formlabs

ENGINEERING RESIN

Tough 2000 Resin V2

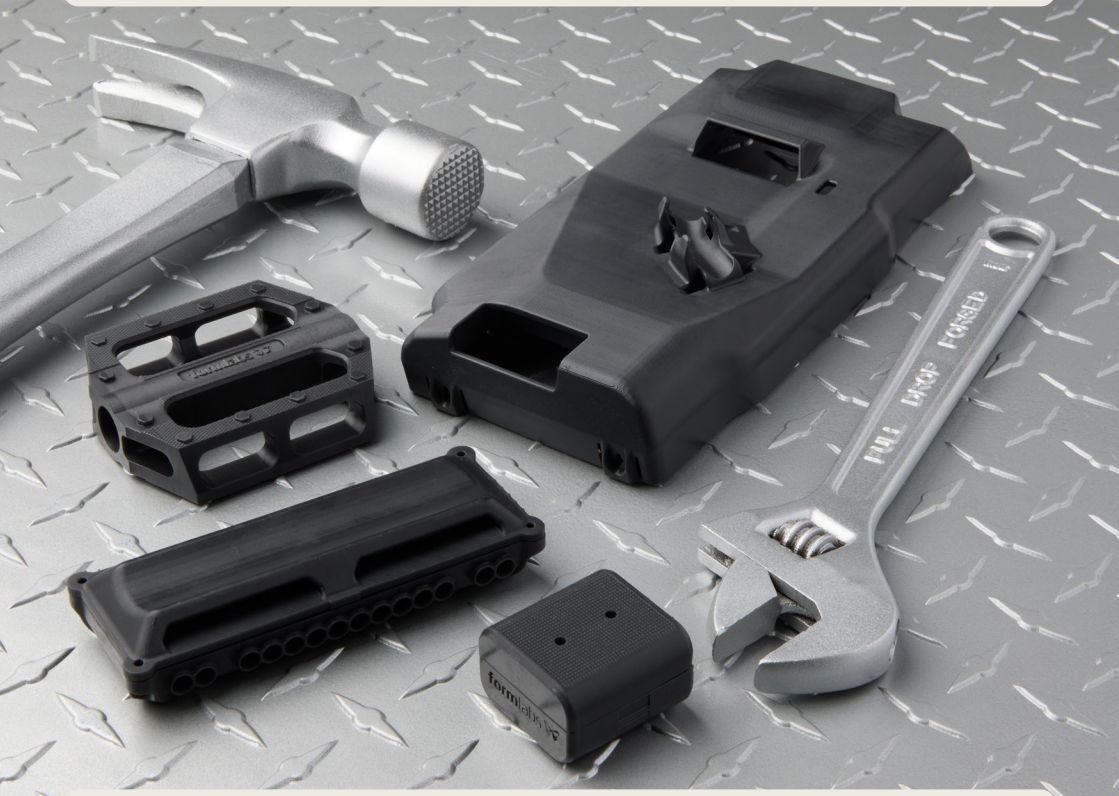
Stiff, sturdy material with toughness that rivals the performance of ABS

Parts requiring the strength and stiffness of ABS

Jigs and fixtures to survive long-term use on the factory floor

Robust enclosures with high temperature and creep resistance

Production-ready parts with a dark, matte finish



V2 **FLTO2002**

Prepared 10/06/2025

Rev. 01 10/06/2025

Tough 2000 Resin V2 is a rugged material with strength and stiffness comparable to acrylonitrile butadiene styrene (ABS), combining toughness with high temperature and creep resistance.

Tough 2000 Resin excels in heavy-duty applications and delivers highly functional prototypes and end-use parts that resist shattering, deformation, and long-term wear. With a 79% elongation at break and a heat deflection temperature (HDT) of 70 °C, parts maintain structural integrity under mechanical and environmental stress. The new formulation is darker with a matte finish, for presentation-ready parts with enhanced details and a smooth finish.

Tough 2000 Resin V2 is a new material formulation that leverages the technology of Form 4 Series printers to deliver 3x higher fracture toughness, improved temperature performance, material longevity, and aesthetics compared to the previous version.

Material Properties	METRIC [1]		IMPERIAL [1]		METHOD
	Green [2]	**Post-Cured [3]**	**Green [2]**	**Post-Cured [3]**	
Tensile Properties	METRIC [1]		IMPERIAL [1]		METHOD
Ultimate Tensile Strength	26.1 MPa	40.4 MPa	3785 psi	5802 psi	ASTM D638-14
Tensile Modulus	1235 MPa	1800 MPa	179 ksi	261 ksi	ASTM D638-14
Tensile Strength at Yield	26.1 MPa	40.4 MPa	3785 psi	5802 psi	ASTM D638-14
Elongation at Yield	5.0%	4.5%	5.0%	4.5 %	ASTM D638-14
Elongation at Break	149%	79%	149%	79%	ASTM D638-14
Flexural Properties	METRIC [1]		IMPERIAL [1]		METHOD
Flexural Strength	38 MPa	67 MPa	5511 psi	9718 psi	ASTM D790-17
Flexural Modulus	1040 MPa	1701 MPa	151 ksi	247 ksi	ASTM D790-17
Toughness Properties	METRIC [1]		IMPERIAL [1]		METHOD
Notched Izod	24 J/m	25 J/m	0.45 ft-lb/in	0.47 ft-lb/in	ASTM D256-10
Unnotched Izod	323 J/m	325 J/m	6.05 ft-lb/in	6.09 ft-lb/in	ASTM D4812-11
Notched Charpy	2 kJ/m^2	2.4 kJ/m^2	0.95 $ft\text{-}lb/in^2$	1.14 $ft\text{-}lb/in^2$	ISO 179-1
Unnotched Charpy	20 kJ/m^2	31 kJ/m^2	9.52 $ft\text{-}lb/in^2$	14.75 $ft\text{-}lb/in^2$	ISO 179-1
Gardner Impact Strength at 1/32" (0.79 mm) thickness	4.8 J	1.6 J	42 in-lb	14 in-lb	ASTM D5420-21
Ross Flex Fatigue	11900 cycles	3560 cycles	11900 cycles	3560 cycles	Internal (23 °C, 30 Degree deflection at 1 Hz)
Fracture Properties	METRIC [1]		IMPERIAL [1]		METHOD
Maximum Stress Intensity Factor (Kmax)	1.4 $MPa\text{-}m^{1/2}$	1.65 $MPa\text{-}m^{1/2}$	1277 $psi\text{-}in^{1/2}$	1505 $psi\text{-}in^{1/2}$	ASTM D5045-14
Work of Fracture (W_f)	330 J/m^2	305 J/m^2	22.6 $ft\text{-}lb/ft^2$	20.87 $ft\text{-}lb/ft^2$	ASTM D5045-14

[1] Material properties can vary with part geometry, print orientation, print settings, and temperature.

[2] Data was obtained from parts printed on a Form 4 printer with 100µm Tough 2000 Resin V2 settings, washed in a Form Wash V2 for 10+5 minutes in >= 99% Isopropyl Alcohol.

[3] Data was obtained from parts printed on a Form 4 printer with 100µm Tough 2000 Resin V2 settings, washed in a Form Wash V2 for 10+5 minutes in ≥ 99% Isopropyl Alcohol, and post-cured at 70 °C for 12 minutes in a Form Cure V2.

Material Properties	METRIC [1]		IMPERIAL [1]		METHOD
	Green [2]	Post-Cured [3]	Green [2]	Post-Cured [3]	
Thermal Properties	METRIC [1]		IMPERIAL [1]		METHOD
Heat Deflection Temp. @ 1.8 MPa	45 °C	57 °C	113 °F	135 °F	ASTM D648-16
Heat Deflection Temp. @ 0.45 MPa	53 °C	70 °C	127 °F	158 °F	ASTM D648-16
Thermal Expansion (0-150 °C)	142.6 µm/m/°C	134.2 µm/m/°C	79.2 µin/in/°F	74.6 µin/in/°F	ASTM E 831-19
Flammability	Not Tested	HB	Not Tested	HB	UL 94
Electric Properties	METRIC [1]				METHOD
	Post-Cured [3]				
Dielectric Strength	15.5 kV/mm				ASTM D149-20
Dielectric Constant (50 Hz)	3.46				ASTM D150 (50 Hz)
Dielectric Constant (1 kHz)	3.38				ASTM D150 (1 kHz)
Dissipation Factor (50 Hz)	0.018				ASTM D150 (50 Hz)
Dissipation Factor (1 kHz)	0.012				ASTM D150 (1 kHz)
Volume Resistivity	$3 * 10^{15}$ Ω-cm				ASTM D257-14
Other Properties	METRIC [1]				METHOD
Shore D Hardness	61D		76D		ASTM D2240
Bulk Density	1.09 g/mL				ASTM D792-20
Viscosity at 25 °C	2680 cP				ASTM D792-20
Liquid Density	1.03 g/mL				ASTM D792-20

CHEMICAL COMPATIBILITY

Percent weight gain over 24 hours for a printed and cured 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid (5%)	0.17	Isooctane (aka gasoline)	21.24
Acetone	22.92	Mineral Oil (Light)	0.12
Isopropyl Alcohol	4.21	Mineral Oil (Heavy)	0.07
Bleach ~5% NaOCl	0.11	Salt Water (3.5% NaCl)	0.16
Butyl Acetate	18.65	Sodium Hydroxide Solution (0.025% pH = 10)	0.18
Diesel Fuel	0.08	Water	0.19
Diethyl Glycol Monomethyl Ether	4.65	Xylene	27.69
Hydraulic Oil	0.06	Strong Acid (HCl conc)	1.96
Skydrol 5	0.96	TPM	1.86
Hydrogen Peroxide (3%)	0.21		

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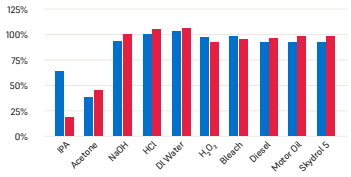
[3] Data was obtained from parts printed on a Form 4 printer with 100µm Tough 2000 Resin V2 settings, washed in a Form Wash V2 for 10+5 minutes in ≥ 99% Isopropyl Alcohol, and post-cured at 70 °C for 12 minutes in a Form Cure V2.

Chemical Compatibility (ASTM D543)

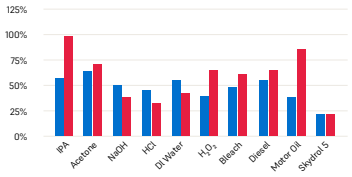
Tested for chemical compatibility according to ASTM D543. The influence of various chemicals was tested by measuring tensile modulus and strength after different exposure times. Exposed samples were stored in containers and fully immersed in the test chemicals for 1 day and 1 week. After removal, exposed samples were washed and conditioned for 24 hours at 22 °C before mechanical testing. Mechanical testing was conducted according to ASTM D638 using Type IV tensile samples at standard lab conditions (22 °C). Results are reported as a % difference from the measured values of non-exposed samples.

Solvent	IPA	Acetone	NaOH (10% pH=14)	HCl (10%)	DI Water	H_2O_2 (3%)	Bleach (~5% NaOCl)	Diesel	Motor Oil	Skydrol 5
Relative Modulus										
1 day	63%	37%	93%	100%	103%	100%	98%	93%	92%	93%
1 week	18%	45%	100%	104%	106%	92%	95%	97%	98%	98%
Relative Strength										
1 day	66%	43%	101%	102%	102%	102%	100%	101%	101%	101%
1 week	27%	39%	97%	99%	97%	93%	92%	92%	96%	94%
Relative Elongation										
1 day	116%	131%	102%	100%	111%	81%	97%	113%	77%	43%
1 week	197%	144%	78%	65%	85%	133%	123%	131%	173%	45%
Relative Mass										
1 day	107%	139%	100%	100%	100%	100%	100%	100%	100%	102%
1 week	119%	137%	101%	100%	101%	101%	100%	101%	100%	103%

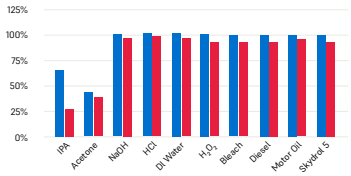
Tensile Modulus after Immersion Time



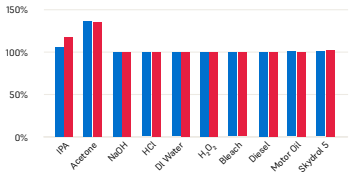
Elongation at Break after Immersion Time



Ultimate Tensile Strength after Immersion Time



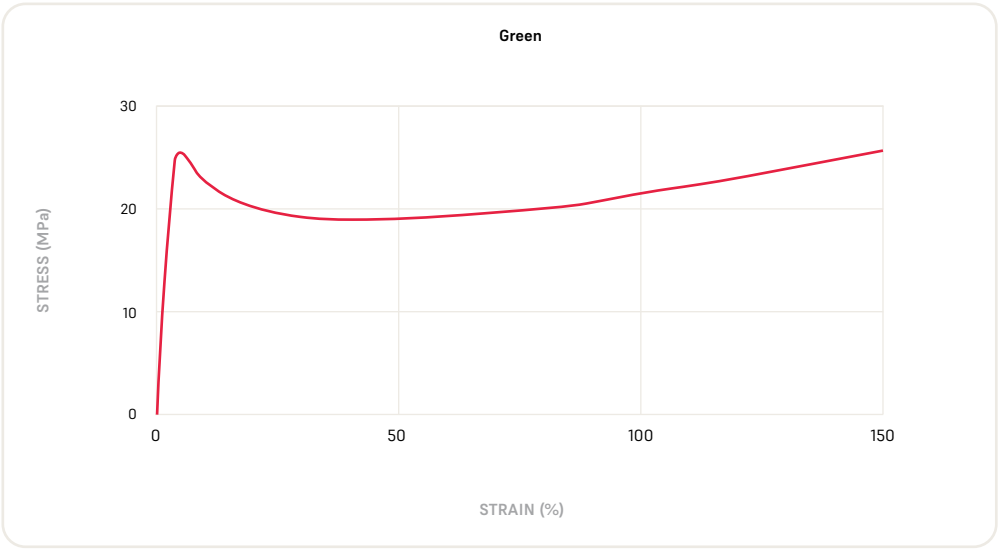
Mass Absorption after Immersion Time

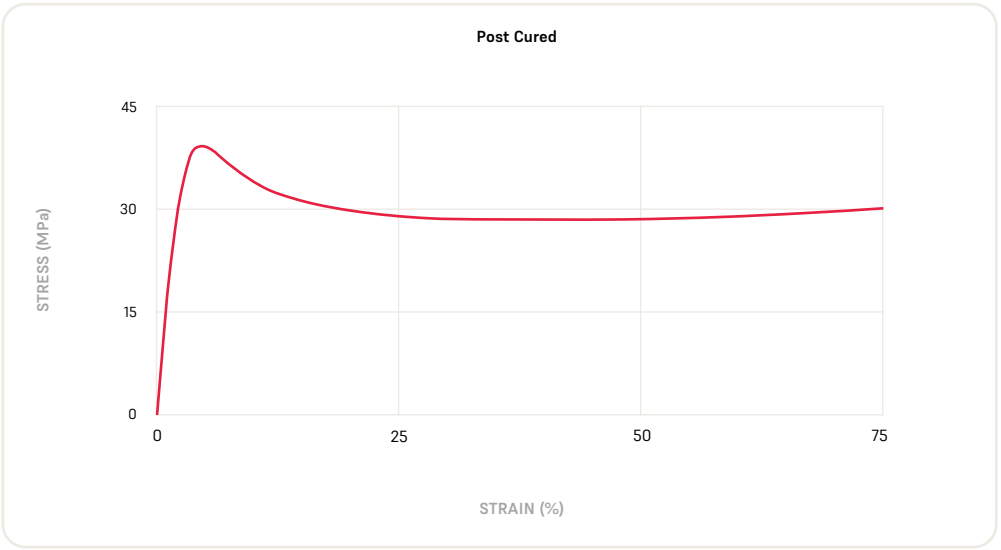


1 DAY 1 WEEK

Representative Tensile Curve (ASTM D638-14)

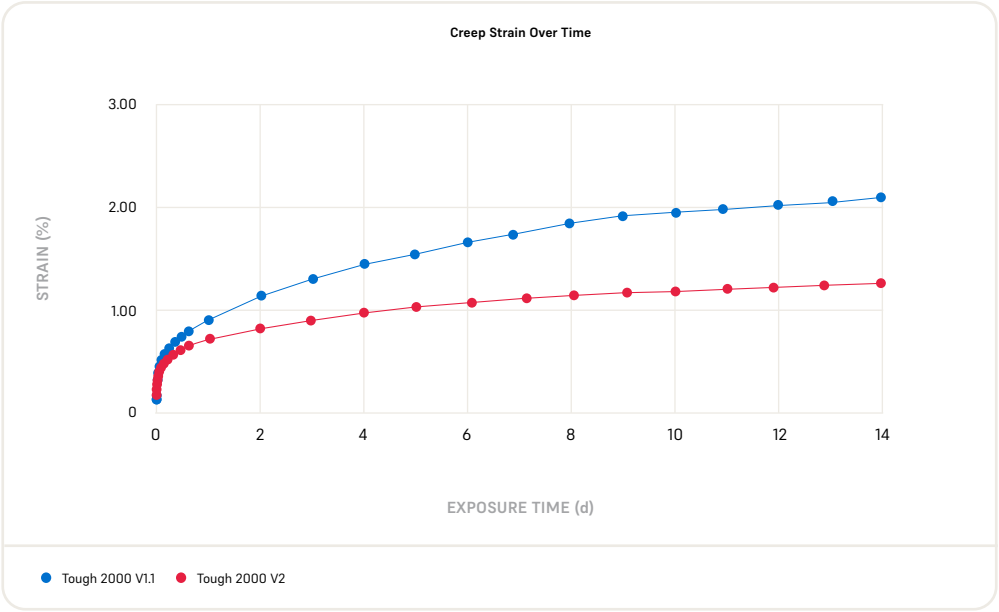
Type I, 5 mm/min





Flexural Creep ISO 6602

Formlabs evaluated the creep resistance of Tough 2000 Resin V2 using ISO 6602. This test measures a materials rate of deformation at a constant temperature under a fixed load. Speciments were tested at 22 °C under a 4.0 MPa load. Deflection was measured over the course of 14 days.



Dynamic Mechanical Analysis (DMA)

A DMA curve of Tough 2000 V2 from 0 °C to 150 °C at 3 °C/min is shown. A glass transition is observed at 112.2 °C, and an inflection of the storage modulus is observed at 76.96 °C.