

# RPU 70

**RPU 70 is a tough, rigid material that is a good choice for parts requiring strength, toughness, and moderate heat-resistance.**

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Tensile Properties	Test Standard	Metric	US
Tensile Modulus	ASTM D638 Type I 50 mm/min	1700 MPa	245 ksi
Yield Strength		40 MPa	6 ksi
Strain at Yield		5%	5%
Ultimate Tensile Strength		40 MPa	6 ksi
Elongation at Break		30%	30%
Tensile Modulus	ASTM D638 Type V 10 mm/min	1700 MPa	245 ksi
Yield Strength		40 MPa	6 ksi
Strain at Yield		5%	5%
Ultimate Tensile Strength		40 MPa	6 ksi
Elongation at Break		100%	100%

Flexural Properties	Test Standard	Metric	US
Flexural Stress at 5% strain	ASTM D790-B	55 MPa	8 ksi
Flexural Modulus (Chord, 0.5-1%)		1500 MPa	220 ksi

Impact Properties	Test Standard	Metric	US
Unnotched Charpy	ISO 179-1/1eU	35 kJ/m <sup>2</sup>	17 ft-lb/in <sup>2</sup>
Notched Charpy	ISO 179-1/1eA	1.5 kJ/m <sup>2</sup>	0.7 ft-lb/in <sup>2</sup>
Unnotched Izod, 23 °C (-30 °C)	ASTM D4812	300 J/m (320 J/m)	6 ft-lb/in (6 ft-lb/in)
Notched Izod, 23 °C (-30 °C)	ASTM D256	15 J/m (20 J/m)	0.3 ft-lb/in (0.3 ft-lb/in)

Thermal Properties	Test Standard	Metric	US
Heat Deflection Temperature at 0.455 MPa/66 psi	ASTM D648	60 °C	140 °F
Heat Deflection Temperature at 1.82 MPa/264 psi		45 °C	110 °F
Coefficient of Thermal Expansion (-40, 40 °C)	ASTM E831	100 ppm/°C	50 ppm/°F
Heat Capacity, 23 °C	ASTM E1269	1.8 J/g-°C	0.5 BTU/lb-°F
Flammability	UL 94	HB (15 mm & 3mm) for L1, M1, M2, M3 and M3 Max printers UL Blue Card® file # E485325	

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

Dielectric/Electric Properties	Test Standard	Metric	US
Dielectric Strength	ASTM D149	16 kV/mm	390 V/mil
Dielectric Constant	ASTM D150	3.3	3.3
Dissipation Factor		0.017	0.017
Volume Resistivity	ASTM D257	$8.0 \times 10^{14}$ ohm-cm	$3.2 \times 10^{14}$ ohm-in

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General Properties	Test Standard	
Hardness	ASTM D2240	80, Shore D
Bulk Density	ASTM D792	1.08 g/mL
Taber Abrasion	ASTM D4060 CS-17, 1 kg, 100% vacuum	70 mg / 1000 cycles
Water Absorption, Short Term (24 hours)	ASTM D570	< 0.5%
Water Absorption, Long Term (14 days)		< 1.5%

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Liquid Properties	
Liquid Density (Part A)	1.03 g/mL
Liquid Density (Part B)	0.98 g/mL
Liquid Density (Part A+B)	1.02 g/mL
Part A:B Volume Ratio (Mass Ratio)	10.0 (10.5)
25 °C Viscosity (Part A)	2800 cP
25 °C Viscosity (Part B)	70 cP
25°C Viscosity (Part A+B)	2100 cP

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

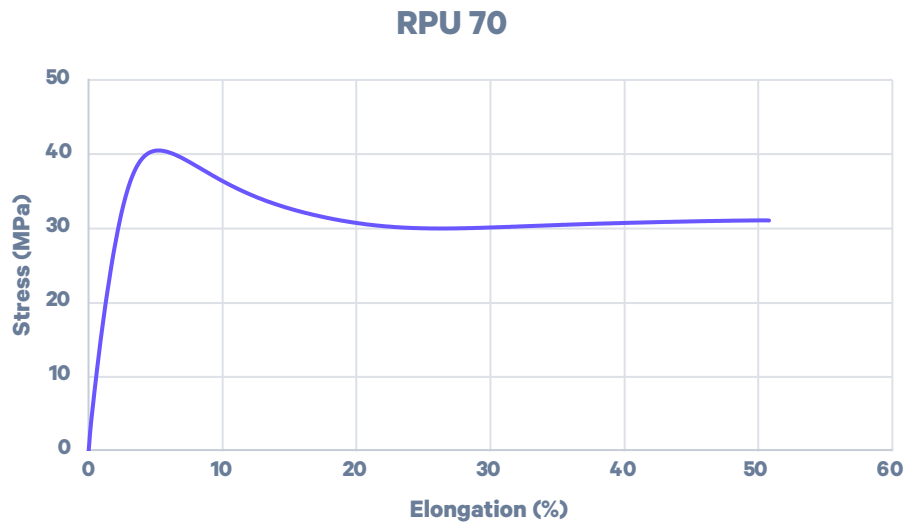
# RPU 70

## **Extended TDS**

# RPU 70 Mechanical Properties

## Representative Tensile Curve

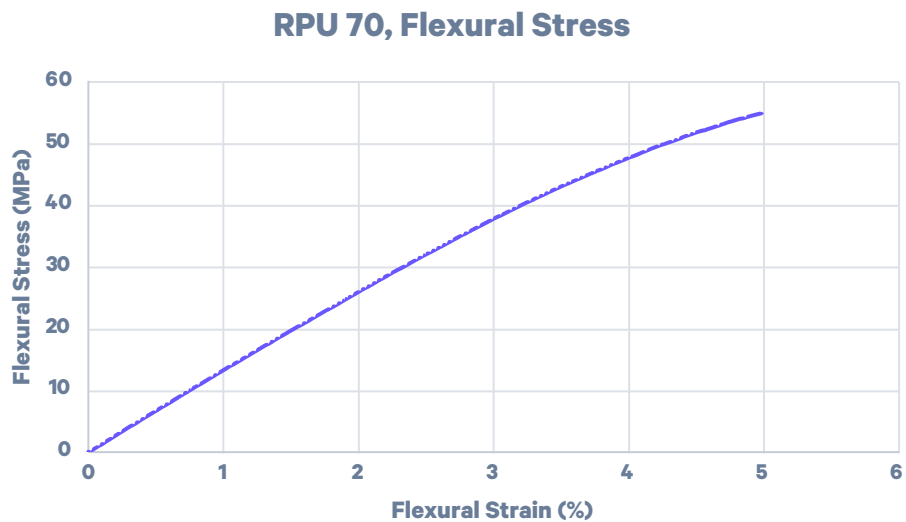
ASTM D638, Type I, 50 mm/min



## Representative Flexural Curve

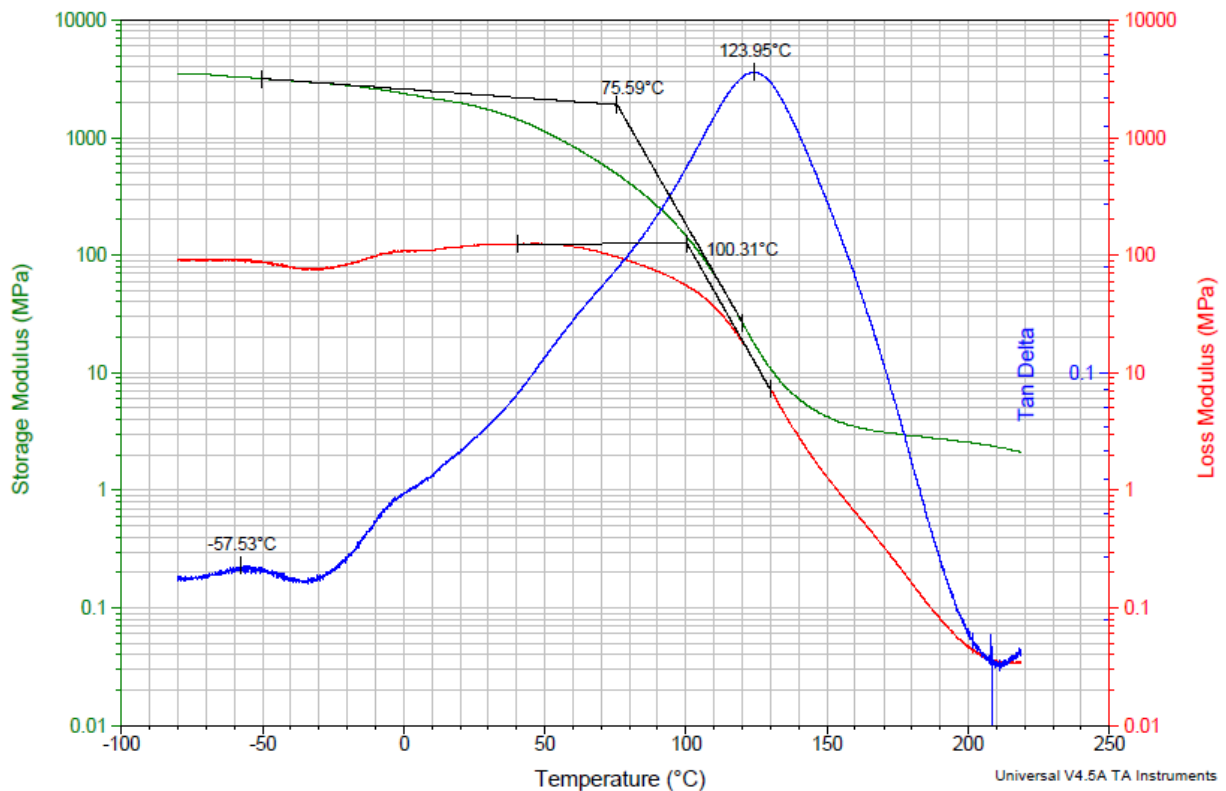
ASTM D790-B

Samples are tested to 5% extension.



# RPU 70 Dynamic Mechanical Analysis (DMA)

Dynamic mechanical analysis provides insight into the resin's viscoelastic properties across a range of temperatures. The figure below shows a temperature ramp of RPU 70. RPU 70 exhibits a storage modulus softening temperature at 75 °C. The peak in the tan( $\delta$ ) curves indicates that the glass transition temperature of RPU 70 is approximately 125 °C.



**Standard:** ASTM D4065

**Instrument:** TA DMA Q800

**DMA Mode:** Tension

**Sample Dimensions:** L=20mm, W=10mm, t=1mm (rectangular block)

**Strain Amplitude:** 0.1% (linear regime of viscoelasticity)

**Oscillation frequency:** 1 Hz

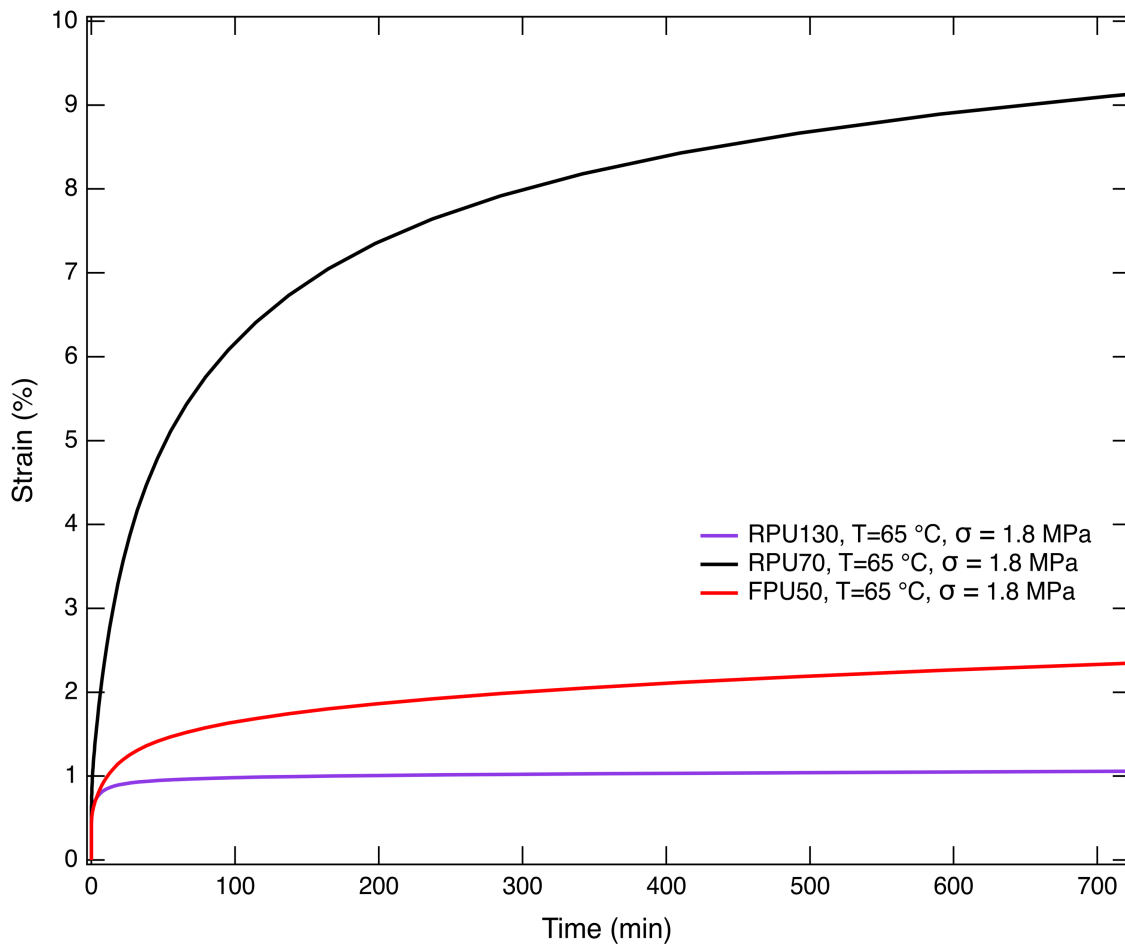
**Temperature Range:** -100°C to 200°C

**Ramp Rate:** 1.5 °C/min

**Print Conditions:** Samples were hand-wiped and not washed with solvent. The thermal cure for all materials complies with the Carbon user manual. Values may differ based on post processing conditions.

# RPU 70 Creep Behavior

A creep test measures a polymer's rate of deformation under constant load at a fixed temperature and is a fundamental property for materials that need to operate under load. The figure below shows RPU 70 creeps up to 10% strain over 12 hours at 65 °C and 1.8 MPa applied load. Low creep behavior is necessary for dimensional stability over time and loads.





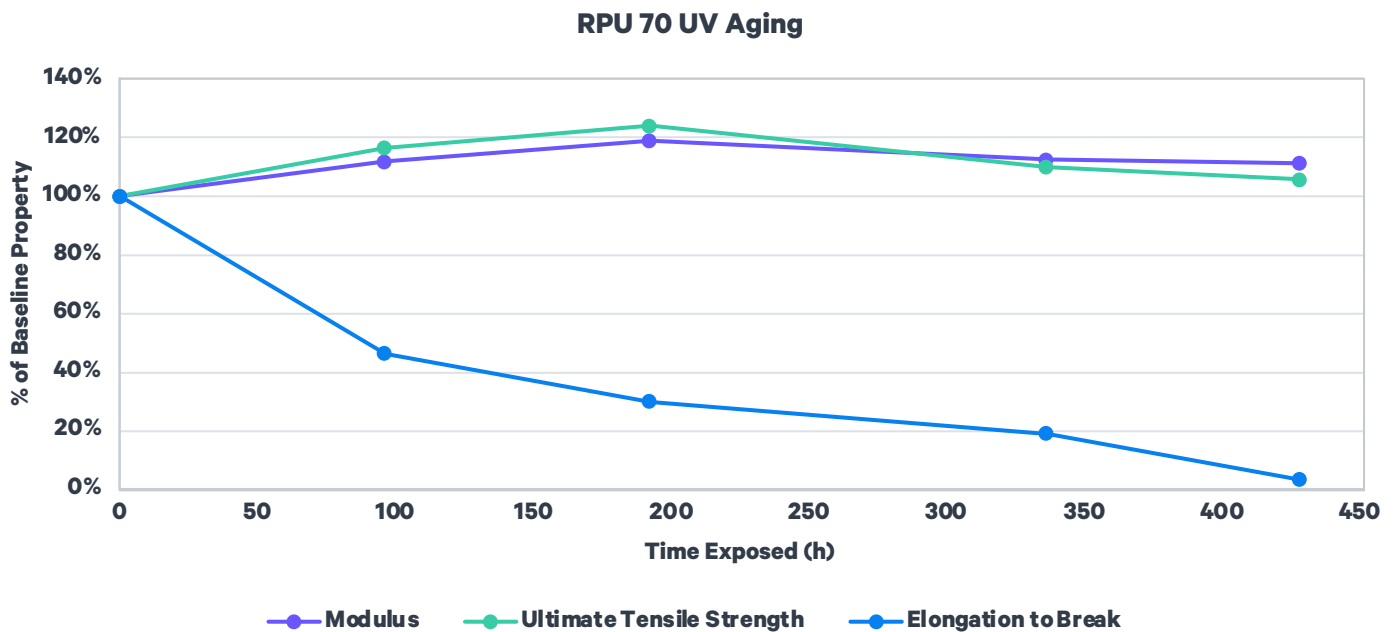
# RPU 70 Chemical Compatibility

	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)	< 5%
Detergent (Tide, Original)	< 5%
Windex Powerized Formula	< 5%
Hydrogen Peroxide (30%)	< 5%
Ethanol (95%)	15 – 30%
<b>Industrial Fluids</b>	
Engine Oil (Havoline SAE 5W-30)	< 5%
Brake Fluid (Castrol DOT-4)	< 5%
Airplane Deicing Fluid (Type I Ethylene Glycol)	< 5%
Airplane Deicing Fluid (Type I Propylene Glycol)	< 5%
Airplane Deicing Fluid (Type IV Ethylene Glycol)	< 5%
Airplane Deicing Fluid (Type IV Propylene Glycol)	< 5%
Transmission Fluid (Havoline Synthetic ATF)	< 5%
Engine Coolant (Havoline XLC, 50%/50% premixed)	< 5%
Diesel (Chevron #2)	< 5%
Gasoline (Chevron #91)	> 30%
Skydrol 500B-4	5 – 15%
<b>Strong Acid/Base</b>	
Sulfuric Acid (30%)	< 5%
Sodium Hydroxide (10%)	< 5%

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

## RPU 70 UV Aging

Natural polymer aging can occur in the presence of light, sun, and heat. Carbon evaluated the UV aging performance of RPU 70 using ASTM D4459, which is intended to simulate indoor exposure of solar radiation through glass. RPU 70 retained up to 46% of the original elongation at break after 96 hours of exposure.



ASTM 4459: Q-Sun XE-1, 0.8 W/m<sup>2</sup>/nm at 420 nm, 55 °C

ASTM D638: Type V, 10 mm/min, average values represented

# RPU 70 Biocompatibility

## Biocompatibility Testing

Printed parts were provided to NAMSA and Pacific BioLabs for evaluation in accordance with :

ISO 10993-5, *Biological evaluation of medical devices - Part 5: Tests for in vitro cytotoxicity*,

ISO 10993-10, *Biological evaluation of medical devices - Part 10: Tests for irritation and skin sensitization (GPMT)*.

ASTM F756, *Standard Practice for Assessment of Hemolytic Properties of Materials*

& ISO 10993-4, *Biological evaluation of medical devices - Part 4: Selection of tests for interactions with blood*.

The results for all tests indicated that RPU 70 passed the requirements for biocompatibility according to the above tests. Parts were processed using an M series printer and a Smart Part Washer with VF 1 as the solvent. 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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