

Product Information

INFINAM® TI 5400 L

Phippo

HIGH TOUGHNESS AND HIGH DUCTILITY WHITE PHOTOPOLYMER FOR ADDITIVE MANUFACTURING



INFINAM® TI 5400 L resin is a white-colored easy to process (1-part system) liquid photopolymer formulation. The fully cured material exhibits excellent mechanical properties (high toughness and high ductility).

Storage conditions

INFINAM® TI 5400 L resin is a light-sensitive product protected by its original packaging. Store product in a dry location with optimum storage temperature of 10–30 °C. Storage beyond this recommended temperature range can adversely affect both print and product properties. Exposure of the liquid formulation to daylight and especially UV light should be minimized during storage and handling to ensure consistent print quality.

Statement on reported properties

The values reported in this document are derived from printing various parts with one specific bottom-up DLP machine, and follow the recommended procedures as detailed in this document. Those values reflect an approximation of the mean value given as a range of values and are intended for reference and comparison purposes only. Using different printers, post processing, or not following the material handling recommendations as indicated might lead to different values.

Mechanical Properties	Value	Unit	Test Standard
Tensile Modulus	1500 ± 200	MPa	ASTM D638
Ultimate Tensile Strength	40 ± 5	MPa	ASTM D638
Elongation at Break	210 ± 20	%	ASTM D638
Flexural Modulus	1100 ± 200	MPa	ASTM D790
Flexural Stress at 5% Strain	44 ± 5	MPa	ASTM D790
Izod Notched Impact	30 ± 5	J/m	ASTM D256
Charpy Notched Impact Strength	2.0 ± 0.5	kJ/m ²	ISO 179

Note: Tensile bars were tested with Type V specimen at 10 mm/min

Thermal Properties	Value	Unit	Test Standard
Heat Deflection Temperature, 0.455 MPa/66 psi	55 ± 3	°C	ASTM D648
Heat Deflection Temperature, 1.82 MPa/264 psi	46 ± 2	°C	ASTM D648
Glass Transition Temperature (tanδ)	101 ± 3	°C	ASTM D4065
Coefficient of Thermal Expansion (CTE) (35–70 °C)	116	µm/(m.K)	ISO 11359-2

Physical Properties	Value	Unit	Test Standard
Liquid Density, 25 °C	1.07	g/cm ³	ASTM D4052
Liquid Viscosity, 25 °C / 1 Hz	1050 ± 150	mPa.s	ASTM D4287
Shore D Hardness	80 ± 2	–	ASTM D2240
Water Absorption (24 h)	5.5	%	ASTM D570

Electrical Properties	Value	Unit	Test Standard
Dielectric Constant @ 1 kHz	3.8	–	ASTM D150
Dielectric Constant @ 1 MHz	3.5	–	ASTM D150
Dissipation Factor @ 1 kHz	0.017	–	ASTM D150
Dissipation Factor @ 1 MHz	0.029	–	ASTM D150
Dielectric Strength	29	kV/mm	IEC 60243-1
Volume Resistivity	6.3 E15	Ohm.cm	ASTM D257
Surface Resistivity	> 1.6 E15	Ohm	ASTM D257
CTI, test solution A, 50 drops value	600	–	IEC 60112

Biocompatibility	Result	Test Standard
Cytotoxicity	–	ISO 10993-5
Skin Irritation (in-vitro method)	Passed	ISO 10993-23

Burning Behavior	Value	Unit	Test Standard
Burning Behavior at 3.2 mm	HB	class	UL 94
Burning Behavior at 1.6 mm	HB	class	UL 94
Glow Wire Flammability Index (GWFI) at 1.5 mm	650	°C	IEC 60695-2-12
Glow Wire Ignition Temperature (GWIT) at 1.5 mm	650	°C	IEC 60695-2-13

Material handling recommendations

Resin preparation

- Shake the bottle of **INFINAM® TI 5400 L** for ca. 30 sec until the material is homogenous before filling into the printer
- The resin needs to be bubble free prior to printing: allow the resin to rest before printing in order to allow air bubbles to dissipate (prior degassing of the resin can help to expedite this process)

Print settings

- **INFINAM® TI 5400 L** is designed to print optimally on digital light processing (DLP) and LCD machines at 385 or 405 nm (see table below for exposure time)
- At 405 nm: Critical exposure energy $E_c = 2.0\text{--}2.5 \text{ mJ/cm}^2$ – Depth of penetration $D_p = 200\text{--}250 \text{ }\mu\text{m}$
- It is advisable to use standard separation speed (e.g. peeling and separation speed of 2–4 mm/s)

Wavelength (nm)	Intensity (mW/cm ²)	Layer thickness (μm)	Burn-in exposure time (s)	Layer exposure time (s)
405	11	100	3	2

Support structures settings

- **INFINAM® TI 5400 L** is designed to be printed with support contact size of 0.2–0.5 mm for easy support removal from printed parts
- For complex geometries, lattice support structure is recommended to ensure high print success rate

Washing procedure

- Wash printed parts with tripropylene glycol methyl ether (TPM) to remove uncured resin and use compressed air to accelerate the removal of residual solvent from the surface of the parts
- Recommended wash cycles: rinse 2–3 times (each rinse for 1–2 min) until excess resin has been completely removed
- Wash the 3D–printed object with isopropanol (IPA) for 2 minutes to remove excess TPM
- Let the parts dry for at least 30 min before the next post–processing step
- Contact with washing fluids should be minimized, as prolonged immersion or sonication of the uncured parts may result in loss in the mechanical properties: do not exceed more than 10 min total exposure to IPA and TPM
- When support structures are used, they should typically be removed before post–curing

Post–curing procedures

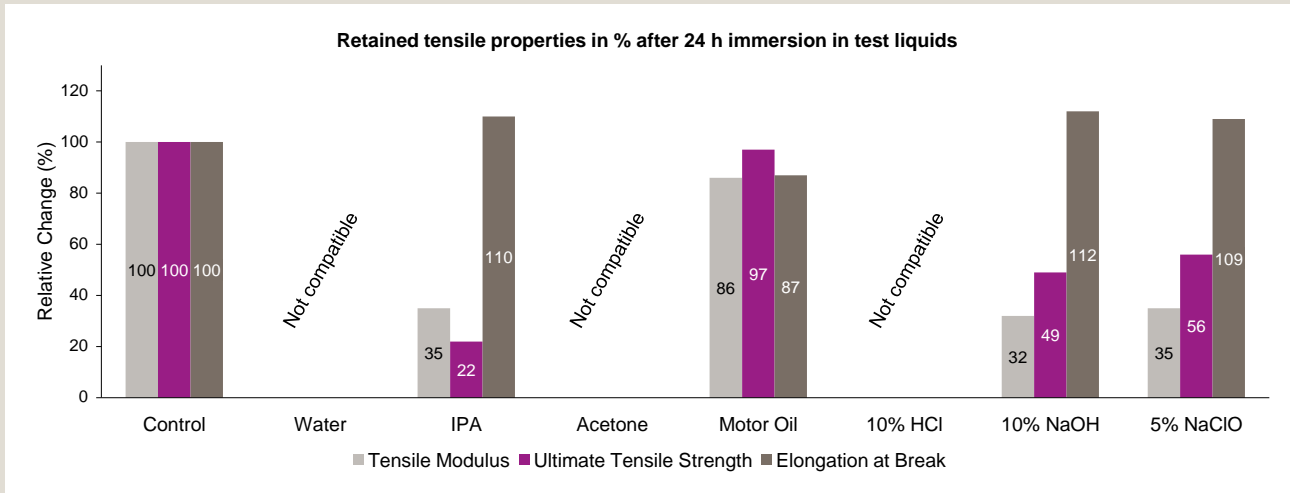
- After washing, the parts should be post–cured in order to achieve specified properties
- Below are two recommended procedures (it is recommended to flip printed parts once during UV–curing):

Method	UV–curing	Thermal–curing
Option 1	405 nm lamp (LED, 40 W) at 80 °C for 120 min	80 °C for 180 min
Option 2	Broad–spectrum lamp (metal–halide, 400 W) for 20 min	–

Note: TDS values with their ranges, as reported in this document, were obtained following **Option 1** with minimal exposure to IPA (using wipes wetted with IPA).

Chemical resistance

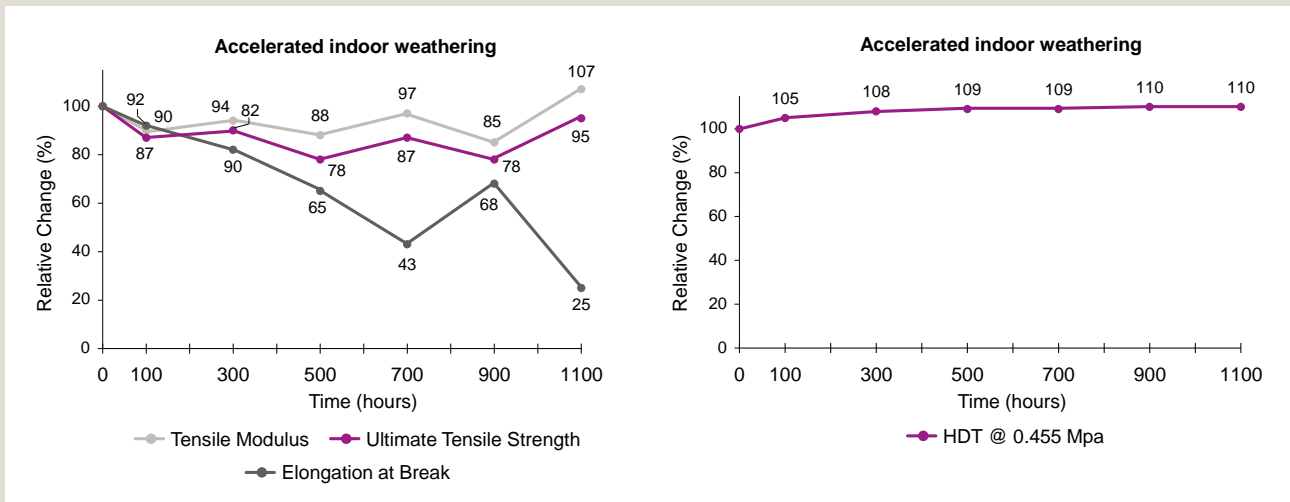
INFINAM® TI 5400 L was tested for solvent compatibility following standard ASTM D543. Tensile specimens were immersed in various liquid media for either 24 hours or 7 days (see charts below) and tested following ASTM D638.



Note: after 7 days immersion, INFINAM® TI 5400 L retains excellent mechanical properties in motor oil, while the other liquids tested above are not compatible.

Long term environmental stability

INFINAM® TI 5400 L was tested for its stability towards indoor and outdoor weathering conditions. The method is intended to reproduce the weathering effects that occur when the material is exposed to either solar radiation through glass (indoor conditions, ASTM D4459, Q-Sun). INFINAM® TI 5400 L is not recommended for outdoor applications.



Note: For the indoor method, it is possible to infer that accelerated weathering times of 400 and 800 hours correspond to ca. 5 and 10 years of ageing in normal conditions, respectively.

This information and any recommendations, technical or otherwise, are presented in good faith and believed to be correct as of the date prepared. Recipients of this information and recommendations must make their own determination as to its suitability for their purposes. In no event shall Evonik assume liability for damages or losses of any kind or nature that result from the use of or reliance upon this information and recommendations. EVONIK EXPRESSLY DISCLAIMS ANY REPRESENTATIONS AND WARRANTIES OF ANY KIND, WHETHER EXPRESS OR IMPLIED, AS TO THE ACCURACY, COMPLETENESS, NON-INFRINGEMENT, MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE (EVEN IF EVONIK IS AWARE OF SUCH PURPOSE) WITH RESPECT TO ANY INFORMATION AND RECOMMENDATIONS PROVIDED. Reference to any trade names used by other companies is neither a recommendation nor an endorsement of the corresponding product and does not imply that similar products could not be used. Evonik reserves the right to make any changes to the information and/or recommendations at any time, without prior or subsequent notice.

INFINAM® is registered trademark of Evonik Industries AG or one of its subsidiaries

Evonik Operations GmbH
Smart Materials
High Performance Polymers
 45772 Marl / Germany

Tel: +49 2365 49-9878
 evonik-hp@evonik.com