

# Ultracur3D<sup>®</sup> ST 45

Tough | Fast | Clear

## Extended TDS

Complete Technical Documentation  
and Testing Summary



Version: 2.0

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# Technical Data Sheet

## Multi-purpose resin with optimum toughness and processing speed.

General Properties	Norm	Typical Values
Appearance	-	Clear
Viscosity, 25°C	Cone/Plate Rheometer <sup>1)</sup>	320 mPas
Viscosity, 30°C	Cone/Plate Rheometer <sup>1)</sup>	210 mPas
Density (Printed Part)	ASTM D792	1.2 g/cm <sup>3</sup>
Density (Liquid Resin)	ASTM D4052-18a	1.12 g/cm <sup>3</sup>

Tensile Properties <sup>2)</sup>	Norm	Typical Values
E Modulus	ASTM D638	2300 MPa
Ultimate Tensile Strength	ASTM D638	60 MPa
Elongation at Break	ASTM D638	25%

Flexural Properties	Norm	Typical Values
Flexural Modulus	ASTM D790	2400 MPa
Flexural Strength	ASTM D790	110 MPa

Impact Properties	Norm	Typical Values
Notched Izod (Machined), -30°C	ASTM D256	20 J/m
Notched Izod (Machined), 23°C	ASTM D256	30 J/m
Unnotched Izod, 23°C	ASTM D256	509 J/m
Notched Charpy (Machined), 23°C	ISO 179-1	1.3 kJ/m <sup>2</sup>

Thermal Properties	Norm	Typical Values
HDT at 0.45 MPa	ASTM D648	73°C
HDT at 1.82 MPa	ASTM D648	61°C
Glass transition temperature (DMA, tan(d))	ASTM D4065	91°C

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.

Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

The safety data given in this publication is for informational purposes only and does not constitute a legally binding MSDS. The relevant MSDS can be obtained upon request from your supplier or you may contact BASF 3D Printing Solutions GmbH directly at sales@basf-3dps.com.

Thermal Properties	Norm	Typical Values
Flammability	UL 94 (1.5 mm)	HB
Glow-wire Test	IEC 60695-2-12/-13 (2 mm)	GWIT: 650°C GWFI: 625°C

Biocompatibility	Norm	Typical Values
Cytotoxicity – Neutral Red	ISO 10993-5 (2009)	PASS <sup>4)</sup>
Human Skin Irritation <sup>3)</sup>	ISO 10993-10 (2013)	PASS <sup>4)</sup>
In Vivo Sensitization – Local Lymph Node Assay	ISO 10993-10 (2013); OECD Guideline No. 429	PASS <sup>4)</sup>
In Vitro Skin Irritation	OECD Guideline No. 439	PASS <sup>4)</sup>

Other	Norm	Typical Values
Hardness Shore D	ASTM D2240	80
Water Absorption, Short-Term (24 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>
- 2) Tensile type ASTM D638 type IV, Pulling speed 5 mm/min
- 3) Patch test on 30 volunteers
- 4) For the statement on Biocompatibility data see Chapter: [Biocompatibility](#).
- 5) 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 80 x 4 x 10 mm, ASTM D256 63 x 3.2 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 1.5 x 13 mm, IEC 60695-2-12/-13 60 x 2 x 60 mm.

## International Material Data System (IMDS)

This material is listed in the IMDS (International Material Data System), which contains information on materials used in the automotive industry. Access to the database can be granted on request by sharing the IMDS ID with us ([sales@basf-3dps.com](mailto:sales@basf-3dps.com)).

## 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](#).

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# 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.

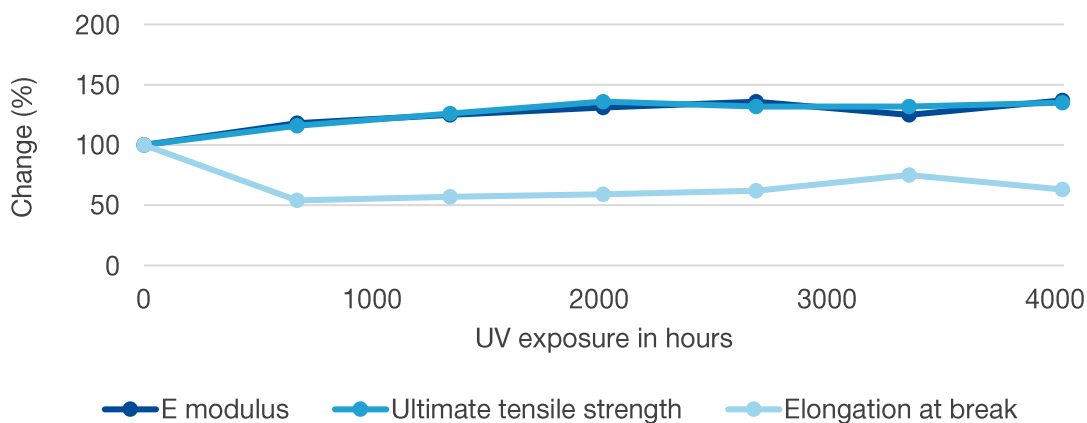
## Test Method and Specimens

The ageing tests were performed with ISO 527-2 Type 5A tensile bars and color cones as per ISO 4892-2:2013 method B, cycle 1.

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/m <sup>2</sup>	Narrowband (340 nm) in W/(m <sup>2</sup> nm)			
1	Continuously dry	50 ± 2	1.10 ± 0.02	65 ± 3	38 ± 3	50 ± 10

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

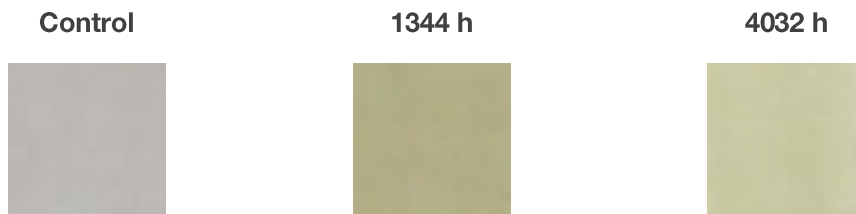
## Mechanical Testing



Change in mechanical properties after accelerated weathering

## Coloration

After being exposed up to 4000 hours, visible yellowing can be seen.



*Effect of UV exposure on color of the specimens*

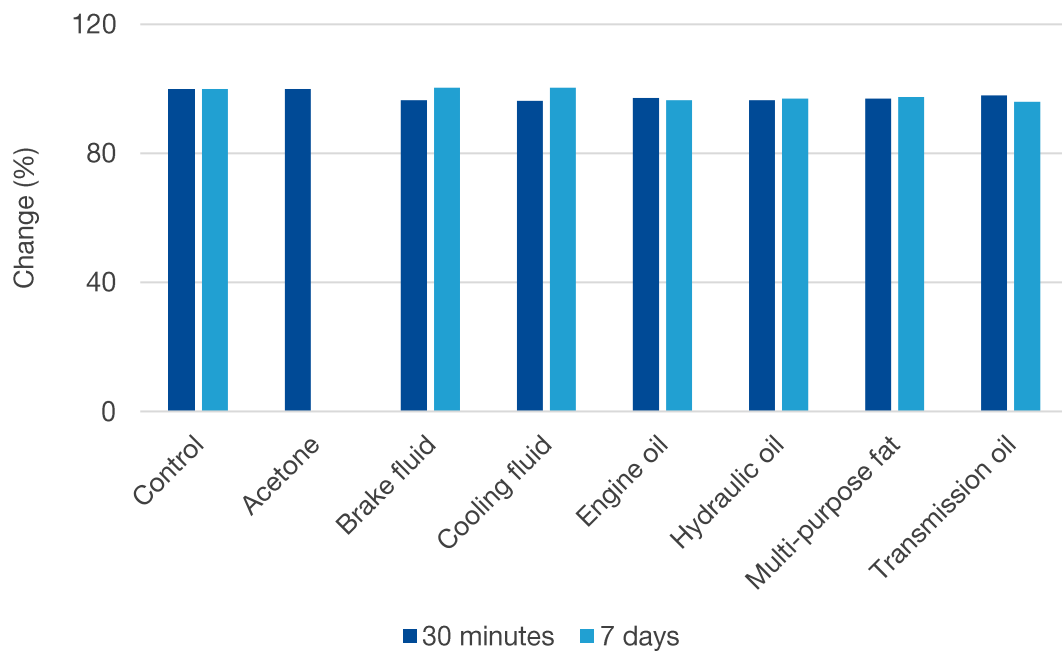
# Industrial Chemical Resistance

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.

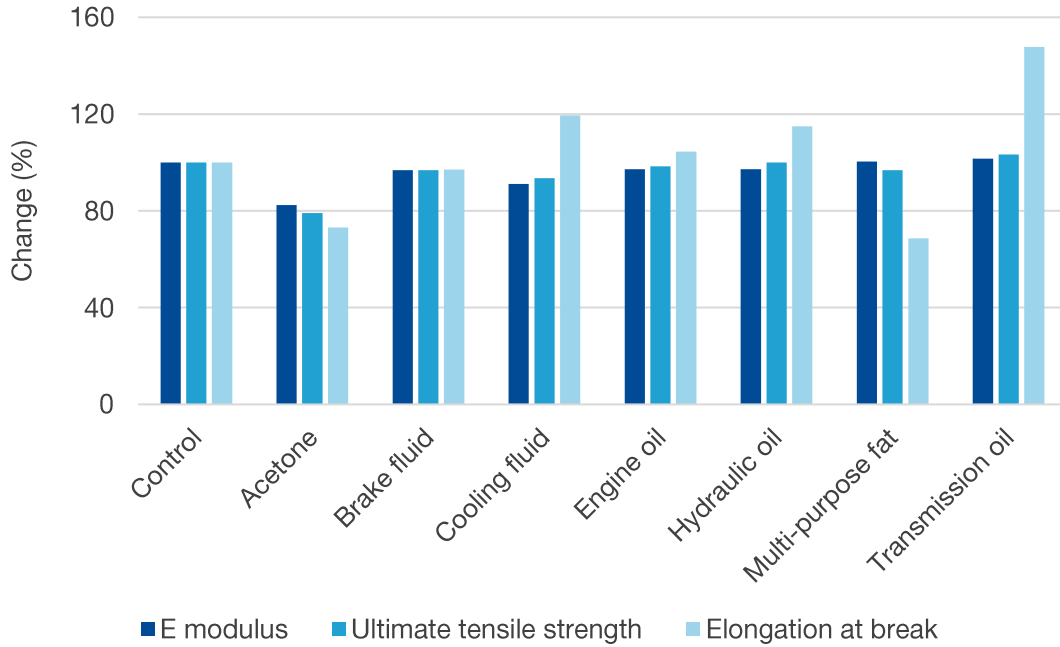
## Weight Measurement



*Change in weight after immersion time*

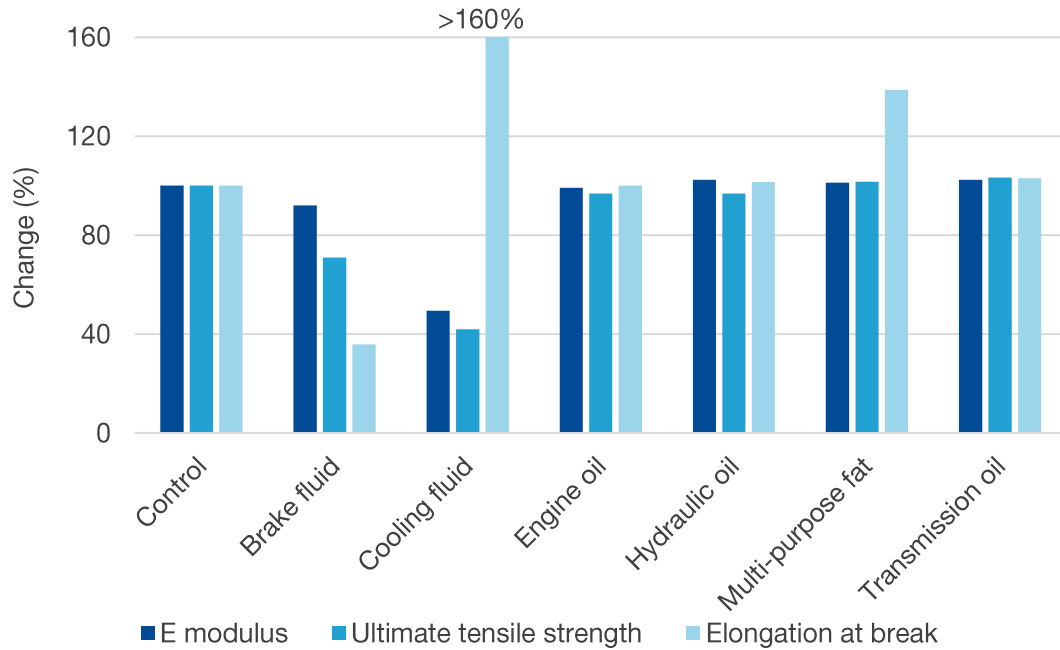
## Mechanical Testing

### 30 minutes



Change in mechanical properties after 30 minutes immersion

### 7 days



Change in mechanical properties after 7 days immersion

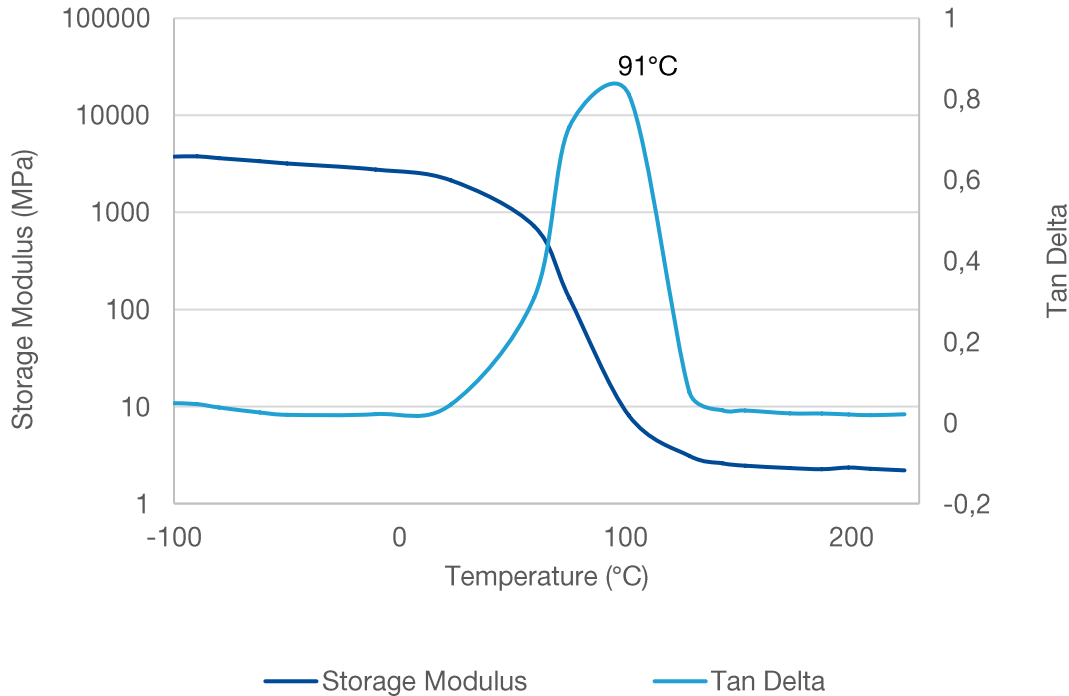


# Dynamic Mechanical Analysis (DMA)

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	0.019% (linear viscoelastic regime)
Type of loading	Dual cantilever
Frequency	1 Hz

*Testing conditions DMA*



*DMA curve*

# Biocompatibility

**Product: Ultracur3D® ST 45**

Revision: 03<sup>rd</sup> of December 2020

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**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))

**In Vitro Skin Irritation Testing:**

(OECD Guideline No. 439)

**Human Skin Irritation Test:**

(ISO 10993-10 (2013))<sup>6)</sup>

**In Vivo Sensitization Testing- Local Lymph Node Assay:**

(ISO 10993-10 (2013); OECD Guideline No. 429)

<sup>6)</sup> Patch test on 30 volunteers.

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.

**For notice:**

We give no warranties, expressed or implied, concerning the suitability of above-mentioned product for use in any medical device and pharmaceutical applications. All information contained in this document is given in good faith and is based on sources believed to be reliable and accurate at the date of publication of this document.

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# Sterilization

Sterilization is an essential requirement in many applications especially when used in the medical field. Testing not only ensures the material quality but also determines how effectively the chosen sterilization process is eliminating potential microorganisms.

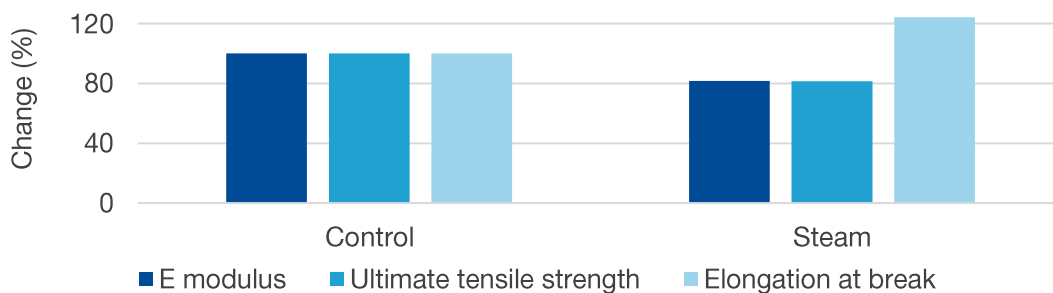
## Test Method and Specimens

### Steam Sterilization

Steam sterilization parameters	Settings
Vacuum pulses	4
Temperature	134°C
Pressure	210 kPa
Holding time	4 minutes
Drying time	20 minutes

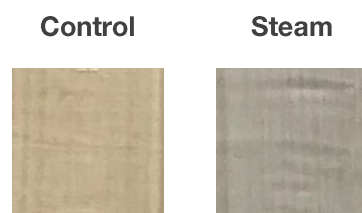
*Testing conditions steam sterilization*

### Mechanical Testing



*Change in mechanical properties after sterilization*

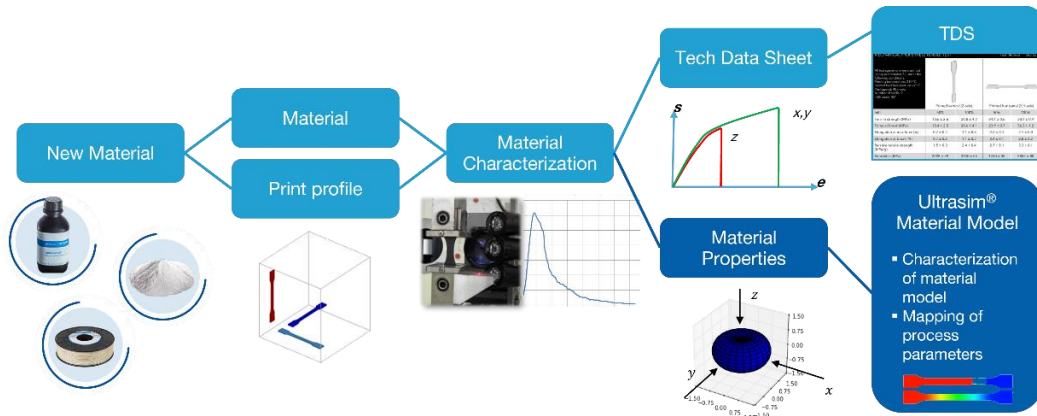
### Coloration



*Color samples before and after sterilization*

# Material Model & FEA Simulation

3D simulation helps to speed up the engineering process using a digital twin. We offer 3 easy methods to get started. Support is available on request ([ultrasim3d-support@basf-3dps.com](mailto:ultrasim3d-support@basf-3dps.com)).



Material modeling workflow

Raw Material Data	3D Simulation	Material Model as a Service
<p><b>Starter:</b> Get the curves behind our TDS data to start basic simulation work.</p>	<p><b>Premium:</b> We run the simulation for you. We help you to speed up your engineering process and increases confidence in part performance using a digital twin of your part.</p>	<p><b>Enterprise:</b> Use our in-house developed material models for 3D-Printing incl. anisotropy of the process and FEA support of our experienced virtual engineers.</p> <ul style="list-style-type: none"> <li>Anisotropic</li> <li>Nonlinear</li> <li>Strain-rate sensitive</li> <li>Tensile-compression asymmetry</li> <li>Failure modelling</li> <li>Temperature dependent</li> </ul>

Ultrasim® 3D simulation (FEA)

	Available temperatures			Strain rate / loads	
	Low	23°C	High	Quasi static	High speed
<b>Ultracur3D® ST 45</b>		●		●	

- Validated, available as Material Data Set (Can be converted into a Ultrasim® Material Model)
- Validated, available via Ultrasim® Material Model
- Preliminary

Simulation material availability

