

EPU 43

EPU 43 is an energy-damping elastomer that is soft while offering good energy damping and excellent durability under high-cycle flexing.

Table of Contents

Standard Technical Data Sheet:	Page 2-3
Extended Technical Data Sheet:	Page 4-10
- Properties with IPA washing	Page 5
- Mechanical Properties	Page 6
- Thermomechanical Properties	Page 7
- Compression Set	Page 8
- Chemical Compatibility	Page 9
- Water Uptake & Conditioned Properties Page	Page 10

EPU 43

Tensile Properties	Test Standard	Metric	US
Tensile Modulus	ASTM D412 Die C 500 mm/min	10 MPa	1450 psi
Elongation at Break		380%	380%
Stress at 50% Elongation		2 MPa	290 psi
Stress at 100% Elongation		4 MPa	580 psi
Stress at 200% Elongation		13 MPa	1900 psi
Ultimate Tensile Strength		17 MPa	2500 psi

Other Mechanical Properties	Test Standard	Metric	US
Tear Strength	ASTM D624 Die C (die cut)	23 kN/m	131 lbf/in
Compression Set	ASTM D395-B 23 °C, 72 h	39%	
Ross Flexing Fatigue (Notched), 23°C	ASTM D1052	> 350,000 cycles (with crack growth < 500%)	

Thermal Properties	Test Standard	Metric	US
T _g (DMA, tan(d))	ASTM D4065, 2 °C/min, 1Hz	4 °C	39 °F

Dielectric/Electric Properties	Test Standard	Metric	US
Dielectric Constant	ASTM D150	6.75	
Dissipation Factor		0.0015	
Dielectric Strength	ASTM D149	16 kV/mm	
Volume Resistivity	ASTM D	2.7 x 10 ¹⁴ ohm-cm	

General Properties	Test Standard	Metric	US
Shore A Hardness	ASTM D2240	76 (Instant), 71 (5 sec)	
Bulk Density	ASTM D792	1.03 g/mL	
Relative Abrasion Volume Loss	ISO-4649 A	213 mm ³	

The information in this document includes values derived from printing various parts, reflects an approximation of the mean value of a range of values, and is intended for reference and comparison purposes only. This information should not be used for testing, design specification or quality control purposes. End-use material performance can be impacted by, but not limited to, design, processing, color treatment, operating and end-use conditions, test conditions, etc. Actual values will vary with build conditions. In addition, product specifications are subject to change without notice.

This information and Carbon's technical advice are given to you in good faith but without warranty. The application, use and processing of these and other Carbon products by you are beyond Carbon's control and, therefore, entirely your own responsibility. Carbon products are only to be used by you, subject to the terms of the written agreement by and between you and Carbon.

You are responsible for determining that the Carbon material is safe, lawful, and technically suitable for the intended application, as well as for identifying the proper disposal (or recycling) method consistent with applicable environmental laws and regulations. CARBON MAKES NO WARRANTIES OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR USE, OR NON-INFRINGEMENT. Further, it is expressly understood and agreed that you assume and hereby expressly release Carbon from all liability, in tort, contract or otherwise, incurred in connection with the use of Carbon products, technical assistance and information. No license with respect to any intellectual property is implied.

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

EPU 43

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)	11.3 (11.9)
25 °C Viscosity (Part A)	2900 cP
25 °C Viscosity (Part B)	80 cP
25°C Viscosity (Part A+B)	2400 cP

The information in this document includes values derived from printing various parts, reflects an approximation of the mean value of a range of values, and is intended for reference and comparison purposes only. This information should not be used for testing, design specification or quality control purposes. End-use material performance can be impacted by, but not limited to, design, processing, color treatment, operating and end-use conditions, test conditions, etc. Actual values will vary with build conditions. In addition, product specifications are subject to change without notice.

This information and Carbon's technical advice are given to you in good faith but without warranty. The application, use and processing of these and other Carbon products by you are beyond Carbon's control and, therefore, entirely your own responsibility. Carbon products are only to be used by you, subject to the terms of the written agreement by and between you and Carbon.

You are responsible for determining that the Carbon material is safe, lawful, and technically suitable for the intended application, as well as for identifying the proper disposal (or recycling) method consistent with applicable environmental laws and regulations. CARBON MAKES NO WARRANTIES OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR USE, OR NON-INFRINGEMENT. Further, it is expressly understood and agreed that you assume and hereby expressly release Carbon from all liability, in tort, contract or otherwise, incurred in connection with the use of Carbon products, technical assistance and information. No license with respect to any intellectual property is implied.

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

EPU 43

Extended TDS

EPU 43 – Properties with IPA Washing

Tensile Properties	Test Standard	Metric	US
Tensile Modulus	ASTM D412 Die C 500 mm/min	11 MPa	1600 psi
Elongation at Break		420%	420%
Stress at 50% Elongation		2 MPa	290 psi
Stress at 100% Elongation		4 MPa	580 psi
Stress at 200% Elongation		13 MPa	1900 psi
Ultimate Tensile Strength		19 MPa	2750 psi
Tear Strength	ASTM D624 Die C (die cut)	26 kN/m	148 lbf/in

The information in this document includes values derived from printing various parts, reflects an approximation of the mean value of a range of values, and is intended for reference and comparison purposes only. This information should not be used for testing, design specification or quality control purposes. End-use material performance can be impacted by, but not limited to, design, processing, color treatment, operating and end-use conditions, test conditions, etc. Actual values will vary with build conditions. In addition, product specifications are subject to change without notice.

This information and Carbon's technical advice are given to you in good faith but without warranty. The application, use and processing of these and other Carbon products by you are beyond Carbon's control and, therefore, entirely your own responsibility. Carbon products are only to be used by you, subject to the terms of the written agreement by and between you and Carbon.

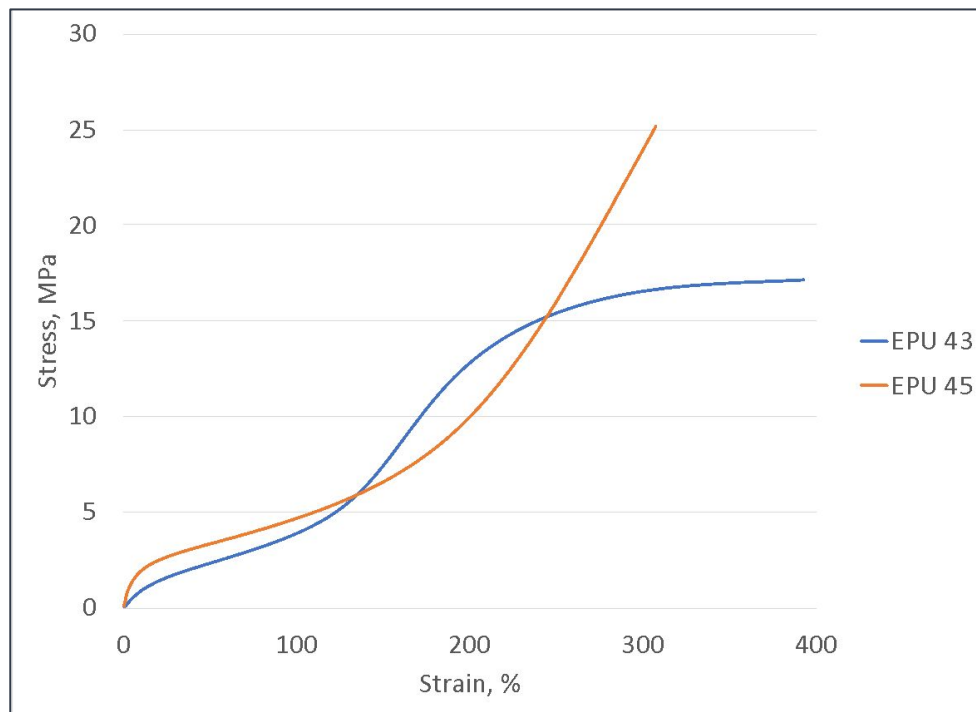
You are responsible for determining that the Carbon material is safe, lawful, and technically suitable for the intended application, as well as for identifying the proper disposal (or recycling) method consistent with applicable environmental laws and regulations. CARBON MAKES NO WARRANTIES OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR USE, OR NON-INFRINGEMENT. Further, it is expressly understood and agreed that you assume and hereby expressly release Carbon from all liability, in tort, contract or otherwise, incurred in connection with the use of Carbon products, technical assistance and information. No license with respect to any intellectual property is implied.

Parts were processed using an L series printer and washed in IPA

EPU 43 Mechanical Properties

Representative Tensile Curve & comparison with EPU 45

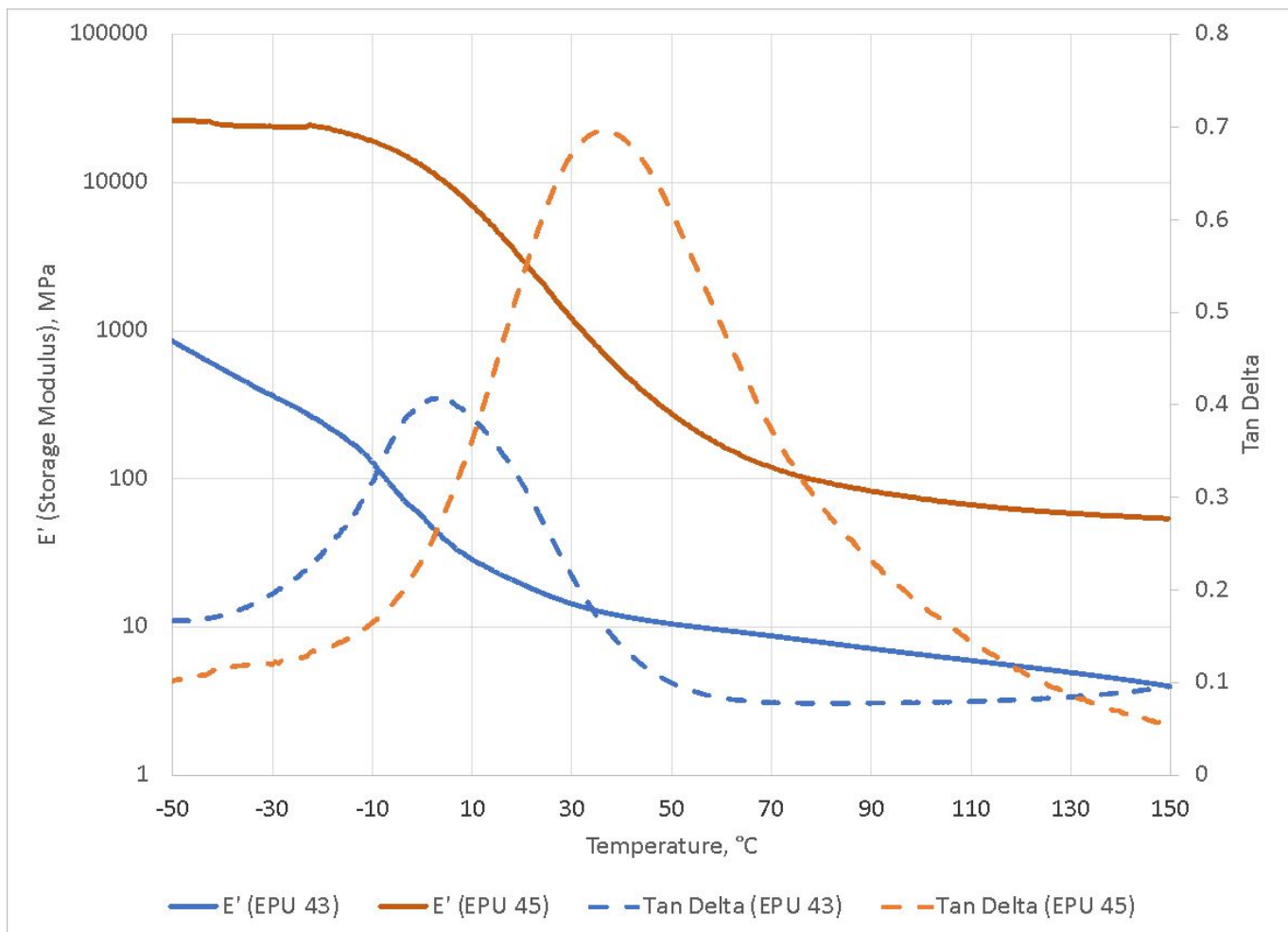
ASTM D412, Die C, 500 mm/min



Dynamic Mechanical Analysis (DMA)

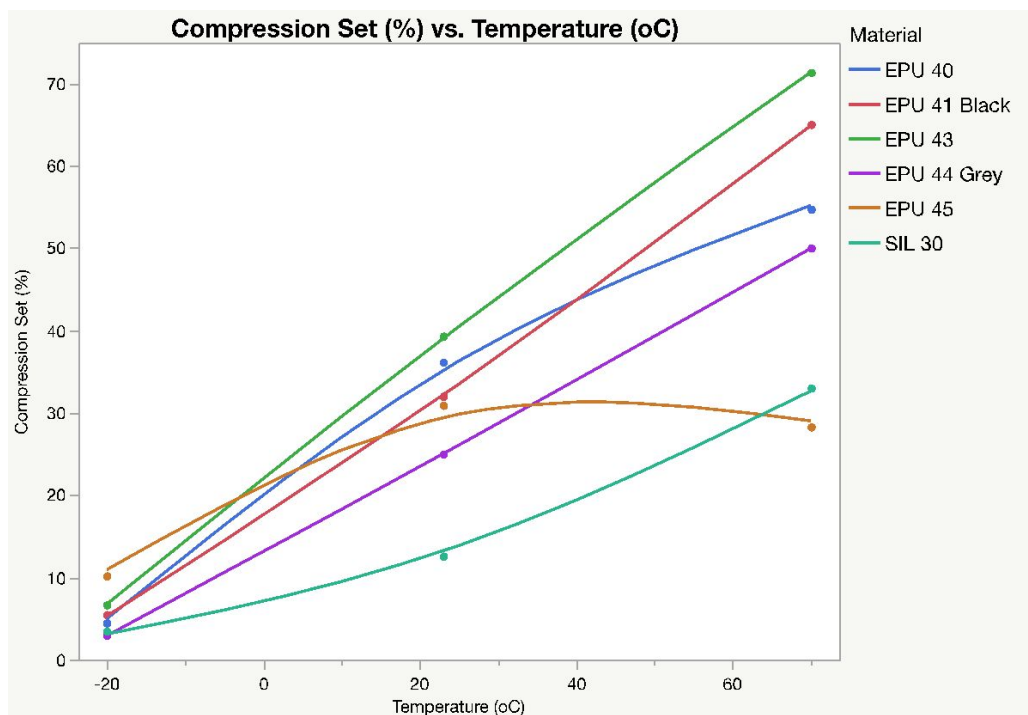
EPU 43 vs EPU 45

The figure below shows the thermomechanical behavior of EPU 43 and its comparison to EPU 45. EPU 43 has a T_g at 4 °C and a room temperature storage modulus around 18 MPa.



EPU 43 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 43, EPU 45, EPU 44 Gray, and SIL 30 were compressed to 25% of its original sample height and held at various temperatures (-20, 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 43 Chemical Compatibility

	Mass Gain* (%)
Household Chemicals	
Bleach (NaClO, 5%)	< 5%
Sanitizer (NH ₄ Cl, 10%)	< 5%
Distilled Water	< 5%
Sunscreen (Banana Boat, SPF 50)	< 5%
Detergent (Tide, Original)	< 5%
Windex Powerized Formula	< 5%
Hydrogen Peroxide (30%)	15-30%
Ethanol (95%)	> 30%
Industrial Fluids	
Diesel (Chevron #2)	5 - 15%
Strong Acid/Base	
Sulfuric Acid (30%)	5 - 15%
Sodium Hydroxide (10%)	< 5%
Sebum	15-30%

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

EPU 43 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 43 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.

Subscriber acknowledges the contents of this document are subject to the Terms and Conditions outlined in the Subscription Agreement, including the Restrictions on Use section.

DO NOT USE CARBON MATERIALS IN MEDICAL APPLICATIONS INVOLVING IMPLANTATION IN THE HUMAN BODY OR CONTACT WITH BODY FLUIDS OR TISSUES UNLESS THE MATERIAL HAS BEEN PROVIDED FROM CARBON UNDER A WRITTEN CONTRACT THAT IS CONSISTENT WITH THE CARBON POLICY REGARDING MEDICAL APPLICATIONS AND EXPRESSLY ACKNOWLEDGES THE CONTEMPLATED USE. CARBON MAKES NO REPRESENTATION, PROMISE, EXPRESS WARRANTY OR IMPLIED WARRANTY CONCERNING THE SUITABILITY OF THESE MATERIALS FOR USE IN IMPLANTATION IN THE HUMAN BODY OR IN CONTACT WITH BODY FLUIDS OR TISSUES. If Carbon has permitted in the Subscription Agreement use of the Carbon printer for applications that require biocompatibility, Subscriber acknowledges that it is the responsibility of Subscriber, its respective customers and end-users to determine the biocompatibility of all printed parts for their respective uses.

Carbon, Inc. | www.carbon3d.com
1089 Mills Way Redwood City, CA 94063
1 (650) 285-6307