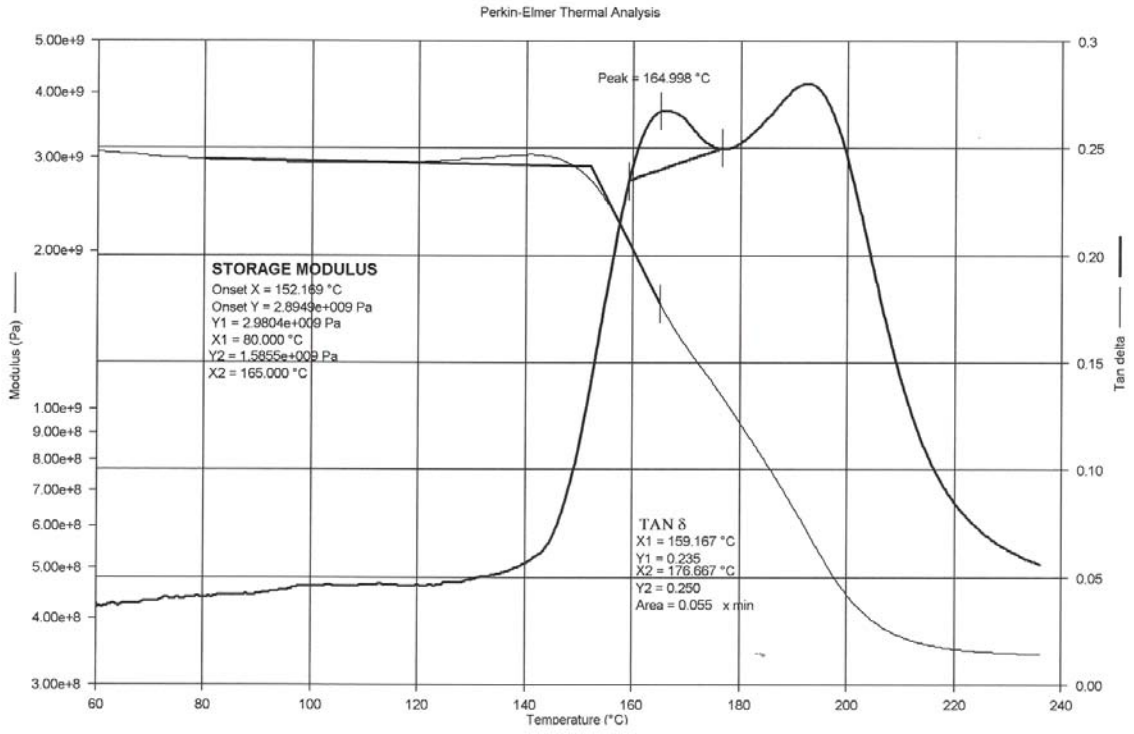

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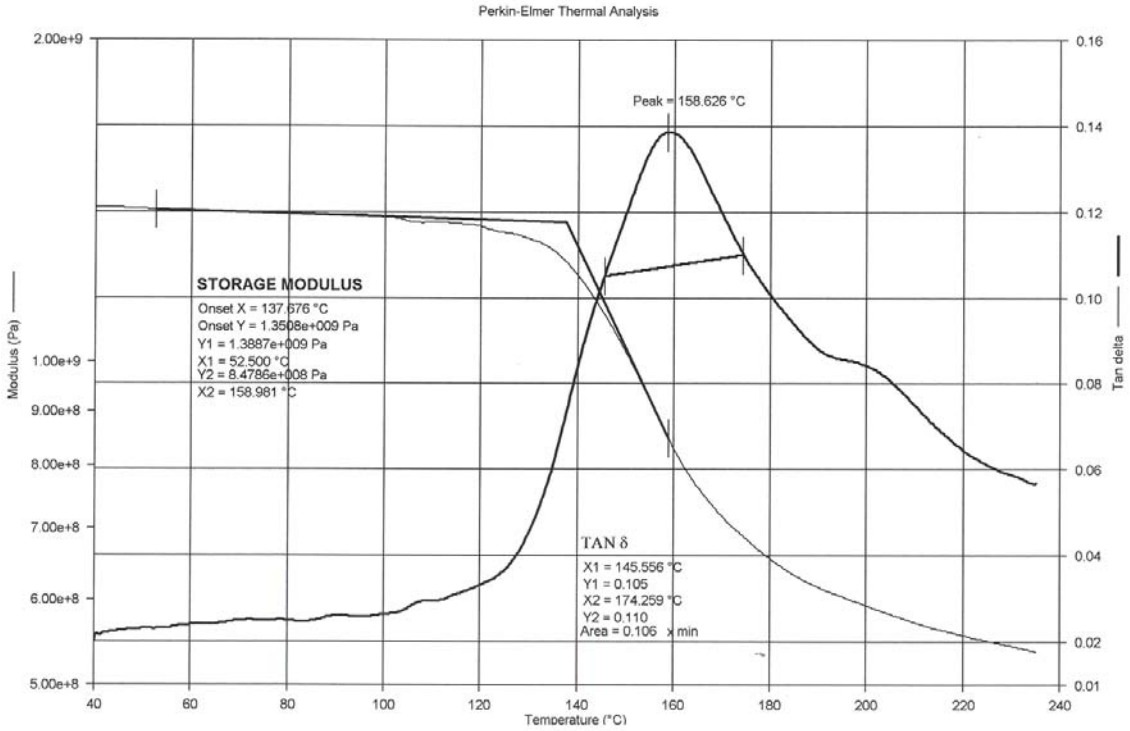

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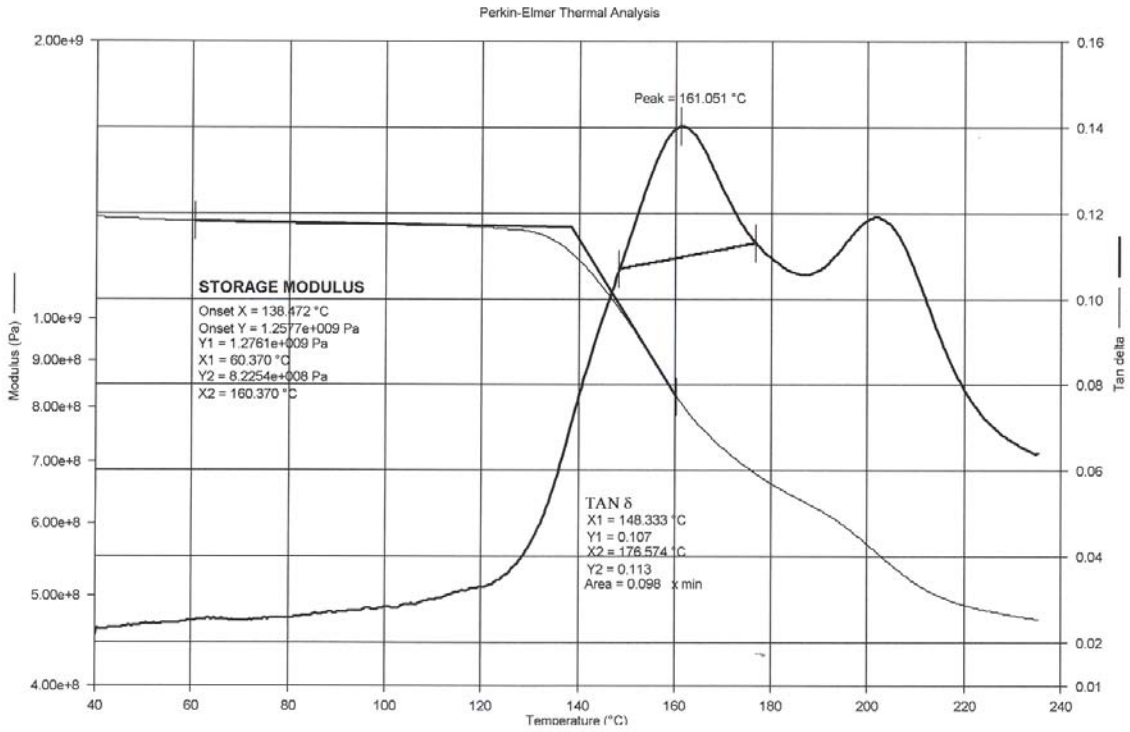

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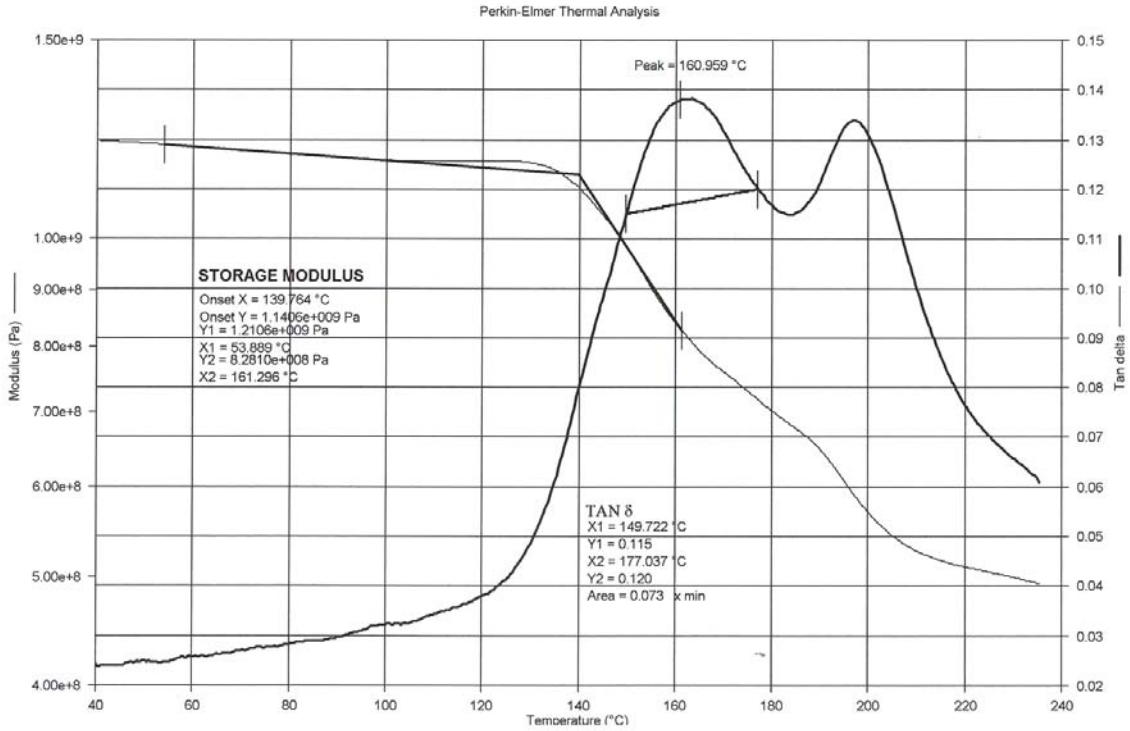

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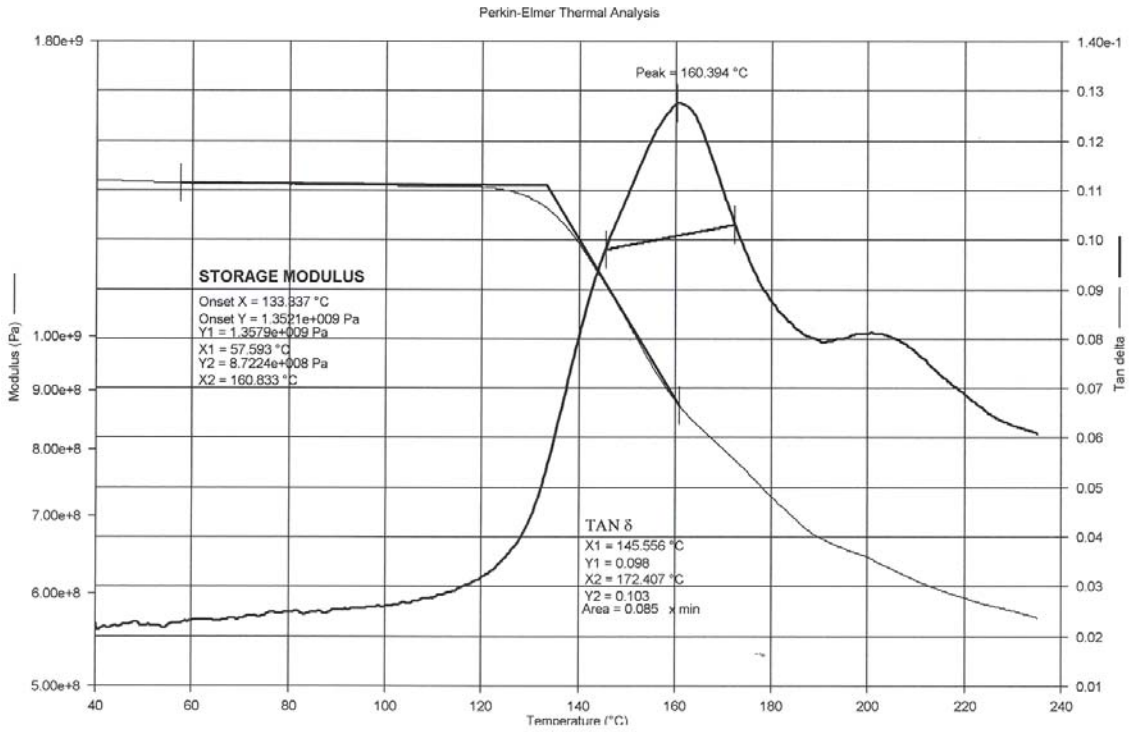

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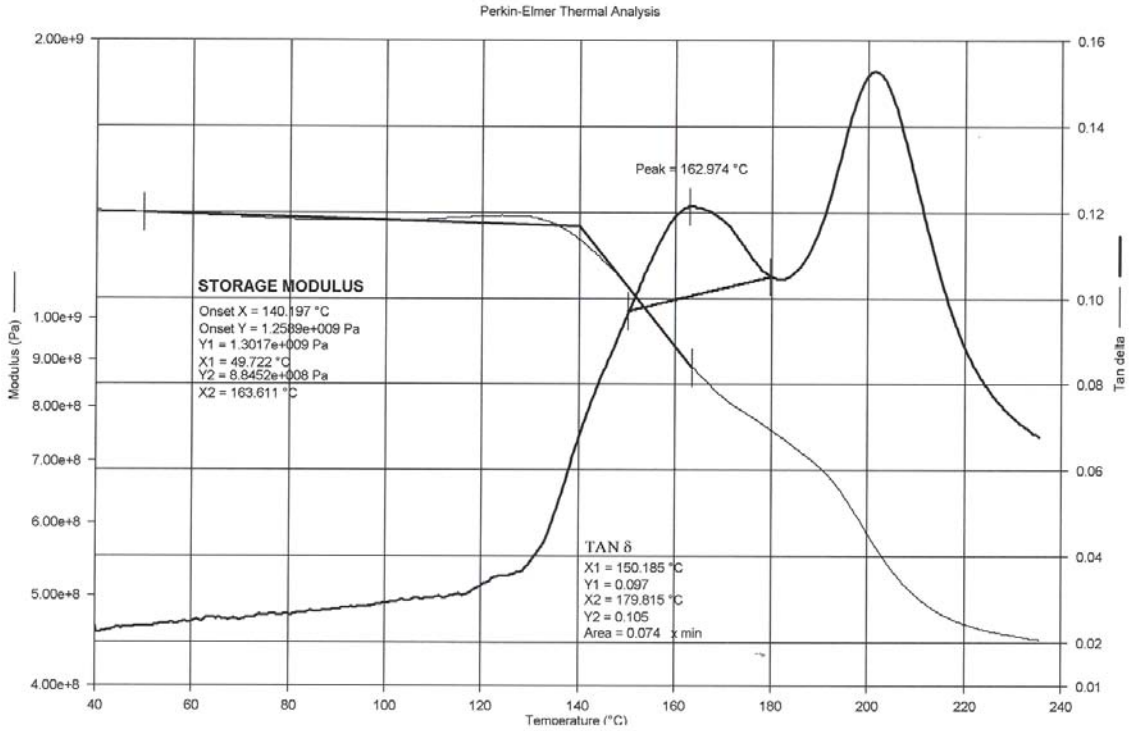

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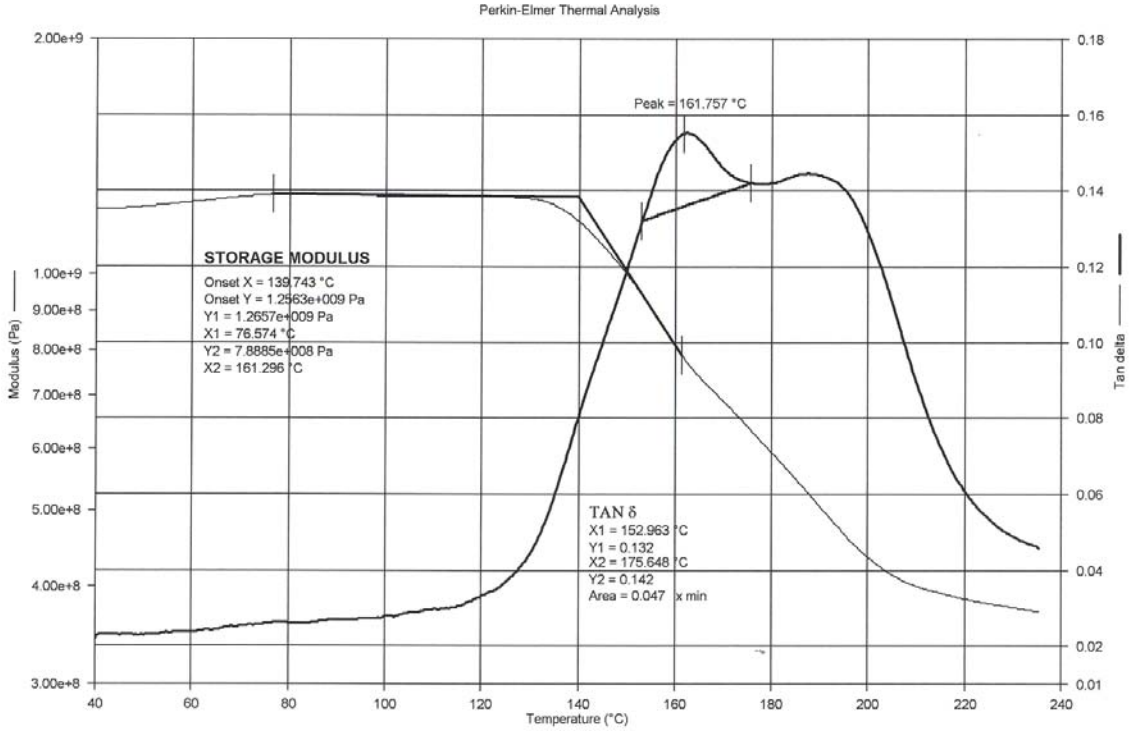

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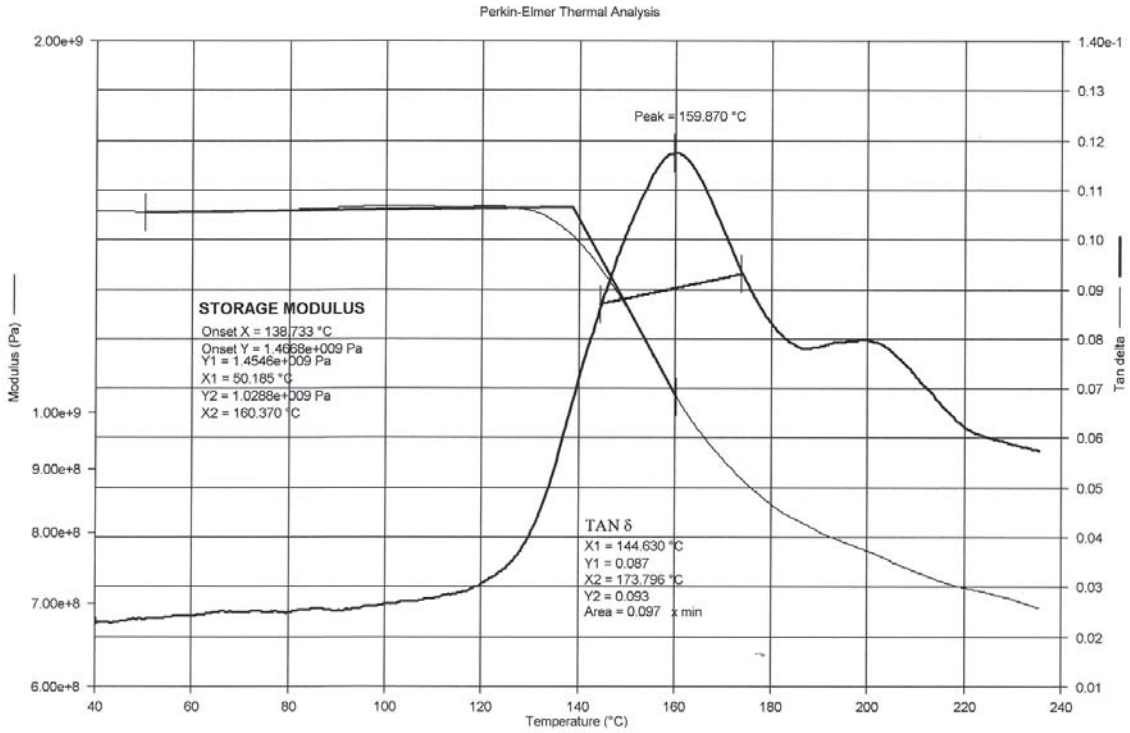

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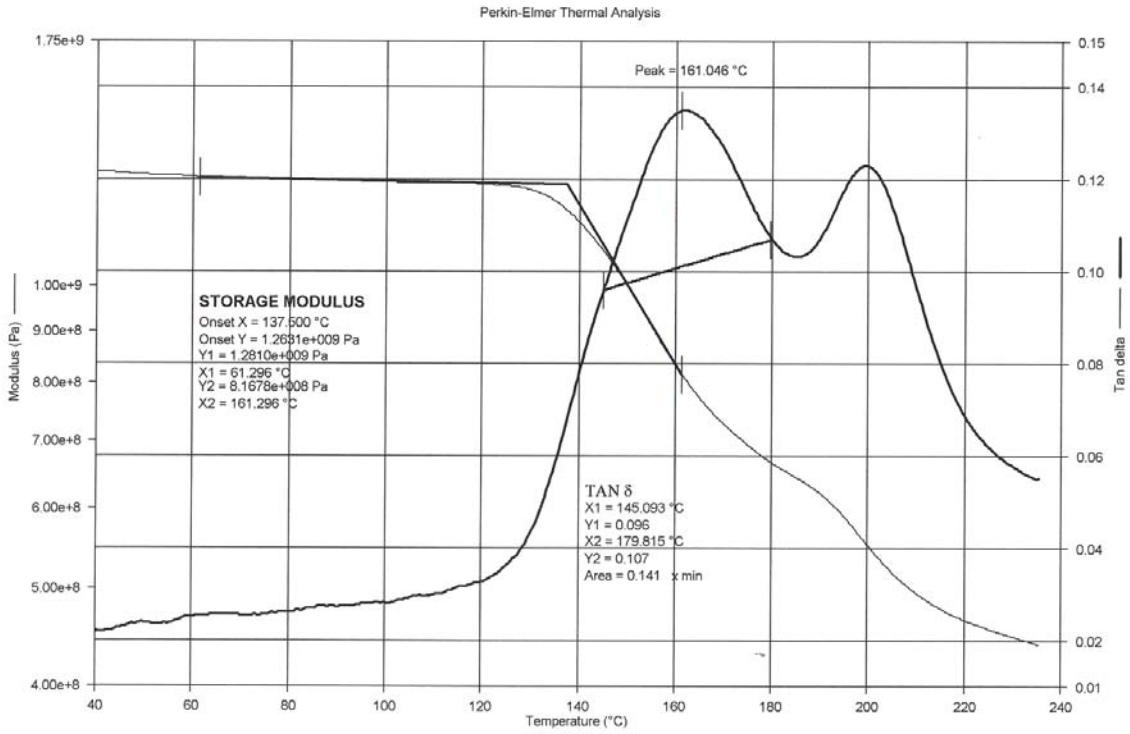

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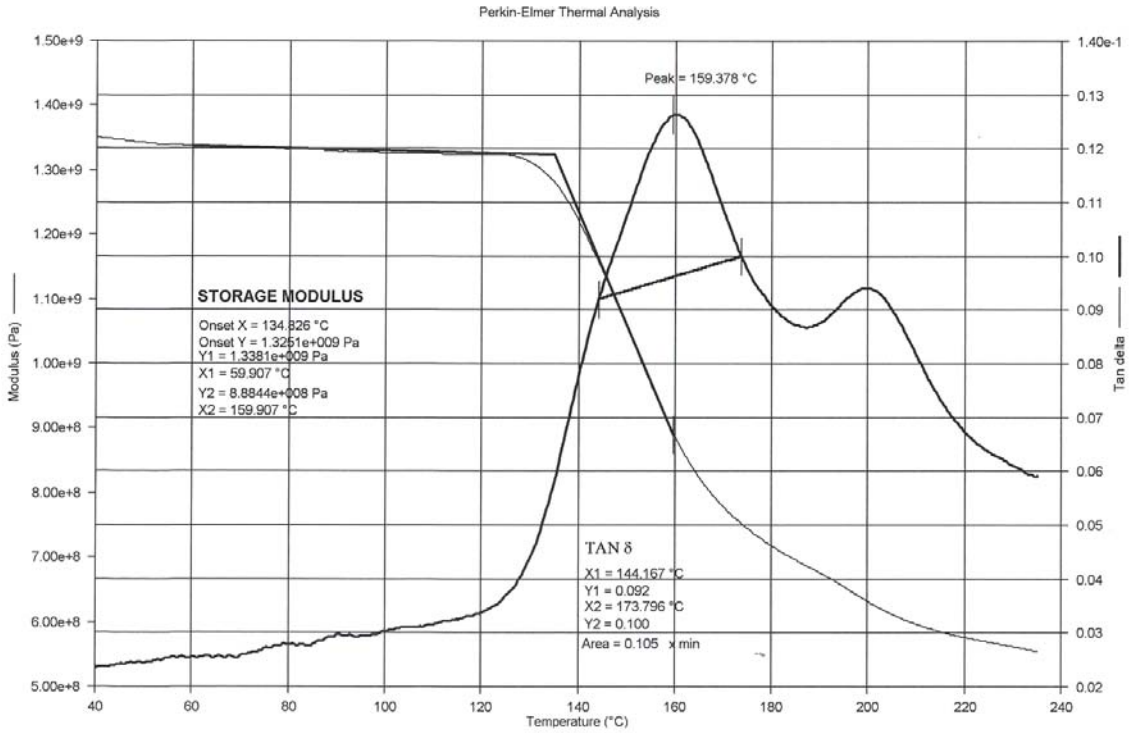

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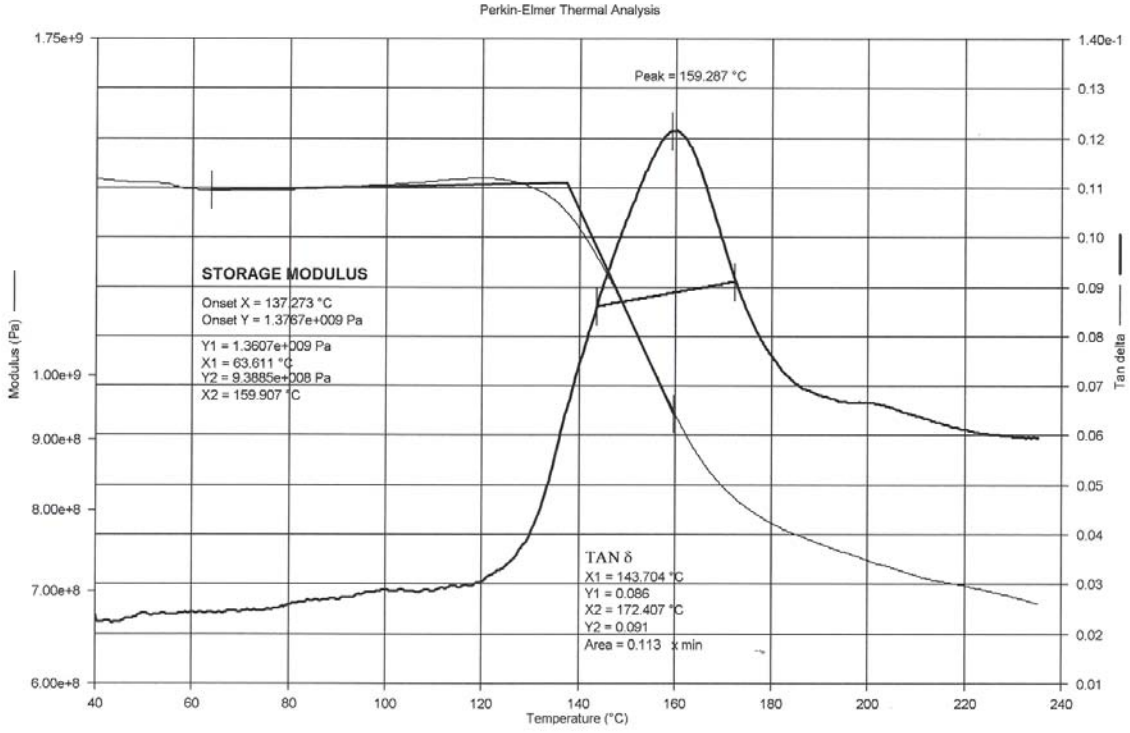

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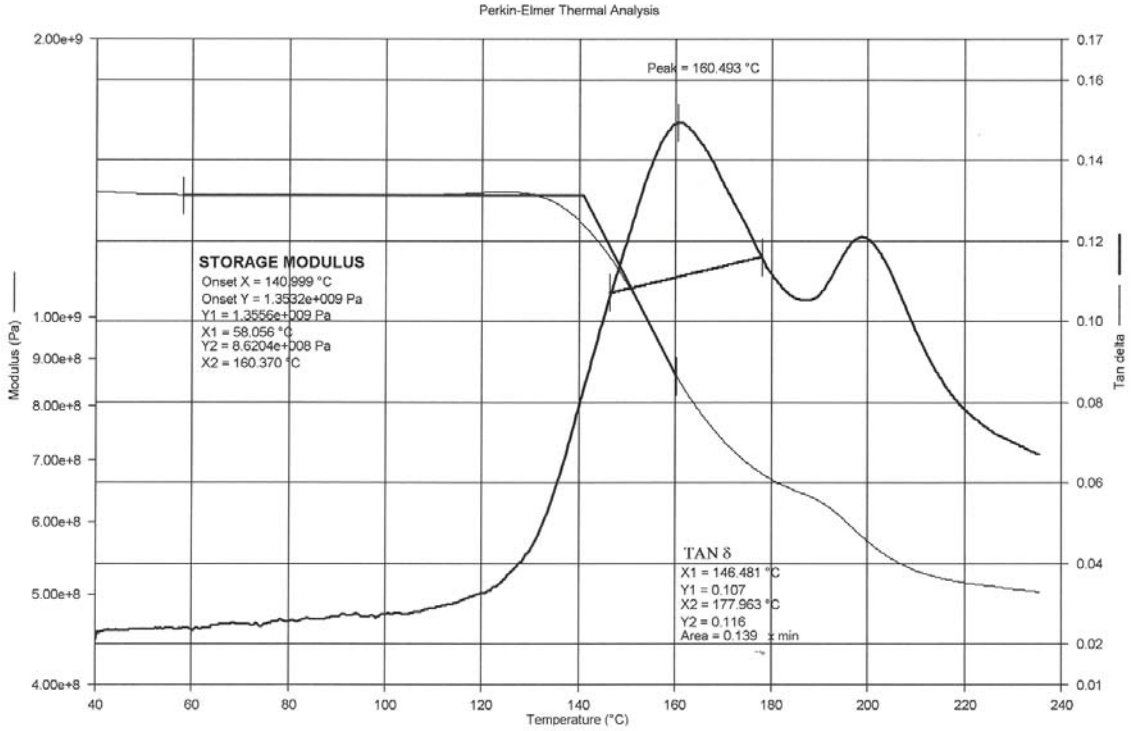

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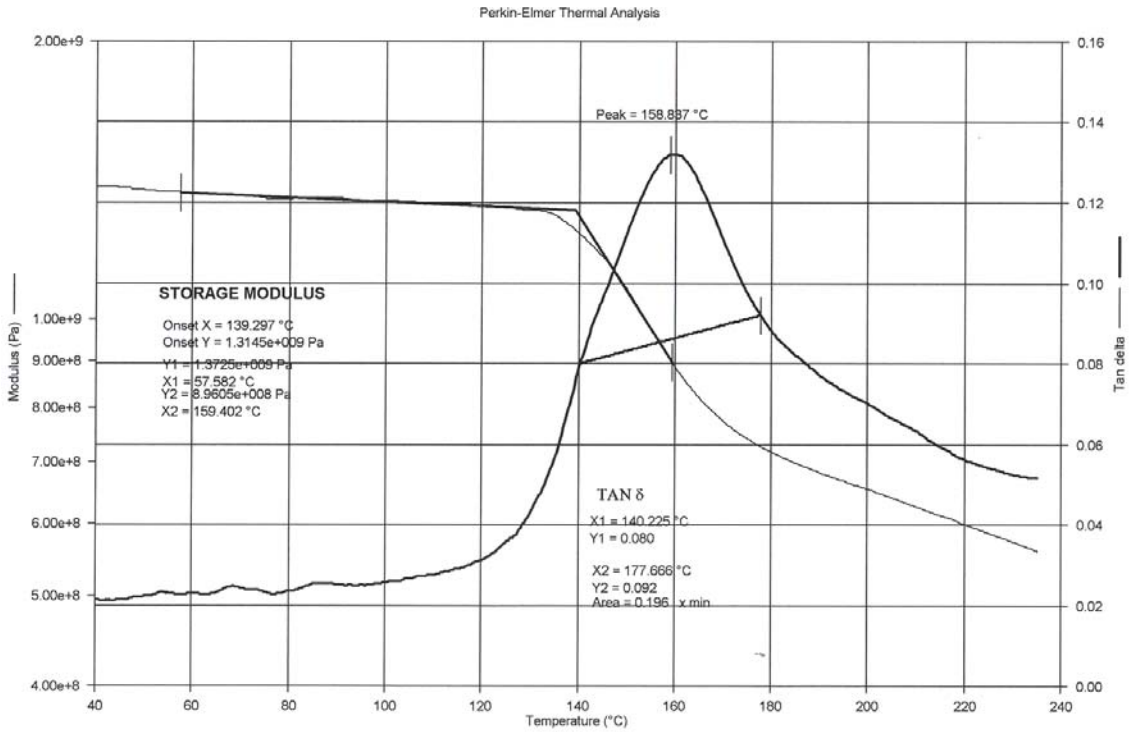

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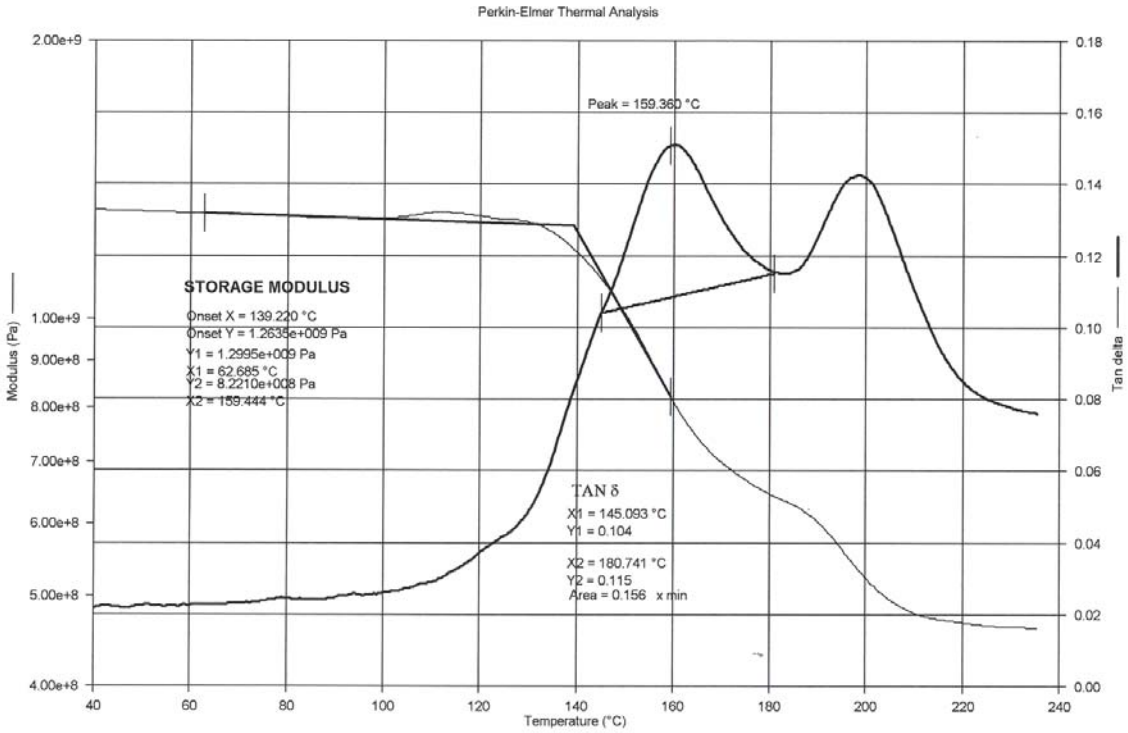

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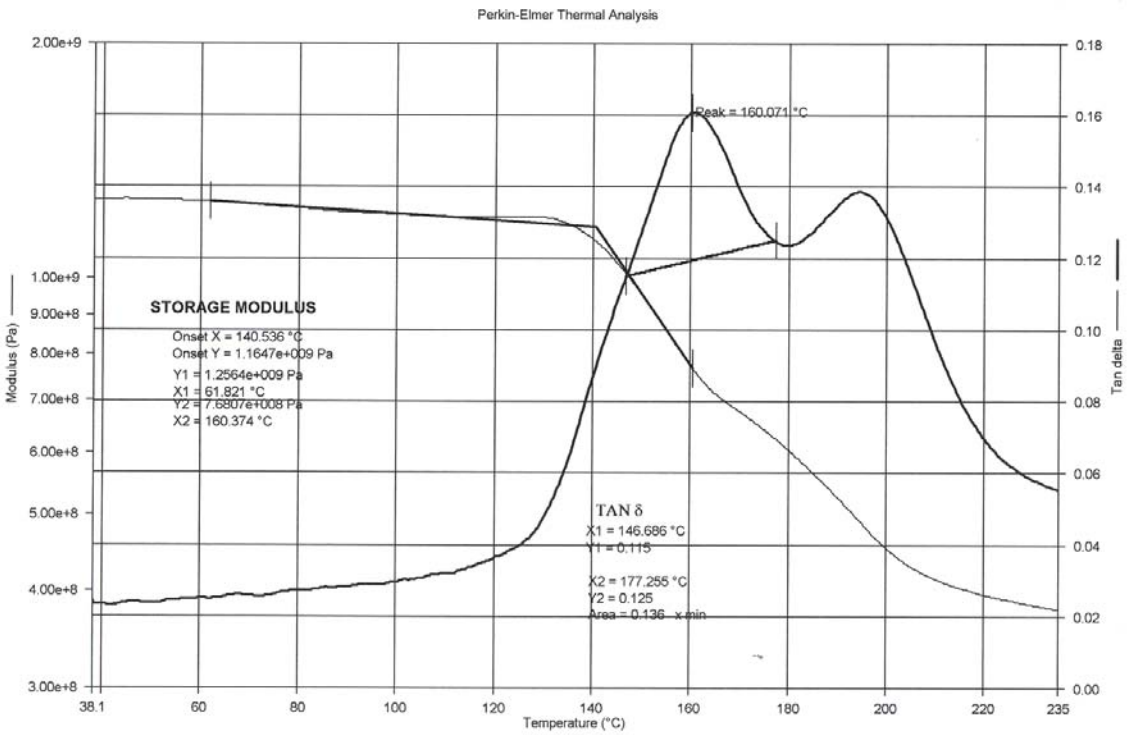

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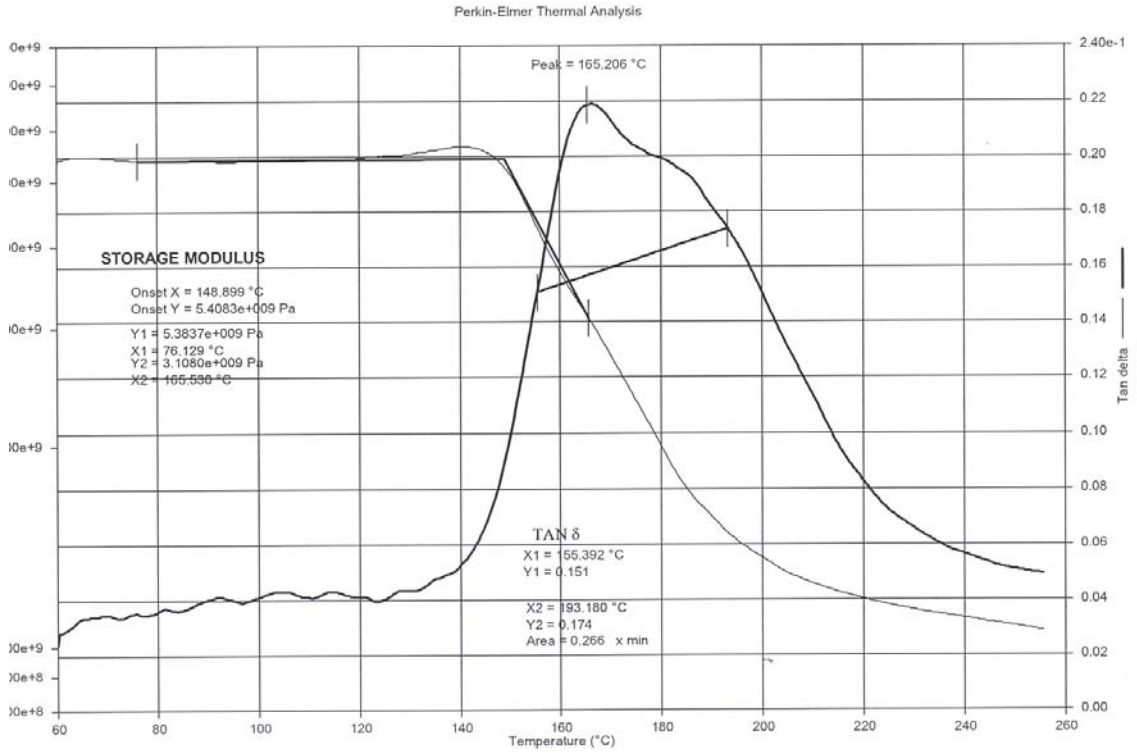

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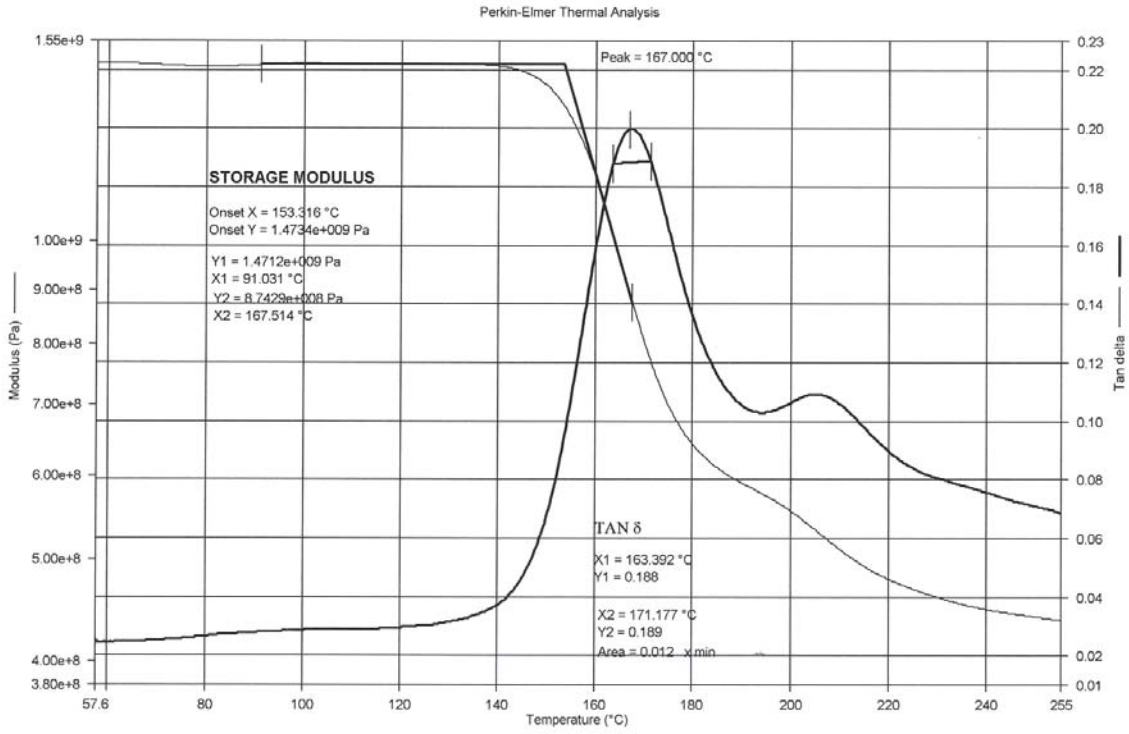

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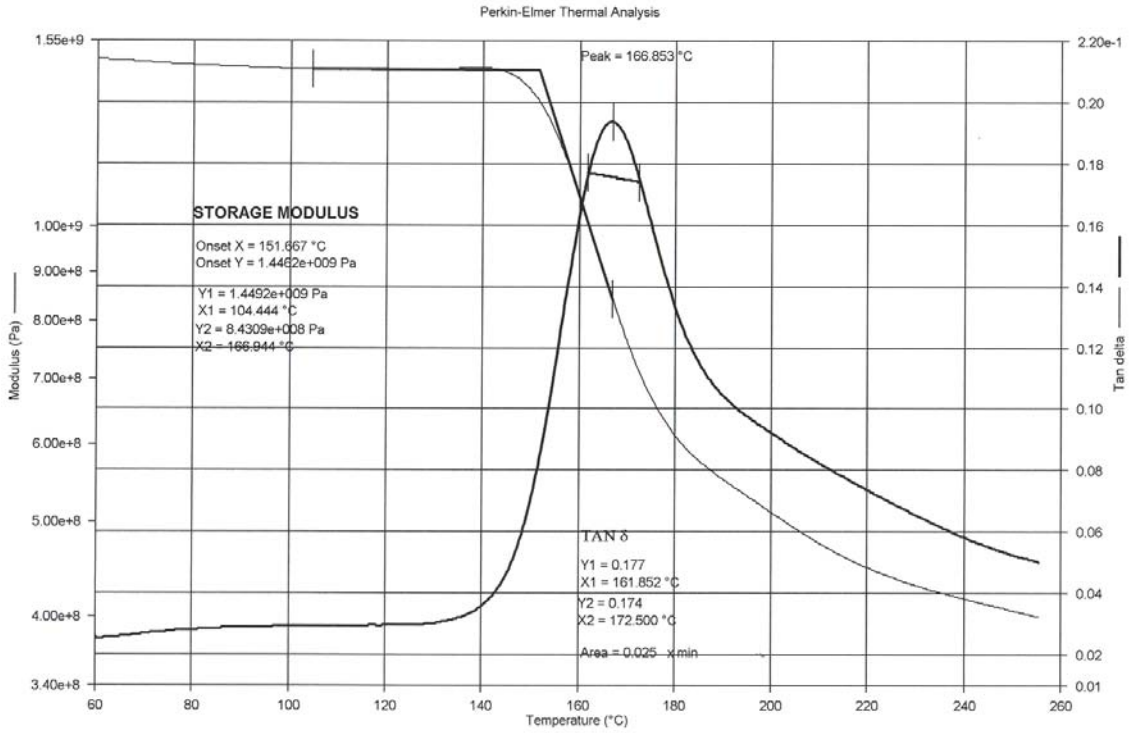

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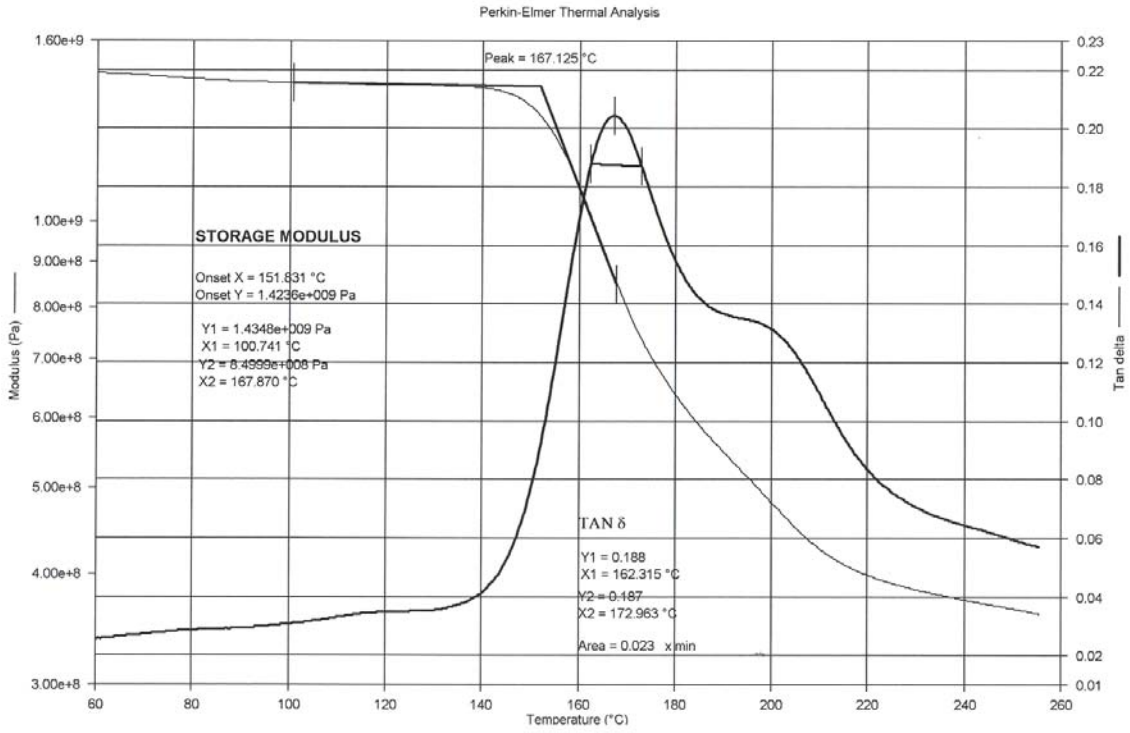

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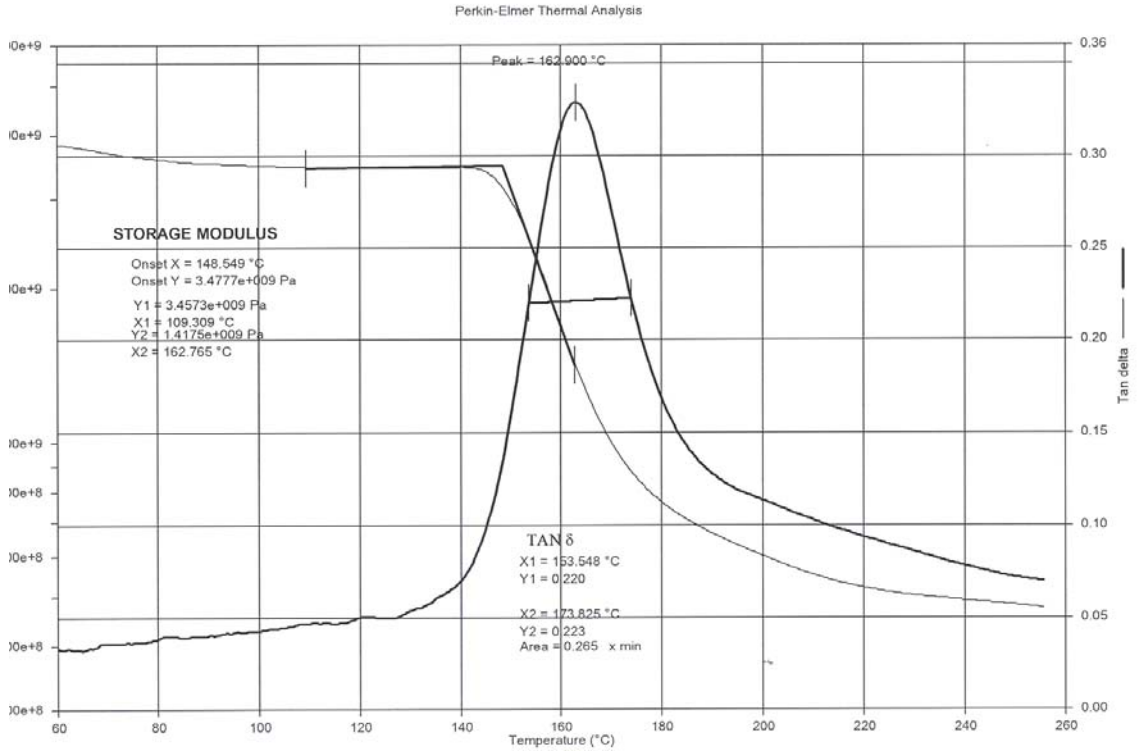

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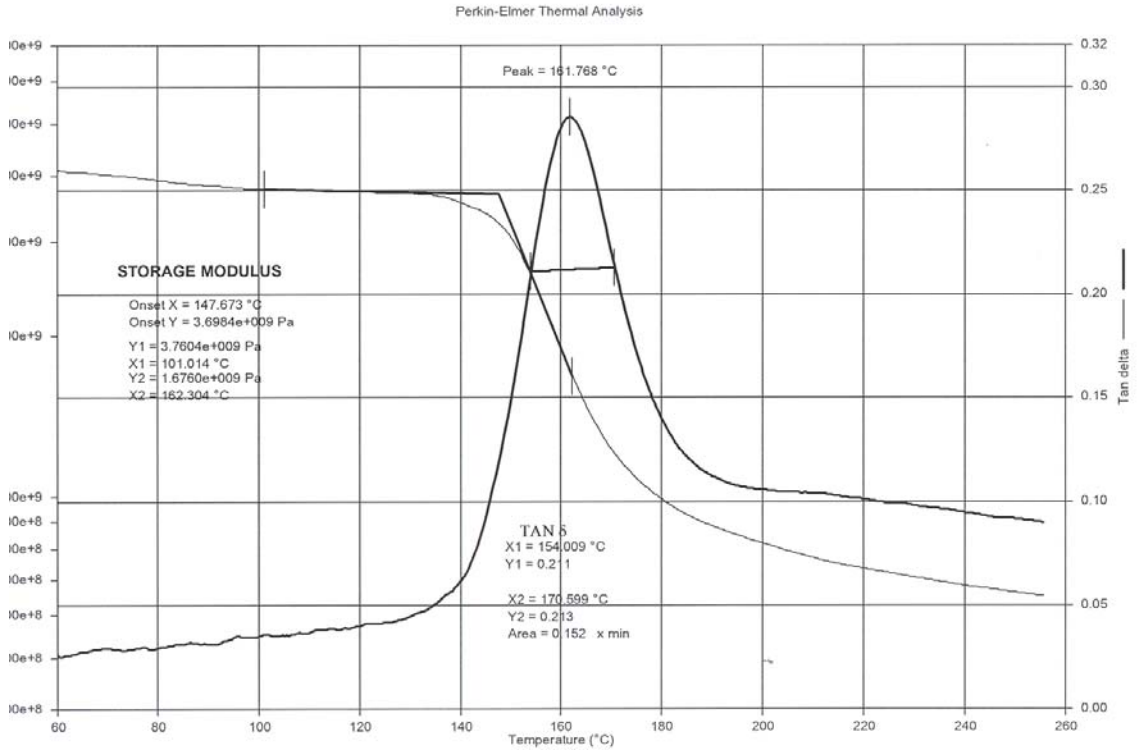

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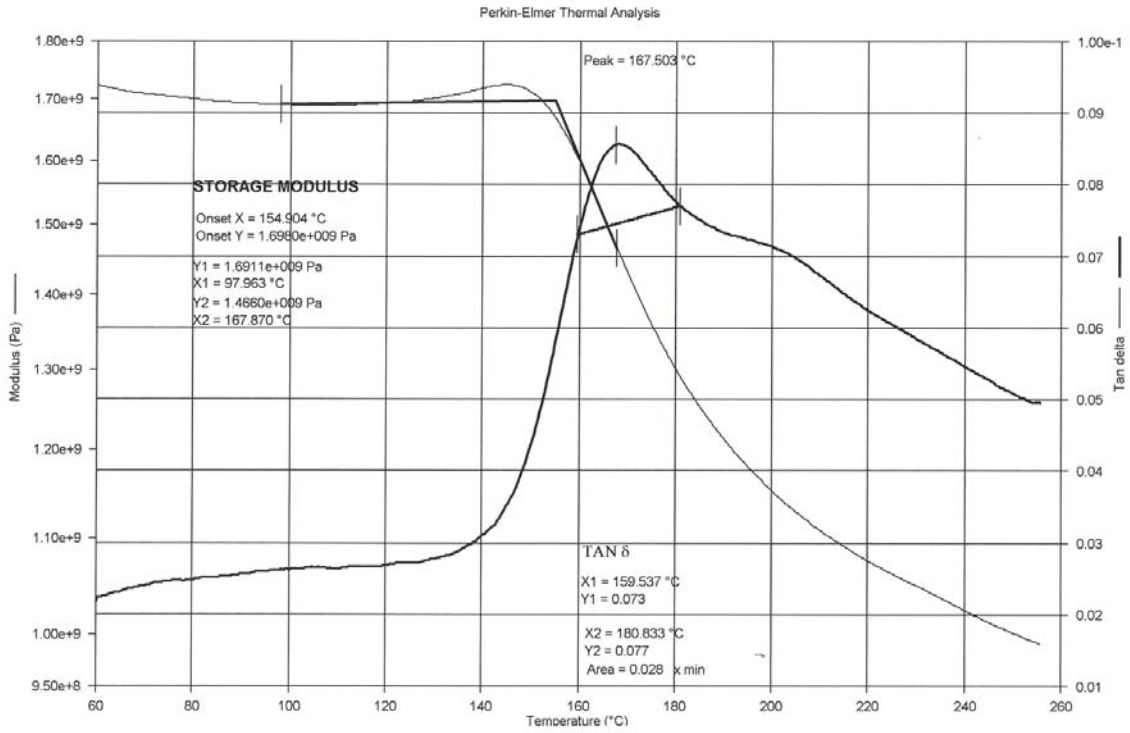

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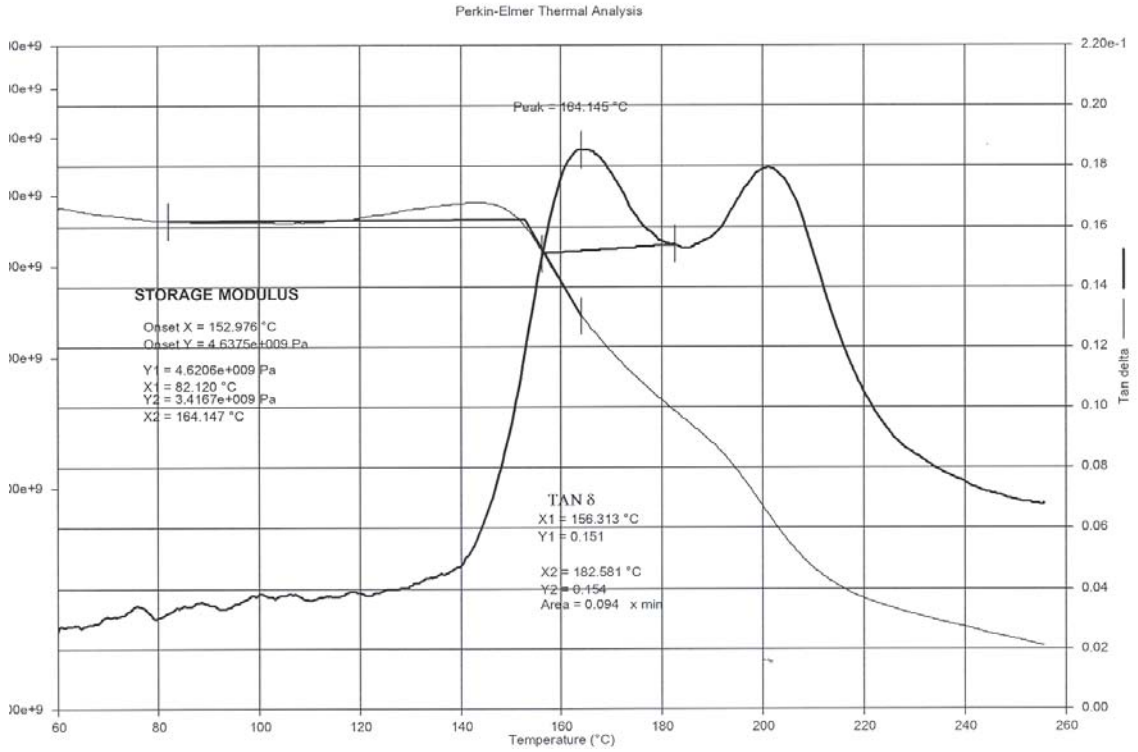

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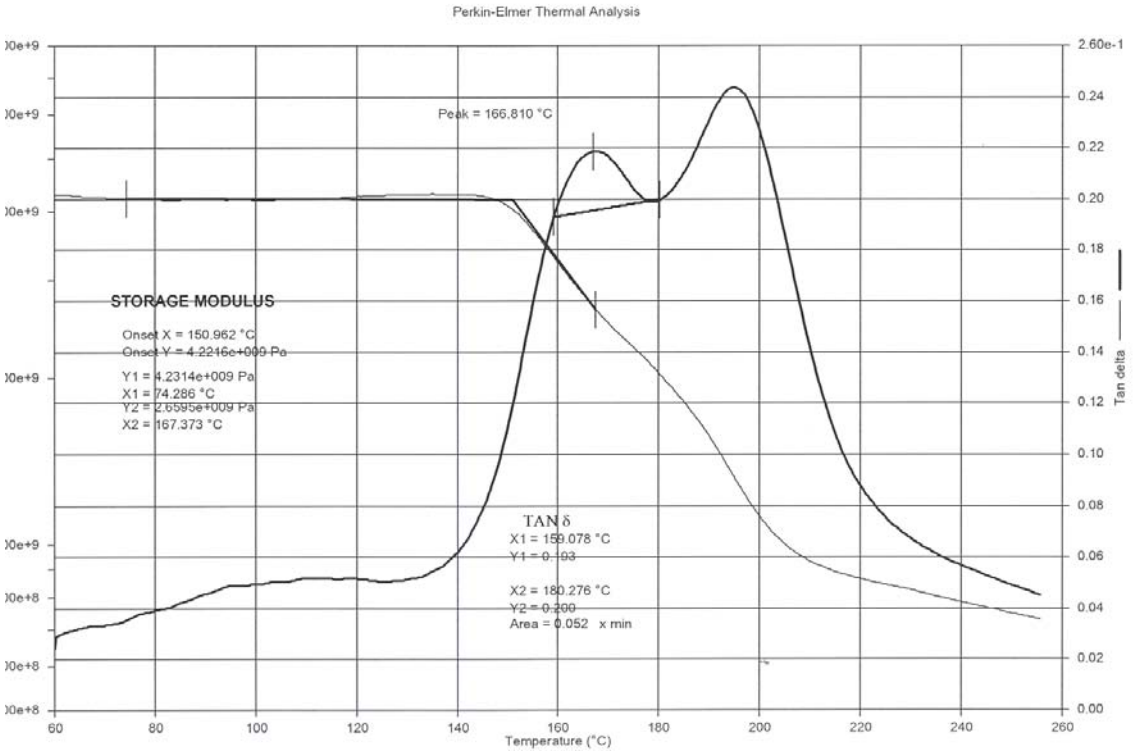

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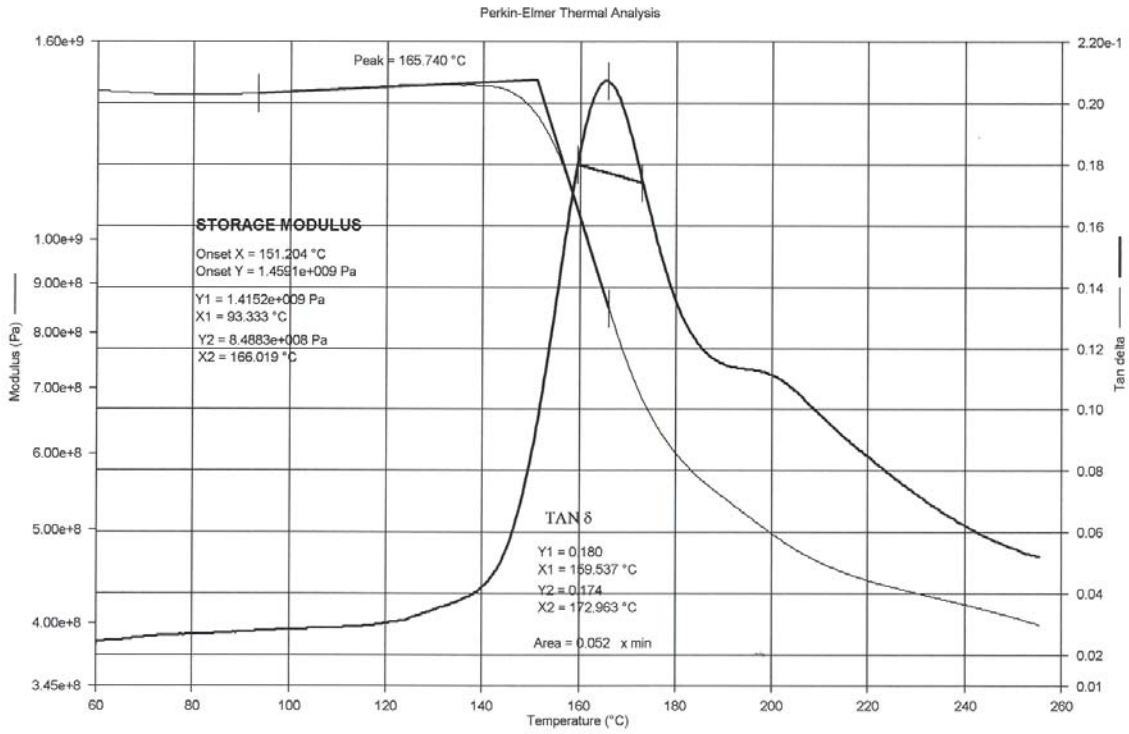

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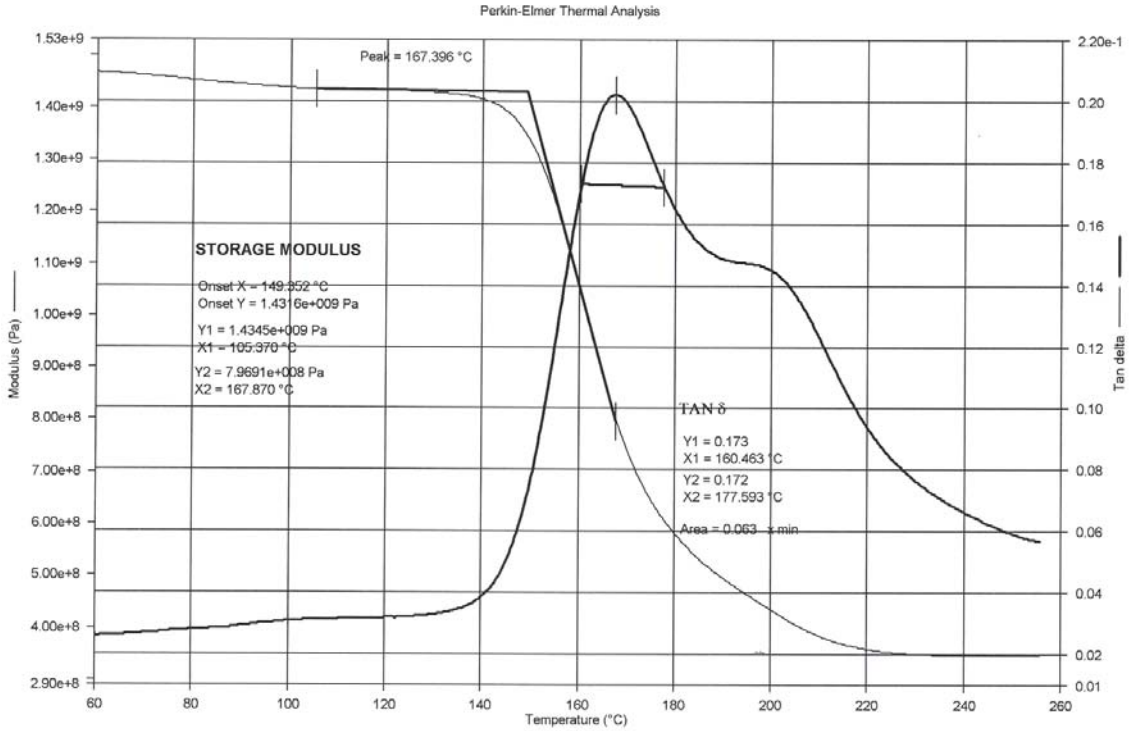

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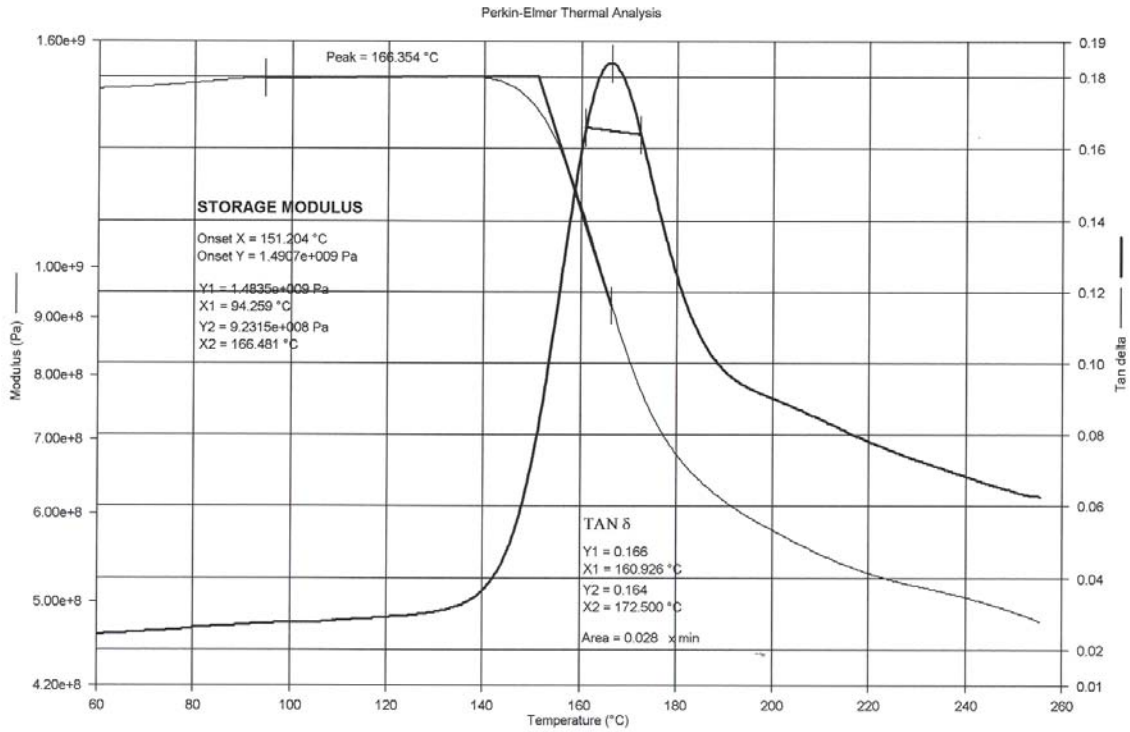

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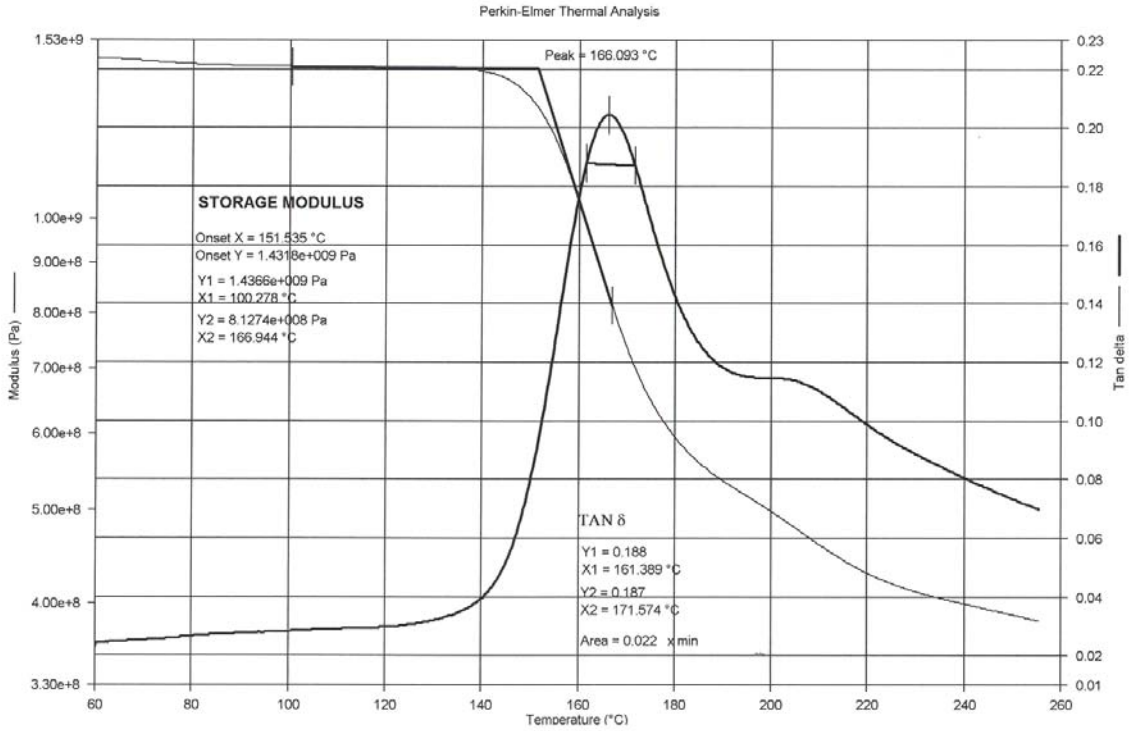

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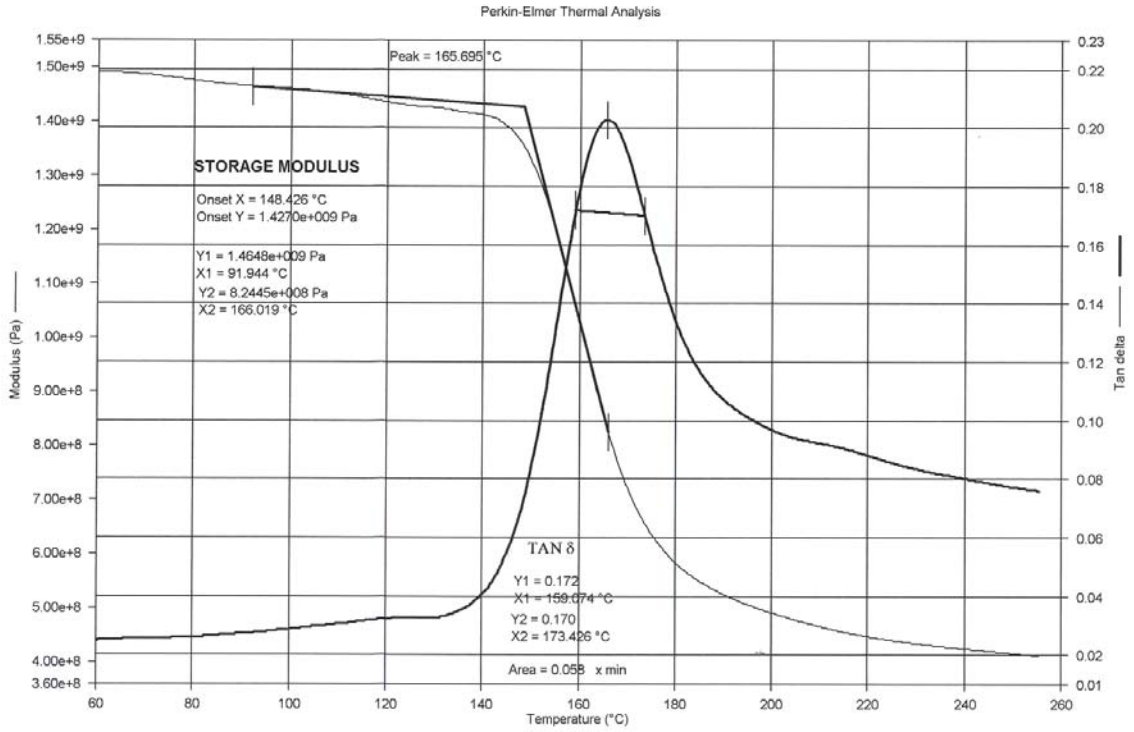

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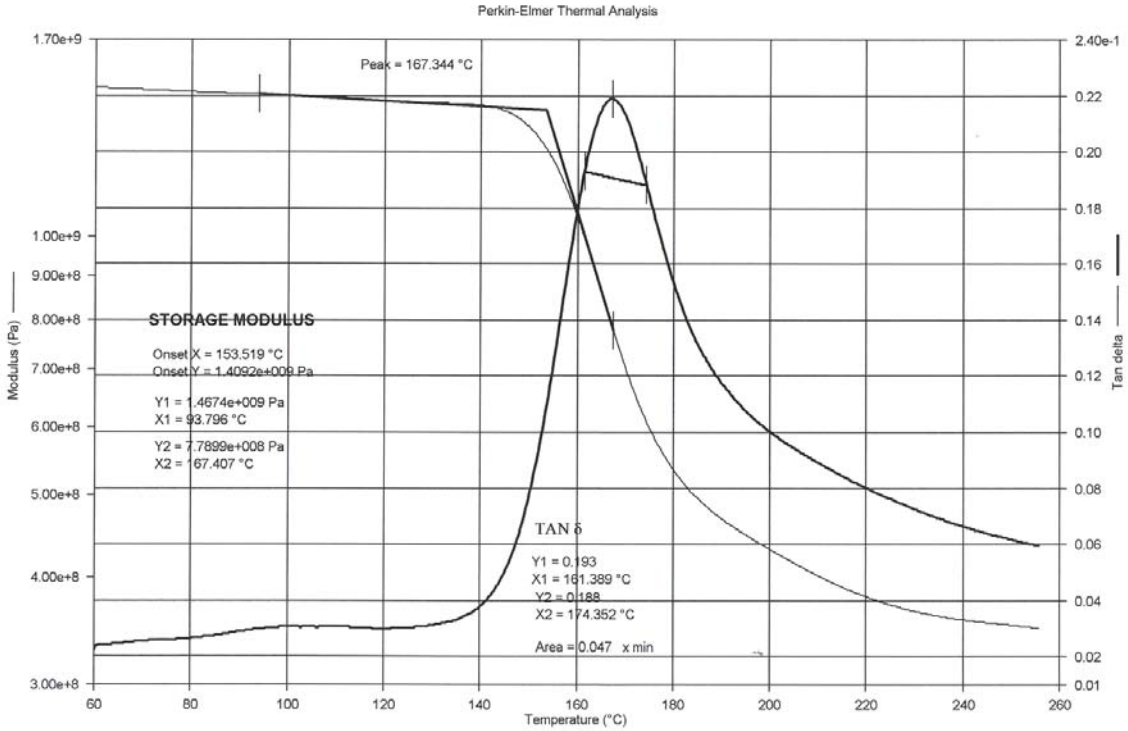

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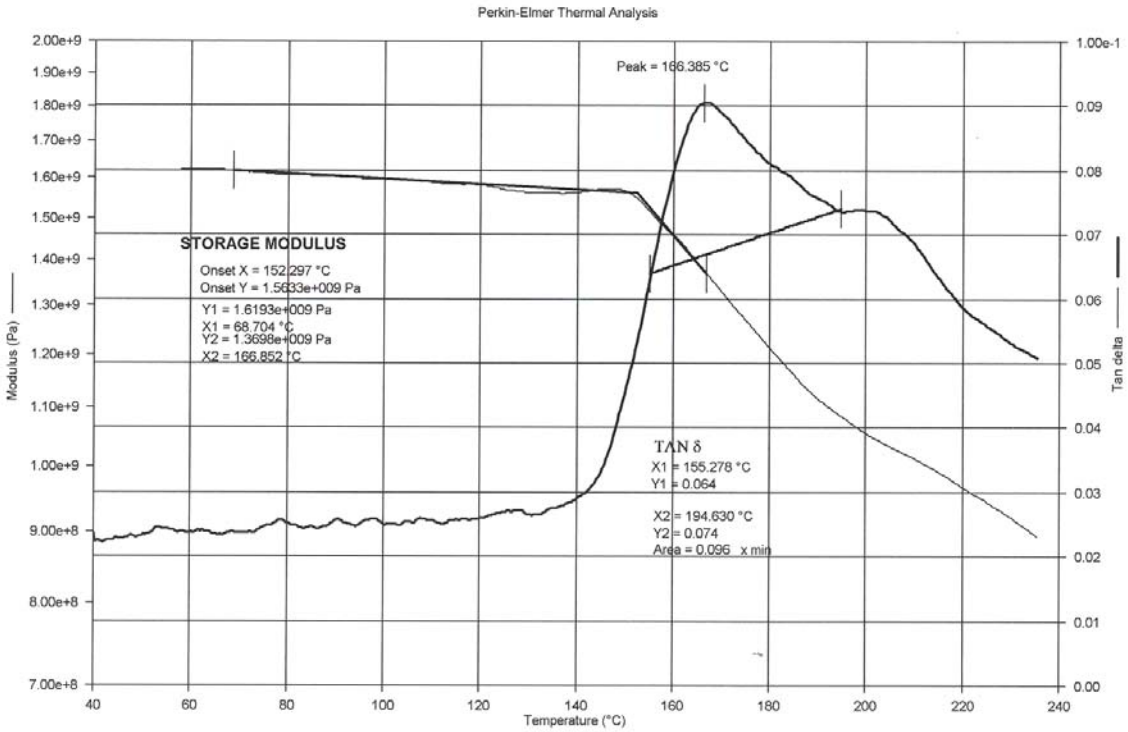

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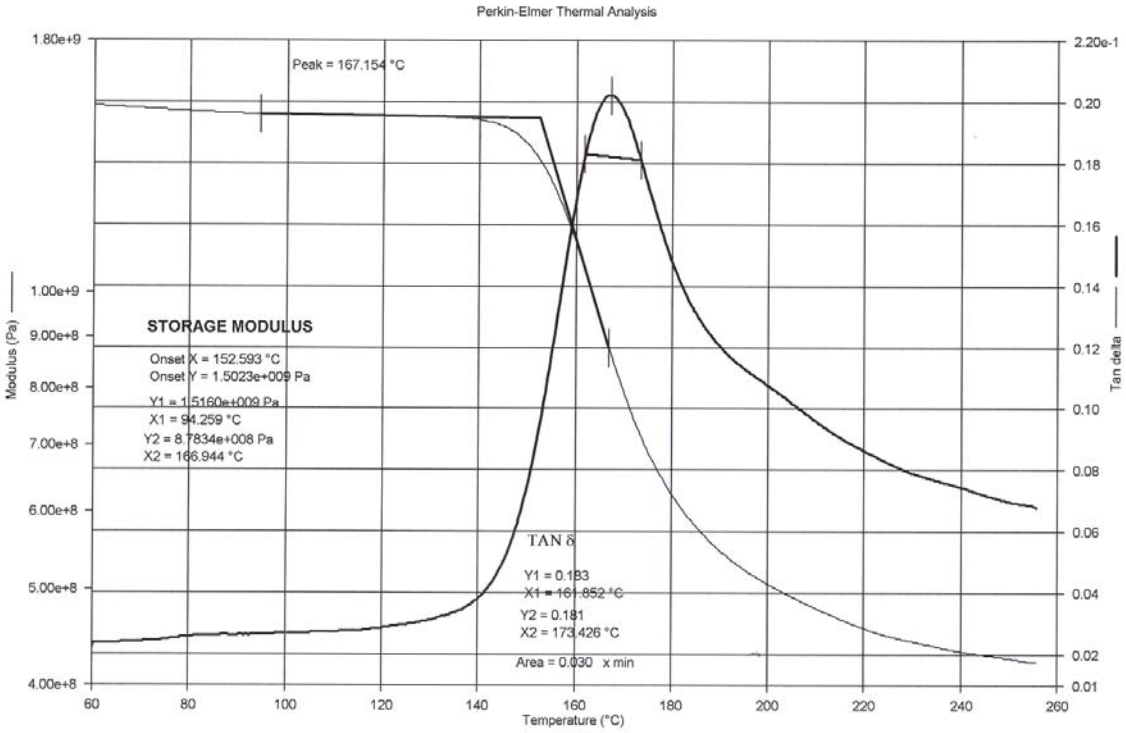

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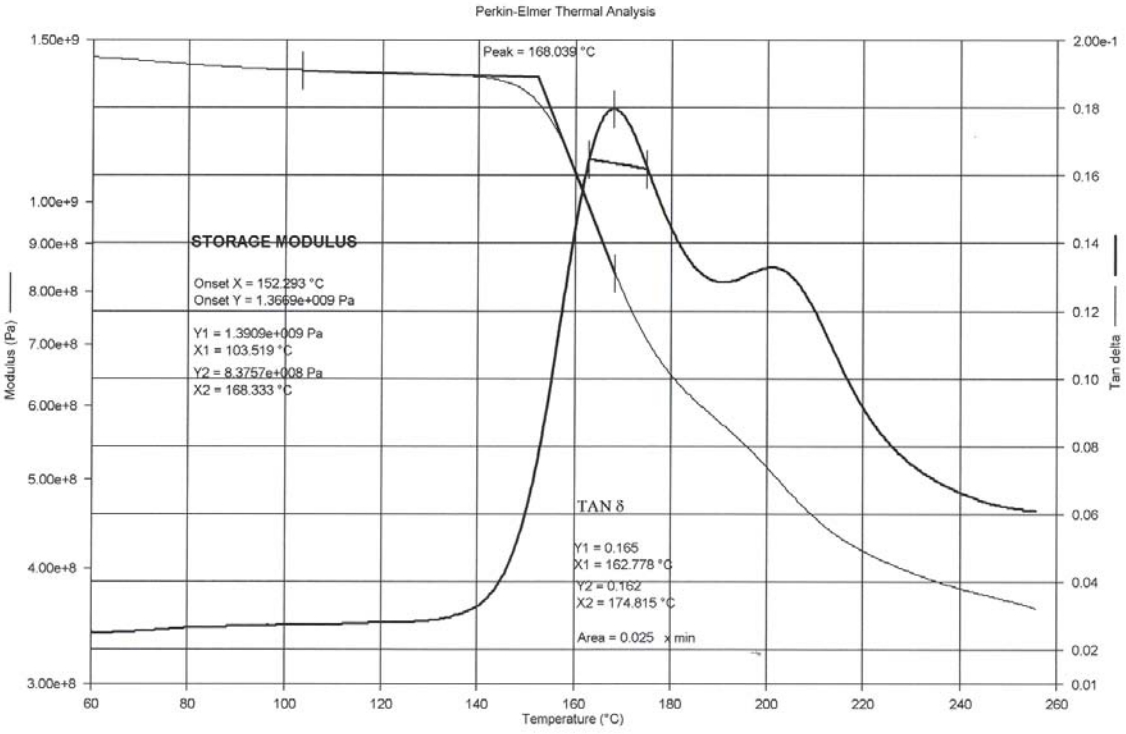

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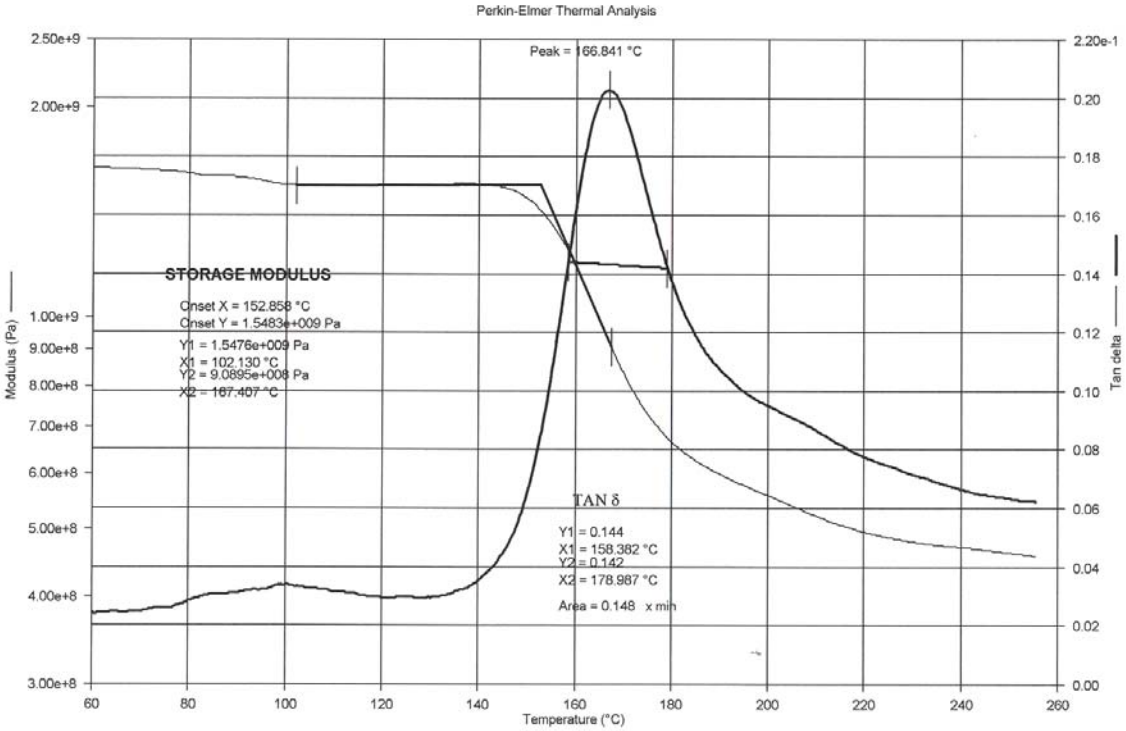

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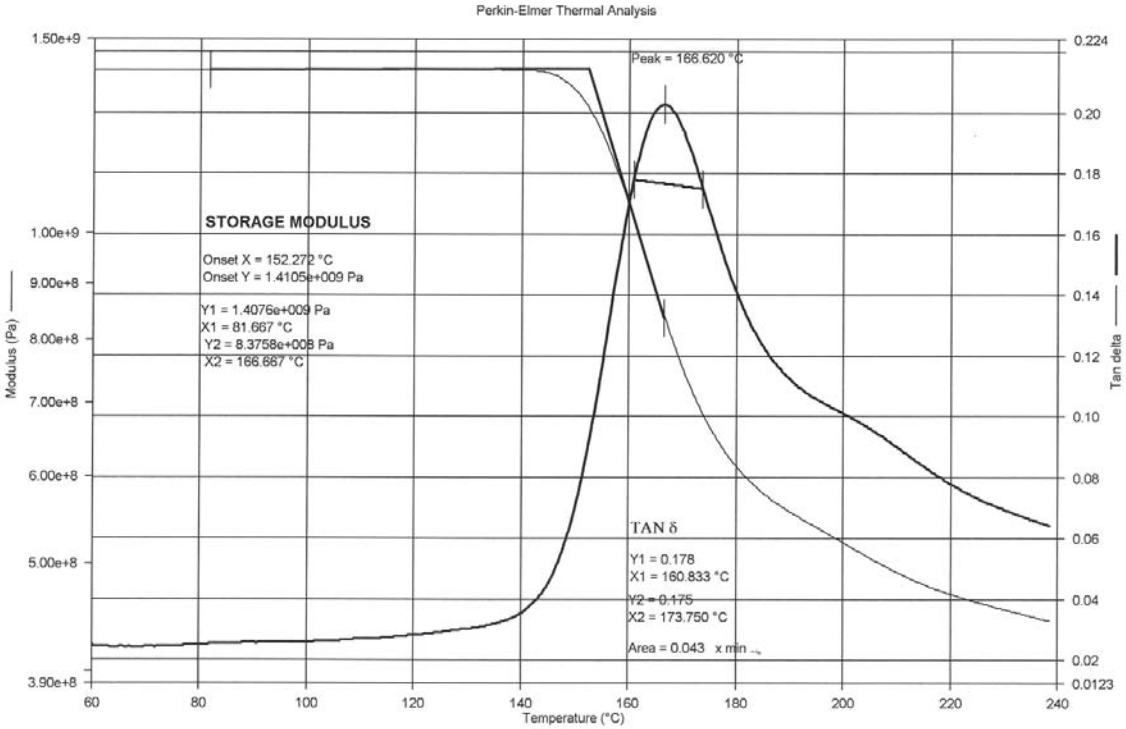

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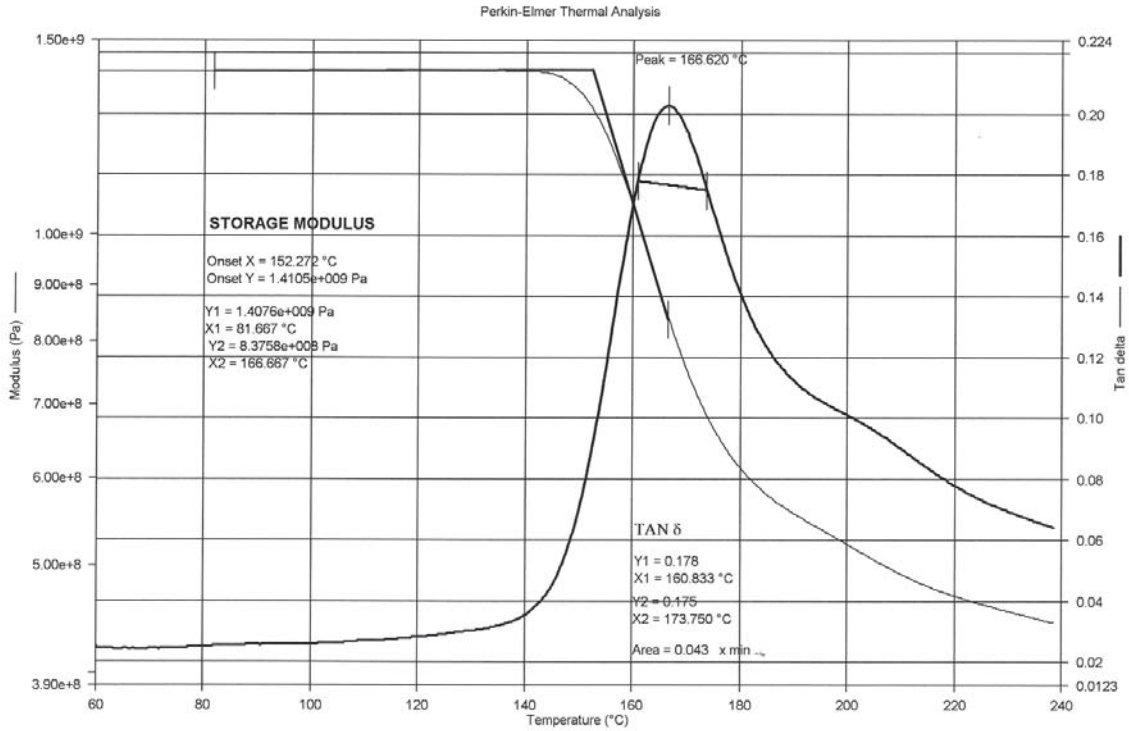

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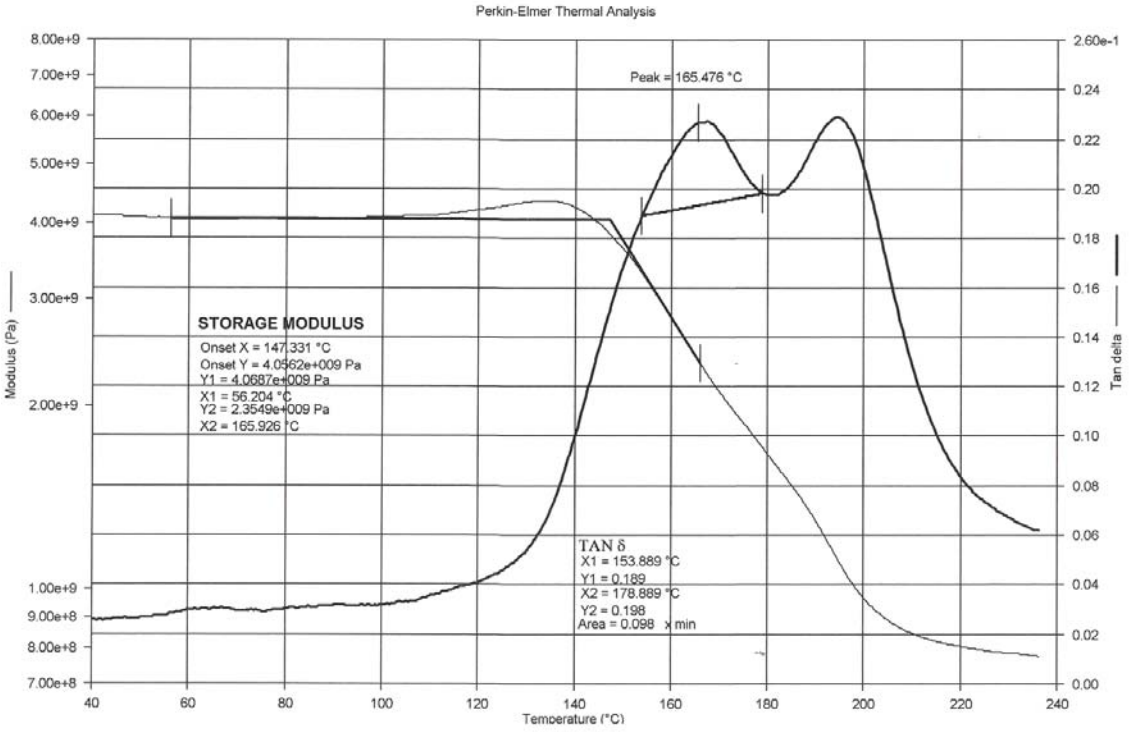

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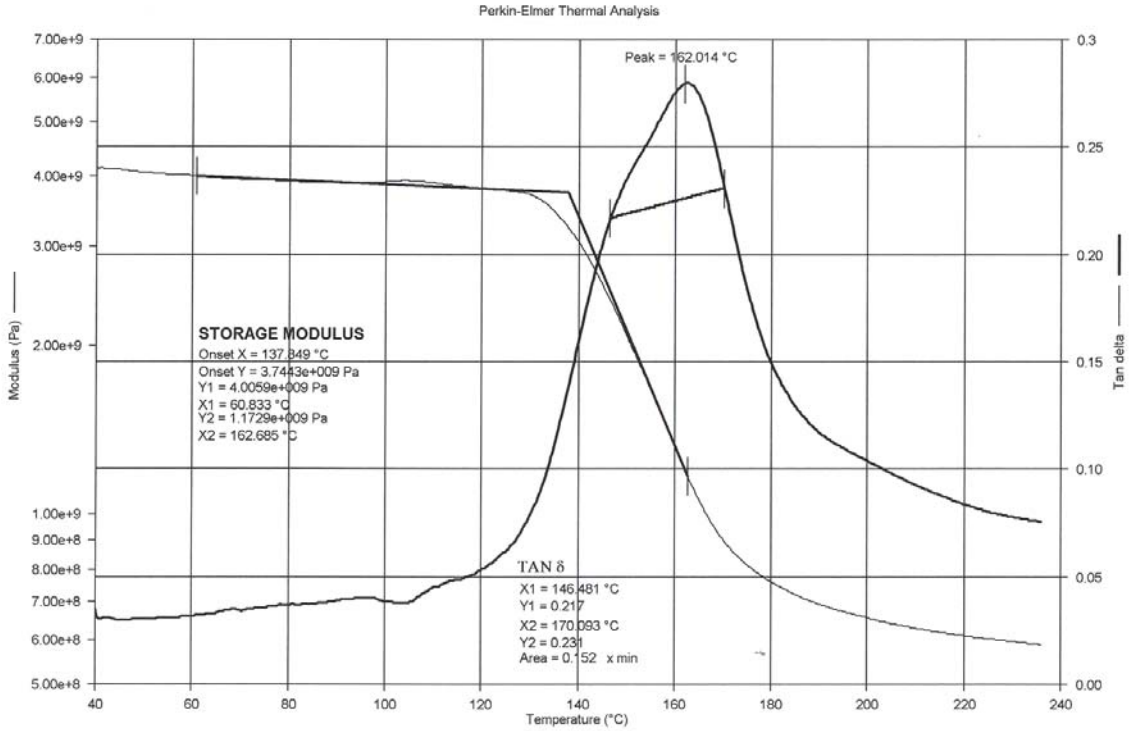

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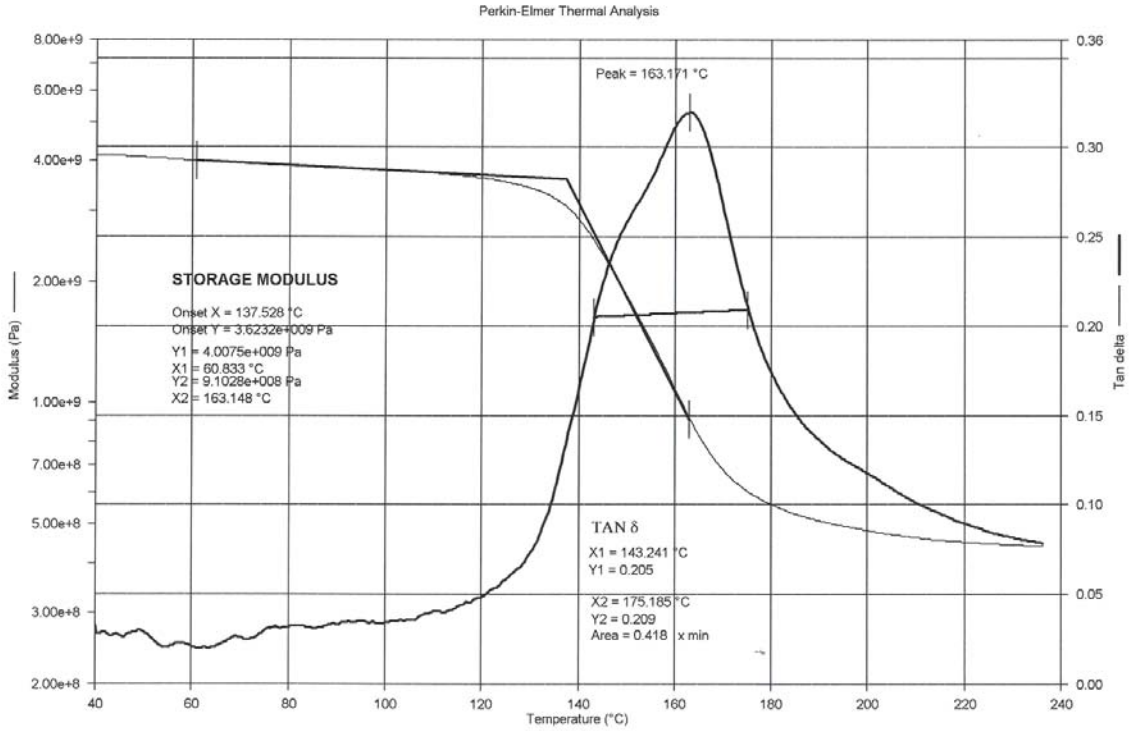

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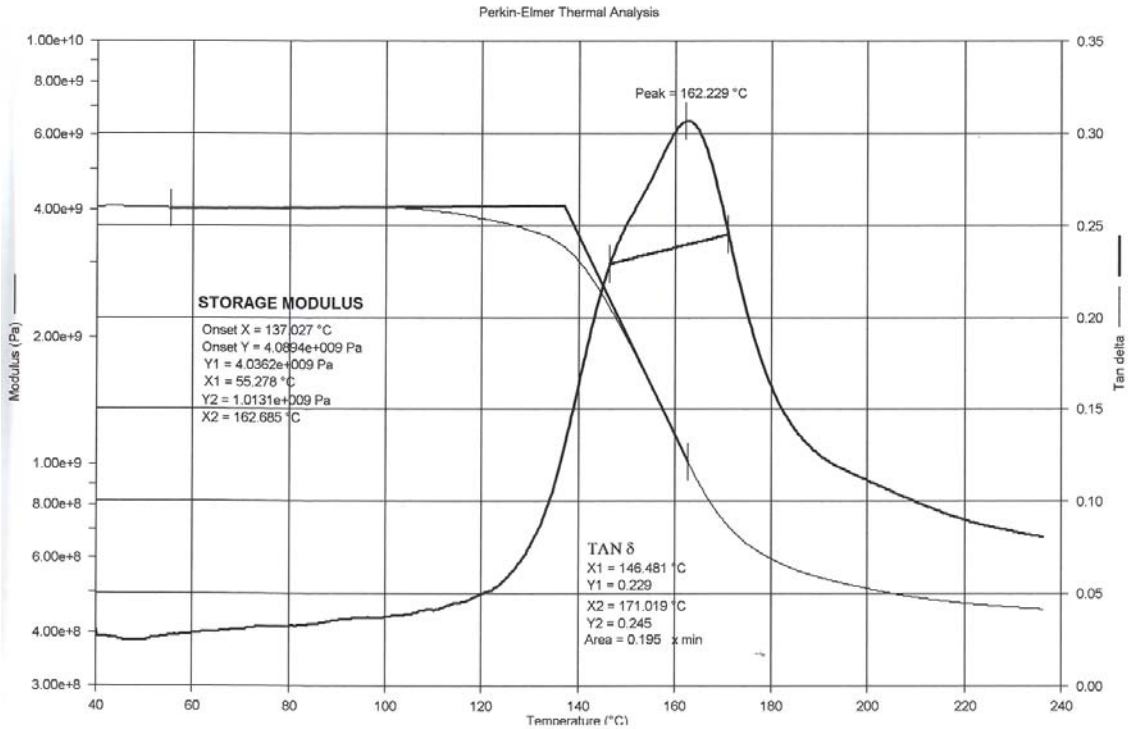

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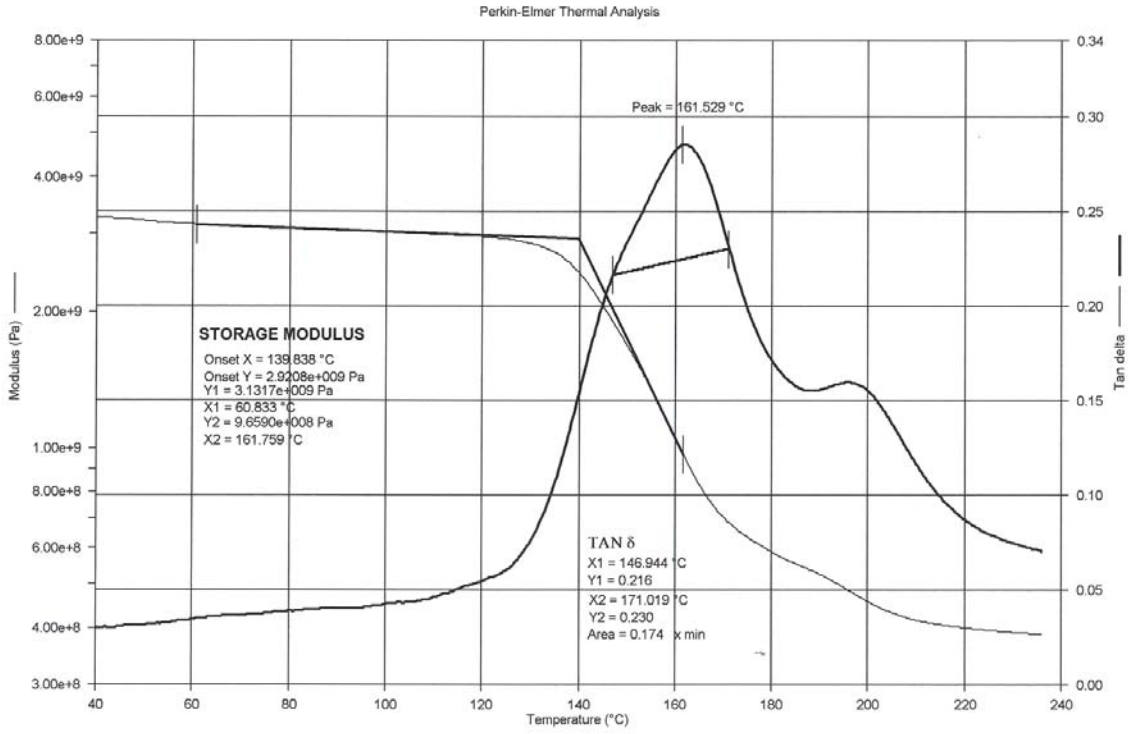

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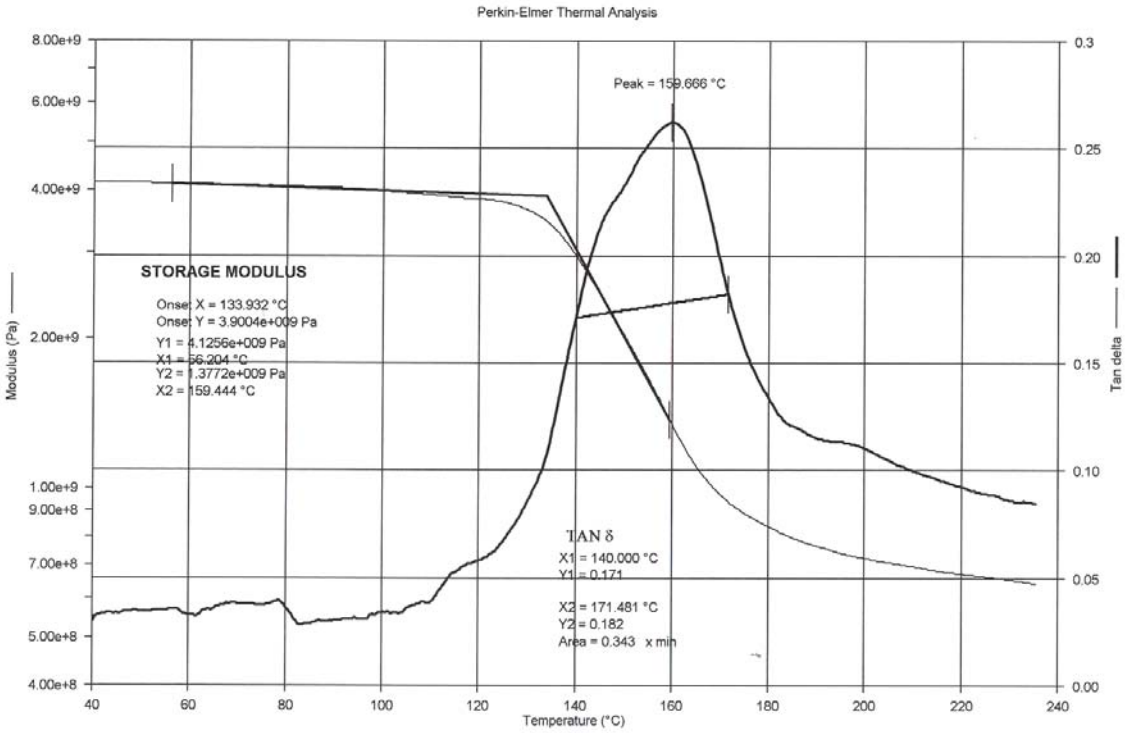

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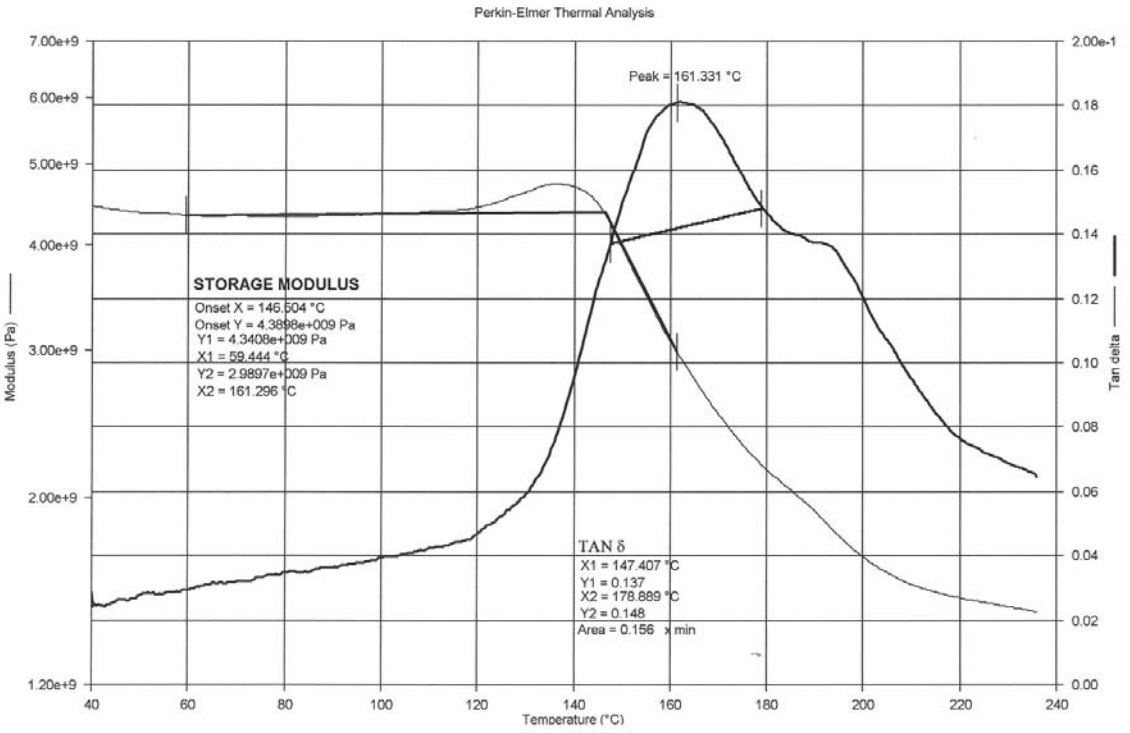

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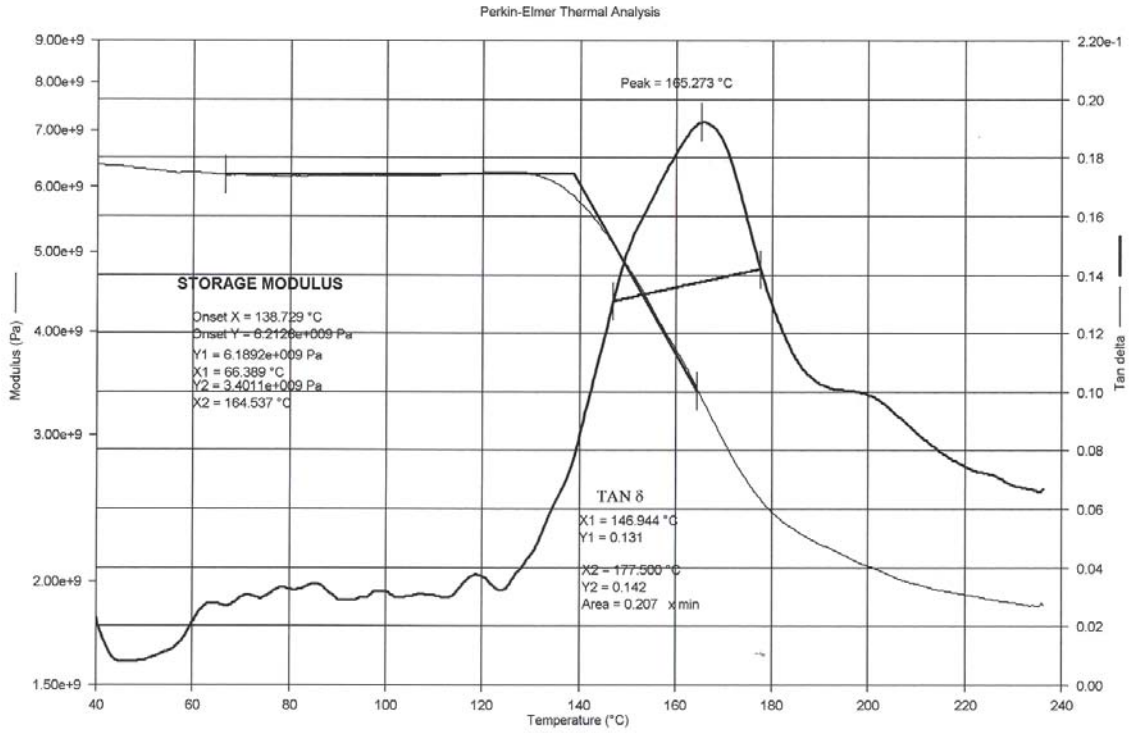

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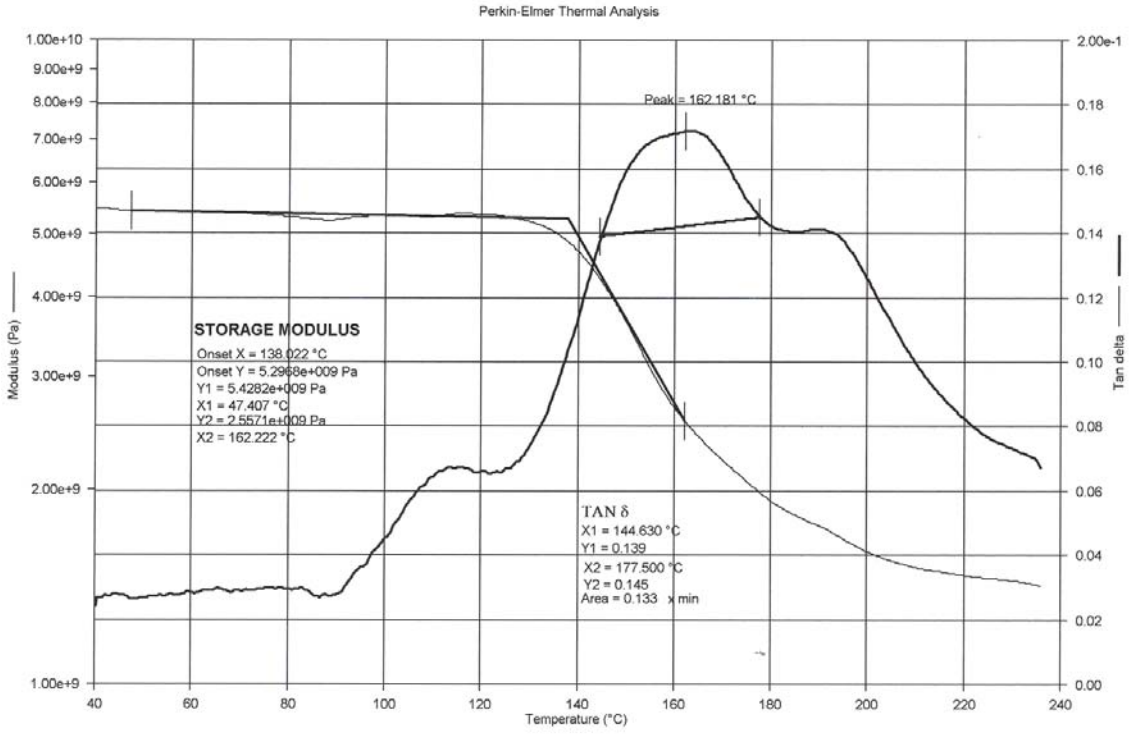

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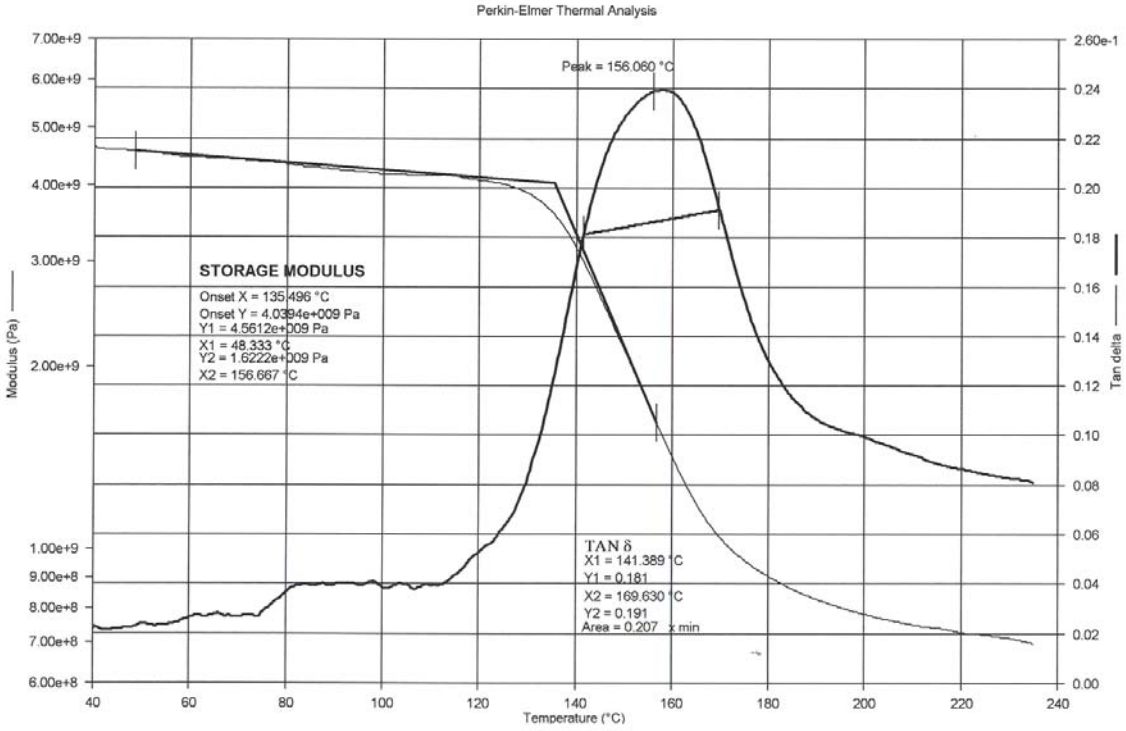

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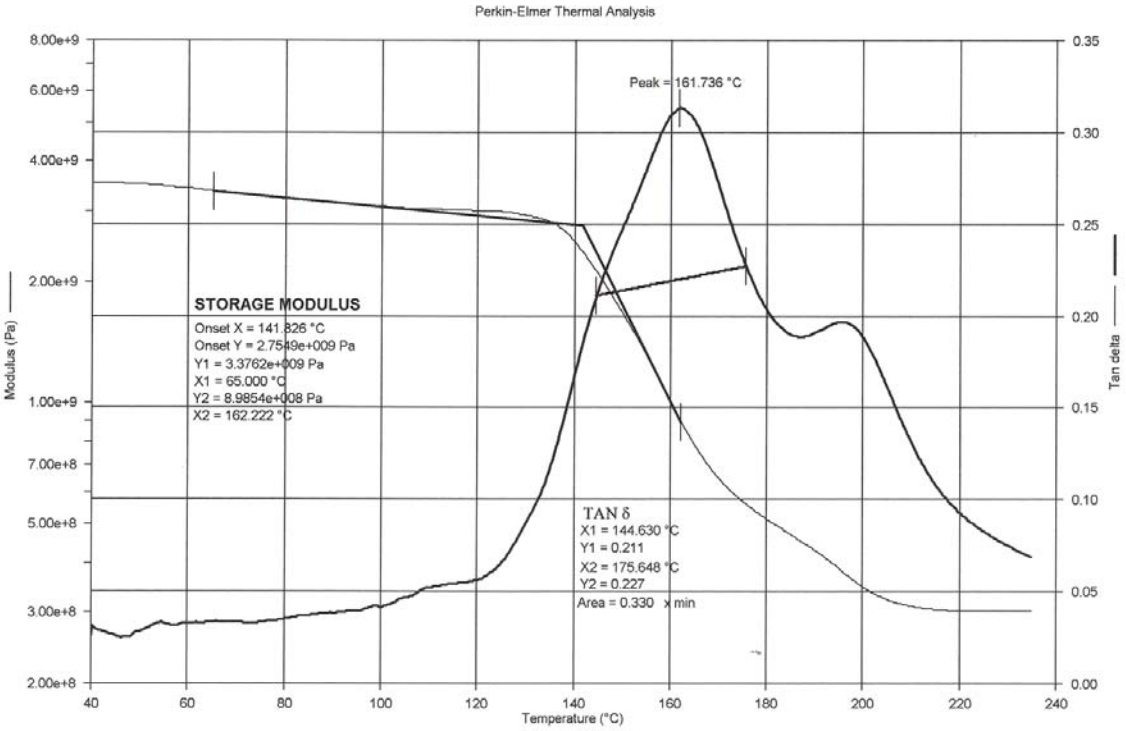

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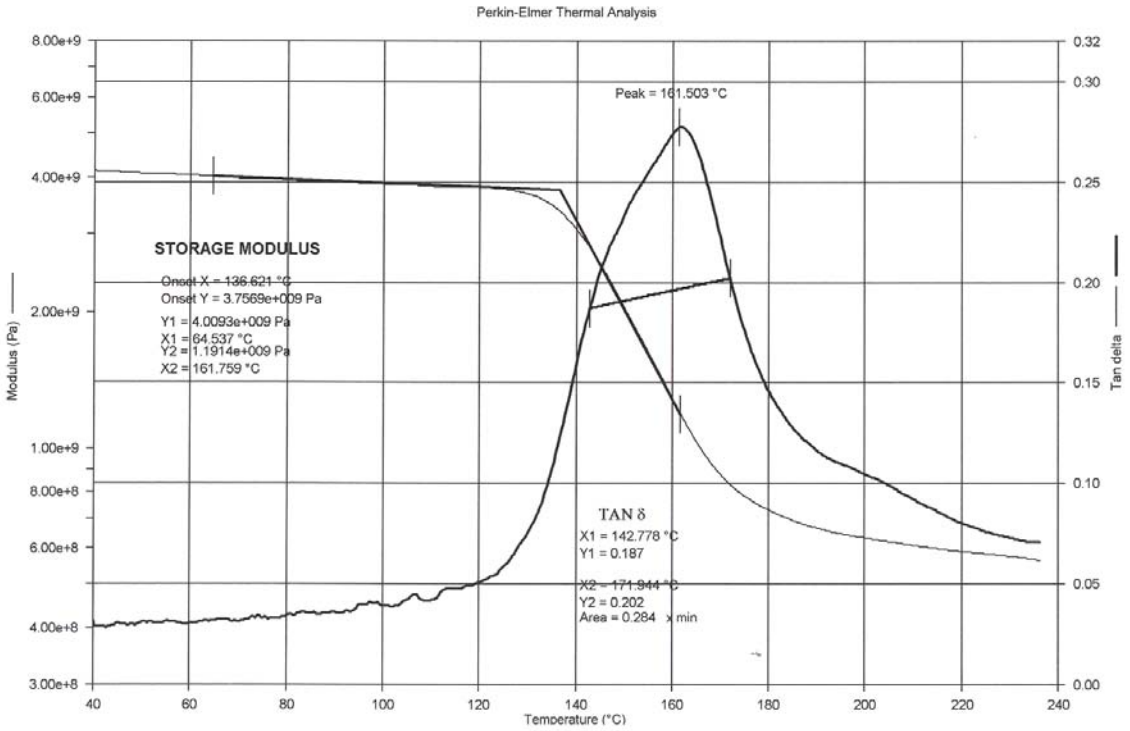

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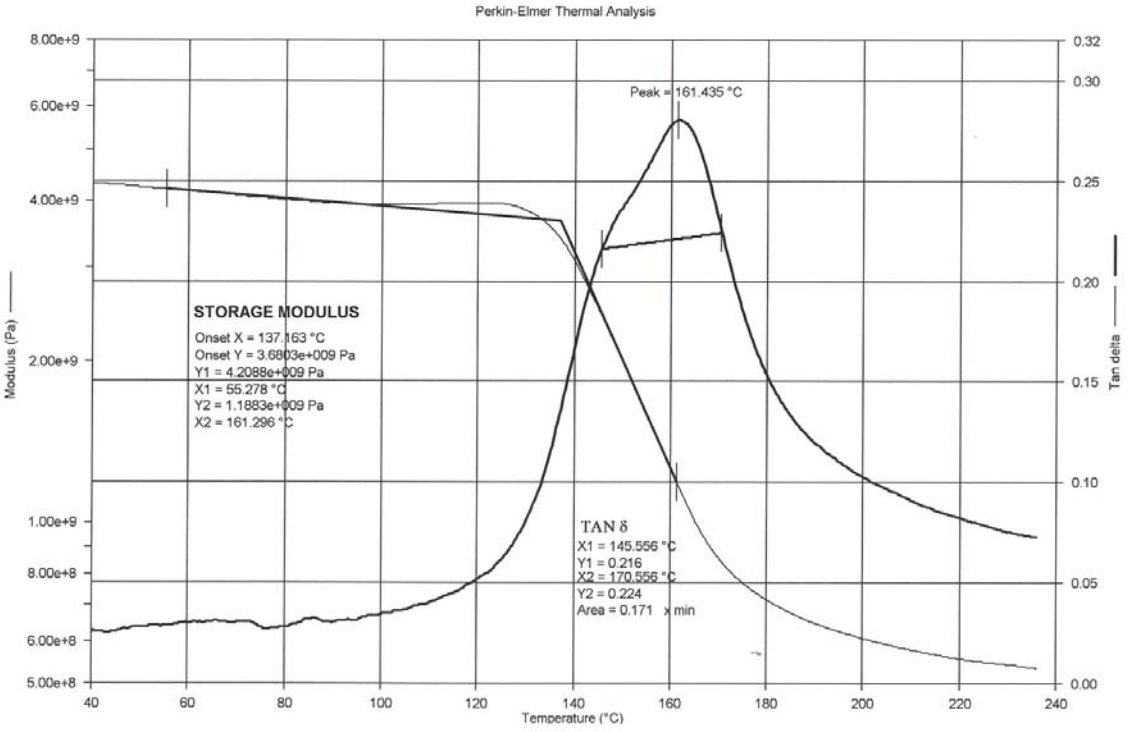

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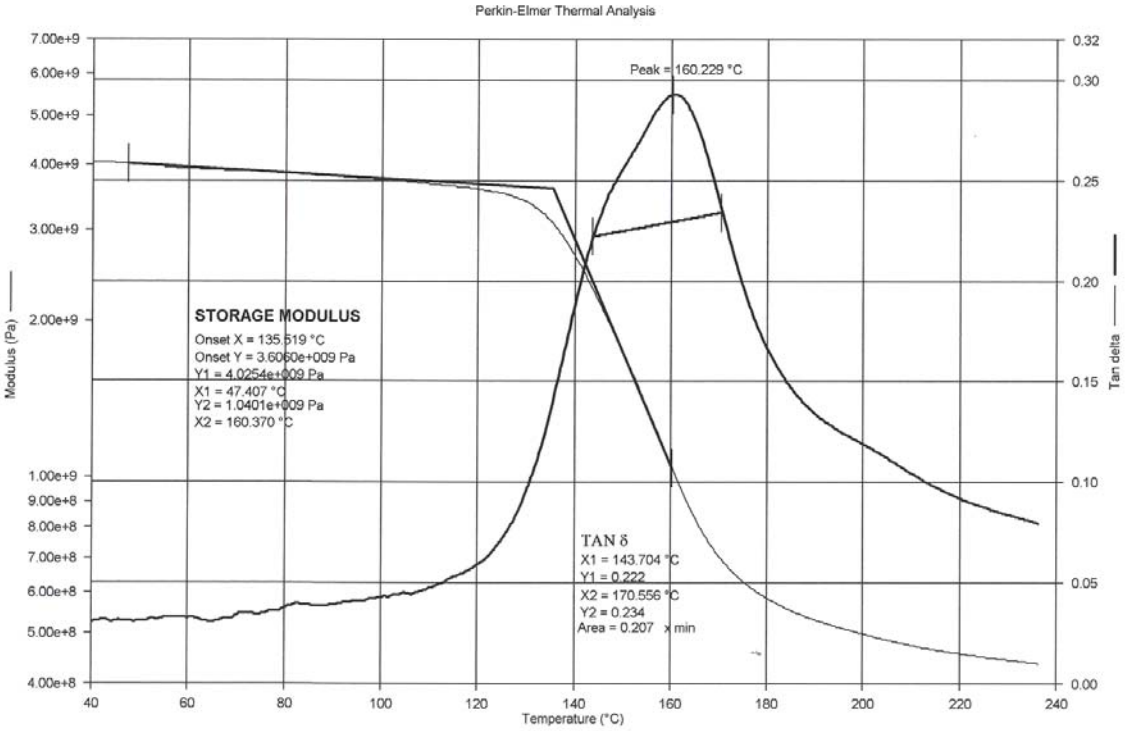

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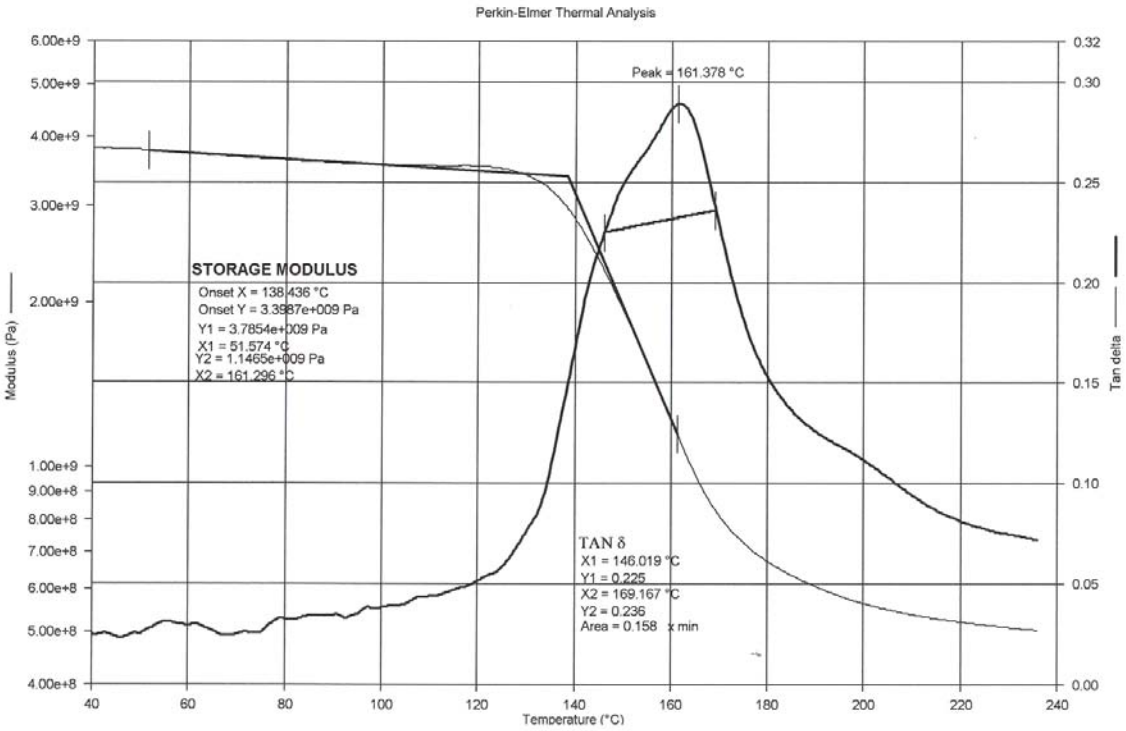

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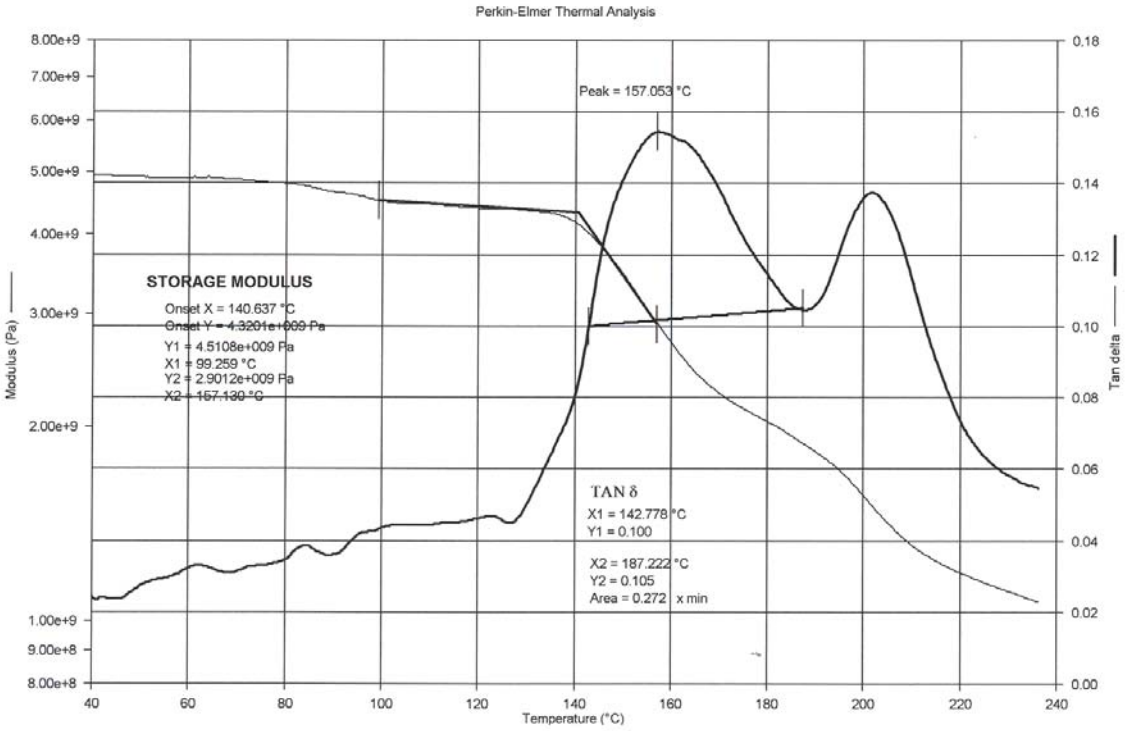

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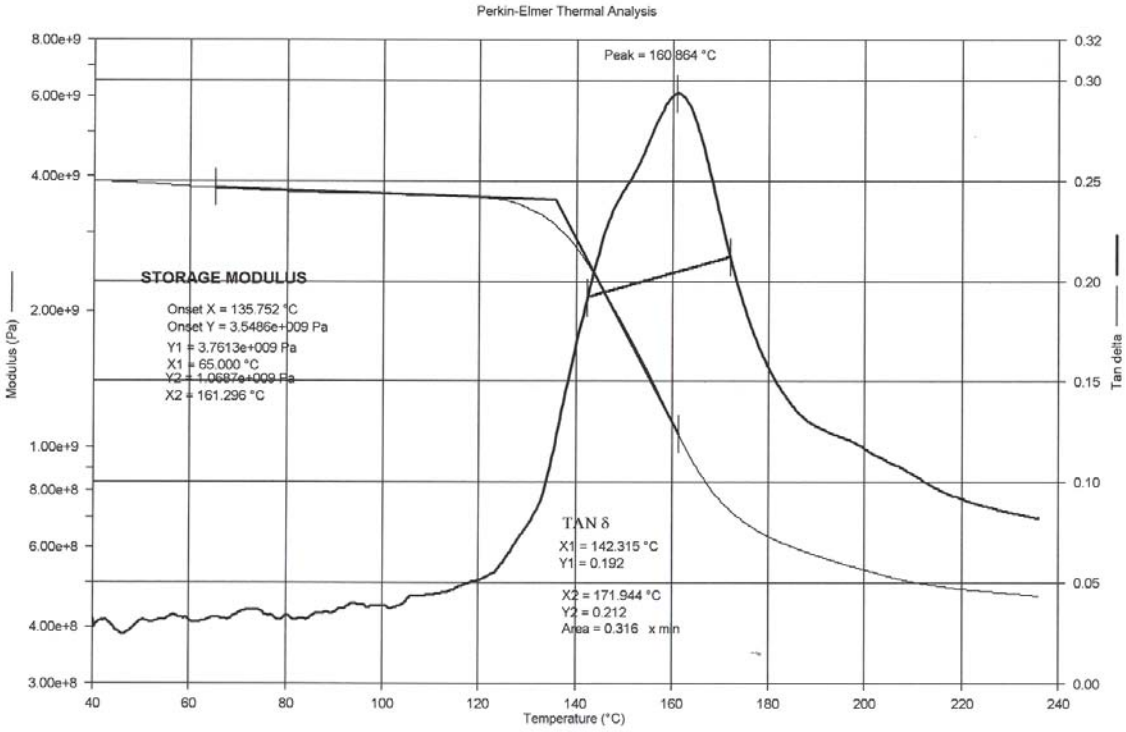

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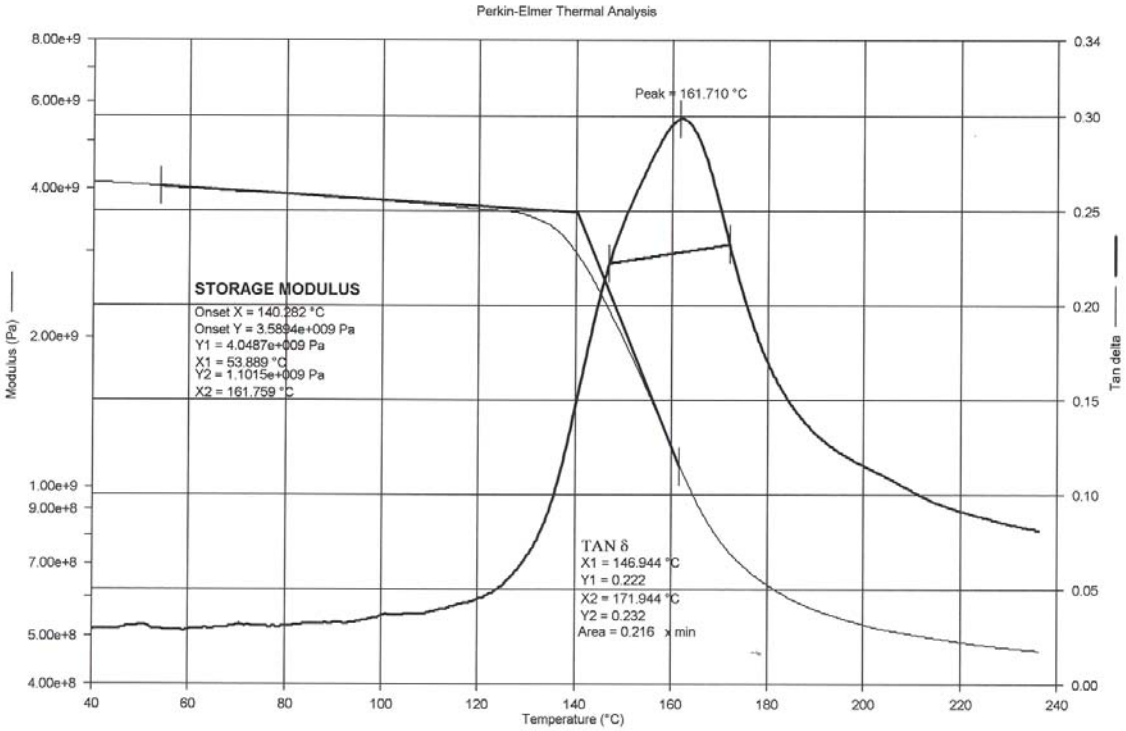

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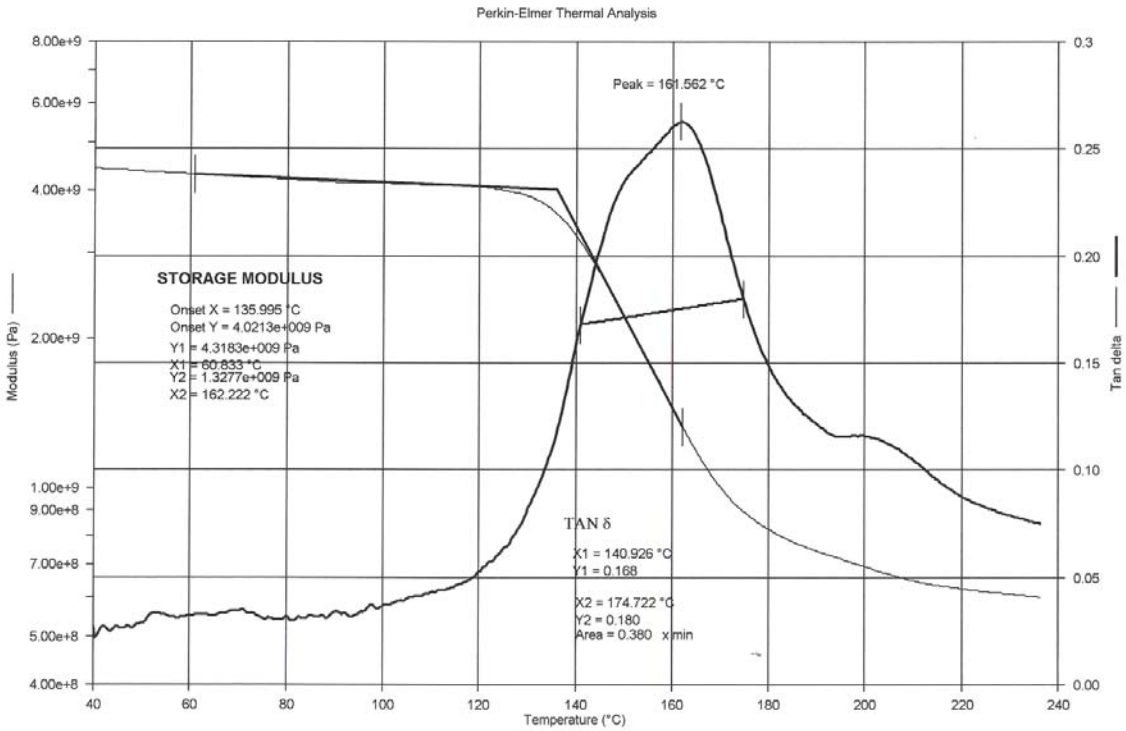

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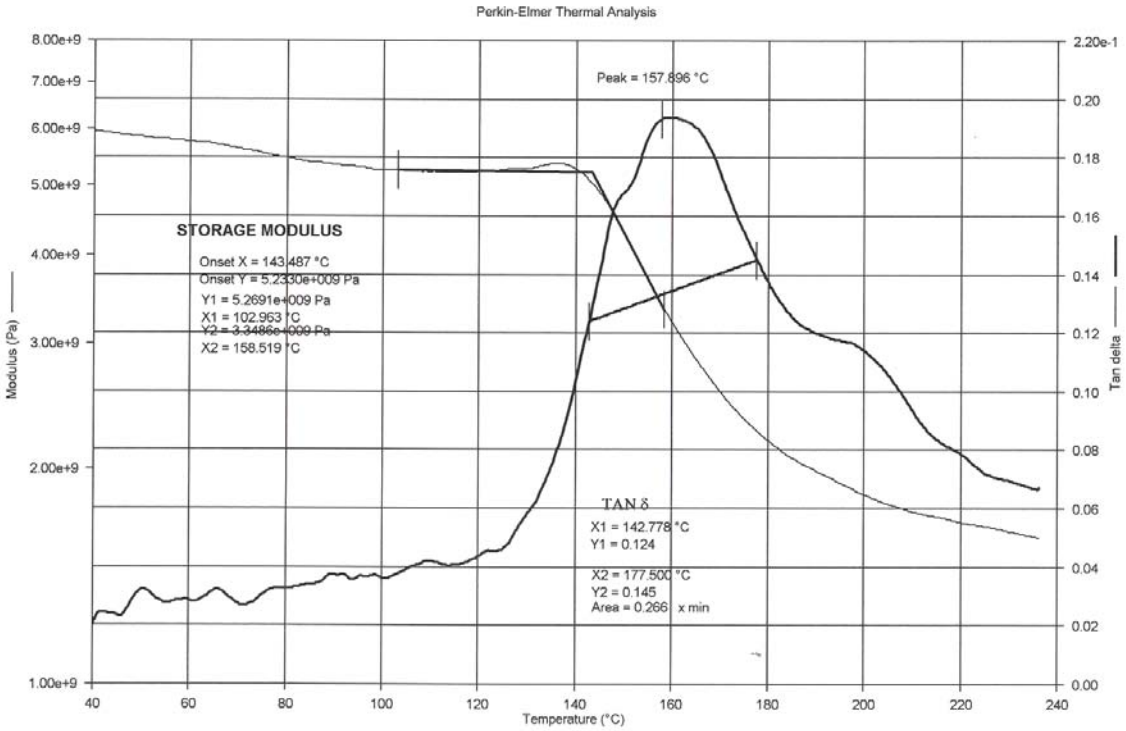

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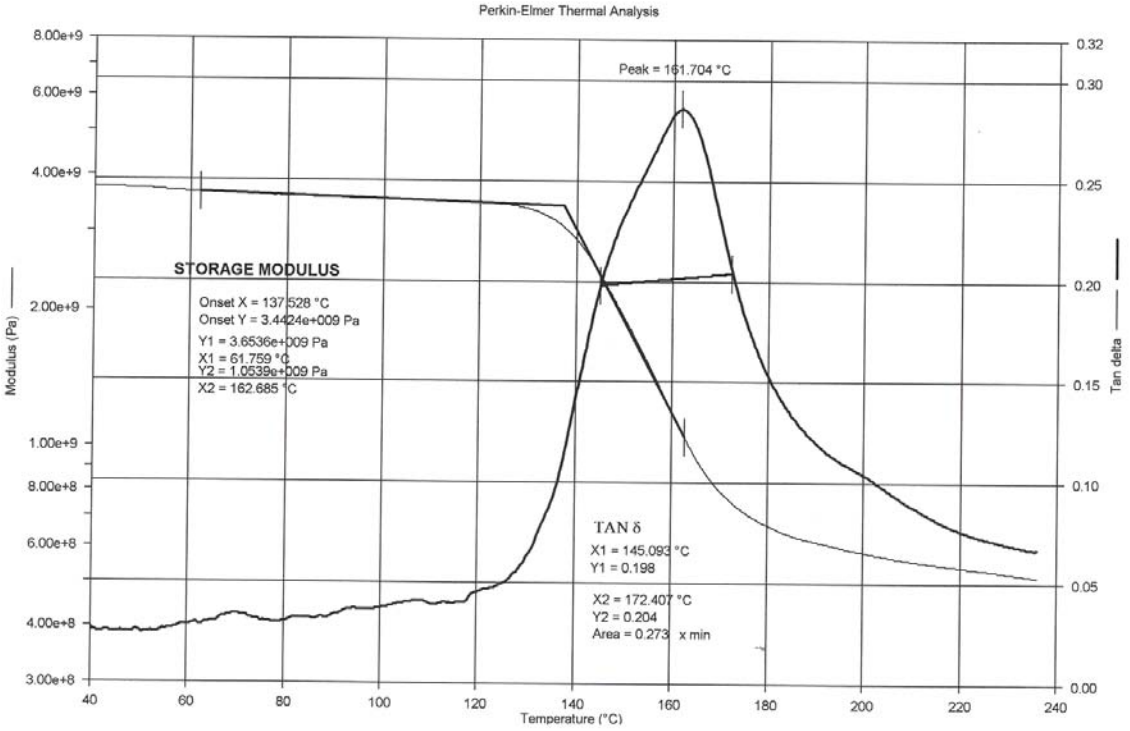

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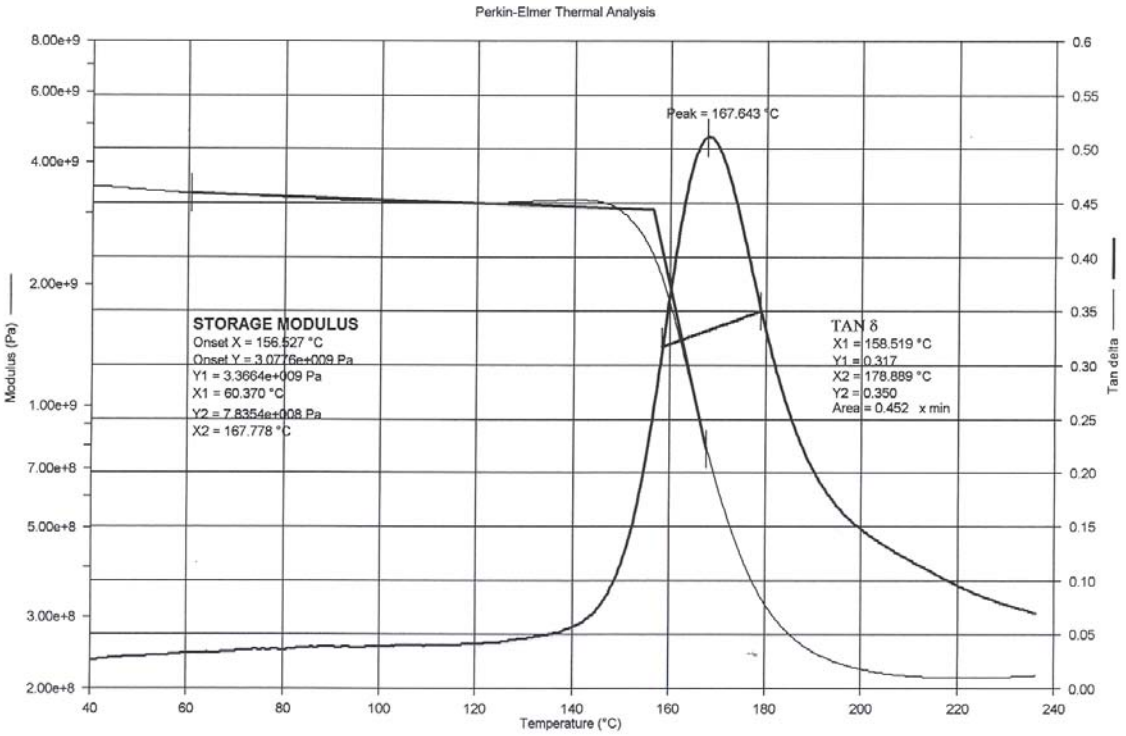

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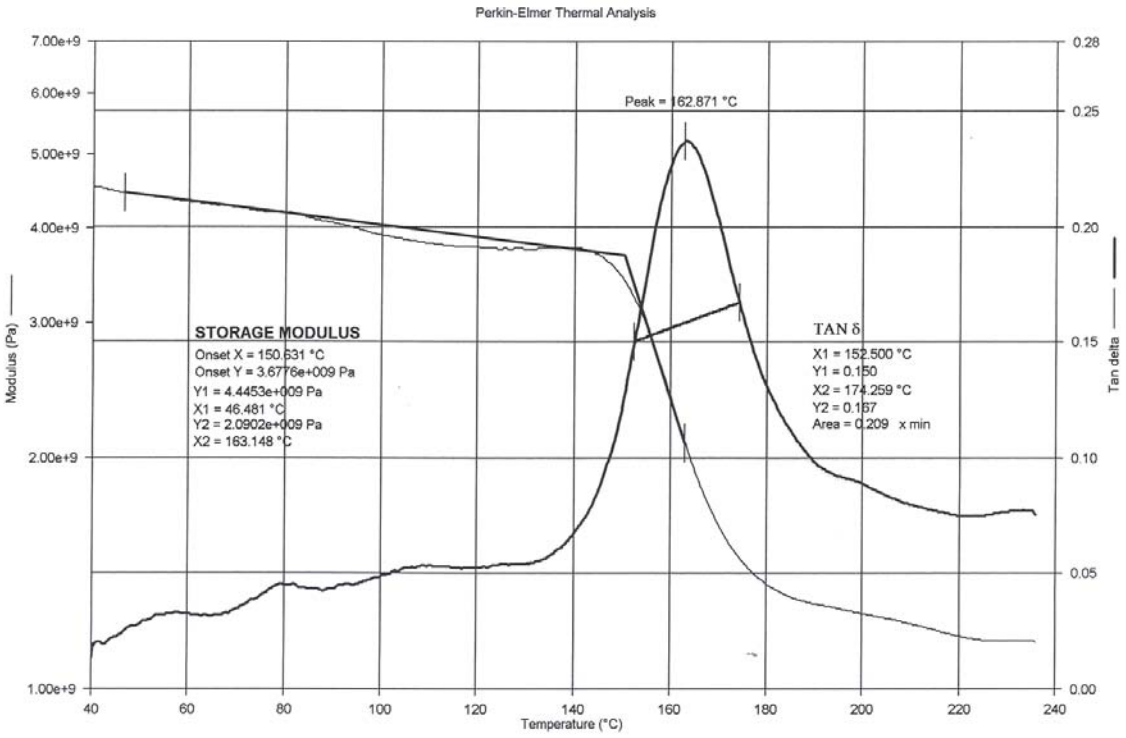

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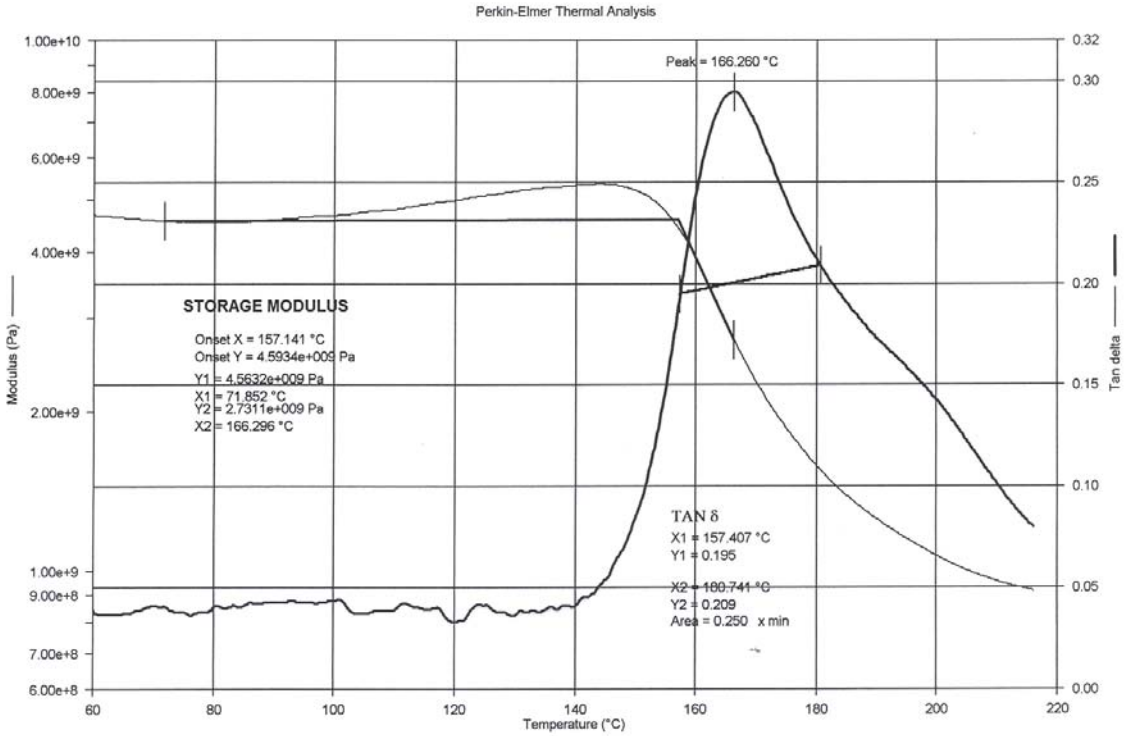

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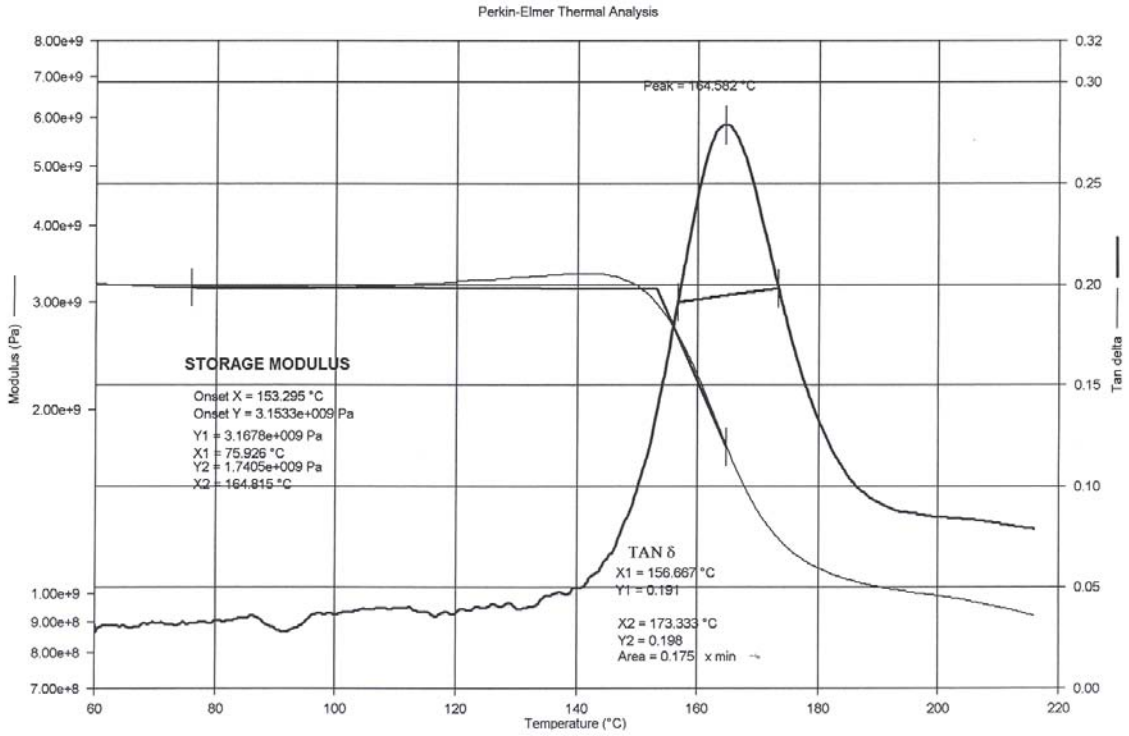

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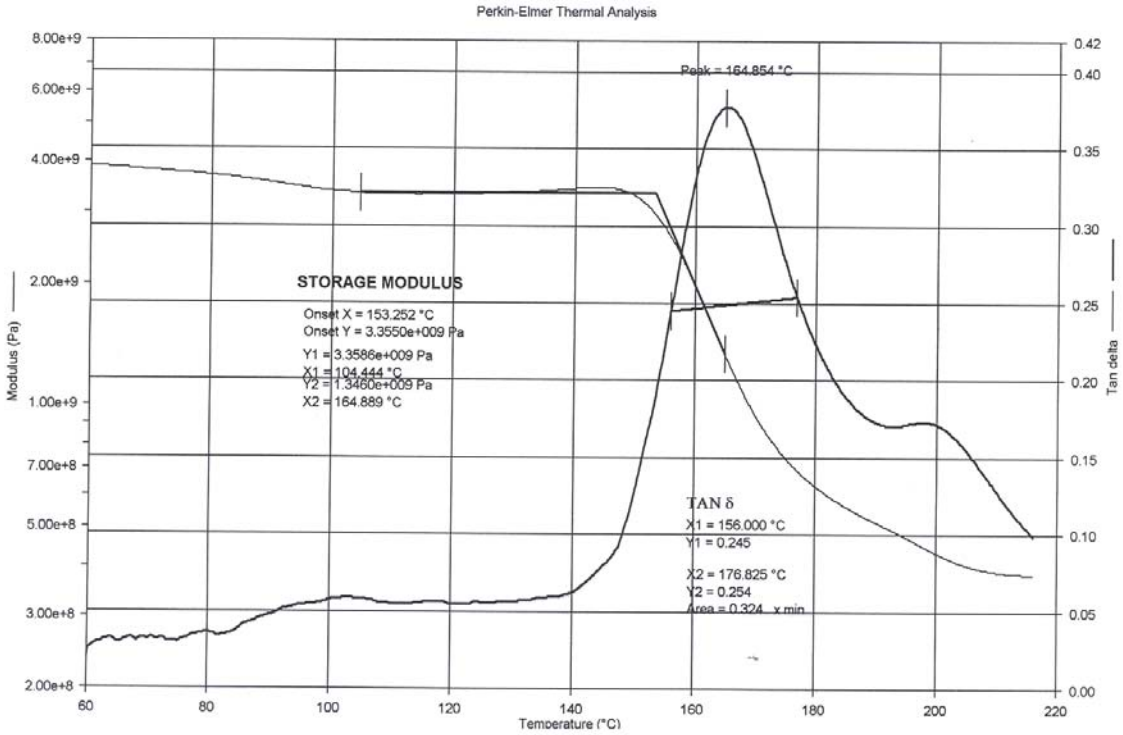

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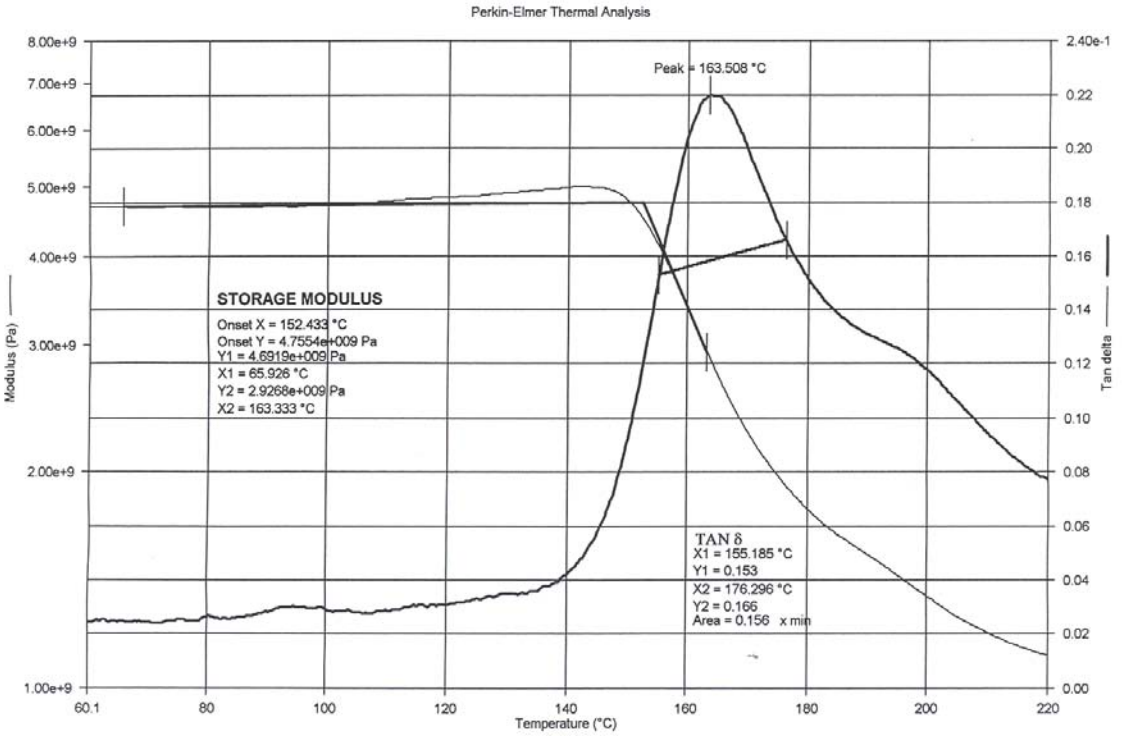

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