EPU 44

EPU 44 is a resilient elastomeric material that contains 40% biobased content, that enables high performance lattices with lower cost part economics.

Table of Contents

EPU 44 Gray & White

Tensile Properties	Test Standard	Metric	US
Tensile Modulus	ASTM D412 Die C 500 mm/min	16 MPa	2300 psi
Elongation at Break		275%	275%
Stress at 50% Elongation		4 MPa	580 psi
Stress at 100% Elongation		8 MPa	1100 psi
Stress at 200% Elongation		20 MPa	2900 psi
Ultimate Tensile Strength		24 MPa	3500 psi

Other Mechanical Properties	Test Standard	Metric	US
Tear Strength	ASTM D624 Die C (die cut)	35 kN/m	200 lbf/in
Compression Set	ASTM D395-B 23 °C, 72 h	25%	
Ross Flexing Fatigue (Unnotched), 23 °C	Based on ASTM D1052 60° bending 100 cycles/min 2 mm thickness	> 100,000 cycles (no crack propagation)	
Ross Flexing Fatigue (Notched), -10 °C		> 100,000 cycles (no crack propagation)	

Thermal Properties	Test Standard	Metric	US
T_g (DMA, tan(d))	ASTM D4065	-5 °C	23 °F

Dielectric/Electric Properties	Test Standard	
Dielectric Constant	ASTM D150	4.26
Dissipation Factor		0.0368
Dielectric Strength	ASTM D149	17 kV/mm
Volume Resistivity	ASTM D	1.1 x 10^{11} ohm-cm

General Properties	Test Standard	
Shore A Hardness	ASTM D2240	78 (Instant), 77 (5 sec)
Bulk Density	ASTM D792	1.03 g/mL
Relative Abrasion Volume Loss	ISO-4649 A	70 mm^3

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Parts were processed using an L series printer and centrifugal spinner.

EPU 44 Gray & White

Liquid Properties	
Liquid Density (Part A)	1.05 g/mL
Liquid Density (Part B)	0.94 g/mL
Liquid Density (Part A+B)	1.03 g/mL
Part A:B Volume Ratio (Mass Ratio)	Gray: 10.8 (12.0)
	White: 10.3 (11.4)
25 °C Viscosity (Part A)	8600 cP
25 °C Viscosity (Part B)	80 cP
25°C Viscosity (Part A+B)	6700 cP

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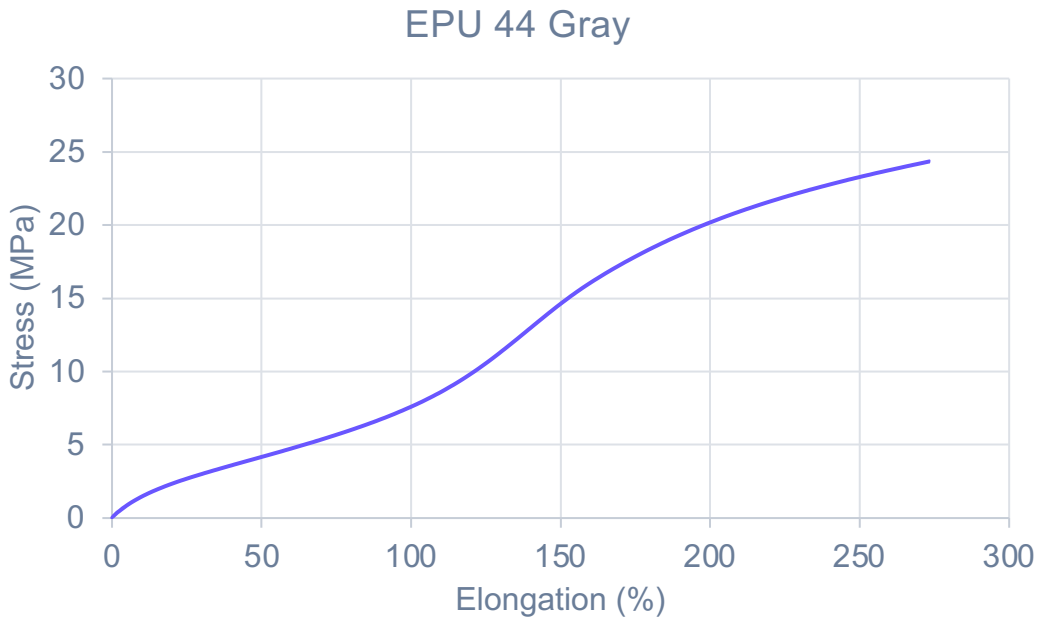
EPU 44

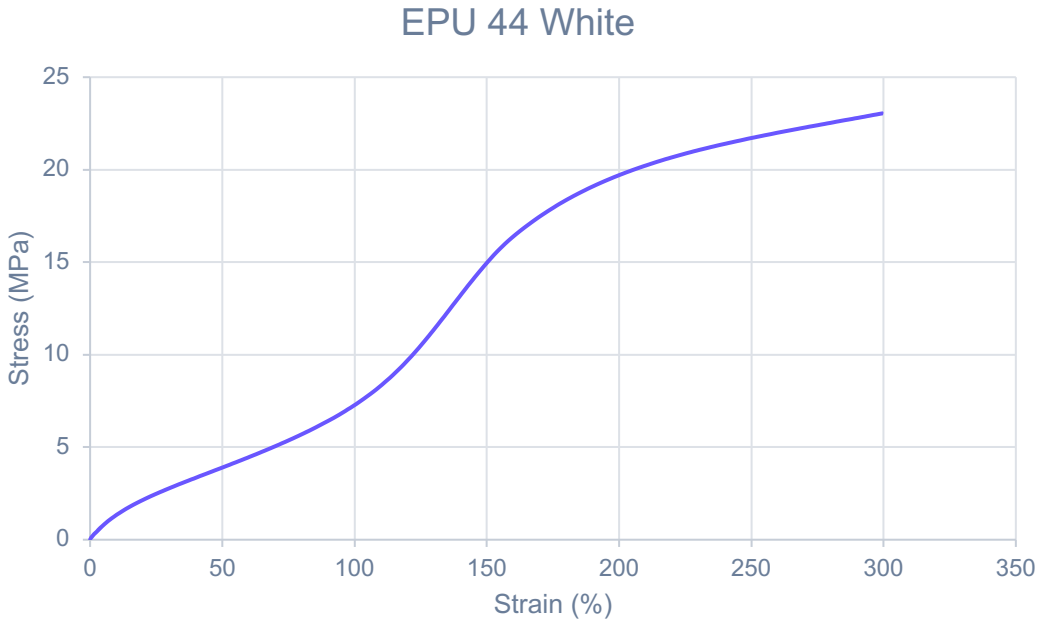
Extended TDS

EPU 44 Mechanical Properties

Representative Tensile Curve

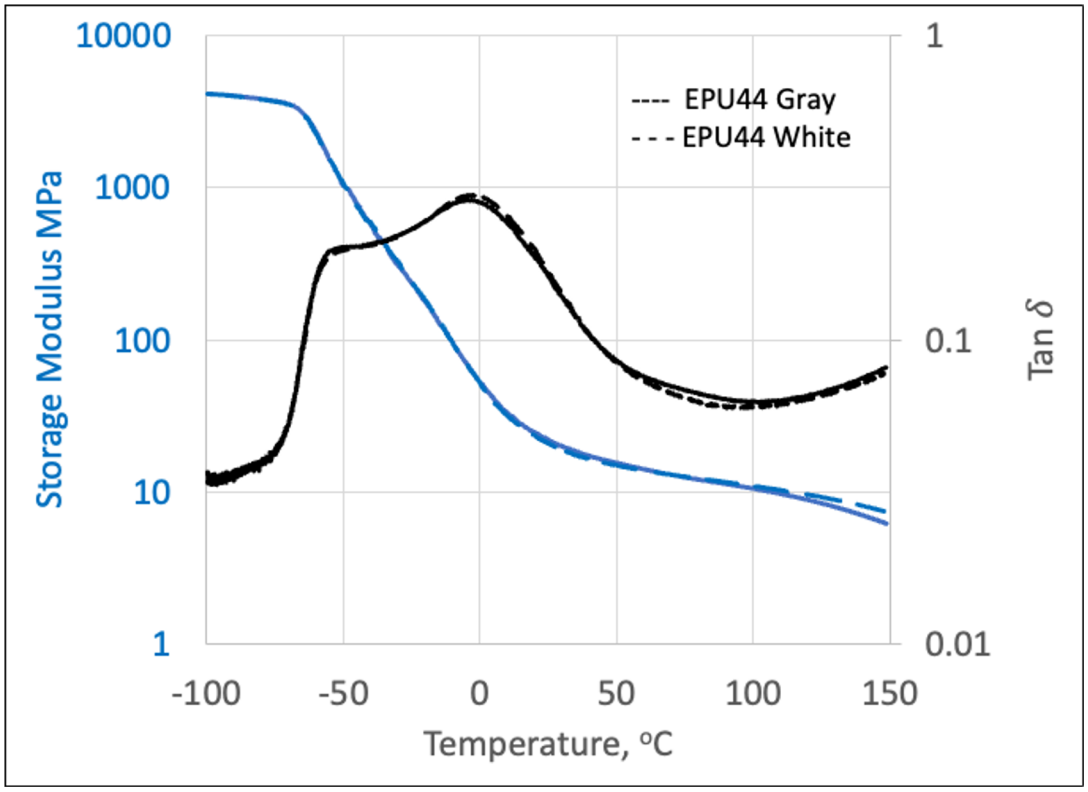
ASTM D412, Die C, 500 mm/min





Dynamic Mechanical Analysis (DMA)
EPU 44 Gray vs White

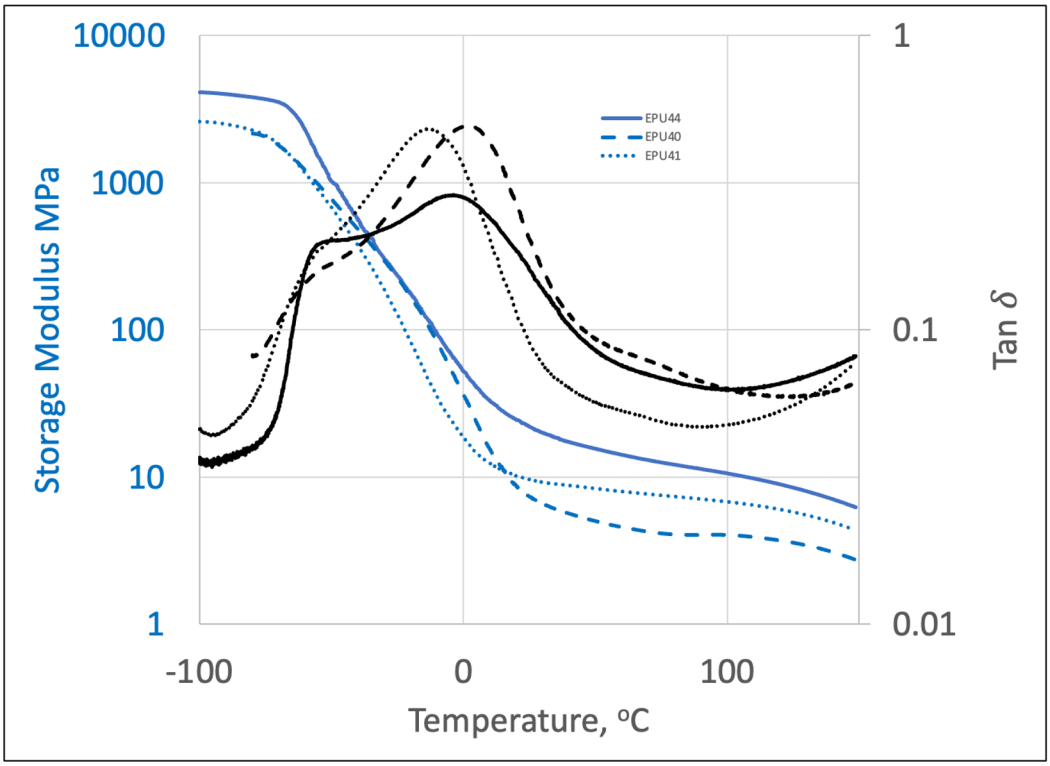
The figure below shows the thermomechanical behavior of EPU 44 Gray and White are similar. EPU 44 has a T_g at -5 °C and a room temperature storage modulus around 20 MPa.



Dynamic Mechanical Analysis (DMA)

Both EPU 41 Black and EPU 44 have improved cold temperature performance compared to EPU 40. EPU 44 has a T_g between EPU 41 Black and EPU 40. In addition, EPU 44 has the highest room temperature storage modulus and rubbery plateau compared to EPU 41 Black and EPU 40.

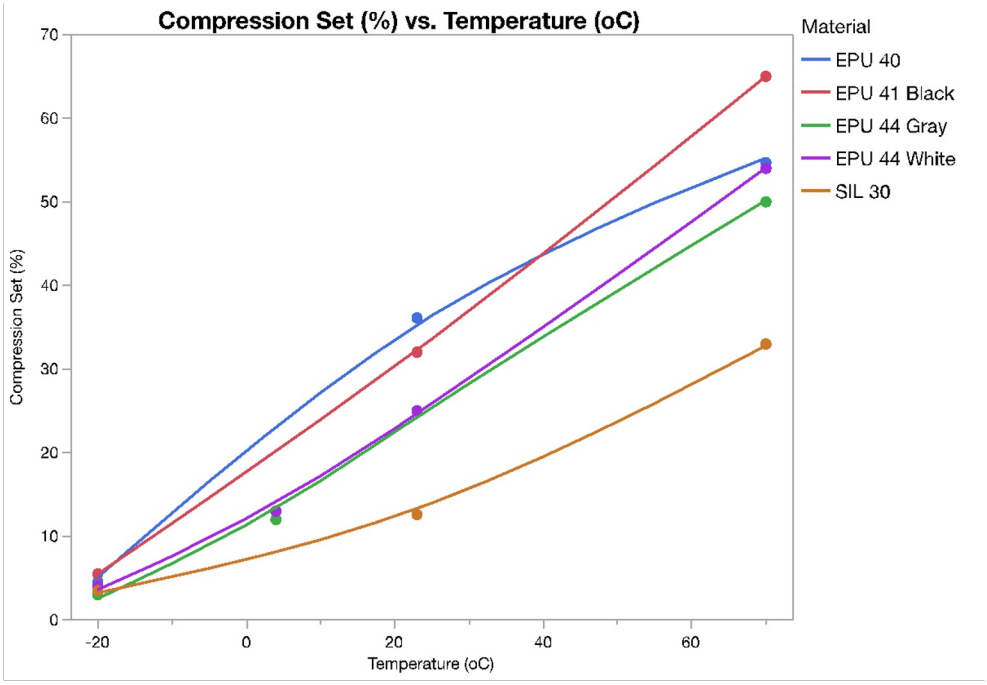
EPU 44 Gray $T_g(\tan(\delta))$ = -5 °C
EPU 41 Black $T_g(\tan(\delta))$ = -10 °C
EPU 40 T_g $(\tan(\delta))$ = 10 °C



ASTM D4065
Q800 Tension Mode, Ramp Rate 2 °C/min, 1 Hz, 0.1% strain
Samples were post processed using DPM Smart Part Washer.

EPU 44 Compression Set

In many elastomeric applications, compression set is an important property that reflects the amount of residual deformation after holding compression at a fixed time, temperature and displacement. EPU 40, EPU 41 Black, EPU 44 Gray, EPU 44 White, and SIL 30 were compressed to 25% of its original sample height and held at various temperatures (-20, 4, 23, and 70 °C) for 72 hours. The compression set measurement is the residual deformation of a test specimen where 0% represents full recovery of the original thickness and 100% indicates no recovery. The image below summarizes the compression set results for various Carbon elastomers.



ASTM D394-14 Method B

EPU 44 Chemical Compatibility

	Mass Gain* (%)
Household Chemicals	
Bleach (NaClO, 5%)	< 5%
Sanitizer (NH_4Cl, 10%)	5 - 15%
Distilled Water	5 - 15%
Sunscreen (Banana Boat, SPF 50)	5 - 15%
Detergent (Tide, Original)	5 - 15%
Windex Powerized Formula	15 - 30%
Hydrogen Peroxide (30%)	> 30%
Ethanol (95%)	> 30%
Industrial Fluids	
Diesel (Chevron #2)	< 5%
Strong Acid/Base	
Sulfuric Acid (30%)	5 - 15%
Sodium Hydroxide (10%)	< 5%

**Percent weight gained after one week submersion following ASTM D543. Values do not represent changes in dimension or mechanical properties.*

EPU 44 Gray and White Biocompatibility

Biocompatibility Testing

Printed parts were provided to NAMSA for evaluation in accordance with ISO 10993-10*, Biological evaluation of medical devices - Part 10: Tests for irritation and skin sensitization* (specifically the Closed Patch Sensitization Study and dermal contact irritation). Parts were processed using an L series printer and centrifugal spinner. The results for all tests indicated that EPU 44 passed the requirements for biocompatibility according to the above tests. **Carbon makes no representation and is not responsible for the results of any biocompatibility tests other than those specified above.**

Disclaimer

Biocompatibility results may vary based on printing and/or post-processing procedures.

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