

# Ultracur3D<sup>®</sup> RG 9400 B FR

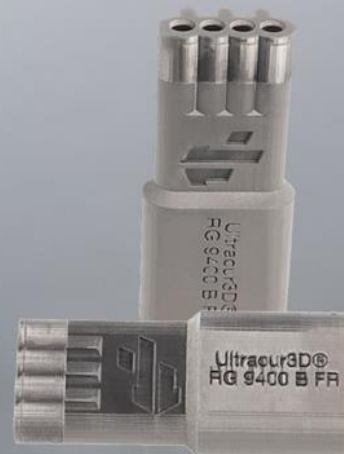
Rigid | Flame-Retardant | Black

## Extended TDS

Complete Technical Documentation  
and Testing Summary



Version: 2.0



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# Technical Data Sheet

## Flame-retardant resin with UL 94 V-0 rating and superior HDT.

General Properties	Norm	Typical Values
Appearance	-	Black
Viscosity, 25°C	Cone/Plate Rheometer <sup>1)</sup>	830 mPas
Viscosity, 30°C	Cone/Plate Rheometer <sup>1)</sup>	490 mPas
Density (Printed Part)	ASTM D792	1.32 g/cm <sup>3</sup>
Density (Liquid Resin)	ASTM D4052-18a	1.21 g/cm <sup>3</sup>

Tensile Properties <sup>2)</sup>	Norm	Typical Values	
		(UV)	(UV + Thermal <sup>3)</sup> )
E Modulus	ASTM D638	3900 MPa	4200 MPa
Ultimate Tensile Strength	ASTM D638	78 MPa	74 MPa
Elongation at Break	ASTM D638	3%	2%

Flexural Properties	Norm	Typical Values
Flexural Modulus	ASTM D790	3400 MPa
Flexural Strength	ASTM D790	115 MPa

Impact Properties	Norm	Typical Values
Notched Izod (Machined), 23°C	ASTM D256	20 J/m
Unnotched Izod, 23°C	ASTM D256	176 J/m
Notched Charpy (Machined), 23°C	ISO 179-1	0.9 kJ/m <sup>2</sup>

The data contained in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, this data does not relieve processors from carrying out their own investigations and tests; neither does this data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose.

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Thermal Properties	Norm	Typical Values	
		(UV)	(UV +Thermal <sup>3)</sup> )
HDT at 0.45 MPa	ASTM D648	255°C	280°C
HDT at 1.82 MPa	ASTM D648	86°C	152°C
Glass transition temperature (DMA, tan(d))	ASTM D4065	175°C	-
Degradation temperature (TGA, 5% mass loss, air)	ISO 11358	330°C	-

Fire, Smoke, Toxicity (FST) properties	Norm	Typical Values (UV)
Flammability	UL 94	V-0 (3.0 mm) V-0 (2.5 mm) V-0 (2.0 mm) V-1 (1.5 mm)
Fire classification Railway (R22)	DIN EN 45545-2	compliant to HL1 (2.0 mm, 2.5 mm)
Fire classification Railway (R23, R24)	DIN EN 45545-2	compliant to HL2 (2.0 mm, 2.5 mm)
Smoke generation and density	ISO 5659-2	D <sub>s</sub> (4) < 600 VOF4 < 1200 D <sub>s</sub> (max) < 600 (2.0 mm, 2.5 mm)
Limiting Oxygen Index	ISO 4589-2	LOI ≥ 28.0
Smoke gas toxicity	NF X70-100	CIT <sub>NLP</sub> : 0.36
Glow-wire Test	IEC 60695-2-12/-13 (2.1 mm)	GWIT: 825°C GWFI: 960°C

Advanced Thermal Properties	Norm	Typical Values (UV)
C.T.E. (-40°C to 0°C)	ASTM E831	49 µm/(m·K)
C.T.E. (0°C to 50°C)	ASTM E831	81 µm/(m·K)
C.T.E. (50°C to 100°C)	ASTM E831	137 µm/(m·K)
C.T.E. (100°C to 150°C)	ASTM E831	111 µm/(m·K)

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Dielectric/Electric Properties	Norm	Typical Values (UV)
Electrical Strength	DIN EN 60243-1	31 kV / mm
Volume resistivity	DIN EN 62631-3-1	2.20E+13 Ωcm
Surface resistivity	DIN EN 62631-3-2	4.50E+13 Ω
Comparative tracking index, CTI	DIN EN 60112	600 V

Other	Norm	Typical Values (UV)
Hardness Shore D	ASTM D2240	88
Water Absorption, Short-Term (24 hours)	ASTM D570	0.65%
Water Absorption, Long-Term (>1500 hours)	ASTM D570	>5%

### Mechanical properties overview

- 1) Determined with TA-Instrument DHR rheometer, cone/plate, diameter 60 mm, shear rate 100 s<sup>-1</sup>. Samples were preheated 5h at 40°C to make sure no solid crystals are present.
- 2) Tensile type ASTM D638 type IV, Pulling speed 5 mm/min
- 3) Regular UV post-curing and additional thermal post-cure of 3h at 150°C, see [User Guideline](#) for more details.
- 4) If not noted otherwise, all specimens are 3D printed. Samples were tested at room temperature, 23°C. ASTM sample size (L x W x H): ASTM D790 127 x 3.2 x 12.7 mm, ASTM D256 63 x 12,7 x 12 mm, ASTM D648 127 x 3.2 x 13 mm, ISO 179-1 80 x 4 x 10 mm, UL 94 125 x 3 x 13 mm, IEC 60695-2-12/-13 60 x 21 x 60 mm.

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## Printing Performance

The combination of 3D printer and material has a huge impact on the quality of the parts produced. The measured design characteristics as well as the printing speed can be found in the [Printing Evaluation Guideline of Ultracur3D® Resins](#).

# Flammability Data

Formblatt MA4.5\_F003, Revision: 3.4, gültig ab: 05.01.2021



<p><b>TEST REPORT according to ISO/IEC 17025</b>                  No. AVS: 2303493                  Date: 2023-10-11                  File: 2303493_3DPS_V_EN.DOCX</p>	
<p><b>Testing laboratory</b>                  BASF SE                  RBU Performance Materials Europe                  Materials and Parts Testing                  PMD/EX-H201                  67056 Ludwigshafen                  Deutschland</p>	<p><b>Contact at laboratory</b>                  Name: Daniel Francke                  Phone: +49 621 60 46167                  E-Mail: <a href="mailto:daniel.francke@basf.com">daniel.francke@basf.com</a>                  Position: Team lead                   Signature: </p>
<p><b>Client</b>                  Company: BASF 3D Printing Solutions GmbH                  Speyerer Strasse 4                  69115 Heidelberg                  Germany</p>	<p><b>Contact at client</b>                  Name: Giulia Knopf                  Phone: +49 152 56449881                  E-Mail: <a href="mailto:atlas@basf-3dps.com">atlas@basf-3dps.com</a></p>
<p><b>Test specimen / Material</b>                  A2023_5323 Ultracur3D RG 9400 B FR                  A2023_5507 Ultracur3D RG 9400 B FR</p>	<p><b>Test methods (Standard and publication date)</b>                  - IEC 60695-11-10:2014 vertical (equivalent to UL94:2023)</p>
<p>Order received on: 2023-07-31                  Specimen received on: 2023-07-31                  Tests conducted on: 2023-08-08,                  2023-09-07</p>	<p><b>This report contains:</b>                  Pages: 3                  Diagrams: 0                  Tables: 2                  Photos: 0                  Attachments: 2</p>

## Decision rule

Compliance with flame class V-0.

## Result

Test specimen of three materials in nominal thickness 3 mm were subjected to vertical flammability testing according to DIN EN 60695-11-10:2014 (equivalent to UL94:2023). The test result is class V-0.

The test results of this report are only valid for the specimens tested and only describe the results achieved by the application of the particular tests methods to these specimens. They do not imply any guarantee nor any agreement on a contractual quality or a suitability of the product for a specific purpose. In view of the many factors that may affect processing and application of the product, the test results do not relieve processor from carrying out own investigations and tests. The report does not imply any recommendation for a product. The report shall only be reproduced and passed on in full.  
 The testing laboratory is accredited by DAkkS Deutsche Akkreditierungsstelle GmbH (German Accreditation Body) according to ISO 17025 for mechanical, thermal, physical-chemical and flammability tests. The accreditation is valid only for the scope of accreditation listed in the Annex to the accreditation certificate (Registration No. D-PL-14121-04-00).

Preparation: 3D-Printing

Conditioning:

Comments: Samples were post-processed with regular UV post-curing.

\*\*\* Flame testing \*\*\*  
Flammability V acc. to UL 94 : 2023

Information about test procedure and test specimens

M 0 0324			Measurements & observations										Classification
Dimensions of test specimens			1st flame application, 10 s				2nd flame application, 10 s				Total		
127 * 12,7 * d mm <sup>3</sup>			After-flame time t1 [s]	Cotton Indicator Ignited?	Burning up to holding clamp?	Observations	After-flame time t2 [s]	Cotton Indicator Ignited?	Burning up to holding clamp?	Observations	Afterflame & Afterglow time t2 + t3 [s]	Afterflame time t1 + t2 [s]	
Requirements			≤ 10	no	no	—	≤ 10	no	no	—	≤ 30	≤ 50	= V-0
			≤ 30	no	no	—	≤ 30	no	no	—	≤ 60	≤ 250	= V-1
			≤ 30	yes	no	—	≤ 30	yes	no	—	≤ 60	≤ 250	= V-2
Pre-conditioning	Spec no.	Thickn. [mm]	Abbrev.: A=dripping parts, K=edge-burning, T=dripping parts, R=rolls up										V-0
Conditioning chamber (2d / 23°C / 50%)	1	3.04	1	No	No		1	No	No		1		
	2	3.08	1	No	No		1	No	No		1		
	3	3.02	1	No	No		1	No	No		1		
	4	3.03	1	No	No		1	No	No		1		
	5	3.04	1	No	No		1	No	No		1	10	
			First test 2023-08-03 14:23 - 2023-08-03 14:26										
Drying oven (7d / 70°C)	1	3.03	2	No	No		3	No	No		3		
	2	3.04	1	No	No		2	No	No		2		
	3	3.02	1	No	No		3	No	No		3		
	4	3.03	1	No	No		1	No	No		1		
	5	3.04	1	No	No		2	No	No		2	17	
			First test 2023-08-08 10:09 - 2023-08-08 10:15										
Conditioning chamber (2d / 23°C / 50%)	1												
	2												
	3												
	4												
	5												
			Repeated test -										
Drying oven (7d / 70°C)	1												
	2												
	3												
	4												
	5												
			Repeated test -										V-0 @3.6mm

Comment MT:

Date of report: 2023-08-08

*Geibel*

Preparation: 3D-Printing  
 Comments: Samples were post-processed with regular UV post-curing and additional thermal post-cure of 3h at 150°C.

**\*\*\* Flame testing \*\*\***  
**Flammability V acc. to UL 94 : 2023**

**Information about test procedure and test specimens**

M 0 0323			Measurements & observations									Classification	
Dimensions of test specimens 127 * 12,7 * d mm³			1st flame application, 10 s				2nd flame application, 10 s				Total		
			After-flame time t1 [s]	Cotton ignited?	Burning up to holding clamp?	Observations	After-flame time t2 [s]	Cotton ignited?	Burning up to holding clamp?	Observations	Afterflame & Afterglow time t2 + t3 [s]		Afterflame time t1 + t2 [s]
Requirements			≤ 10	no	no	---	≤ 10	no	no	---	≤ 30	≤ 50	= V-0
			≤ 30	no	no	---	≤ 30	no	no	---	≤ 60	≤ 250	= V-1
			≤ 30	yes	no	---	≤ 30	yes	no	---	≤ 60	≤ 250	= V-2
Pre-conditioning	Spec no.	Thickn [mm]	Abbrev.: A=dripping parts, K=edge-burning, T=dripping parts, R=rolls up										
Conditioning chamber (2d / 23°C / 50%)	1	3.01	1	No	No		1	No	No		1		V-0
	2	3.00	1	No	No		1	No	No		1		
	3	2.99	1	No	No		1	No	No		1		
	4	3.03	1	No	No		2	No	No		1		
	5	2.95	1	No	No		1	No	No		1	11	
			First test 2023-09-05 14:35 - 2023-09-05 14:40										
Drying oven (7d / 70°C)	1	3.01	1	No	No		2	No	No		2		V-0
	2	3.03	1	No	No		1	No	No		1		
	3	2.95	1	No	No		1	No	No		1		
	4	2.99	1	No	No		1	No	No		1		
	5	2.98	1	No	No		1	No	No		1	11	
			First test 2023-09-07 10:14 - 2023-09-07 10:26										
Conditioning chamber (2d / 23°C / 50%)	1												
	2												
	3												
	4												
	5												
			Repeated test -										
Drying oven (7d / 70°C)	1												
	2												
	3												
	4												
	5												
			Repeated test -										
			V-0 @3.0mm										

Date of report: 2023-09-07





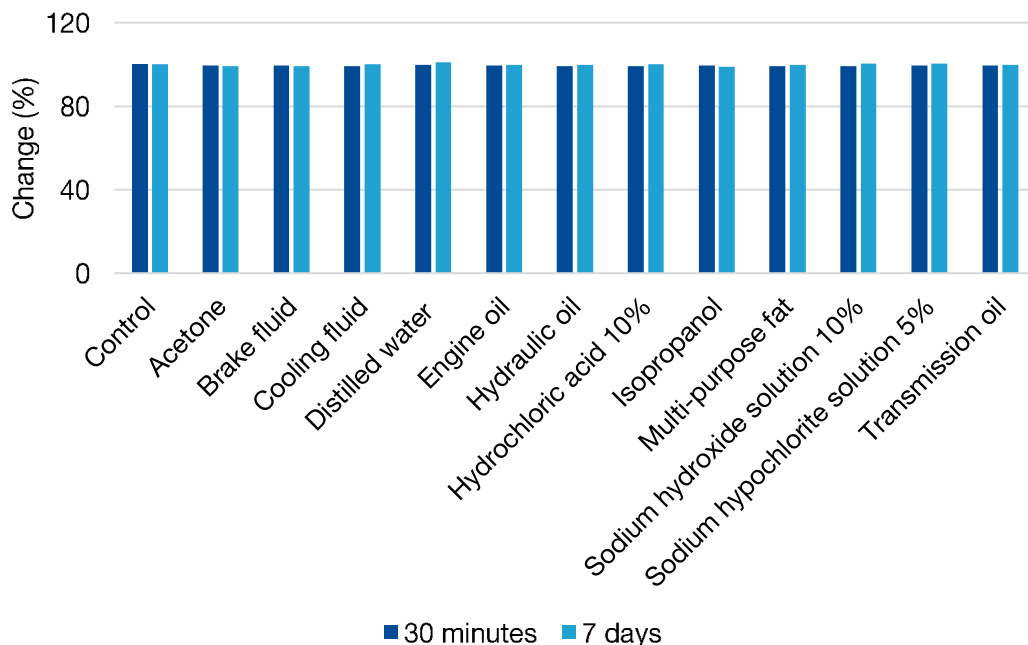
# Industrial Chemical Resistance

The resistance of resin materials against chemicals, solvents and other contact substances is an important criterion of selection for many industrial applications. General chemical resistance depends on the period of exposure, the temperature, the quantity, the concentration and the type of the chemical substance. When exposed to industrial chemicals, the chemical bonds of photopolymers can break or degrade, causing a change in the mechanical properties.

## Test Method and Specimens

ASTM D638 type IV tensile bars were soaked in each fluid at room temperature, one set for 30 minutes and one set for 7 days. Upon completion of the soaking time, the parts were removed from the test fluid and were dried to measure the weight and the mechanical properties.

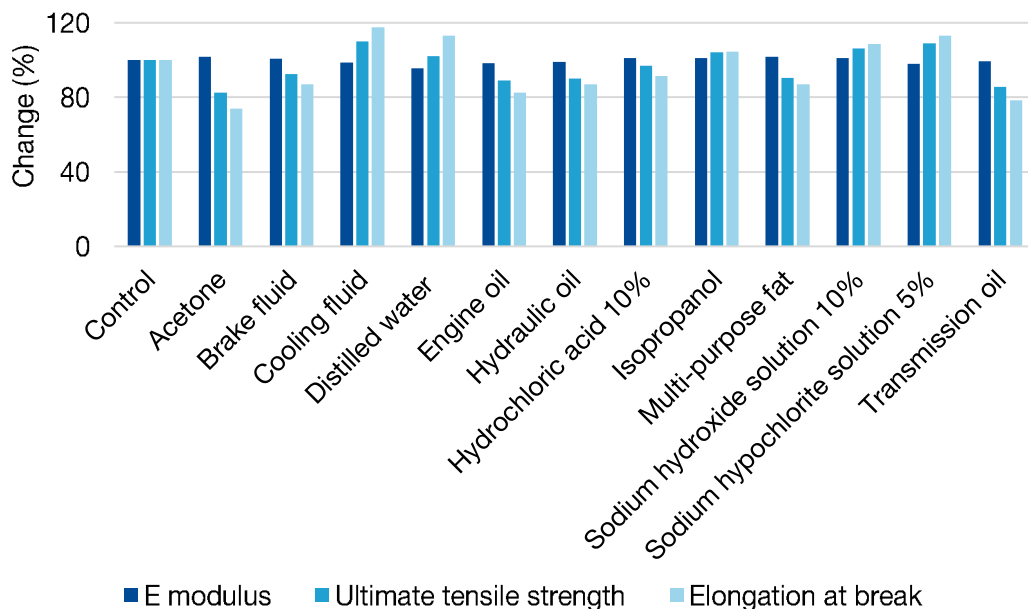
## Weight Measurement



Change in weight after immersion time

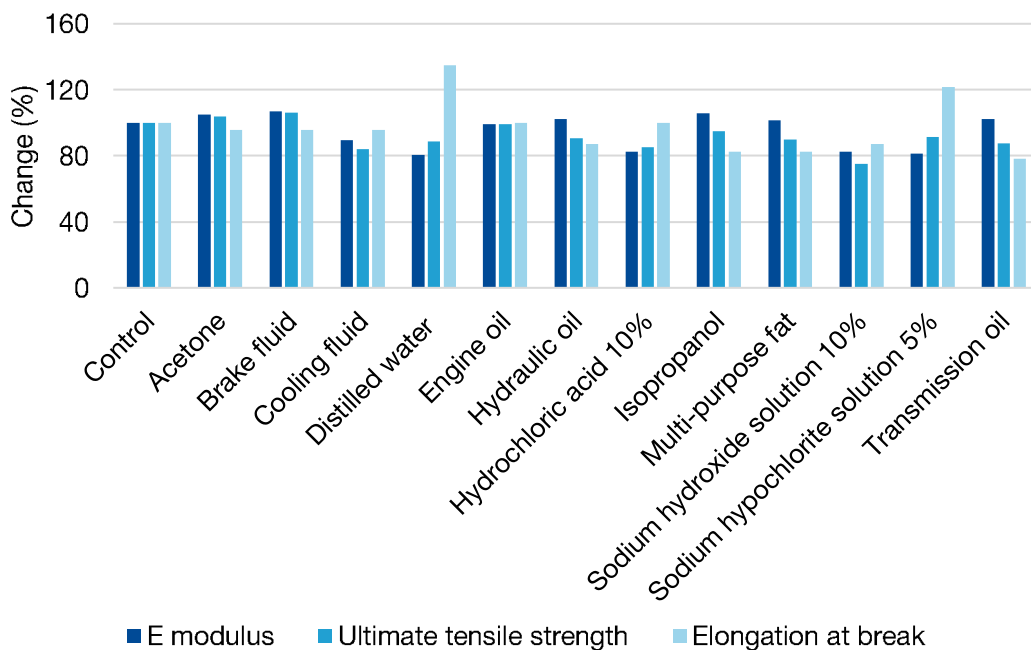
## Mechanical Testing

### 30 minutes



Change in mechanical properties after 30 minutes immersion

### 7 days



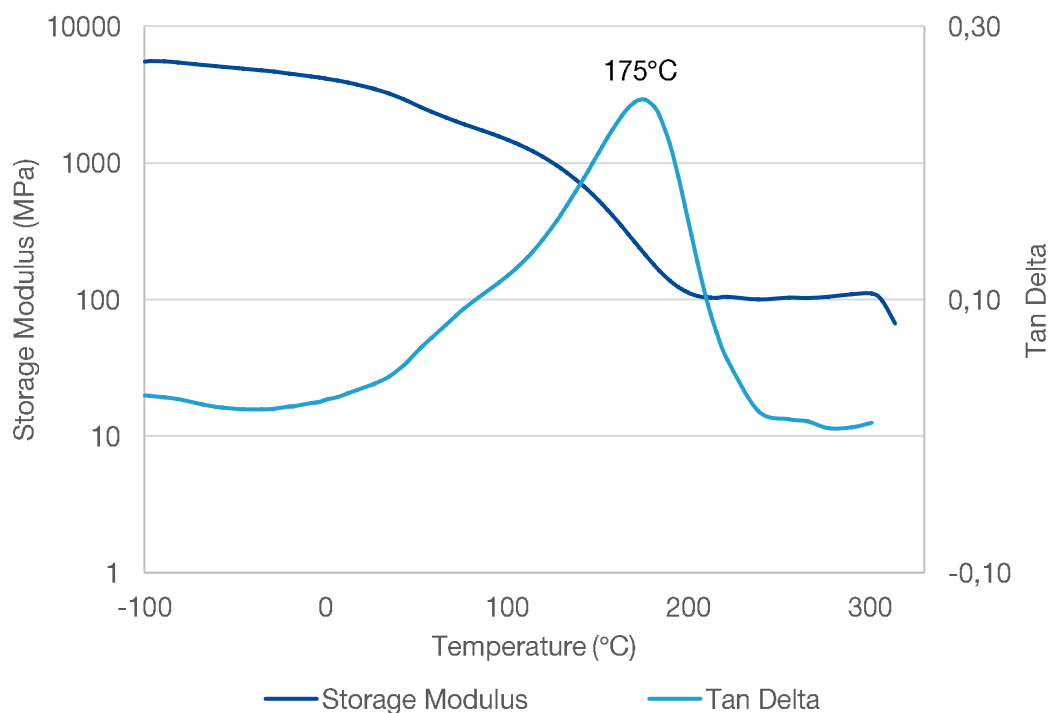
Change in mechanical properties after 7 days immersion

# Dynamic Mechanical Analysis (DMA)

In this DMA measurement, a cyclic strain is applied to the sample, and the response of the sample is recorded as a function of temperature. This can give a good impression of the changes in material behavior, both at low and high temperatures. The measured Storage modulus is a good indication of the stiffness of the material. The maximum in Tan Delta gives the glass transition temperature.

	Setting
Measurement	Strain-controlled
Temperature sweep	1°C / min
Strain	0.023% (linear viscoelastic regime)
Type of loading	Dual cantilever
Frequency	1 Hz

Testing conditions DMA



DMA curve