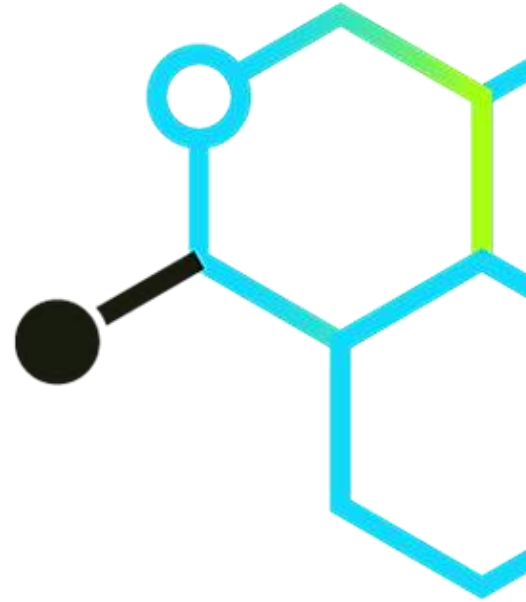# Technical Datasheet

TOUGH-ESD

High Toughness Static Dissipative Photopolymer Resin

Black

mechnano™

TOUGH-ESD

Tough-ESD is a high impact static dissipative photopolymer resin. It uses a urethane methacrylate base that includes a stable dispersion of discrete functionalized carbon nanotubes (D'Func) to achieve consistent static dissipative properties without compromising mechanical performance.

Advantages

- Isotropic ESD performance: 10^6 Ω
- Impact resistance 40-50 J/m
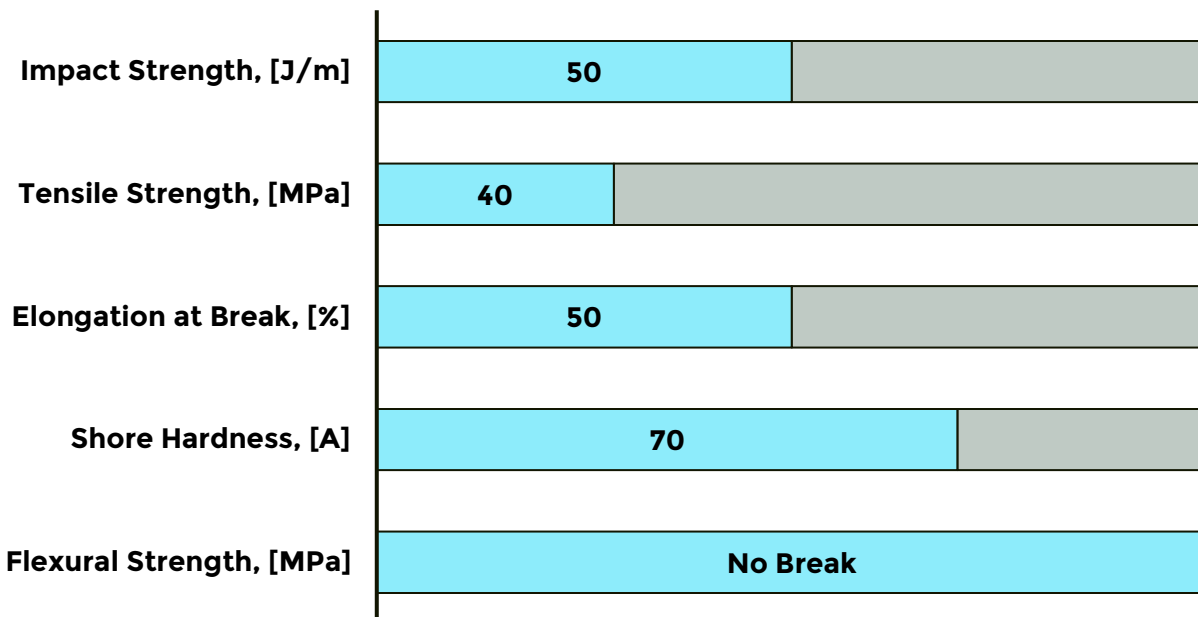- Excellent surface finish & fine details

Industries

- Electronic Manufacturing
- Semiconductor Manufacturing
- Automotive

Applications

- Conformal coating masks
- Jigs & fixtures for electronic device manufacturing
- Electronic components carriers & housings
- Hand tools

Property	Value
Impact Strength, [J/m]	50
Tensile Strength, [MPa]	40
Elongation at Break, [%]	50
Shore Hardness, [A]	70
Flexural Strength, [MPa]	No Break

PROPERTIES

The performance of the components is influenced by the hardware's processing parameters and post-cure protocols.

Mechanical Properties	Green	Post-Cured	Units	Method
Ultimate Tensile Strength	20-30	25-40	MPa	ASTM D 638-14
Tensile Modulus	250-800	750-850	MPa	ASTM D 638-14
Elongation at Break	35-65	35-45	%	ASTM D 638-14
Flexural Stress @5% Strain[1]	10-20	25-30	MPa	ASTM D 790-15
Flexural Modulus	200-400	800-950	MPa	ASTM D 790-15
IZOD Impact Strength (Notched)	30-65	40-50	J/m	ASTM D 256-10
Hardness Shore "A"	70	75		ASTM D 2240
Electrical Properties				
Surface Resistance	10^6-10^8	10^6	Ω	ANSI ESD S11.11
Volume Resistivity	10^7	10^6-10^7	Ω×cm	ASTM D257
Liquid Properties				
Viscosity (25°C)[2]	1200-1300		cps	ASTM D7867
Density	1.1 – 1.2		g/cm³	ASTM D1475

Notes

[1] Specimens did not break within the 5% strain limit when tested by Procedure A and B per ASTM D790-15. Beyond 5% strain, this test is not applicable. Testing was continued until 20% strain without a break on both green and post-cured specimens.

[2] The resin is shear-thinning. The data reported at shear rate 10, [1/s] @25°C.

WORKFLOW

To achieve the properties specified in the TDS, validated workflows must be complied with. The following is an example of the verified workflow steps.

WORKING CURVE

The working curve was collected using 3.0 mW/cm^2 light source (405 nm) at room temperature.

$$y = 0.0005x + 0.0089$$
$$R^2 = 0.9255$$

E_c:	3.051	[mJ/cm^2]
D_p:	0.066	[mm]
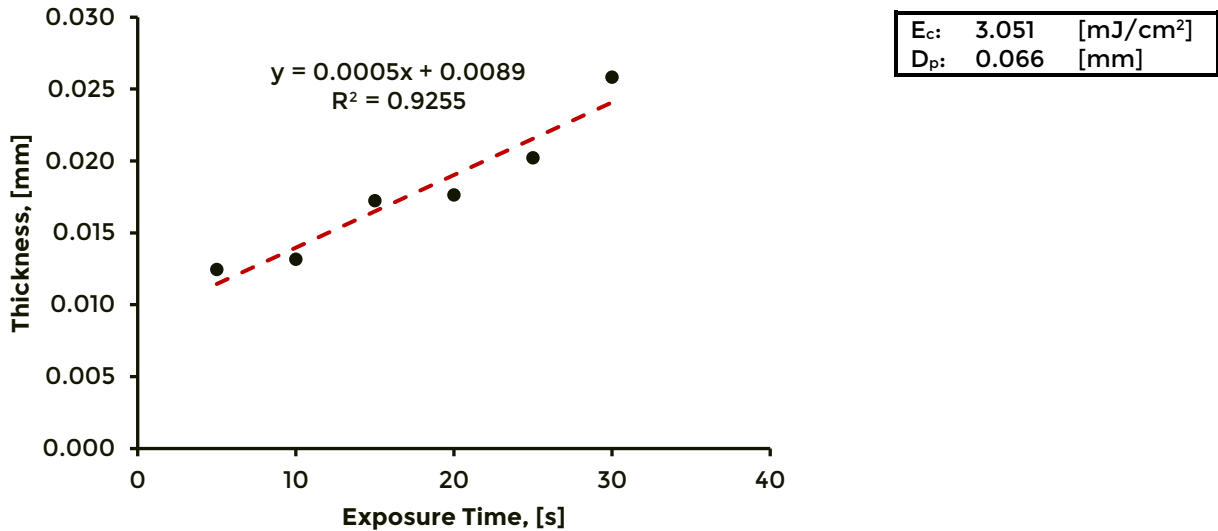
MACHINE SETTINGS

Tough-ESD is designed to fabricate parts on desktop and industrial DLP machines.

Recommended Build Parameters		Example Build Parameters (5 mW/cm^2 at 405 nm, 22°C):	
Temperature, [°C]	20 – 22	Layer Height, [μm]	100
Wavelength, [nm]	385, 405	Base Layer Exposure, [s]	7 - 25
Irradiance, [mW/cm^2]	3 – 10	Model Layer Exposure, [s]	5 – 15

VERIFIED HARDWARE

OEM	System(s)	Status
B9 Creations	Core 550	Qualified
Nexa3D	XiP	Qualified
Stratasys	Origin One	In development
MiiCraft	Alpha, Prime 4K, Profession	Qualified
Genera	All models	Qualified

POST-PROCESSING

Tough-ESD requires post-processing to achieve specified performance. Prior to post-curing, support structures should be removed from the fabricated component, and the part should be washed. It is recommended to use compressed air to remove residual solvent from features such as holes, pockets, slots, etc. between cleaning steps and prior to post-curing.

Step	Agent	Method	Duration	Intervals
Cleaning 1	Glycol-Ether based cleaner	Agitated Bath	2 – 5 min	1 to 2
Cleaning 2*	IPA	Agitated Bath	2 – 3 min	1 to 2
Dry**	n/a	Compressed air	60 s	1 or 2
Wait before post-cure	n/a	Ambient	60 min	1

Notes
[1] Dry before intervals
[2] Dark space is recommended for storage

POST-CURE

Tough-ESD requires post-curing to achieve specified properties. The following protocol and post-curing equipment has been qualified to date. Other post-curing protocols will be added later.

Curing Unit	Energy Source	Wavelength	Cure Time/side	Cure Temperature
Nexa3D XiP Cure	UV LED	405 nm	20 min	ambient
Photocentric Cure L2	UV LED	405 nm	15 min	60°C