

# EPU 41

**EPU 41 is a production-grade elastomeric material that is especially well-suited for elastomeric lattices where high resiliency is needed.**

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# EPU 41 Black

Tensile Properties	Test Standard	Metric	US
Tensile Modulus	ASTM D412 Die C 500 mm/min	8 MPa	1160 psi
Elongation at Break		300%	300%
Stress at 50% Elongation		2 MPa	290 psi
Stress at 100% Elongation		4 MPa	580 psi
Stress at 200% Elongation		9 MPa	1300 psi
Ultimate Tensile Strength		15 MPa	2200 psi

Other Mechanical Properties	Test Standard	Metric	US
Tear Strength, Die C (die cut)	ASTM D624	20 kN/m	110 lbf/in
Compression Set, 23 °C, 72 h	ASTM D395-B	30%	

Thermal Properties	Test Standard	Metric	US
T <sub>g</sub> (DMA, tan(d))	ASTM D4065	-10 °C	14 °F

General Properties	Test Standard	Metric	US
Hardness	ASTM D2240	71 (Instant), 70 (5 sec) Shore A	
Density	ASTM D792	1.03 g/cm <sup>3</sup>	

Liquid Properties	Test Standard	Metric	US
Liquid Density (Part A)		0.99 g/mL	
Liquid Density (Part B)		0.94 g/mL	
Liquid Density (Part A+B)		0.99 g/mL	
Part A:B Volume Ratio (Mass Ratio)		12.4 (13.0)	
25 °C Viscosity (Part A)		9900 cP	
25 °C Viscosity (Part B)		80 cP	
25°C Viscosity (Part A+B)		8000 cP	

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Parts were processed using an M series printer and a Smart Part Washer with VF 1 as the solvent.

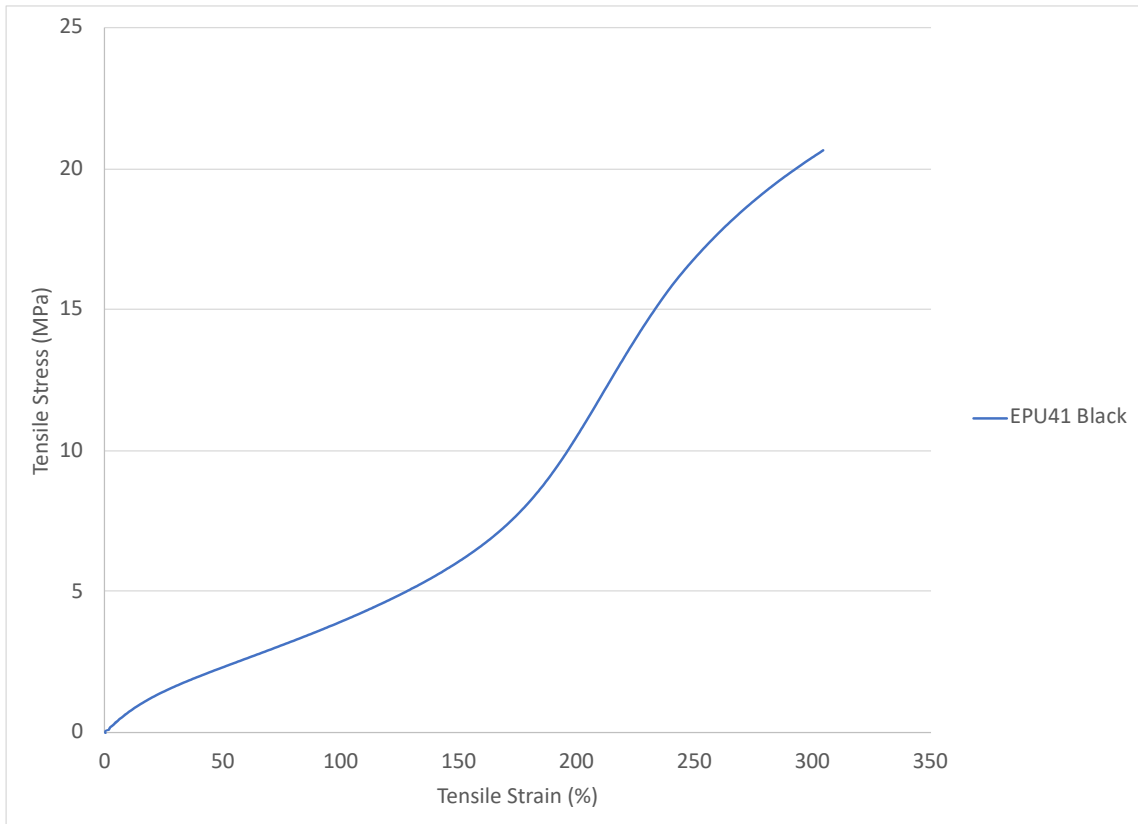
# EPU 41

## Extended TDS

# EPU 41 Black Mechanical Properties

## Representative Tensile Curve

ASTM D412, Die C, 500 mm/min



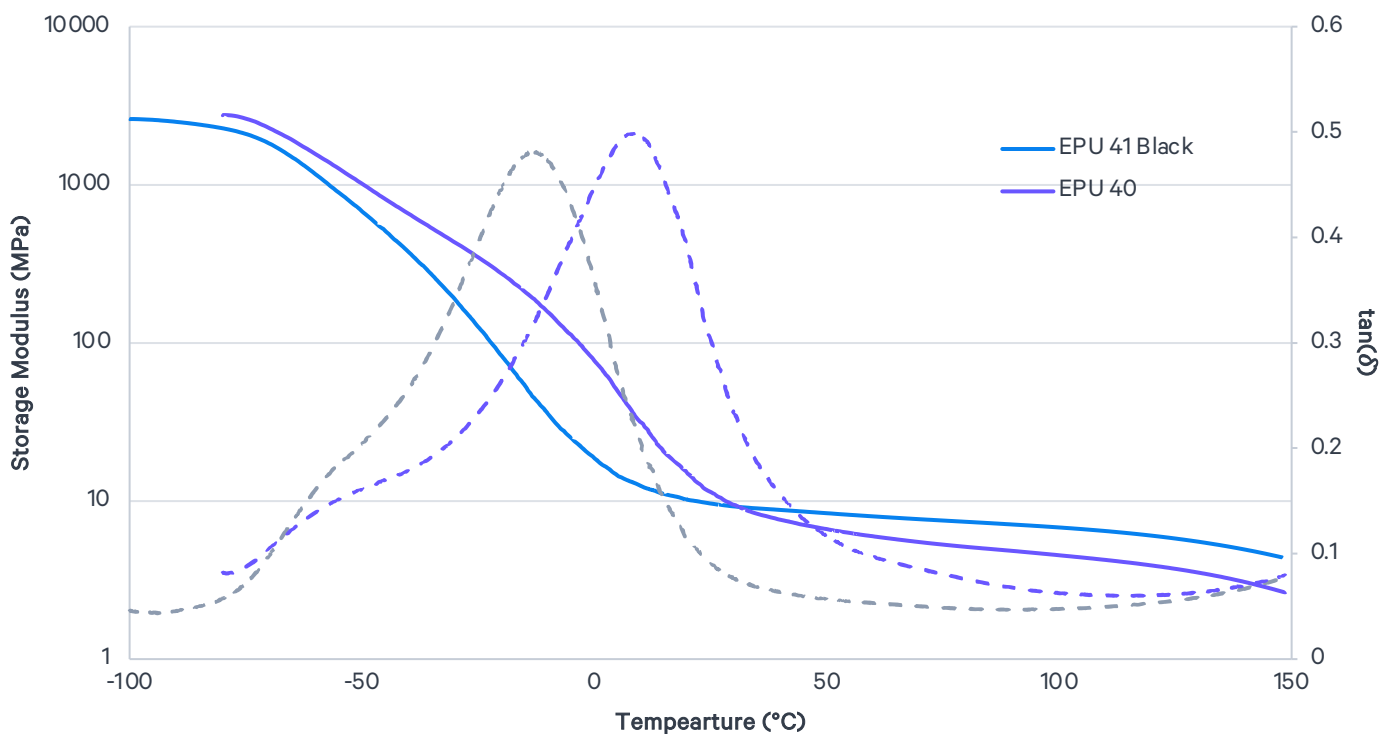
# Dynamic Mechanical Analysis (DMA)

## EPU 41 Black versus EPU 40

EPU 41 Green has improved cold temperature performance compared to EPU 40. EPU 41 Green has lower  $T_g$  ( $\tan(\delta)$  peak), indicating retention of elastomeric properties down to colder temperatures.

EPU 41  $T_g(\tan(\delta)) = -10\text{ }^\circ\text{C}$

EPU 40  $T_g(\tan(\delta)) = 10\text{ }^\circ\text{C}$



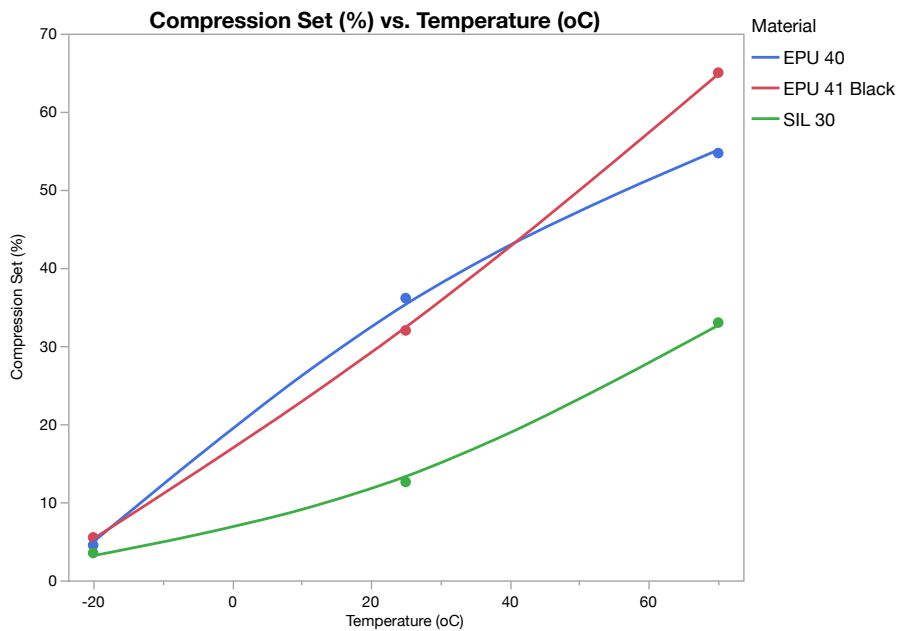
ASTM D4065

Q800 Tension Mode, Ramp Rate 2 °C/min, 1 Hz, 0.1% strain

Samples were post processed using DPM Smart Part Washer.

# EPU 41 Black 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, and SIL 30 were compressed to 25% of its original sample height and held at various temperatures (-20, 25, 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 41 Green

Tensile Properties	Test Standard	Metric	US
Tensile Modulus	ASTM D412 Die C 500 mm/min	6 MPa	870 psi
Elongation at Break		250%	250%
Stress at 50% Elongation		3 MPa	440 psi
Stress at 100% Elongation		5 MPa	730 psi
Stress at 200% Elongation		9 MPa	1300 psi
Ultimate Tensile Strength		15 MPa	2200 psi

Other Mechanical Properties	Test Standard	Metric	US
Tear Strength, Die C (die cut)	ASTM D624	20 kN/m	110 lbf/in
Compression Set, 23 °C, 72 h	ASTM D395-B	30%	
Bayshore Rebound Resilience	ASTM D2632	30%	
Ross Flexing Fatigue (Notched), 23 °C	Based on ASTM D1052 60° bending 100 cycles/min 2 mm thickness	> 50,000 cycles (no crack propagation)	
Ross Flexing Fatigue (Notched), -10 °C		> 40,000 cycles (no crack propagation)	

Thermal Properties	Test Standard	Metric	US
T <sub>g</sub> (DMA, tan(d))	ASTM D4065	-10 °C	14 °F

Dielectric/Electric Properties	Test Standard	Metric	US
Dielectric Constant	ASTM D150	5	5
Dissipation Factor		0.03	0.03
Dielectric Strength	ASTM D149	17 kV/mm	430 V/mil
Volume Resistivity	ASTM D257	3.1 x 10 <sup>11</sup> ohm-cm	1.2 x 10 <sup>11</sup> ohm-in

General Properties	Test Standard	Metric	US
Hardness	ASTM D2240	72 (Instant), 71 (5 sec), Shore A	
Bulk Density	ASTM D792	1.03 g/mL	
Relative Abrasion Volume Loss	ISO-4649 A	70 mm <sup>3</sup>	

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Parts were processed using an M series printer and a Smart Part Washer with VF 1 as the solvent.



# EPU 41 Green

Liquid Properties	
Liquid Density (Part A)	0.99 g/mL
Liquid Density (Part B)	0.94 g/mL
Liquid Density (Part A+B)	0.99 g/mL
Part A:B Volume Ratio (Mass Ratio)	12.4 (13.0)
25 °C Viscosity (Part A)	9900 cP
25 °C Viscosity (Part B)	80 cP
25°C Viscosity (Part A+B)	8000 cP

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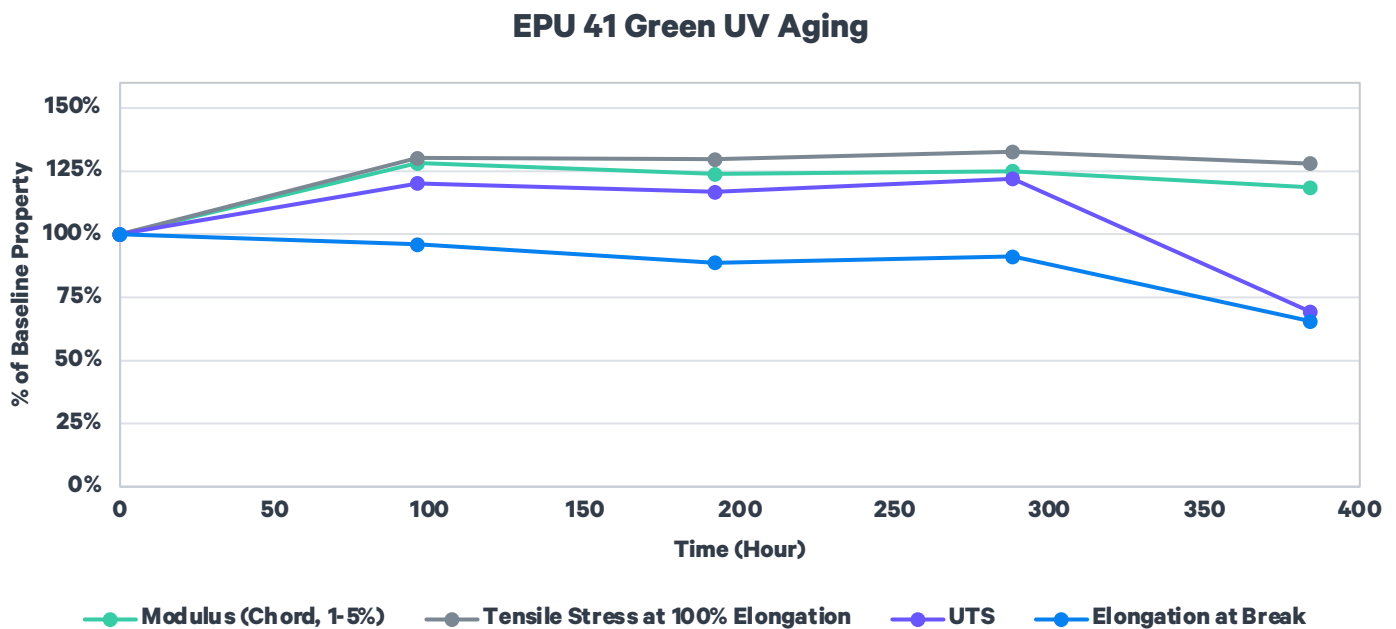
# EPU 41 Green Chemical Compatibility

	Mass Gain* (%)
<b>Household Chemicals</b>	
Bleach (NaClO, 5%)	< 5%
Sanitizer (NH <sub>4</sub> Cl, 10%)	< 5%
Distilled Water	< 5%
Sunscreen (Banana Boat, SPF 50)	> 30%
Detergent (Tide, Original)	5 - 15%
Windex Powerized Formula	5 - 15%
Hydrogen Peroxide (30%)	15 - 30%
Ethanol (95%)	> 30%
<b>Industrial Fluids</b>	
Engine Oil (Havoline SAE 5W-30)	< 5%
Brake Fluid (Castrol DOT-4)	15 - 30%
Airplane Deicing Fluid (Type I Ethylene Glycol)	-
Airplane Deicing Fluid (Type I Propylene Glycol)	-
Airplane Deicing Fluid (Type IV Ethylene Glycol)	-
Airplane Deicing Fluid (Type IV Propylene Glycol)	-
Transmission Fluid (Havoline Synthetic ATF)	5 - 15%
Engine Coolant (Havoline XLC, 50%/50% premixed)	< 5%
Diesel (Chevron #2)	> 30%
Gasoline (Chevron #91)	-
Skydrol 500B-4	> 30%
<b>Strong Acid/Base</b>	
Sulfuric Acid (30%)	15 - 30%
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 41 Green UV Aging

Natural polymer aging can occur in the presence of light, sun, and heat. Carbon evaluated the UV aging performance of EPU 41 using ASTM D4459, which is intended to simulate indoor exposure of solar radiation through glass.



ASTM D4459: Q-Sun XE-1, 0.8 W/m<sup>2</sup>/nm at 420 nm, 55 °C

ASTM D412: Die C, 500 mm/min, average values represented

## Color Fastness After UV Aging

EPU 41 Green has excellent color fastness after UV aging. Color change is calculated from L\*a\*b\* values measured by colorimeter.

Color change after UV aging, dE = 0.7

ISO 4892-1/4892-2: Xenon-arc lamp, UV-Quartz filter, 1.2 W/m<sup>2</sup>/nm, at 420 nm, 70 °C, 6 hours



# EPU 41 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). Parts were processed using an M series printer and a Smart Part Washer with VF 1 as the solvent. The results for all tests indicated that EPU 41 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.**

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

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