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POLYURETHANE RESIN

formlabs

PU Rigid 650

For Impact Resistant and Semi-Stiff Polyurethane Parts

PU Rigid 650 Resin is a tough and pliable polyurethane material that can withstand extreme impacts while maintaining true shape long-term.

Impact-resistant components

Pliable mechanical connectors

Shock-absorbing bumpers and dampeners

Noise-dampening components



V1 **FLPU6501** * May not be available in all regions

Prepared 05 . 03 . 2022

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To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

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MATERIAL PROPERTIES DATA

PU Rigid 650 Resin

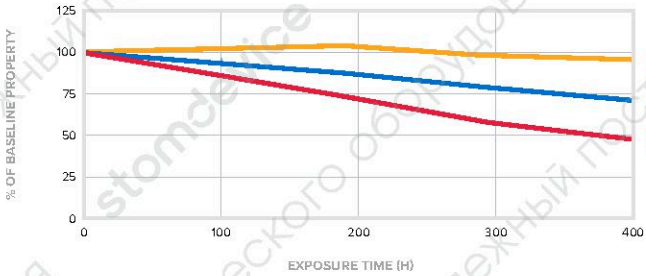
	METRIC [1]	IMPERIAL [1]	METHOD
	Post-Cured [2]	Post-Cured [2]	
Tensile Properties			
Ultimate Tensile Strength	34 ± 3.4 MPa	5 ± 0.5 ksi	ASTM D638
Young's Modulus	0.67 ± 0.06 GPa	97 ± 9 ksi	ASTM D638
Elongation at Break	170 ± 17 %	170 ± 17 %	ASTM D638
Flexural Properties			
Flexural Strength	22 ± 1.1 MPa	3.2 ± 0.2 ksi	ASTM D 790-15
Flexural Modulus	0.57 ± 0.03 GPa	83 ± 4 ksi	ASTM D 790-15
Ross Flexing Fatigue (unnotched)	> 50,000 cycles (PASS-no crack propagation)		ASTM D 1052 (-10 °C)
Ross Flexing Fatigue (unnotched)	> 50,000 cycles (PASS-no crack propagation)		ASTM D 1052 (23 °C)
Impact Properties			
Notched Izod	375 J/m	7.0 ft-lbs/in	ASTM D 256-10
Charpy Impact Test (Notched)	44 kJ/m^2	21 ft-lbs/in^2	ISO 179-1:2010(E)
Tabor Abrasion	101 mm^3	6.2 x 10-3 in^3	ISO 4649 (40rpm, 10N load)
Physical Properties			
Hardness	64D		ASTM D 2240
Density (solid)	1.16 g/cm^3	72.42 lb/ft^3	ASTM D 792-20
Viscosity (@ 25 °C)	1070 cP		
Viscosity (@ 35 °C)	519 cP		
Thermal Properties			
Heat Deflection Temp. @ 1.8 MPa	59 °C	138 °F	ASTM D 648-16
Heat Deflection Temp. @ 0.45 MPa	82 °C	179 °F	ASTM D 648-16
Thermal Expansion	130.4 µm/m/°C	72.4 µin/in/°F	ASTM E 813-13
Glass Transition Temperature (Tg1)	-19 °C	-2 °F	DMA*
Glass Transition Temperature (Tg2)	142 °C	286 °F	DMA*
Electrical Properties			
Dielectric Strength	1.8 x 10^7 V/m	460 V/mil	ASTM D149-20
Dielectric Constant	4.3		ASTM D 150, 0.5 MHz
Dielectric Constant	4.7		ASTM D 150, 1.0 MHz
Dissipation Factor	0.088		ASTM D 150, 0.5 MHz
Dissipation Factor	0.088		ASTM D 150, 1.0 MHz
Volume resistivity	4.7x 10^{11} ohm-cm	1.9 x 10^{11} ohm-in	ASTM D257-14
Flammability Properties			
Flammability rating	HB		UL 94
Smoke Density	(D s 1.5) = 15 (PASS) (D s 4.0) = 262 (FAIL)		ASTM E662-21
Automotive Specific Testing			
Volatile Organic Compounds	444 µg/g	0.07 oz/lb	VOC VDA 278
Fogging	10.7 mg	3.8 x 10^{-4} oz	DIN 75201, Method B

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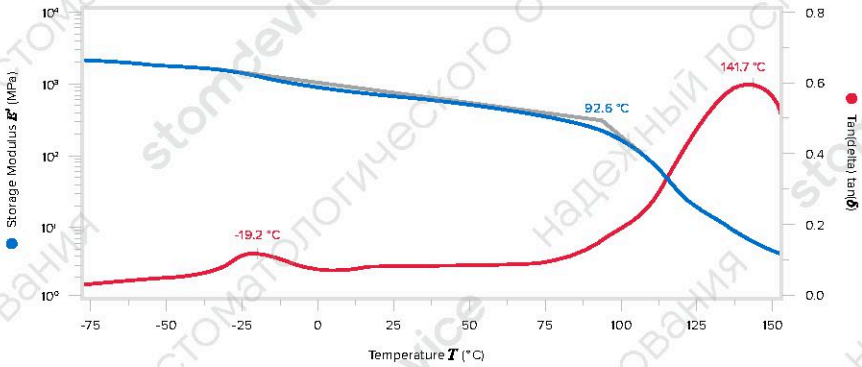
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Accelerated Aging



Dynamic mechanical analysis (DMA) is used to study the viscoelastic behavior of materials. Below is the DMA thermogram for PU Rigid 650. Storage modulus and tan(delta) are plotted as function of temperature. Two glass transition temperatures are observed for PU Rigid 1000, which are -19.2°C and +141.7°C. A drop in storage modulus, indicating softening, is observed around 90°C.



PU Rigid 650 Resin has been evaluated as a **skin contacting device** in accordance with ISO 10993-1, and passed the requirements for the following biocompatibility endpoints:

ISO Standard	Description [3,4]
EN ISO 10993-5	Not cytotoxic
EN ISO 10993-10	Not an irritant
EN ISO 10993-10	Not a sensitizer

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SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-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%	0.4	Isopropyl Alcohol	1.3
Acetone	8.9	Castor Oil	< 0.1
Bleach ~5% NaOCl	< 0.1	Mineral oil, light	< 0.1
Butyl Acetate	2.6	Propylene Glycol Diacetate	0.7
Dichloromethane	116.1	Salt Water (3.5% NaCl)	0.3
Diesel Fuel	< 0.1	Skydrol 500B-4	0.1
Diethyl glycol monomethyl ether	2.7	Sodium hydroxide solution (0.025% pH = 10)	0.2
Gasoline	< 0.1	Strong Acid (HCl Conc)	-3.0
Hexane	< 0.1	Water	0.3
Hydraulic Oil	< 0.1	Xylene	2.0
Hydrogen peroxide (3%)	0.2		

[1] Material properties may vary based on part geometry, print orientation, print settings, temperature, and disinfection or sterilization methods used.

[2] Data for post-cured samples were measured on Type IV tensile bars printed on a Form 2 printer with 100 µm PU Rigid 650 Resin settings, washed in a Form Wash for 2 minutes in ≥99% PGDA, and post-cured.

[3] ISO 10993 standard testing samples were printed on a Form 3 with 100um PU Rigid 650 Resin settings, washed in PGDA for 5 minutes, dried for at least 24 hours and cured at 46°C at 70% RH for 3 day in an oven.

[4] PU Rigid 650 Resin was tested at NAMSA World Headquarters, OH, USA.

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