

# FPU 50

**FPU 50 is an impact, abrasion, and fatigue resistant semi-rigid material that is a good choice for parts that must withstand repetitive stresses, such as living hinges or friction fits.**

<b>Tensile Properties</b> ASTM D638, Type I, 50 mm/min	<b>Metric</b>	<b>US</b>
Tensile Modulus	700 MPa	100 ksi
Yield Strength	15 MPa	2 ksi
Strain at Yield	7%	7%
Ultimate Tensile Strength	25 MPa	4 ksi
Elongation at Break	200%	200%

<b>Tensile Properties</b> ASTM D638, Type V, 10 mm/min	<b>Metric</b>	<b>US</b>
Tensile Modulus	700 MPa	100 ksi
Yield Strength	15 MPa	2 ksi
Strain at Yield	7%	7%
Ultimate Tensile Strength	25 MPa	4 ksi
Elongation at Break	200%	200%

<b>Flexural Properties</b> ASTM D790-B	<b>Metric</b>	<b>US</b>
Flexural Stress at 5% strain	30 MPa	4 ksi
Flexural Modulus (Chord, 0.5-1%)	800 MPa	120 ksi

<b>Impact Properties</b>	<b>Metric</b>	<b>US</b>
Notched Charpy (Machined Notch), ISO 179-1/1eA	2.5 kJ/m <sup>2</sup>	1.2 ft-lb/in <sup>2</sup>
Notched Izod (Machined Notch), 23 °C, ASTM D256	40 J/m	0.7 ft-lb/in
Notched Izod (Machined Notch), -30 °C, ASTM D256	30 J/m	0.5 ft-lb/in

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

Thermal Properties	Metric	US
Heat Deflection Temperature at 0.455 MPa/66 psi, ASTM D648	70 °C	155 °F
Heat Deflection Temperature at 1.82 MPa/264 psi, ASTM D648	45 °C	110 °F
Coefficient of Thermal Expansion (-40, 40 °C), ASTM E831	130 ppm/°C	70 ppm/°F
Heat Capacity, 23 °C, ASTM E1269	1.5 J/g-°C	0.35 BTU/lb-°F
Thermal Conductivity, ASTM C518	0.14 W/m-K	0.08 BTU/h-ft-°F

Dielectric/Electric Properties	Metric
Dielectric Strength, ASTM D149	13 kV/mm
Dielectric Constant, ASTM D150	3.2
Dissipation Factor, ASTM D150	0.013
Volume Resistivity, ASTM D257	1. E+13 ohm-cm

General Properties	
Hardness, ASTM D2240	71, Shore D
Density, ASTM D792	1.05 g/cm <sup>3</sup>
Density (liquid resin)	1.06 g/cm <sup>3</sup>
Taber Abrasion, ASTM D4060, CS-10, 1 kg, 100% vacuum	6.5 mg / 1000 cycles
Water Absorption, 23 °C, 24 hours ASTM D570	< 1%
Water Absorption, 23 °C, 7 days, ASTM D570	< 1%

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

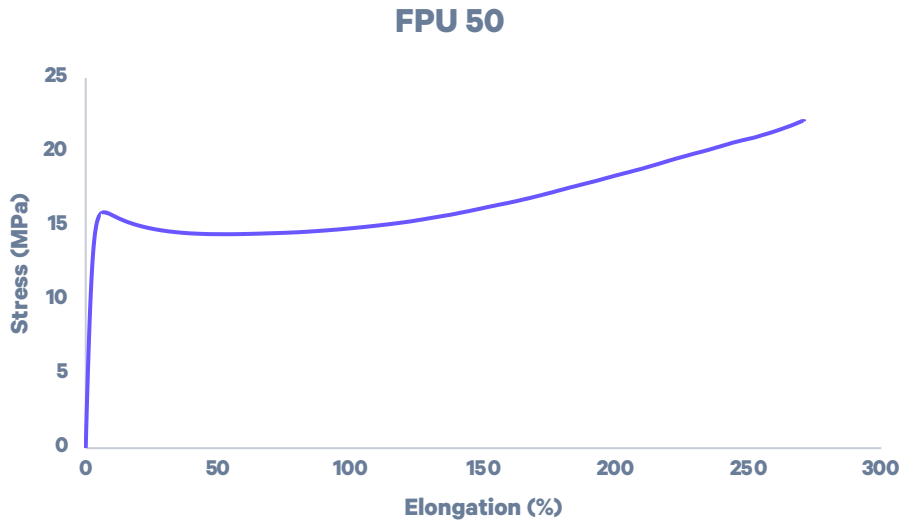
# FPU 50

## Extended TDS

# FPU 50 Mechanical Properties

## Representative Tensile Curve

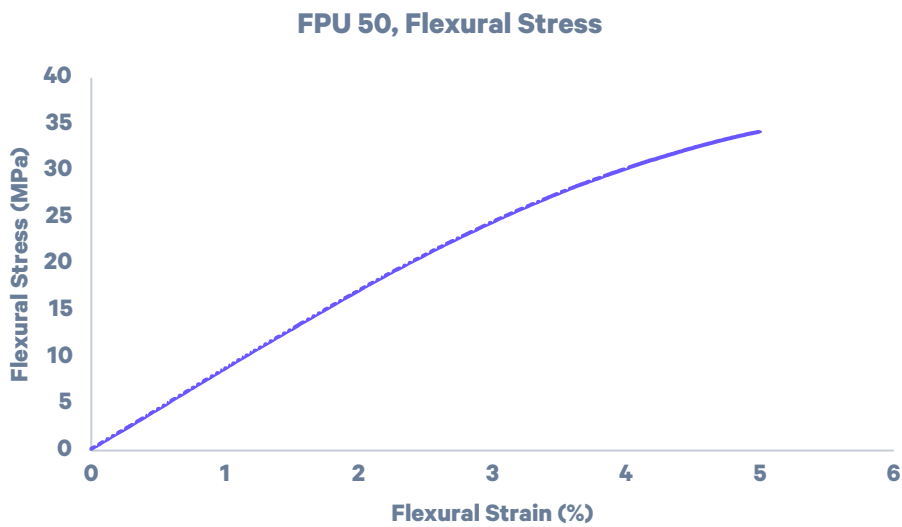
ASTM D638, Type I, 50 mm/min



## Representative Flexural Curve

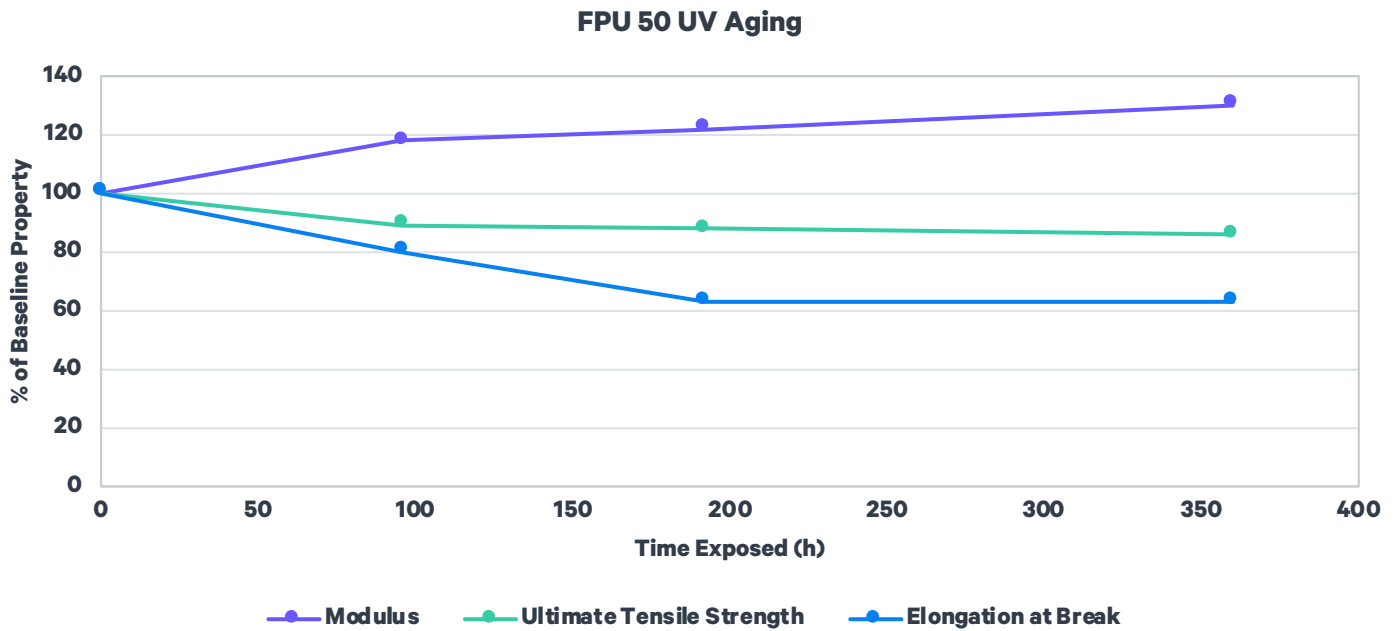
ASTM D790-B

Samples are tested to 5% extension.



# FPU 50 UV Aging

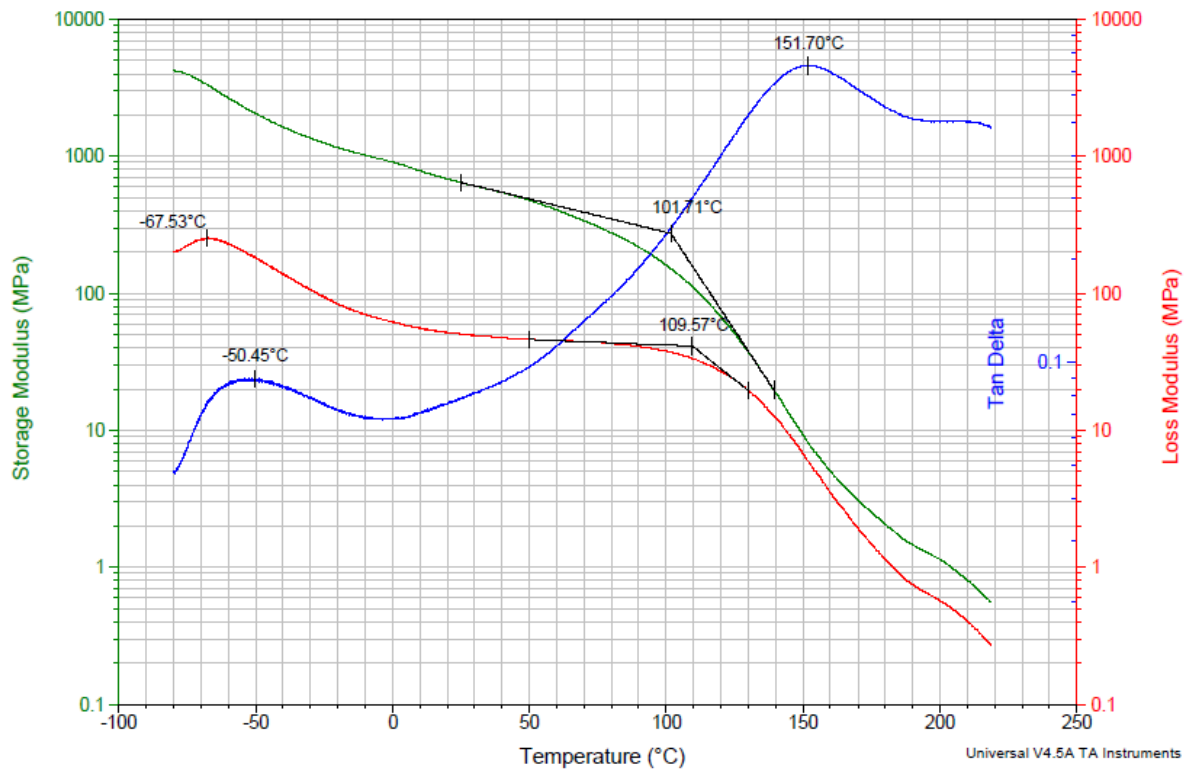
Natural polymer aging can occur in the presence of light, sun, and heat. Carbon evaluated the UV aging performance of FPU 50 using ASTM D4459, which is intended to simulate indoor exposure of solar radiation through glass.



ASTM 4459: Q-Sun XE-1, 0.8 W/m<sup>2</sup> at 420 nm, 55 °C  
ASTM D638: Type V, 10 mm/min, average values represented

# FPU 50 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 FPU 50. This material exhibits a storage modulus softening temperature near 100 °C. The peak in the tan( $\delta$ ) curves indicates that the glass transition temperature of FPU 50 is approximately 150 °C.



**Standard:** ASTM D4065

**Instrument:** TA DMA Q800

**DMA Mode:** Tension

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

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

**Oscillation frequency:** 1 Hz

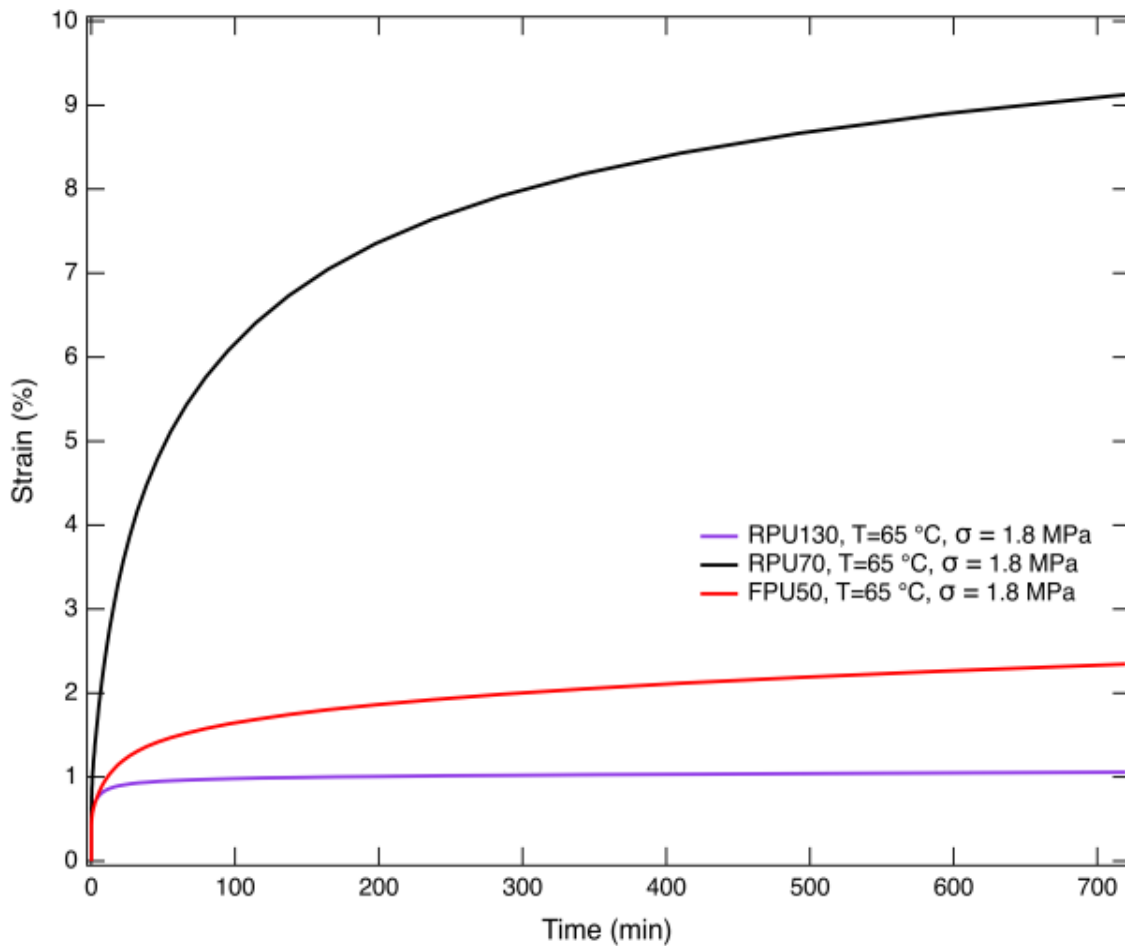
**Temperature Range:** -80 °C to 220 °C

**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.

# FPU 50 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 FPU 50 creeps approximately 2% 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.





# FPU 50 Biocompatibility

## Biocompatibility Testing

Printed parts were provided to NAMSA for evaluation in accordance with ISO 10993-5, *Biological evaluation of medical devices - Part 5: Tests for in vitro cytotoxicity*. Parts were processed using an M series printer and a Smart Part Washer with VF 1 as the solvent. The results indicated that FPU 50 passed the requirements for biocompatibility according to the above test. **Carbon has not conducted ISO 10993-10, *Biological evaluation of medical devices - Part 10: Tests for irritation and skin sensitization (GPMT)* testing. 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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