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Ultracur3D® RG 9400 B FR

Rigid | Flame-Retardant | Black

Extended TDS

Complete Technical Documentation and Testing Summary

Version: 4.0

Contents

Are you looking for an updated TDS version? Check out the latest online version here.

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[1)]	830 mPas
Viscosity, 30°C	Cone/Plate Rheometer[1)]	490 mPas
Density (Printed Part)	ASTM D792	1.32 g/cm³
Density (Liquid Resin)	ASTM D4052-18a	1.21 g/cm³

Tensile Properties[2)]	Norm	Typical Values	
		(UV)	(UV + Thermal[3)])
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/m²

Thermal Properties	Norm	Typical Values	
		(UV)	(UV +Thermal[3])
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) HB (1.0 mm)
Hot-Wire Ignition (HWI)	UL 746 A (2.0 mm)	PLC 0 (≥ 120s)
High Amp Arc Ignition (HAI)	UL 746 A (2.0 mm)	PLC 0 (> 150s)
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_s (4) < 600 VOF4 < 1200 D_s (max) < 600 (2.0 mm, 2.5 mm)
Limiting Oxygen Index	ISO 4589-2	LOI ≥ 28.0
Smoke gas toxicity	NF X70-100	CIT_{NLP}: 0.43
Glow-wire Test	IEC 60695-2-12/-13 (2.1 mm)	GWIT: 825°C GWFI: 960°C

Fire, Smoke, Toxicity (FST) properties	Norm	Typical Values (UV)
Vertical flammability 12s[4)]	FAR 25.853 App F, Part I (a)(1)(ii)-	PASS (2.0 mm)

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)
Specific heat capacity, 23°C[5)]	DIN EN ISO 11357-4	1.22 J/(g·K)
Specific heat capacity, 200°C[5)]	DIN EN ISO 11357-4	1.99 J/(g·K)

Dielectric/Electric Properties	Norm	Typical Values (UV)
Dielectric 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	PLC 0 (≥ 600 V)
RTI (Elec, Imp., Str.)	UL 746 B (generic value)	50°C
Dielectric constant, 1 MHz	IEC 62631-2-1	3.4
Dissipation factor, 1 MHz	IEC 62631-2-1	0.004

Biocompatibility	Norm	Typical Values (UV +Thermal[3)])
Cytotoxicity – Neutral Red	ISO 10993-5 (2009)	PASS[6)]

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^{-1}. 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) Different aerospace manufacturers and regulators use different names to refer to very similar or equivalent tests, please refer to the following table:

Test	FAR = JAR = CS	Airbus	Boeing
Vertical flammability 12s	FAR 25.853 App F, Part I (a)(1)(ii)	AITM 2.0002B	BSS 7230 F2

5) Data at different temperatures are available on request
6) For the statement on Biocompatibility data see Chapter: Biocompatibility.
7) 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 x12.7 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.

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.

Long-Term UV

Durability is a key feature for the components utilized within many industries, as they expect the materials used to withstand years of exposure to the elements. Through the effects of UV radiation, photopolymers can degrade over time. The aging can be caused by the influence of UV light, heat and water. The degree of ageing depends on duration and intensity.

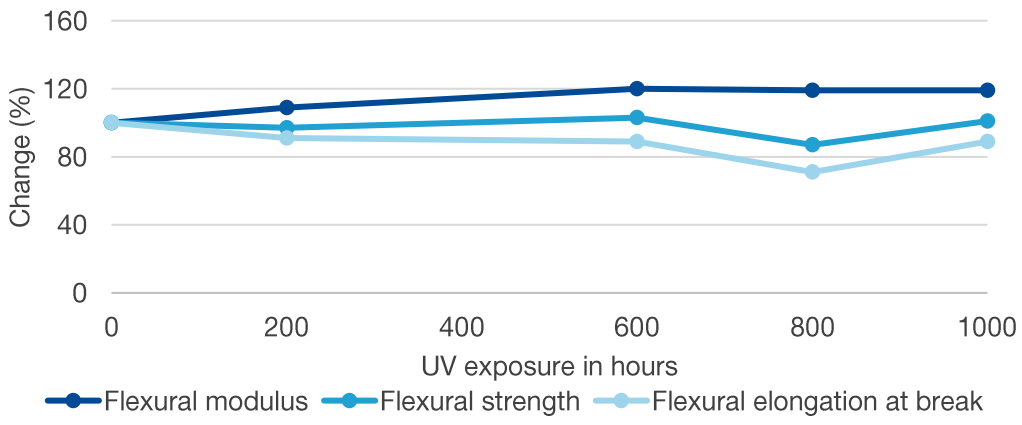
Test Method and Specimens

The ageing tests were performed with ASTM D790 flexural bars and color plates as per ISO 4892-2:2013 method A, cycle 1. Exposed samples were always removed at the end of a dry cycle, and conditioned for 24 hours at 22°C before mechanical testing.

Cycle No.	Exposure period	Irradiance		Black standard temperature in °C	Chamber temperature in °C	Relative humidity in %
		Broadband (300 nm to 400 nm) in W/m²	Narrowband (340 nm) in W/(m² nm)			
1	102 min dry	60 ± 2	0.51 ± 0.02	65 ± 3	38 ± 3	50 ± 10
	18 min water spray	60 ± 2	0.51 ± 0.02	-	-	-

Testing conditions for ISO 4892-2 method A, cycle 1

Mechanical Testing



Change in mechanical properties after accelerated weathering

The final values after 1000 hours of long-term UV exposure can be found below.

Property	Before long-term UV exposure	After 1000 hours of UV exposure
Flexural modulus	3400 MPa	4030 MPa
Flexural strength	115 MPa	116 MPa
Flexural elongation at break	3.5%	3.1%

Mechanical properties before and after 1000 hours of UV exposure as per ISO 4892:2 method A

Coloration

After being exposed up to 1000 hours, there was no visual change or additional yellowing compared to the reference sample.

Effect of UV exposure on color of the specimens

Flammability Testing

In addition to mechanical properties and color, also UL94 flammability was evaluated after long-term UV exposure. Samples (2mm thickness) exposed for respectively 400h and 1000h were tested, and both obtained the V-0 flammability rating. So it appears the UV weathering did not affect the flame retardant properties of the material.

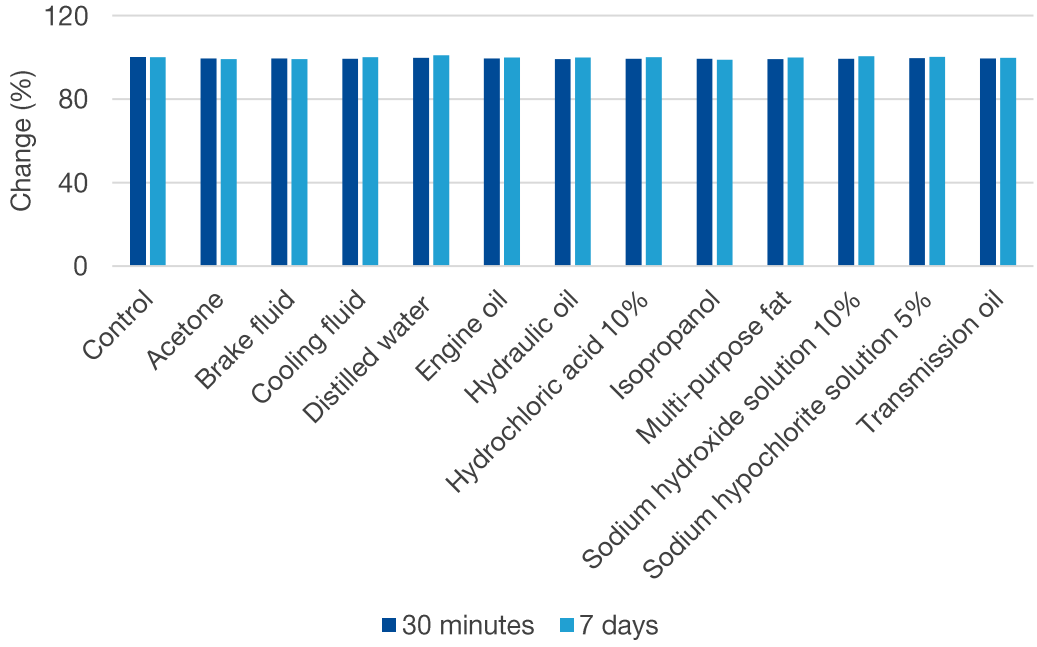
Industrial Chemical Resistance

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.

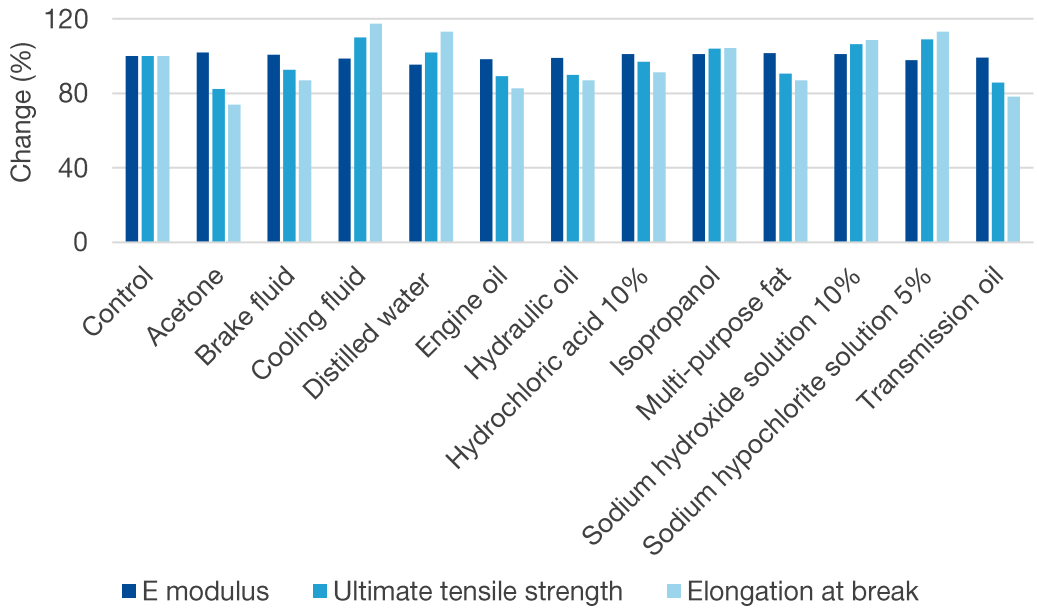
Weight Measurement



Change in weight after immersion time

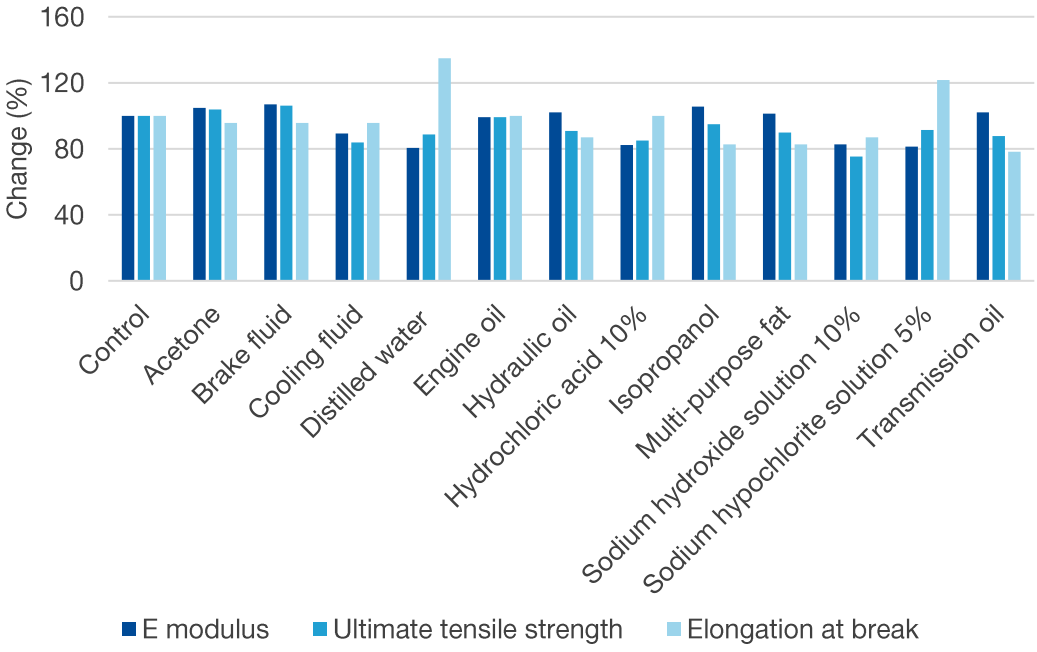
Mechanical Testing

30 minutes



Change in mechanical properties after 30 minutes immersion

7 days



Change in mechanical properties after 7 days immersion

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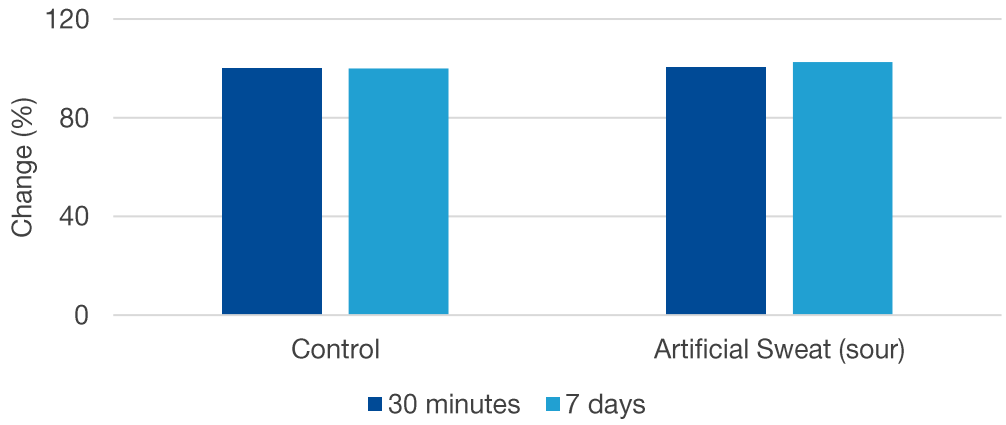
Consumer Chemical Resistance

Similar to the industrial sector, different consumer applications may also require resistance against various chemicals, solvents and other contact substances. Testing for these application-specific requirements helps to evaluate the suitability of photopolymers for the intended use.

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 mechanical properties.

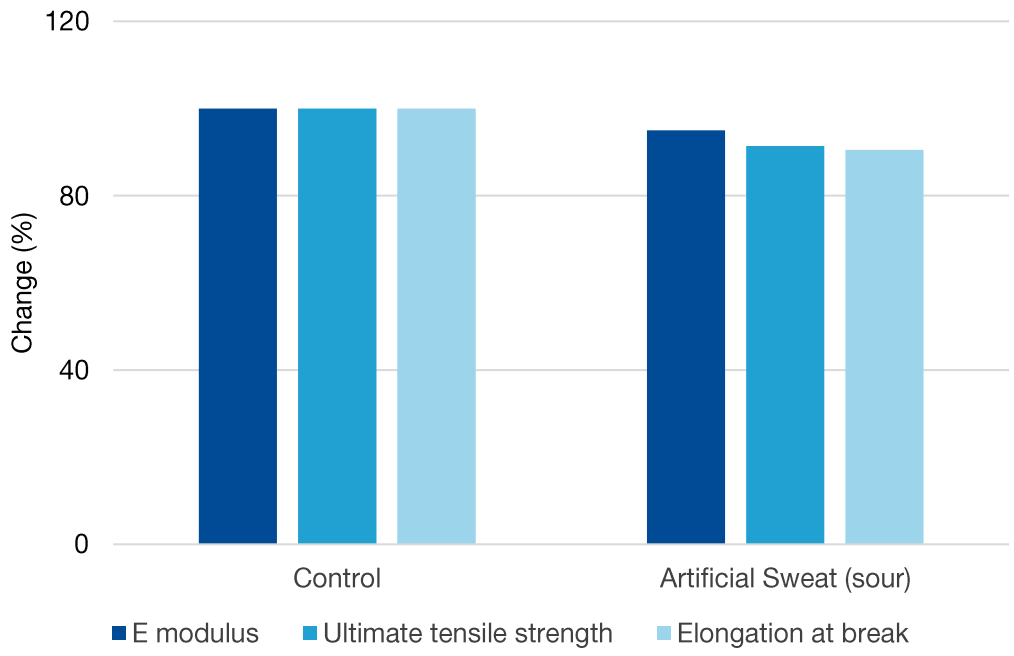
Weight Measurement



Change in weight after immersion time

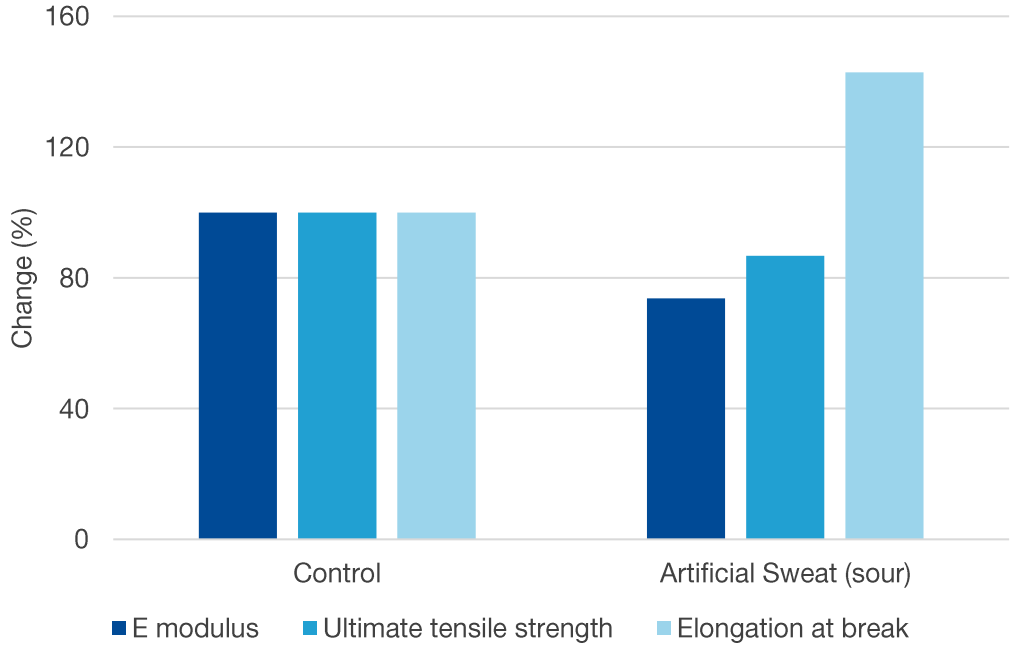
Mechanical Testing

30 minutes



Change in mechanical properties after 30 minutes immersion

7 days



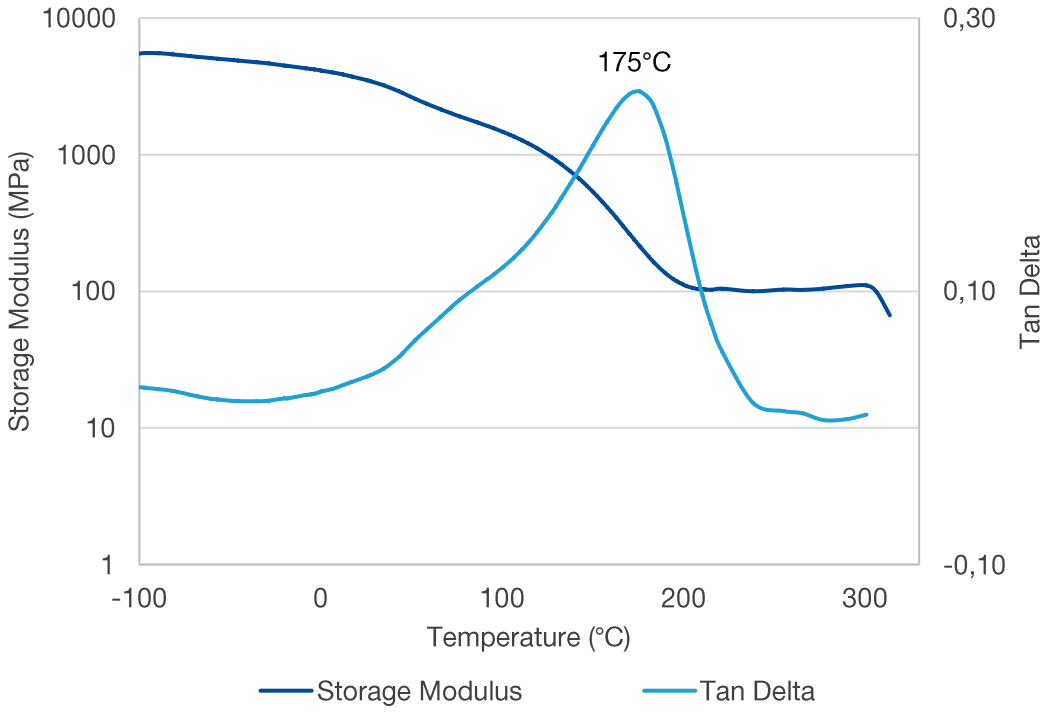
Change in mechanical properties after 7 days immersion

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

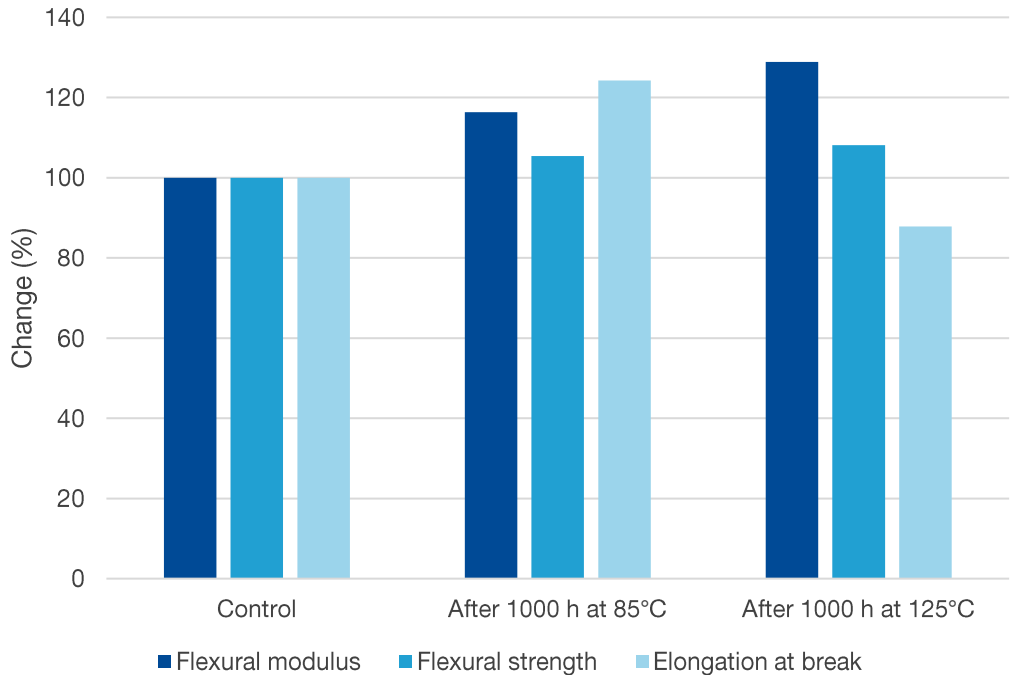
Heat Ageing

Long-time exposure to increased temperatures can have a substantial effect on material performance. Measuring these data can help to determine whether the material is suitable for applications that require it to maintain a certain performance after extended times at high temperatures.

Test Method and Specimens

Flexural bars were stored for 1000 h (+-6 weeks) at two temperatures, 85°C and 125°C. After the temperature storage, samples were cooled down to room temperature and subsequently measured.

Mechanical Testing



Change in mechanical properties after 1000 h

Biocompatibility

Product: Ultracur3D® RG 9400 B FR

Revision: 10th of June 2024

3D printed test items of the above stated product have fulfilled the requirements of tests as stated below:

Cytotoxicity Testing- Neutral Red:

(ISO 10993-5 (2009))

Additionally

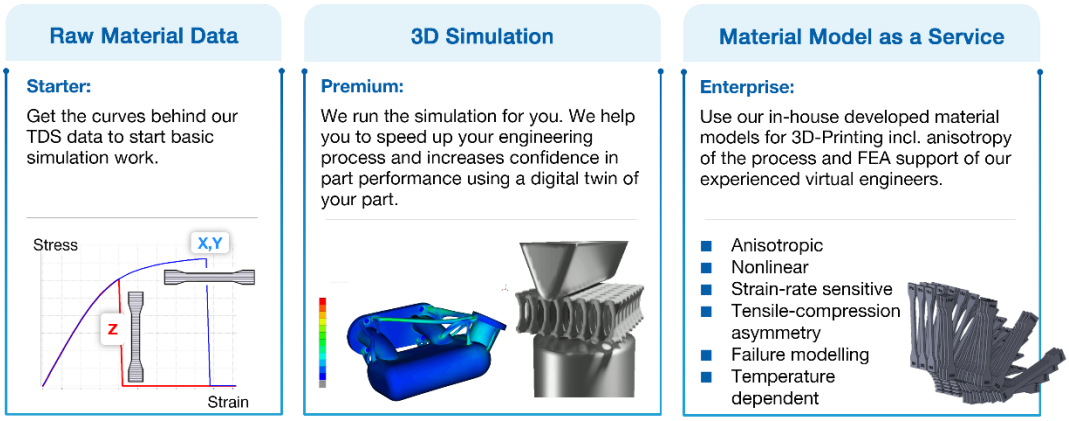
Parts underwent an additional thermal postcuring as described in the User Guideline for this material.

The biocompatibility tests were recorded on test specimen of the above referenced product to show compatibility of the material in general. The biocompatibility tests listed are not part of any continuous production protocol. The test assessments reflect only the test specimen and have to be retested on the final product. It remains the responsibility of the device manufacturers and /or end-users to determine the suitability of all printed parts for their respective application.

Material Model & FEA Simulation

FEA simulation can be used to predict how different parameters such as temperature and mechanical stress affect the final printed parts. This information can be used to significantly expedite application development, and to optimize the part design to ensure all performance requirements for the application are met. In order to run simulations with a specific material, a material model is required. This model is generated based on a wide range of testing data under different loads and at different temperatures and other relevant conditions.

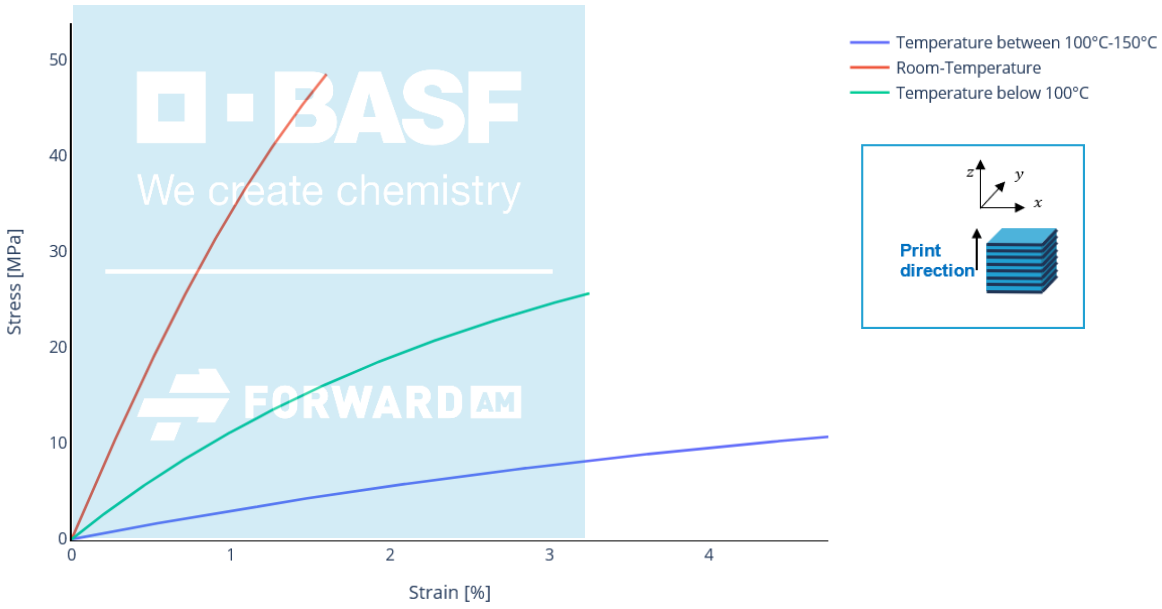
We can support you with 3D simulation in different ways, ranging from simply supplying you with raw test data, to doing the full simulation for you. These are the 3 options we offer:



Specifically for Ultracur3D® RG 9400 B FR, below you can find some of the data (at specific temperatures / mechanical loads) we have available in our Ultrasim® Material Model or that we could provide to you for your own simulations. More information is available on request (sales@basf-3dps.com).

	Available temperatures			Strain rate / loads	
	Low	23°C	High	Quasi static	High speed
Ultracur3D® RG 9400 B FR		●	●	●	

● Validated, available via Ultrasim® Material Model



Stress-strain response of Ultracur3D® RG 9400 B FR under quasi static load, loaded in x direction, at different temperatures.

Warning: The description of polymer materials under large strains with standard hyperelastic material models (Mooney-Rivlin, Ogden, Polynomial type) offered by common FEM programs/solvers can lead to significant deviations from the experimentally observed mechanical response. To achieve realistic simulation results extended models have to be considered to account for effects like strain rate dependence, viscous behavior, strain softening (Mullins Effect) and permanent deformation. BASF has developed such models which are made available via Ultrasim® to support our customers with high confidence simulations.

Additional material data available on request

- Quasi static Raw data (.csv/ASCII)
- Low temperature performance
- High temperature performance
- Higher strain rate performance
- Additional load cases (x,y,z,xy)

Request raw data for internal use via sales@basf-3dps.com or your key account

See full material overview under: Material data overview

For more information visit : Ultrasim® 3D Simulation (FEA) (forward-am.com)

Flammability UL 94 Data

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

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TEST REPORT according to ISO/IEC 17025 No. AVS: 2304644 Date: 2024-01-31 File: 2304644_3DPS_V_EN.DOCX	DAkkS Deutsche Akkreditierungsstelle D-PL-14121-04-00
Testing laboratory BASF SE RBU Performance Materials Europe Materials and Parts Testing PMD/EX-H201 67056 Ludwigshafen Deutschland	**Contact at laboratory** Name: Daniel Francke Phone: +49 621 60 46167 E-Mail: daniel.francke@basf.com Position: Team lead Signature: D. Francke
Client Company: BASF 3D Printing Solutions GmbH Speyerer Strasse 4 69115 Heidelberg Germany	**Contact at client** Name: Joshua Schell Phone: +49 62216741712 E-Mail: atlas@basf-3dps.com
Test specimen / Material A2023_5688 ULTRACUR3D RG 9400 B FR	**Test methods (Standard and publication date)** - IEC 60695-11-10:2014 vertical (equivalent to UL94:2024)
Order received on: 2023-10-23 Specimen received on: 2023-10-24 Tests conducted on: 2023-10-24, 2023-11-02	This report contains: Pages: 3 Diagrams: 0 Tables: 2 Photos: 0 Attachments: 2

Decision rule
Compliance with flame class V-0.

Result
Test specimen in nominal thickness 2 and 2.5 mm were subjected to vertical flammability testing according to DIN EN 60695-11-10:2014 (equivalent to UL94:2024). The test result is class V-0.

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TEST REPORT

BASF SE, PMD/EX - H202, D-67056 Ludwigshafen
Tester: Miriam Miedreich

Date of order: 2023-10-24
Order no.: 0 -E039/GK SAP: 40357409
AVS no.: 2304644
Customer: Knopf Giulia / Ott Christian
PDF no.: 379

Product: 3 A2023_5688 ULTRACUR3D RG 9400 B FR
ZXY D_2MM 40009143_LFS
Preparation: As received
Conditioning:
Comments:

*** 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			1st flame application, 10 s				2nd flame application, 10 s					Total	
127 * 12,7 * d mm³			After-flame time t1 [s]	Cotton indicator ignited?	Burning up to holding clamp?	Obser-vations	After-flame time t2 [s]	Cotton indicator ignited?	Burning up to holding clamp?	Obser-vations	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	2.01	10	No	No		1	No	No		1		
	2	1.99	1	No	No		4	No	No		4		
	3	2.00	2	No	No		4	No	No		4		
	4	2.00	1	No	No		3	No	No		3		
	5	1.96	0	No	No		5	No	No		5	31	V-0
			First test	2023-10-24 9:54 - 2023-10-24 9:59									
Drying oven (7d / 70°C)	1	2.01	1	No	No		4	No	No		4		
	2	1.99	1	No	No		2	No	No		2		
	3	2.01	1	No	No		1	No	No		1		
	4	1.98	11	No	No		4	No	No		4		
	5	2.01	1	No	No		4	No	No		4	30	V-1
			First test	2023-11-02 14:40 - 2023-11-02 14:46									
Conditioning chamber (2d / 23°C / 50%)	1												
	2												
	3												
	4												
	5												
			Repeated test	-									
Drying oven (7d / 70°C)	1	2.05	1	No	No		3	No	No		3		
	2	1.98	1	No	No		3	No	No		3		
	3	2.10	1	No	No		2	No	No		2		
	4	1.99	1	No	No		3	No	No		3		
	5	1.98	1	No	No		3	No	No		3	19	V-0
			Repeated test	2023-11-02 14:46 - 2023-11-02 14:51									V-0 @2.0mm

Date of report: 2023-11-02

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TEST REPORT

BASF SE, PMD/EX - H202, D-67056 Ludwigshafen
Tester: Miriam Miedreich

Date of order: 2023-10-24
Order no.: 0 -E039/GK SAP: 40357409
AVS no.: 2304644
Customer: Knopf Giulia / Ott Christian
PDF no.: 380

Product: 4 A2023_5688 ULTRACUR3D RG 9400 B FR
ZXY D_2,5MM 40009143_LFS
Preparation: As received
Conditioning:
Comments:

*** 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			1st flame application, 10 s				2nd flame application, 10 s					Total	
127 * 12,7 * d mm³			After-flame time t1 [s]	Cotton indicator ignited?	Burning up to holding clamp?	Obser-vations	After-flame time t2 [s]	Cotton indicator ignited?	Burning up to holding clamp?	Obser-vations	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	2.49	1	No	No		3	No	No		3		
	2	2.49	1	No	No		3	No	No		3		
	3	2.50	1	No	No		1	No	No		1		
	4	2.48	1	No	No		2	No	No		2		
	5	2.50	1	No	No		2	No	No		2	16	V-0
			First test	2023-10-24 10:00 - 2023-10-24 10:29									
Drying oven (7d / 70°C)	1	2.48	1	No	No		1	No	No		1		
	2	2.46	1	No	No		1	No	No		1		
	3	2.47	1	No	No		1	No	No		1		
	4	2.50	1	No	No		1	No	No		1		
	5	2.45	1	No	No		1	No	No		1	10	V-0
			First test	2023-11-02 14:55 - 2023-11-02 15:01									
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 @2.5mm

Date of report: 2023-11-02

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

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TEST REPORT according to ISO/IEC 17025 No. AVS: 2303493 Date: 2023-10-11 File: 2303493_3DPS_V_EN.DOCX	DAkkS Deutsche Akkreditierungsstelle D-PL-14121-04-00
Testing laboratory BASF SE RBU Performance Materials Europe Materials and Parts Testing PMD/EX-H201 67056 Ludwigshafen Deutschland	**Contact at laboratory** Name: Daniel Francke Phone: +49 621 60 46167 E-Mail: daniel.francke@basf.com Position: Team lead Signature: D. Francke
Client Company: BASF 3D Printing Solutions GmbH Speyerer Strasse 4 69115 Heidelberg Germany	**Contact at client** Name: Giulia Knopf Phone: +49 152 56449881 E-Mail: atlas@basf-3dps.com
Test specimen / Material A2023_5323 Ultracur3D RG 9400 B FR A2023_5507 Ultracur3D RG 9400 B FR	**Test methods (Standard and publication date)** - IEC 60695-11-10:2014 vertical (equivalent to UL94:2023)
Order received on: 2023-07-31 Specimen received on: 2023-07-31 Tests conducted on: 2023-08-08, 2023-09-07	This report contains: Pages: 3 Diagrams: 0 Tables: 2 Photos: 0 Attachments: 2

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.

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TEST REPORT

BASF SE, PMD/EX - H202, D-67056 Ludwigshafen
Tester: Ilona Hiebl

Page 1 of 1

Date of order: 2023-07-31
AVS no.: 2303493
PDF no.: 295

Order no.: 0 -E030/GK SAP: 40357409
Customer: Knopf Giulia / Pitz Andreas

Product: 1 A2023_5323_3MM RG9400_B_FR BLACK
40010605_LFS
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 mm³			After-flame time t1 [s]	Cotton indicator ignited?	Burning up to holding clamp?	Obser-vations	After-flame time t2 [s]	Cotton indicator ignited?	Burning up to holding clamp?	Obser-vations	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	3.04	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	V-0
			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	V-0
			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 @3.0mm**

Comment MT:

Date of report: 2023-08-08

Page 2 of 3

BASF
We create chemistry

TEST REPORT

BASF SE, PMD/EX - H202, D-67056 Ludwigshafen
Tester: Miriam Miedreich

Date of order: 2023-08-31
Order no.: 0 -E035/GK SAP: 40357409
AVS no.: 2303955
Customer: Knopf Giulia / Pitz Andreas
PDF no.: 14

Product: 1 A2023_5507 U_CUR3D_RG9400 SCHWARZ
EKO_0257_3MM 40010605_LFS
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			1st flame application, 10 s				2nd flame application, 10 s					Total	
127 * 12,7 * d mm³			After-flame time t1 [s]	Cotton indicator ignited?	Burning up to holding clamp?	Obser-vations	After-flame time t2 [s]	Cotton indicator ignited?	Burning up to holding clamp?	Obser-vations	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		
	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	V-0
			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		
	2	3.03	1	No	No		1	No	No		1		
	3	2.96	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	V-0
			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

Smoke Optical Density Data

BASF – Fire Safety Technology

Test Report No.: 15247 / 56181 Date: 15.11.2023

BASF SE
Brandschutztechnik
E-CPB/EG - A521
D-67056 Ludwigshafen

Test according to

ISO 5659 Part 2 : 2017-05

Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Client:

BASF 3D Printing Solutions GmbH

Speyerer Straße 4

69115 Heidelberg

The results refer exclusively to the tested samples.

As an accredited Test Laboratory, the BASF SE Fire Safety Technology Test Centre is authorized to conduct fire tests in accordance with DIN EN ISO/IEC 17025 : 2018.
DAkkS-Register-No.: D-PL-14121-07-00

DAkkS Deutsche Akkreditierungsstelle D-PL-14121-07-00

160_e.dot, Version 14: 11.09.2020; AE056181.doc
Test report according to DIN EN ISO/IEC 17025 : 2018

Page 1 of 7

BASF – Fire Safety Technology

Test according to ISO 5659 Part 2 : 2017-05
Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Test Report No.: 15247 / 56181

Receipt of order: 06.10.2023
Receipt of samples: 17.10.2023
Date of test: 15.11.2023

1. Material: (information supplied by client)

Ultracur 3D RG 9400 B FR
Order number: ATLaS-2023-5657

Colour:

End use application:

2. Summary of results and classification:

Mean value of specific optical density at 4 min	**D_s (4)**	**538**
Cumulative value of spec. optical dens. in the first 4 min.	**VOF4**	**836**
Mean value of maximum specific optical density	**D_s (max)**	**574**
Classification according to DIN EN 45545-2:2016-02, set of requirements R22, with respect to test method ISO 5659-2, at 25 kW/m², with pilot flame		**HL1**
Classification according to DIN EN 45545-2:2016-02, set of requirements R23, with respect to test method ISO 5659-2, at 25 kW/m², with pilot flame		**HL2**

Remarks: For a final classicifaction, additional tests are required.

Any conclusions we draw about the fire safety of the materials we test are based exclusively on the results of the test under the conditions described. The extent to which such conclusions can be applied to non-tested material under non-standard conditions is the sole responsibility of the customer and is done so at his own risk. - Decision rule acc. to DIN EN ISO/IEC 17025: Wherever statements of conformity are made, no measurement uncertainty is taken into account.

BASF Fire Safety Technology **Ludwigshafen, 15.11.2023**

Dr. Houssin
Head of Laboratory

Hammann
Technician

160_e.dot, Version 14: 11.09.2020; AE056181.doc
Test report according to DIN EN ISO/IEC 17025 : 2018

BASF – Fire Safety Technology

Test according to ISO 5659 Part 2 : 2017-05
Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Test Report No.: 15247 / 56181

3. Material:

Information supplied by client

Ultracur 3D RG 9400 B FR
Sample design:
RG9400 B FR Printed on MiiCraft 385.2 Preheated 5h at 40 °C before printing 100um 4mW 2,5s 3min Cleaner+3min IPA 30 min at 40°C 900sDpS (2mm) / XZY
Order number: ATLaS-2023-5657

Additional details from testing laboratory

The tested specimen behaved like an intumescent material. The thickness of the charred residue was >10 mm. Therefore, the distance between the lower rim of the radiator cone shade junction was adjusted to 50 mm above the upper surface of the specimen holder. Calibration of the cone heater was done by a heat flux meter place in position of the specimen with a distance of 50 mm and adjusting the temperature to resulting heat flux of 25 kW/m² to the surface of the specimen.

4. Samples:

Sample size (determined by BASF test laboratory):

Length:	74,92	[mm]	Weight:	14,35	[g]
Width:	74,65	[mm]	Weigt per unit area:	2,56	[kg/m²]
Thickness:	2,00	[mm]	Density:	1282,90	[kg/m³]

Pre-conditioning:

	Conditions	Duration days
Client: (information supplied by client)	Standard 23/50 ISO 554	
Test Laboratory:	Standard 23/50 ISO 554	29

Sample preparation: Specimen tested as received (no sampling by test laboratory).

Exposed surface : Identical surfaces

5. Test equipment:

Test apparatus	PE	0020
Sliding gauge	MB	0038
Balance	MW	0009

BASF – Fire Safety Technology

Test according to ISO 5659 Part 2 : 2017-05
Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Test Report No.: 15247 / 56181

6. Test results:

Test mode		1		
Irradiance	[kW/m²]	25 kW		
Distance between sample and cone heater	[mm]	50 mm		
Flame mode		Flaming		
Test duration	[min]	10		
Sample		1	2	3
Wire grid used	yes/no	no	no	no
Thickness	[mm]	2,0	2,0	2,0
C_f		8,75	8,75	8,75
Clear beam correction factor	Dc	45,85	34,79	41,36
Specific optical density at 4 min	Ds4	594	498	522
Mean value of specific optical density at 4 min	Ds4	537,8		
Specific optical density at 10 min	Ds10	367	308	331
Mean value of specific optical density at 10 min	Ds10	335,2		
Specific optical density (maximum)	$Ds_{(max)}$	646	498	579
Mean value of specific optical density (maximum)	$Ds_{(max)}$	574,4		
Obscuration value in 4 min	VOF4	946	632	930
Mean obscuration value in 4 min	VOF4	836		
Ignition	[s]	90	105	83
Extinguishment	[s]	225	266	235
Thickness of the charred residue:	[mm]	20	21	15

Observations:

BASF – Fire Safety Technology

Test according to ISO 5659 Part 2 : 2017-05
Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Test Report No.: 15247 / 56181

7. Requirements:

DIN EN 45545-2:2016-02 (equivalent to EN 45545-2:2013 + A1:2015) and DIN EN 45545-2:2020-10

Set of requiremt.	Reference	kW/m²	Parameter	HL1	HL2	HL3
R1, R2, R6, R11, R12	T10.01	50 w/o fl.	$D_s(4)$	600	300	150
	T10.02		VOF4	1200	600	300
	T11.01		CIT_G *	1,2	0,9	0,75
R3	T10.01	50 w/o fl.	$D_s(4)$	---	480	240
	T10.02		VOF4	---	960	480
	T11.01		CIT_G *	1,2	0,9	0,75
R5	T10.03	25 w. fl.	D_s(max)	300	250	200
	T11.02		CIT_G *	1,2	0,9	0,75
R7	T10.04	50 w/o fl.	D_s(max)	---	600	300
	T11.01		CIT_G *	---	1,8	1,5
R8, R9	T10.03	25 w. fl.	D_s(max)	---	600	300
	T11.02		CIT_G *	---	1,8	1,5
R10	T10.03	25 w. fl.	D_s(max)	600	300	150
	T11.02		CIT_G *	1,2	0,9	0,75
R17	T10.04	50 w/o fl.	D_s(max)	---	600	300
	T11.01		CIT_G *	---	1,8	1,5
R20	T10.03	25 w. fl.	D_s(max)	200	200	200
	T11.02		CIT_G *	0,75	0,75	0,75
R21	T10.03	25 w. fl.	D_s(max)	300	300	200
	T11.02		CIT_G *	1,2	0,9	0,75
R22	T10.03	25 w. fl.	D_s(max)	600	300	150
	*T12 ** *	*600°C*	*$CIT_{(NLP)}$*	*1,2*	*0,9*	*0,75*
R23	T10.03	25 w. fl.	D_s(max)	---	600	300
	*T12 ** *	*600°C*	*$CIT_{(NLP)}$*	---	*1,8*	*1,5*

* after 4 or 8 minutes, whichever is higher
** NF X 70-100-1 &-2

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Test report according to DIN EN ISO/IEC 17025 : 2018

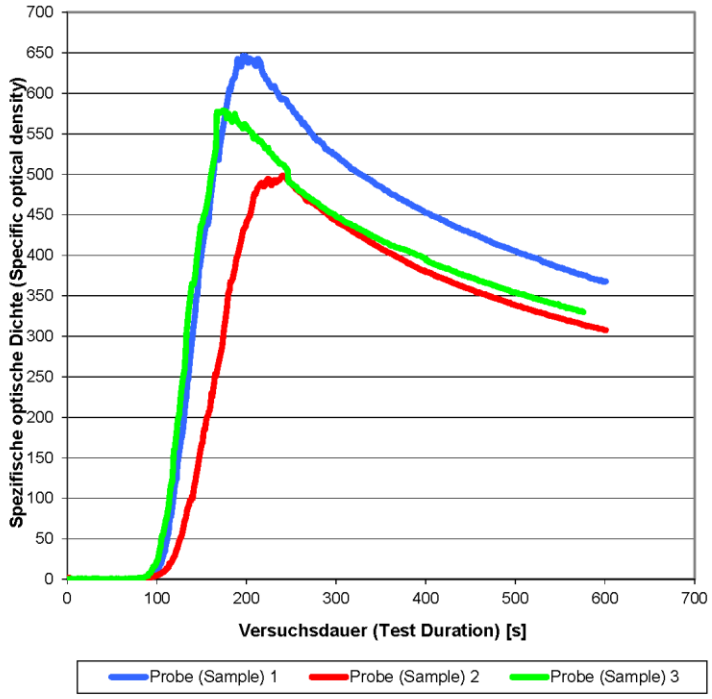
BASF – Fire Safety Technology

Test according to ISO 5659 Part 2 : 2017-05
Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Test Report No.: 15247 / 56181

8. Charts:

Spezifische optische Dichte (Specific optical density)



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Test report according to DIN EN ISO/IEC 17025 : 2018

BASF – Fire Safety Technology

Test according to ISO 5659 Part 2 : 2017-05
Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Test Report No.: 15247 / 56181

9. Pictures:

Tested samples

BASF – Fire Safety Technology

Test Report No.: 15247 / 56180 Date: 15.11.2023

BASF SE
Brandschutztechnik
E-CPB/EG - A521
D-67056 Ludwigshafen

Test according to

ISO 5659 Part 2 : 2017-05

Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Client:

BASF 3D Printing Solutions GmbH

Speyerer Straße 4

69115 Heidelberg

The results refer exclusively to the tested samples.

As an accredited Test Laboratory, the BASF SE Fire Safety Technology Test Centre is authorized to conduct fire tests in accordance with DIN EN ISO/IEC 17025 : 2018.
DAkkS-Register-No.: D-PL-14121-07-00

DAkkS Deutsche Akkreditierungsstelle D-PL-14121-07-00

160_e.dot, Version 14: 11.09.2020; AE056180.doc
Test report according to DIN EN ISO/IEC 17025 : 2018

BASF – Fire Safety Technology

Test according to ISO 5659 Part 2 : 2017-05
Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Test Report No.: 15247 / 56180

Receipt of order: 06.10.2023
Receipt of samples: 17.10.2023
Date of test: 15.11.2023

1. Material: (information supplied by client)

Ultracur 3D RG 9400 B FR
Order number: ATLaS-2023-5656

Colour:

End use application:

2. Summary of results and classification:

Mean value of specific optical density at 4 min	**D_s (4)**	**566**
Cumulative value of spec. optical dens. in the first 4 min.	**VOF4**	**577**
Mean value of maximum specific optical density	**D_s (max)**	**588**
Classification according to DIN EN 45545-2:2020-10, set of requirements R22, with respect to test method ISO 5659-2, at 25 kW/m², with pilot flame		**HL1**
Classification according to DIN EN 45545-2:2020-10, set of requirements R23, with respect to test method ISO 5659-2, at 25 kW/m², with pilot flame		**HL2**

Remarks: For a final classicifaction, additional tests are required.

Any conclusions we draw about the fire safety of the materials we test are based exclusively on the results of the test under the conditions described. The extent to which such conclusions can be applied to non-tested material under non-standard conditions is the sole responsibility of the customer and is done so at his own risk. - Decision rule acc. to DIN EN ISO/IEC 17025: Wherever statements of conformity are made, no measurement uncertainty is taken into account.

BASF Fire Safety Technology **Ludwigshafen, 15.11.2023**

Dr. Houssin
Head of Laboratory

Hammann
Technician

160_e.dot, Version 14: 11.09.2020; AE056180.doc
Test report according to DIN EN ISO/IEC 17025 : 2018

BASF – Fire Safety Technology

Test according to ISO 5659 Part 2 : 2017-05
Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Test Report No.: 15247 / 56180

3. Material:

Information supplied by client

Ultracur 3D RG 9400 B FR
Sample design:
RG9400 B FR Printed on MiiCraft 385.2 Preheated 5h at 40 °C before printing 100um 4mW 2,5s 3min Cleaner+3min IPA 30 min at 40°C 900sDpS (2,5mm) / XZY
Order number: ATLaS-2023-5656

Additional details from testing laboratory

The tested specimen behaved like an intumescent material. The thickness of the charred residue was >10 mm. Therefore, the distance between the lower rim of the radiator cone shade junction was adjusted to 50 mm above the upper surface of the specimen holder. Calibration of the cone heater was done by a heat flux meter place in position of the specimen with a distance of 50 mm and adjusting the temperature to resulting heat flux of 25 kW/m² to the surface of the specimen.

4. Samples:

Sample size (determined by BASF test laboratory):

Length:	74,95	[mm]	Weight:	18,09	[g]
Width:	74,64	[mm]	Weigt per unit area:	3,23	[kg/m²]
Thickness:	2,51	[mm]	Density:	1288,31	[kg/m³]

Pre-conditioning:

	Conditions	Duration days
Client: (information supplied by client)	Standard 23/50 ISO 554	
Test Laboratory:	Standard 23/50 ISO 554	29

Sample preparation: Specimen tested as received (no sampling by test laboratory).

Exposed surface : Identical surfaces

5. Test equipment:

Test apparatus	PE	0020
Sliding gauge	MB	0038
Balance	MW	0009

BASF – Fire Safety Technology

Test according to ISO 5659 Part 2 : 2017-05
Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Test Report No.: 15247 / 56180

6. Test results:

Test mode		1		
Irradiance	[kW/m²]	25		
Distance between sample and cone heater	[mm]	50 mm		
Flame mode		Flaming		
Test duration	[min]	10		
Sample		1	2	3
Wire grid used	yes/no	no	no	no
Thickness	[mm]	2,5	2,5	2,5
C_f		8,75	8,75	8,75
Clear beam correction factor	Dc	46,92	39,97	35,55
Specific optical density at 4 min	Ds4	590	578	528
Mean value of specific optical density at 4 min	Ds4	565,7		
Specific optical density at 10 min	Ds10	374	375	345
Mean value of specific optical density at 10 min	Ds10	365,0		
Specific optical density (maximum)	$Ds_{(max)}$	604	602	556
Mean value of specific optical density (maximum)	$Ds_{(max)}$	587,5		
Obscuration value in 4 min	VOF4	667	582	482
Mean obscuration value in 4 min	VOF4	577		
Ignition	[s]	94	104	112
Extinguishment	[s]	299	314	346
Thickness of the charred residue:	[mm]	31	21	18

Observations:

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Test report according to DIN EN ISO/IEC 17025 : 2018

BASF – Fire Safety Technology

Test according to ISO 5659 Part 2 : 2017-05
Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Test Report No.: 15247 / 56180

7. Requirements:

DIN EN 45545-2:2016-02 (equivalent to EN 45545-2:2013 + A1:2015) and DIN EN 45545-2:2020-10

Set of requiremt.	Reference	kW/m²	Parameter	HL1	HL2	HL3
R1, R2, R6, R11, R12	T10.01	50 w/o fl.	$D_s(4)$	600	300	150
	T10.02		VOF4	1200	600	300
	T11.01		CIT_G *	1,2	0,9	0,75
R3	T10.01	50 w/o fl.	$D_s(4)$	---	480	240
	T10.02		VOF4	---	960	480
	T11.01		CIT_G *	1,2	0,9	0,75
R5	T10.03	25 w. fl.	D_s(max)	300	250	200
	T11.02		CIT_G *	1,2	0,9	0,75
R7	T10.04	50 w/o fl.	D_s(max)	---	600	300
	T11.01		CIT_G *	---	1,8	1,5
R8, R9	T10.03	25 w. fl.	D_s(max)	---	600	300
	T11.02		CIT_G *	---	1,8	1,5
R10	T10.03	25 w. fl.	D_s(max)	600	300	150
	T11.02		CIT_G *	1,2	0,9	0,75
R17	T10.04	50 w/o fl.	D_s(max)	---	600	300
	T11.01		CIT_G *	---	1,8	1,5
R20	T10.03	25 w. fl.	D_s(max)	200	200	200
	T11.02		CIT_G *	0,75	0,75	0,75
R21	T10.03	25 w. fl.	D_s(max)	300	300	200
	T11.02		CIT_G *	1,2	0,9	0,75
R22	T10.03	25 w. fl.	D_s(max)	600	300	150
	*T12 ** *	*600°C*	*$CIT_{(NLP)}$*	*1,2*	*0,9*	*0,75*
R23	T10.03	25 w. fl.	D_s(max)	---	600	300
	*T12 ** *	*600°C*	*$CIT_{(NLP)}$*	---	*1,8*	*1,5*

* after 4 or 8 minutes, whichever is higher
** NF X 70-100-1 &-2

160_e dot. Version 14: 11.09.2020; AE056180.doc
Test report according to DIN EN ISO/IEC 17025 : 2018

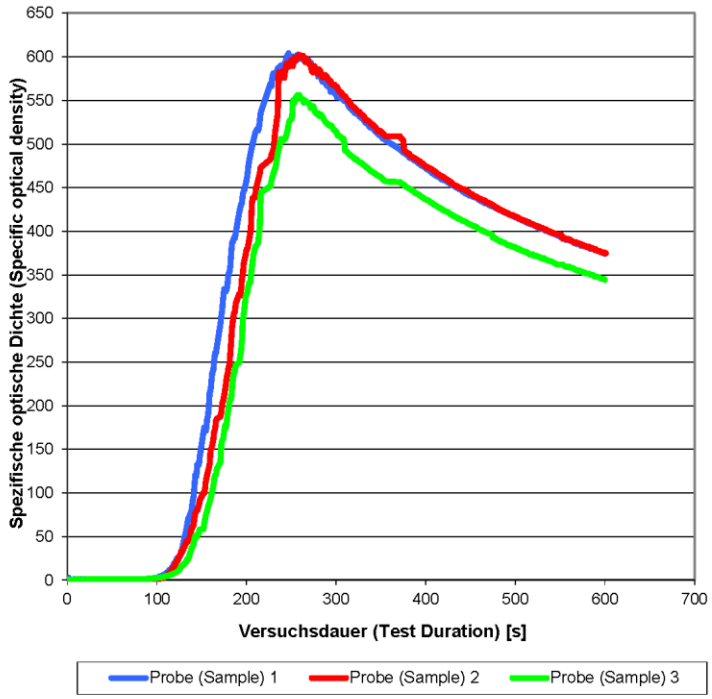
BASF – Fire Safety Technology

Test according to ISO 5659 Part 2 : 2017-05
Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Test Report No.: 15247 / 56180

8. Charts:

Spezifische optische Dichte (Specific optical density)



160_e.dot, Version 14: 11.09.2020; AE056180.doc
Test report according to DIN EN ISO/IEC 17025 : 2018

BASF – Fire Safety Technology

Test according to ISO 5659 Part 2 : 2017-05
Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

Test Report No.: 15247 / 56180

9. Pictures:

Tested samples

Limiting Oxygen Index Data

Test Report No.: 15311 / 56484 Date: 02.02.2024

BASF SE
Brandschutztechnik
E-CPB/EG - A521
D-67056 Ludwigshafen

Test according to

DIN EN ISO 4589 Part 2 Short procedure : 2017-11

Plastics - Determination of burning behaviour by oxygen index, Part 2: Ambient-temperature test Chapter 10 Comparison with a specified minimum value of the oxygen index (short procedure)

Client:

BASF 3D Printing Solutions GmbH

Speyerer Straße 4

69115 Heidelberg

The results refer exclusively to the tested samples.

As an accredited Test Laboratory, the BASF SE Fire Safety Technology Test Centre is authorized to conduct fire tests in accordance with DIN EN ISO/IEC 17025 : 2018.
DAkkS-Register-No.: D-PL-14121-07-00

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-14121-07-00

280_e.dot, Version 1: 17.03.2022; AE056484.doc
Test report according to DIN EN ISO/IEC 17025 : 2018

Page 1 of 5

BASF – Fire Safety Technology

Test according to DIN EN ISO 4589 Part 2 Short procedure : 2017-11
Plastics - Determination of burning behaviour by oxygen index, Part 2: Ambient-temperature test
Chapter 10 Comparison with a specified minimum value of the oxygen index (short procedure)

Test report No.: 15311 / 56484

Receipt of order: 23.01.2024
Receipt of samples: 31.01.2024
Date of test: 02.02.2024

1. **Material:** (information supplied by client)

Ultracur 3D RG 9400 B FR

Colour:

End use application:

2. **Summary of results and classification:**

Limiting Oxygen Index (LOI)	[% O_2]	≥ 28.0
Classification according to DIN EN 45545-2:2020-10, R22, R23, R24, with respect to test acc. to EN ISO 4589-2	HL 1+2	

Remarks:
For a final classification, additional tests are required.

Any conclusions we draw about the fire safety of the materials we test are based exclusively on the results of the test under the conditions described.
The extent to which such conclusions can be applied to non-tested material under non-standard conditions is the sole responsibility of the customer and is done so at his own risk.
Decision rule acc. to DIN EN ISO/IEC 17025:2018: Wherever statements of conformity are made, no measurement uncertainty is taken into account.

BASF Fire Safety Technology

Dr. Houssin
Head of Laboratory

Ludwigshafen, 02.02.2024

Hammann
Technician

112_e.dot, Version 1: 17.03.2022; AE056484.doc
Test report according to DIN EN ISO/IEC 17025 : 2018

BASF – Fire Safety Technology

Test according to DIN EN ISO 4589 Part 2 Short procedure : 2017-11
Plastics - Determination of burning behaviour by oxygen index, Part 2: Ambient-temperature test
Chapter 10 Comparison with a specified minimum value of the oxygen index (short procedure)

Test report No.: 15311 / 56484

3. Material:

Information supplied by client

Ultracur 3D RG 9400 B FR
Order number: ATLaS-2024-5927
Composition: RG9400 B FR Printed on MiiCraft 385.2 Preheated 5h at 40 °C before printing 100um 4mW 2,5s 3min Cleaner+3min IPA 30 min at 40°C 900sDpS (2,5mm)

Additional details from test laboratory

Colour: Black

4. Samples:

Sample size (determined by BASF test laboratory):

Length:	79,64	[mm]	Weight (upon receipt)	4,17	[g]
Width:	10,05	[mm]	Weight (after precond.):	4,19	[g]
Thickness:	4,04	[mm]	Weight loss:		[%]
Outer diameter:		[mm]	Weigt per unit area:	5,23	[kg/m²]
Inner diameter:		[mm]	Density:	1295,79	[kg/m³]
Remarks:					

Pre-conditioning:

	Conditions	Duration days
Client: (information supplied by client)	Standard 23/50 ISO 554	---
Test laboratory:	Standard 23/50 ISO 554	2

Sample preparation: Specimen tested as received (no sampling by test laboratory).

Exposed surface: Identical surfaces

Test gas temperature: (start of test) 25°C

Remarks:

BASF – Fire Safety Technology

Test according to DIN EN ISO 4589 Part 2 Short procedure : 2017-11
Plastics - Determination of burning behaviour by oxygen index, Part 2: Ambient-temperature test
Chapter 10 Comparison with a specified minimum value of the oxygen index (short procedure)

Test report No.: 15311 / 56484

5. Test results:

Sample type: I - For moulding materials

Procedure (Ignition method): A - Top surface ignition

Oxygen [Vol.%]	32,0	32,0	28,0	28,0	28,0	
Duration of burning [s]	>180	>180	45	31	27	
Burning distance [mm]	37	35	3	3	2	
Event (X or O)	X	X	O	O	O	

Observations:

6. Test equipment:

Test apparatus	PK	0023
Caliper gauge	MB	0038
Balance	MW	0009
Stop watch	MU	0059

BASF – Fire Safety Technology

Test according to DIN EN ISO 4589 Part 2 Short procedure : 2017-11
Plastics - Determination of burning behaviour by oxygen index, Part 2: Ambient-temperature test
Chapter 10 Comparison with a specified minimum value of the oxygen index (short procedure)

Test report No.: 15311 / 56484

7. Requirements:

Standard ISO 4589 Part 2 does not define any requirements.

Requirements by other standards:

Standard	Criteria		Requirements
DIN EN 45545-2: 2016-02 and 2020-10	Set of requirements R22, R23, R24	HL 1 and 2	LOI ≥ 28%
		HL 3	LOI ≥ 32%
DIN 5510 – 2:2009-05, section 5.2.2.4	Small electrical parts with a combustible material mass of 50 or 300 g (accessible / not accessible by passengers), which are arranged with a spacing of ≤ 20 cm behind, next to or above one another		LOI ≥ 28%
	Materials used in electrical equipment that is not accessible to passengers		LOI ≥ 30%
NF F 16-101, section 6.1.3	„ I " classification (in conjunction with test acc. to IEC 60695-2-10)	I 0	LOI ≥ 70%
		I 1	LOI ≥ 45%
		I 2	LOI ≥ 32%
		I 3	LOI ≥ 28%
		I 4	LOI ≥ 20%
BS 6853	Tables 7 + 8	Vehicle category Ia and Ib	LOI ≥ 34 %
		Vehicle category II	LOI ≥ 28 %
TSI Freight waggon (2006)*	Section 4.2.7.2.2.4. Material requirement		LOI ≥ 26 %

*from edition 2013-04, no more requirements regarding LOI

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Test report according to DIN EN ISO/IEC 17025 : 2018

Smoke Gas Toxicity Data

Test Report No.: 15311 / 56485 Date: 23.02.2024

BASF SE
Brandschutztechnik
E-CPB/EG - A521
D-67056 Ludwigshafen

Test according to

NF X 70-100 Partie 1+2 : 2006-04

Fire tests - Analysis of gaseous effluents - Part 1 : methods for analysing gases stemming from thermal degradation Calculation of CIT-NLP according to DIN EN 45545:2016

Client:

BASF 3D Printing Solutions GmbH

Speyerer Straße 4

69115 Heidelberg

The results refer exclusively to the tested samples.

As an accredited Test Laboratory, the BASF SE Fire Safety Technology Test Centre is authorized to conduct fire tests in accordance with DIN EN ISO/IEC 17025 : 2018.
DAkkS-Register-No.: D-PL-14121-07-00

DAkkS Deutsche Akkreditierungsstelle D-PL-14121-07-00

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Test report according to DIN EN ISO/IEC 17025 : 2018

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BASF – Fire Safety Technology

Test according to NF X 70-100 Partie 1+2 : 2006-04
Fire tests - Analysis of gaseous effluents - Part 1 : methods for analysing gases stemming from thermal degradation
Calculation of CIT-NLP according to DIN EN 45545:2016

Test report No.: 15311 / 56485

Receipt of order: 23.01.2024
Receipt of samples: 31.01.2024
Date of test: 08.02.2024

1. Material: (information supplied by client)

Ultracur 3D RG 9400 B FR

Colour:

End use application:

2. Summary of results and classification:

Conventional Index of Toxicity	CIT_{NLP}	0,43
Classification with respect to Smoke Gas Toxicity determination for "Non Listed Products" according to DIN EN 45545-2:2016-02, set of requirements	**R22 / R23**	**HL3**

Remarks:
For a final classification, additional tests are required.

Any conclusions we draw about the fire safety of the materials we test are based exclusively on the results of the test under the conditions described. The extent to which such conclusions can be applied to non-tested material under non-standard conditions is the sole responsibility of the customer and is done so at his own risk. - Decision rule acc. to DIN EN ISO/IEC 17025: Wherever statements of conformity are made, no measurement uncertainty is taken into account.

BASF Fire Safety Technology

Dr. Houssin
Head of Laboratory

Ludwigshafen, 23.02.2024

Hammann
Technician

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Test report according to DIN EN ISO/IEC 17025 : 2018

BASF – Fire Safety Technology

Test according to NF X 70-100 Partie 1+2 : 2006-04
Fire tests - Analysis of gaseous effluents - Part 1 : methods for analysing gases stemming from thermal degradation
Calculation of CIT-NLP according to DIN EN 45545:2016

Test report No.: 15311 / 56485

3. Material:

Information supplied by client

Ultracur 3D RG 9400 B FR
Order number: ATLaS-2024-5927
Composition: RG9400 B FR Printed on MiiCraft 385.2 Preheated 5h at 40 °C before printing 100um 4mW 2,5s 3min Cleaner+3min IPA 30 min at 40°C 900sDpS (2,5mm)

Additional description by laboratory

4. Samples:

Dimensions (determined by BASF test laboratory):

Length:	75,15	[mm]	Weight:	22,34	[g]
Width:	74,67	[mm]	Weight per unit area:	3,98	[kg/m²]
Thickness:	3,06	[mm]	Density:	1301,02	[kg/m³]
Outer diameter:		[mm]	Remarks:		
Inner diameter:		[mm]			

Pre-conditioning:

	Conditions	Duration days
Client: (information supplied by client)	Standard 23/50 ISO 554	---
Laboratory:	Standard 23/50 ISO 554	8

Sample preparation: Specimen cut out from moulded parts.

Remarks:

BASF – Fire Safety Technology

Test according to NF X 70-100 Partie 1+2 : 2006-04
Fire tests - Analysis of gaseous effluents - Part 1 : methods for analysing gases stemming from thermal degradation
Calculation of CIT-NLP according to DIN EN 45545:2016

Test report No.: 15311 / 56485

5. Test results:

Test of smoke gas toxicity at a temperature of 600 °C

$$CIT_{NLP} = \frac{450\,g}{150\,m^3 \times N} \times \sum_{i=1}^{i=8} \frac{c_i\,mgg^{-1}}{C_i\,mgm^{-3}}$$ With N* = 3: $$CIT_{NLP} = \sum_{i=1}^{i=8} \frac{c_i}{C_i}$$ (*correction factor)

	Concentration, c_i [mg/g]				Reference value, c_i [mg/m³]	c_i / C_i
Sample No.	1	2	3	Avg.		
Init. weight [g]	1,00	1,00	1,00	1,00		
CO_2	989	1032	987	1003	72000	0,01
CO	192	194	189	192	1380	0,14
HF *)	0,26	0,26	0,26	0,26	25	0,01
HCl *)	0,26	0,26	0,26	0,26	75	0,00
HBr *)	0,25	0,25	0,25	0,25	99	0,00
HCN *)	13,24	13,50	13,50	13,42	55	0,24
NO_x *)	0,44	0,44	0,44	0,44	38	0,01
SO_2 *)	0,37	0,37	0,37	0,37	262	0,00
*) Wet analysis carried out by BASF Central Analytics, DAkkS accreditation No. D-PL-14121-02-00. nd = not detected					**CIT_{NLP}: 0,43**	

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BASF – Fire Safety Technology

Test according to NF X 70-100 Partie 1+2 : 2006-04
Fire tests - Analysis of gaseous effluents - Part 1 : methods for analysing gases stemming from thermal degradation
Calculation of CIT-NLP according to DIN EN 45545:2016

Test report No.: 15311 / 56485

Observations:

6. Test equipment:

Test apparatus	PV	0006
Data acquisition	MC	0005
Analyzer	MA	0009
Balance	MW	0009

7. Requirements:

DIN EN 45545-2:2016-02 (equivalent to EN 45545-2:2013 + A1:2015)

Method	Standard	Parameter	HL1	HL2	HL3
Set of requirements: **R22**					
T12	NF X 70-100-1 & 2	CIT_{NLP} (Max.)	1,2	0,9	0,75
Set of requirements: **R23**					
T12	NF X 70-100-1 & 2	CIT_{NLP} (Max.)	---	1,8	1,5