

UMA 90

UMA 90 is an easy-to-use single cure resin with enhanced toughness, appropriate for use in prototypes and manufacturing jigs and fixtures.

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Tensile Properties	Test Standard	Metric	US
Tensile Modulus	ASTM D638 Type I 50 mm/min	1400 MPa	200 ksi
Ultimate Tensile Strength		30 MPa	4.4 ksi
Yield Strength		30 MPa	4.4 ksi
Yield Strain		7%	7%
Elongation at Break		30%	30%
Tensile Modulus	ASTM D638 Type V 10 mm/min	1400 MPa	200 ksi
Ultimate Tensile Strength		30 MPa	4.4 ksi
Yield Strength		30 MPa	4.4 ksi
Yield Strain		7%	7%
Elongation at Break		30%	30%

Flexural Properties	Test Standard	Metric	US
Flexural Stress at 5% strain	ASTM D790-B	50 MPa	7 ksi
Flexural Modulus (Chord, 0.5-1%)		1200 MPa	174 ksi

Impact Properties	Test Standard	Metric	US
Notched Izod (Machine Notched)	ASTM D256	30 J/m	0.6 ft-lb/in
Notched Charpy (Machine Notched)	ISO 179-1/1eA	2.8 kJ/m ²	1.3 ft-lb/in ²

Thermal Properties	Test Standard	Metric	US
Heat Deflection Temperature at 0.455 MPa/66 psi	ASTM D648	45 °C	113 °F
Heat Deflection Temperature at 1.82 MPa/264 psi		35 °C	95 °F

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Parts were processed using an M series printer and a Smart Part Washer with VF 1 as the solvent. Samples were post-cured using an APM LED UV-Cube II at 100% intensity according to instructions in the Carbon MPI. Deviations from the post processing method listed above may yield different results.

General Properties	Test Standard	Metric
Hardness	ASTM D2240	86, Shore D
Bulk Density	ASTM D792	1.20 g/mL

Liquid Properties	
Liquid Density	1.12 g/mL
25 °C Viscosity	2100 cP

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Parts were processed using an M series printer and a Smart Part Washer with VF 1 as the solvent. Samples were post-cured using an APM LED UV-Cube II at 100% intensity according to instructions in the Carbon MPI. Deviations from the post processing method listed above may yield different results.

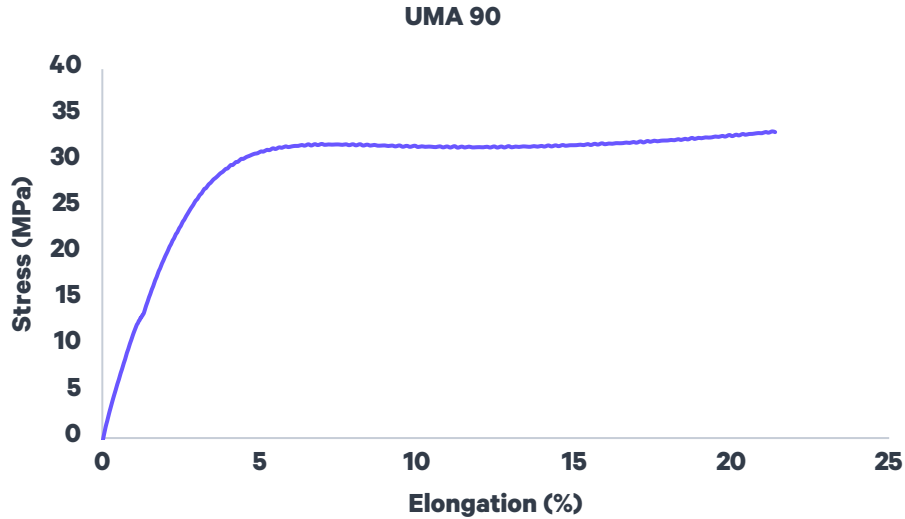
UMA 90

Extended TDS

UMA 90 Mechanical Properties

Representative Tensile Curve

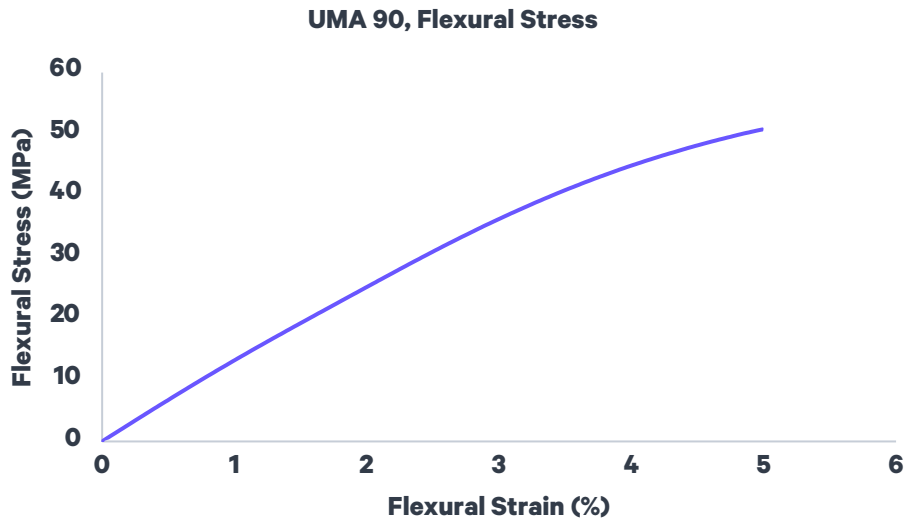
ASTM D638, Type I, 50 mm/min



Representative Flexural Curve

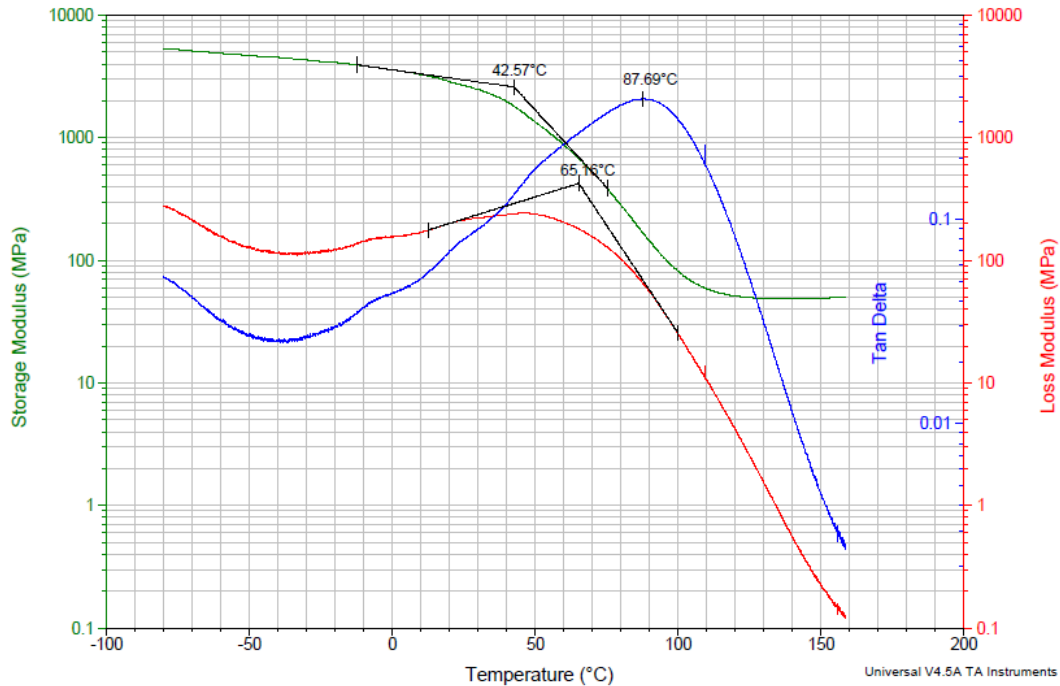
ASTM D790-B

Samples are tested to 5% extension.



UMA 90 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 UMA 90. This material exhibits a storage modulus softening temperature near 40 °C. The peak in the tan(δ) curves indicates that the glass transition temperature of UMA 90 is approximately 90 °C. The presence of a storage modulus rubbery plateau and lack of flow region reflects the crosslinked nature of this material.



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 160 °C

Ramp Rate: 1.5 °C/min

Print Conditions: Samples were hand-wiped and not washed with solvent. Values may differ based on post-processing conditions.

UMA 90 UV Curing Study

One-pot resin systems often require a UV post-cure step. Carbon provides recommended UV curing equipment and standard operating procedure (SOP) outlined in the Carbon MPI document. The table below captures the effect of UV curing equipment as well as cure time. Different UV equipment and processing will lead to variations in lamp intensity and overall heat generation during flood cure, which can further contribute to post-cure mechanical properties differences. The general trends below highlight the tradeoffs of a higher modulus material with general toughness and yield strain.

Tensile Properties ASTM D638, Type I, 50 mm/min	APM LED UV-Cube II (1 min per side)	APM LED UV-Cube II (15 min per side)	Dymax (1 min per side)
Tensile Modulus	1400 MPa	1800 MPa	2100 MPa
Ultimate Tensile Strength	30 MPa	40 MPa	45 MPa
Yield Strength	30 MPa	40 MPa	45 MPa
Yield Strain	7%	6%	4%
Elongation at Break	30%	15%	6%

UMA 90 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*, and ISO 10993-10, *Biological evaluation of medical devices - Part 10: Tests for irritation and skin sensitization (GPMT)*. 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 UMA 90 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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