N3XTDIMENSION®

TECHNICAL DATA SHEET

N3D-HT511

High-temperature material

SLA | DLP | LCD

N3D-HT511 is a stiff, high temperature material that is solvent resistant and autoclavable. N3D-HT511 exhibits injection molding like surface quality, having an excellent balance of high temperature resistance and toughness.

KEY PROPERTIES

N3D-HT511	
Liquid	
Appearance	Black
Viscosity @ 25°C	650 cP
Material	
Tensile Strength	54 MPa
Tensile Modulus	2400 MPa
Tensile Elongation at Break	7%
Flexural Strength	81 MPa
Flexural Modulus	2040 MPa
HDT @ 0.455 MPa	130°C
HDT @ 1.8 MPa	91°C
T_α, by DMA	148°C

KEY FEATURES

- → Tough & rigid
- → High heat deflection temperature
- → Chemical & water resistance

APPLICATIONS

- → High temperature component testing
- → Electrical connectors
- → Tooling
- → Molding

MAIN MARKETS

- → Automotive
- → Industrial
- → Transportation
- → Electronics

ARKEMA

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MATERIAL PROPERTIES

Property	Units	Method	Green[1]	UV Post-Curing[2]	Final Properties[3]
Tensile Strength	MPa	ASTM D638	19 ± 3	49 ± 3	54 ± 1
Tensile Modulus	MPa	ASTM D638	1020 ± 100	2150 ± 140	2400 ± 100
Tensile Elongation at Break	%	ASTM D638		7 ± 1	7 ± 1
Flexural Strength	MPa	ASTM D790	46 ± 1	75 ± 2	81 ± 1
Flexural Modulus	MPa	ASTM D790	1080 ± 20	1890 ± 60	2040 ± 10
Notched Izod Impact Resistance	J/m	ASTM D256[4]			16 ± 4
	kJ/m^2	ISO 180-A[4]			1.7 ± 0.1
Unnotched Izod Impact Resistance	J/m	ASTM D4812			285 ± 100
	kJ/m^2	ISO 180-U			4.4 ± 2.0
HDT @ 0.455 MPa	°C	ASTM D648		98	130
HDT @ 1.8 MPa	°C	ASTM D648		61	91
Shore Hardness	Shore D	ASTM D2240	79	84	86
T_g, by DMA	°C	ASTM D4065	91	123	148
Storage Modulus (E') Onset	°C	ASTM D4065	15	45	79
Loss Modulus (E") Peak	°C	ASTM D4065	-10	80	85
Volumetric Shrinkage	%	Archimedes principle	10.3	10.9	11
Water Absorption	% weight gain, 24 hours	ASTM D570			0.45%
Solid Density	g/cm^3	Density kit[5]			1.217

1 Parts were printed in the XZ orientation with a 50 µm layer thickness on a 405 nm bottom-up DLP printer with an irradiance of 12 mW/cm^2. Green samples were conditioned for 40-80 hours following ASTM D618 Procedure A before testing.

2 Parts were printed in the XZ orientation with a 50 µm layer thickness on a 405 nm bottom-up DLP printer with an irradiance of 12 mW/cm^2. Parts were post-cured for 60 seconds per side with 5,700 mJ/cm^2 of UVV energy dosage & 6,800 of UVA mJ/cm^2 energy dosage. Samples were conditioned for 40-80 hours following ASTM D618 Procedure A before testing.

3 Parts were printed in the XZ orientation with a 50 µm layer thickness on a 405 nm bottom-up DLP printer with an irradiance of 12 mW/cm^2. Parts were post-cured for 60 seconds per side with 5,700 mJ/cm^2 of UVV energy dosage & 6,800 mJ/cm^2 of UVA energy dosage. Following UV post-curing, samples were thermally cured for an additional 2 hours at 120°C. Samples were conditioned for 40-80 hours following ASTM D618 Procedure A before testing.

4 Parts were printed without a notch and a notch was generated with a manual notch cutting plane.

5 Solid density was determined on 10 mm x 10 mm x 10 mm 3D printed cubes via Archimedes principle.

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LIQUID PROPERTIES

Property	Units	Method	Value
Appearance	—	—	Black
Viscosity, 25°C	cP	Brookfield SP #31	650
Liquid Density	g/cm³	Gardco cup	1.096

PRINTING CONDITIONS

Reactivity values were generated on a 385 nm wavelength bottom-up 3D printer with an irradiance of 4.5 mW/cm².

Working-Curves	Units	Value
Critical Exposure (E_c)	mJ/cm²	12.3
Penetration Depth (D_p)	mils	6.2

3D printing parameters that can be used as starting points on LCD and DLP 3D printers are shown in the table below. Although not explicitly stated, other 3D printing parameters may be realized through process development.

3D Printing Parameter	Units	Printing & Reactivity		
Layer Thickness	µm	50	100	50
Wavelength	nm	385	385	405
Intensity	mW/cm²	6	6	3
Standard Exposure Time	Sec	5.5	8	18
Burn in Exposure Time	Sec	22	32	72

For additional guidance on print parameter setup for specific 3D printers, consult with Arkema technical service teams.

POST-CURING CONDITIONS

Post-curing conditions that can be used as starting points are shown in the table below. Although not explicitly stated, other post-processing conditions may be realized through process development.

	Dymax 5000	IntelliRay 400	LED Cure Box
Time (sec)	60	300	300
UVA Irradiance (mW/cm²)	100–120	100-120	50
UVV Irradiance (mW/cm²)	100–120	100-120	75

For best results, thermally cure N3D-HT511 for two hours at 120°C following UV cure.

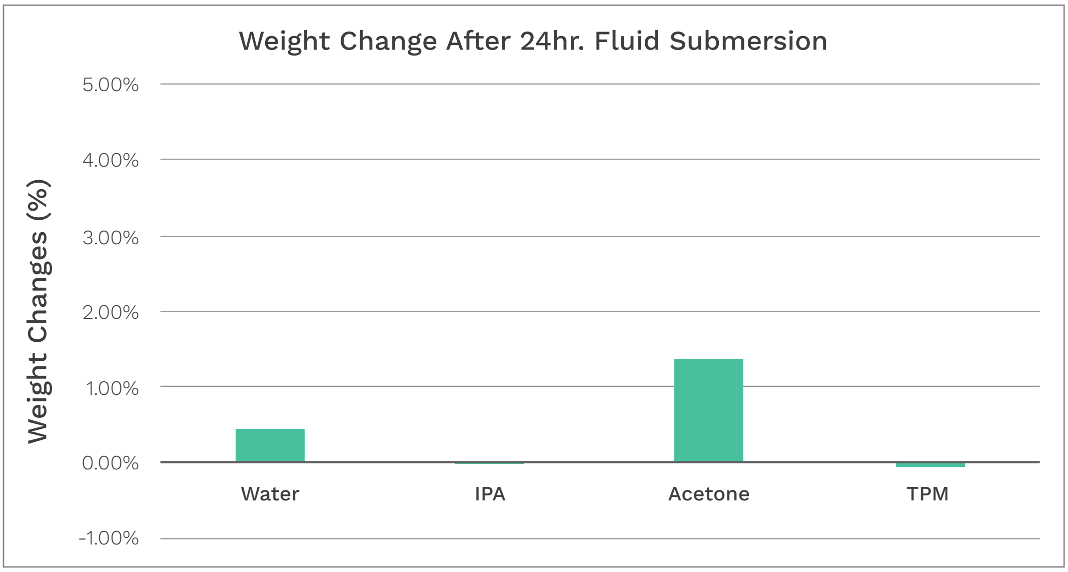
CLEANING PROCESS

Submerge 3D printed parts in traditional 3D printing solvents and agitate and/or sonicate for approximately 10 minutes. Incorporate two-stage cleaning baths for optimal cleaning. Use compressed air to remove any residual liquid material. Repeat steps as necessary until parts are free of residual material, and then proceed to post curing. Although not explicitly stated, other cleaning procedures may be realized that adequately clean 3D printed parts.

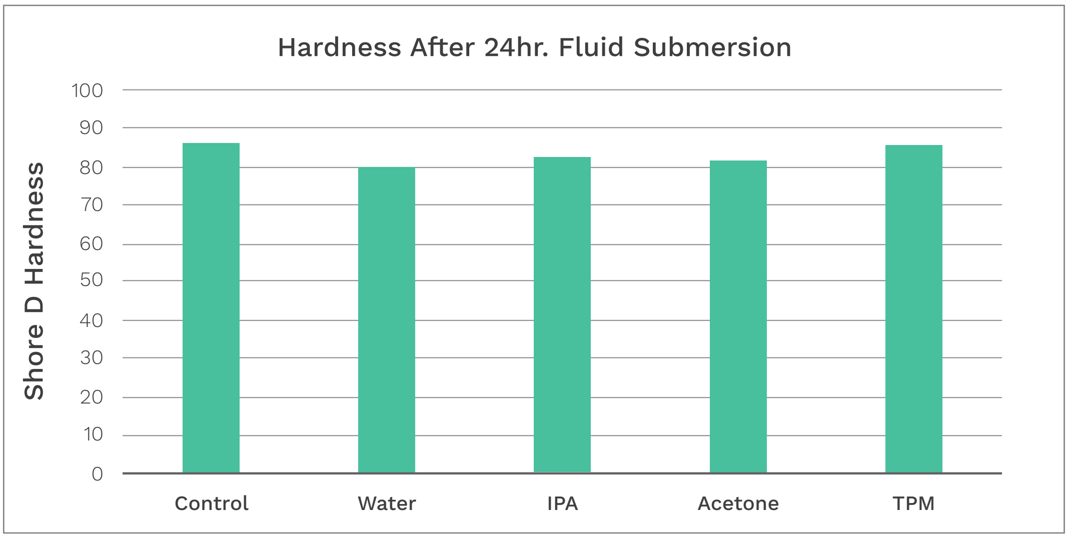
STORAGE & HANDLING

Manually shake bottle before use. Store bottles in a cool, dry place. Do not freeze. The material is light sensitive. Keep open bottles away from ambient lighting or sunlight, and shield material from ambient light. Once opened, packaging should be resealed immediately after use. See Safety Data Sheet for additional storage & handling considerations.

CHEMICAL RESISTANCE



2” diameter discs (1/8” thickness) were 3D printed & post-processed, dried for 24 hours at 50°C, and submerged at room temperature conditions for 24 hours complying with ASTM D570 for water resistance and ASTM D543 for chemical resistance. Weight before and after submersion was measured and resulting percent changes were calculated.



2” diameter discs (1/8” thickness) were 3D printed & post-processed, dried for 24 hours at 50°C, and submerged at room temperature conditions for 24 hours complying with ASTM D543 & ASTM D570. Resulting Shore D hardness was measured via ASTM D2240.

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