

Product Information

# INFINAM® RG 2000 L

## Phisible

CLEAR AND TOUGH PHOTOPOLYMER FOR ADDITIVE MANUFACTURING



INFINAM® RG 2000 L resin is a clear, fast-curing and easy to process (1-part system) liquid photopolymer formulation. The fully cured material exhibits excellent mechanical properties (high toughness) and low water absorption.

### Storage conditions

INFINAM® RG 2000 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	1900 ± 100	MPa	ASTM D638
Ultimate Tensile Strength	50 ± 10	MPa	ASTM D638
Elongation at Break	52 ± 15	%	ASTM D638
Flexural Modulus	1900 ± 50	MPa	ASTM D790
Flexural Stress at 5% Strain	80 ± 3	MPa	ASTM D790
Izod Notched Impact	45 ± 10	J/m	ASTM D256

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	78 ± 5	°C	ASTM D648
Heat Deflection Temperature, 1.82 MPa/264 psi	63 ± 3	°C	ASTM D648
Glass Transition Temperature (tanδ)	107 ± 5	°C	ASTM D4065
Coefficient of Thermal Expansion (CTE) (35–95 °C)	139	µm/(m.K)	ISO 11359-2

Physical Properties	Value	Unit	Test Standard
Liquid Density, 25 °C	1.03	g/cm <sup>3</sup>	ASTM D4052
Liquid Viscosity, 25 °C / 1 Hz	3000 ± 250	mPa.s	ASTM D4287
Shore D Hardness	85 ± 2	-	ASTM D2240
Water Absorption (24 h)	0.36	%	ASTM D570
Water Absorption (7 days)	0.85	%	ASTM D570
Poisson's Ratio	0.40	-	ISO 527

Electrical Properties	Value	Unit	Test Standard
Dielectric Constant @ 1 kHz	3.4	-	ASTM D150
Dielectric Constant @ 1 MHz	3.2	-	ASTM D150
Dissipation Factor @ 1 kHz	0.012	-	ASTM D150
Dissipation Factor @ 1 MHz	0.017	-	ASTM D150
Dielectric Strength	31	kV/mm	IEC 60243-1
Volume Resistivity	9.5 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	Passed	ISO 10993-5
Skin Irritation (in-vitro method)	Passed	ISO 10993-23
Skin Sensitization	Passed	ISO 10993-10

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	625	°C	IEC 60695-2-12
Glow Wire Ignition Temperature (GWIT) at 1.5 mm	650	°C	IEC 60695-2-13

Optical Properties	Value	Unit	Test Standard
Transmittance	98	%	ASTM E1348
Haze (C)	68	-	ASTM D1003
L*	98.94	-	ASTM E1348
a*	0.24	-	ASTM E1348
b*	1.01	-	ASTM E1348
C* (C)	1.04	-	ASTM E308
h (C)	76.62	-	ASTM E308

## Material handling recommendations

### Resin preparation

- Shake the bottle of **INFINAM® RG 2000 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® RG 2000 L** is designed to print optimally on digital light processing (DLP) and LCD machines at 385 nm (see table below for exposure time)
- At 385 nm: Critical exposure energy  $E_c = 6-9 \text{ mJ/cm}^2$  – Depth of penetration  $D_p = 300-400 \text{ }\mu\text{m}$
- It is advisable to use standard separation speed (e.g. peeling and separation speed of 2-3 mm/s)

Wavelength (nm)	Intensity (mW/cm <sup>2</sup> )	Layer thickness (μm)	Burn-in exposure time (s)	Layer exposure time (s)
385	9	100	3	2

### Support structures settings

- **INFINAM® RG 2000 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 isopropanol (IPA) to remove uncured resin and use compressed air to accelerate the removal of residual solvent from the surface of the parts (for better surface finish, parts can first be washed with tri(propylene glycol) methyl ether, followed by a quick wash with isopropanol)
- Recommended wash cycles: rinse 2-3 times (each rinse for 1-2 min) until excess resin has been completely removed
- Let the parts dry for at least 30 min before the next post-processing step
- Contact with washing fluids like IPA 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
- 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):

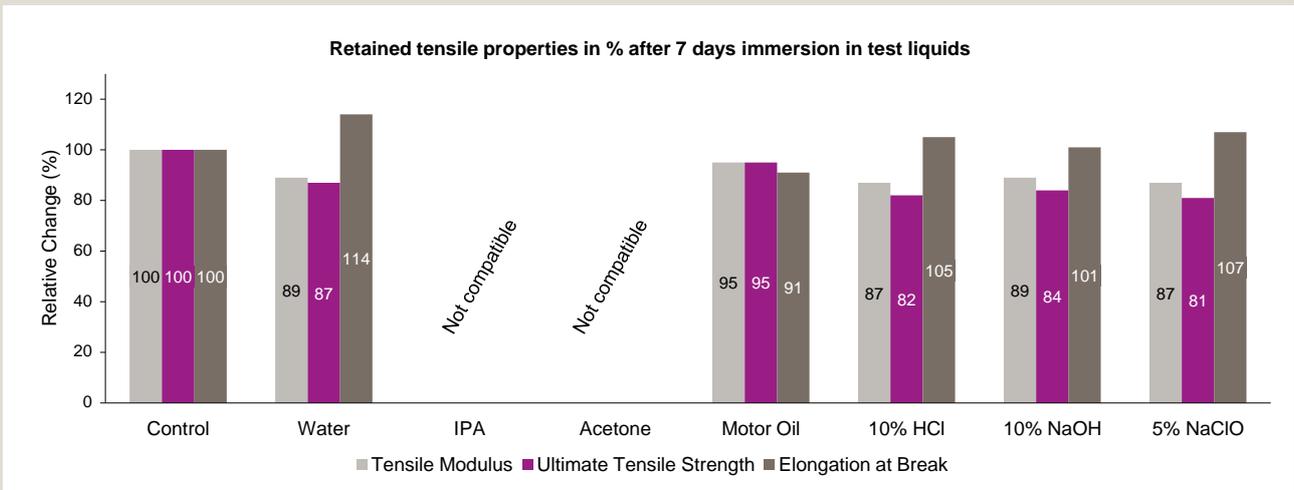
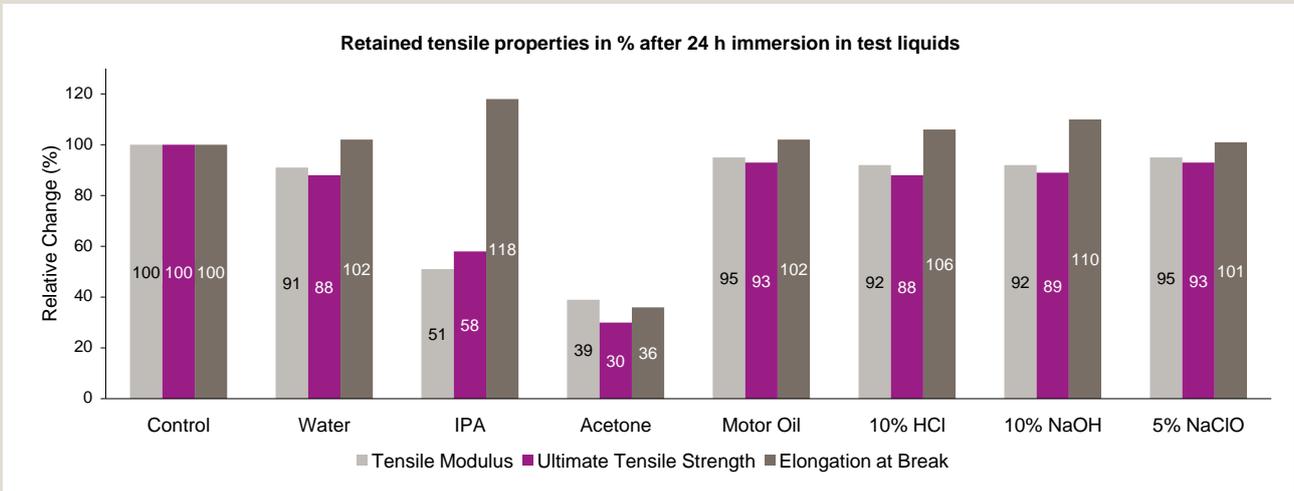
Method	UV-curing	Thermal-curing
<b>Option 1</b>	405 nm lamp (LED, 40 W) at 80 °C for 120 min	80 °C for 180 min
<b>Option 2*</b>	Broad-spectrum lamp (metal-halide, 400 W) for 20 min	-

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). \*In **Option 2**, HDT values of maximum 68 °C are obtained.

- It is possible to obtain higher clarity of finished parts by using mechanical polishing/tumbling, potentially followed by varnishing

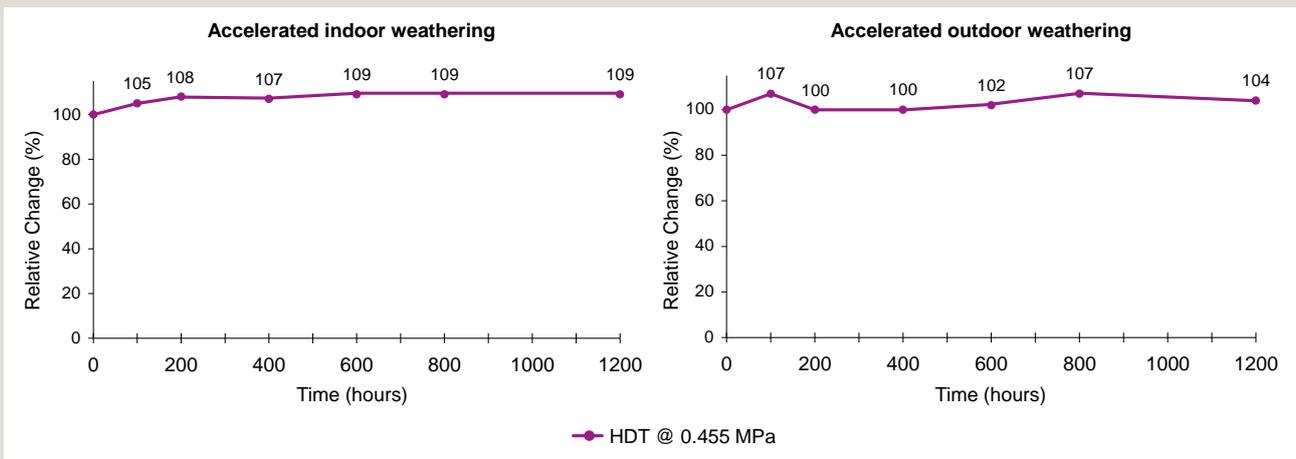
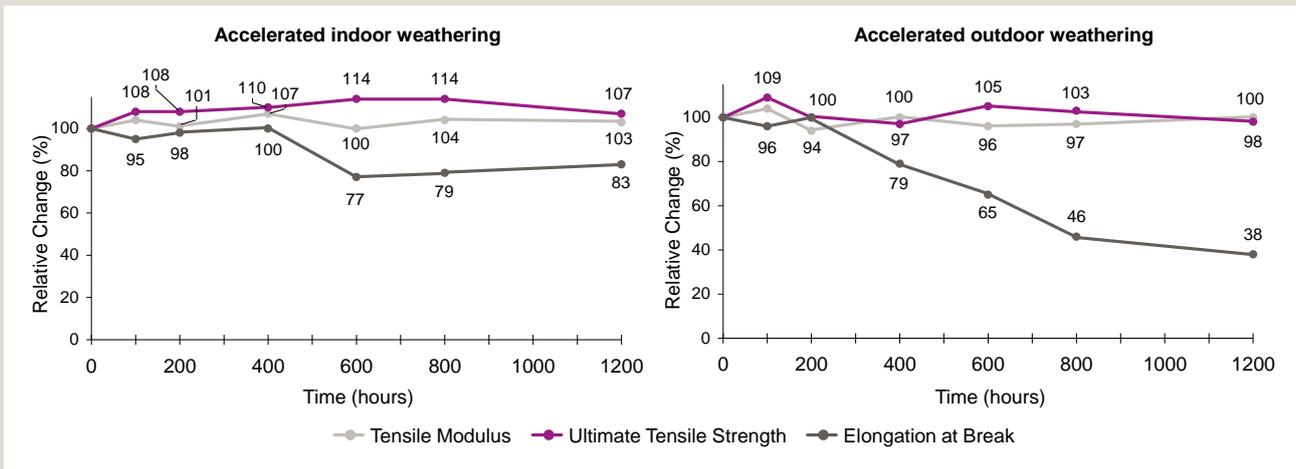
### Chemical resistance

INFINAM® RG 2000 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.



### Long term environmental stability

INFINAM® RG 2000 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) or to sunlight and moisture as rain or dew (outdoor conditions, ASTM G154, Cycle 1, QUV).



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. For the outdoor method, it is possible to infer that accelerated weathering times of 400 and 800 hours correspond to ca. 8 and 16 months of ageing in normal conditions, respectively.

Accelerated outdoor weathering (ASTM G154 Cycle 1, QUV): optical properties

QUV Exposure Time (hours)	L*	a*	b*	Haze (C)
0	100.72	0.52	1.44	86.62
115	100.53	0.37	2.09	86.49
208	100.54	0.40	1.96	86.62
402	100.50	0.45	1.83	87.24
612	100.50	0.47	1.78	86.58
800	100.67	0.50	1.73	86.88

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