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Ultracur3D® RG 3280

Rigid | HDT 280 | Ceramic-Filled

Extended TDS

Complete Technical Documentation and Testing Summary

Version: 3.1

Contents

Technical Data Sheet

Ceramic-filled resin with exceptionally high stiffness and temperature resistance.

General Properties	Norm	Typical Values
Appearance	-	White
Ceramic content	-	≈ 65 wt% silica
Viscosity, 25°C	Cone/Plate Rheometer[1)]	300 mPas
Viscosity, 30°C	Cone/Plate Rheometer[1)]	230 mPas
Density (Printed Part)	ASTM D792	1.73 g/cm³
Density (Liquid Resin)	ASTM D4052-18a	1.65 g/cm³

Tensile Properties[2)]	Norm	Typical Values	
		(UV)	(UV + Thermal[3)])
E Modulus	ASTM D638	10600 MPa	10500 MPa
Ultimate Tensile Strength	ASTM D638	87 MPa	85 MPa
Elongation at Break	ASTM D638	1.3%	1%
Poisson's Ratio	ISO 527-2	0.31	-

Flexural Properties	Norm	Typical Values (UV)
Flexural Modulus	ASTM D790	8780 MPa
Flexural Strength	ASTM D790	73 MPa

Impact Properties	Norm	Typical Values (UV)
Notched Izod (Machined), 23°C	ASTM D256	24 J/m
Notched Charpy (Machined), 23°C	ISO 179-1	0.98 kJ/m²

Thermal Properties	Norm	Typical Values	
		(UV)	(UV +Thermal[3])
HDT at 0.45 MPa	ASTM D648	284°C	284°C
HDT at 1.82 MPa	ASTM D648	132°C	162°C
Flammability	UL 94 (1.8 mm)	HB	-
Glass transition temperature (DMA, tan(d))	ASTM D4065	168°C	171°C

Advanced Thermal Properties	Norm	Typical Values (UV)
C.T.E. (-45°C to 0°C)	ASTM E831	23.2 µm/(m·K)
C.T.E. (0°C to 50°C)	ASTM E831	30.2 µm/(m·K)
C.T.E. (50°C to 100°C)	ASTM E831	61.4 µm/(m·K)
C.T.E. (100°C to 150°C)	ASTM E831	56.8 µm/(m·K)
Thermal conductivity, 23°C[4]	MTPS	0.47 W/(m·K)
Thermal conductivity, 200°C[4]	MTPS	0.69 W/(m·K)
Specific heat capacity, 23°C[5]	MTPS	1.01 J/(g·K)
Specific heat capacity, 200°C[5]	MTPS	1.81 J/(g·K)

Dielectric/Electric Properties	Norm	Typical Values (UV)
Dielectric Strength	DIN EN 60243-1	29 kV / mm
Volume resistivity	DIN EN 62631-3-1	2.80E+16 Ωcm
Surface resistivity	DIN EN 62631-3-2	3.40E+16 Ω

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

Other	Norm	Typical Values (UV)
Hardness Shore D	ASTM D2240	96
Volatile content, outgassing in vacuum (125°C, 24 hours)	ASTM E595-15	PASS (mass loss <0.1%)
Water Absorption, Short-Term (24 hours)	ASTM D570	0.29%
Water Absorption, Long-Term (>3000 hours)	ASTM D570	2.60%

Mechanical properties overview

1) Determined with TA-Instrument DHR rheometer, cone/plate, diameter 60 mm, shear rate 100 s^{-1}. Remark: since this is a resin with a high loading of solid particles, the viscosity is strongly dependent on shear rate. If another shear rate is used, or a viscometer where the shear rate is less defined, viscosity values different from the ones reported here may be obtained.
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) Data at intermediate temperatures, as well as thermal effusively data are available on request
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 80 x 4 x10 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, ASTM E595-15 50 x 50 x 50 mm. Samples for ASTM D638 and ASTM D648 were cleaned using IPA wipes.

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.

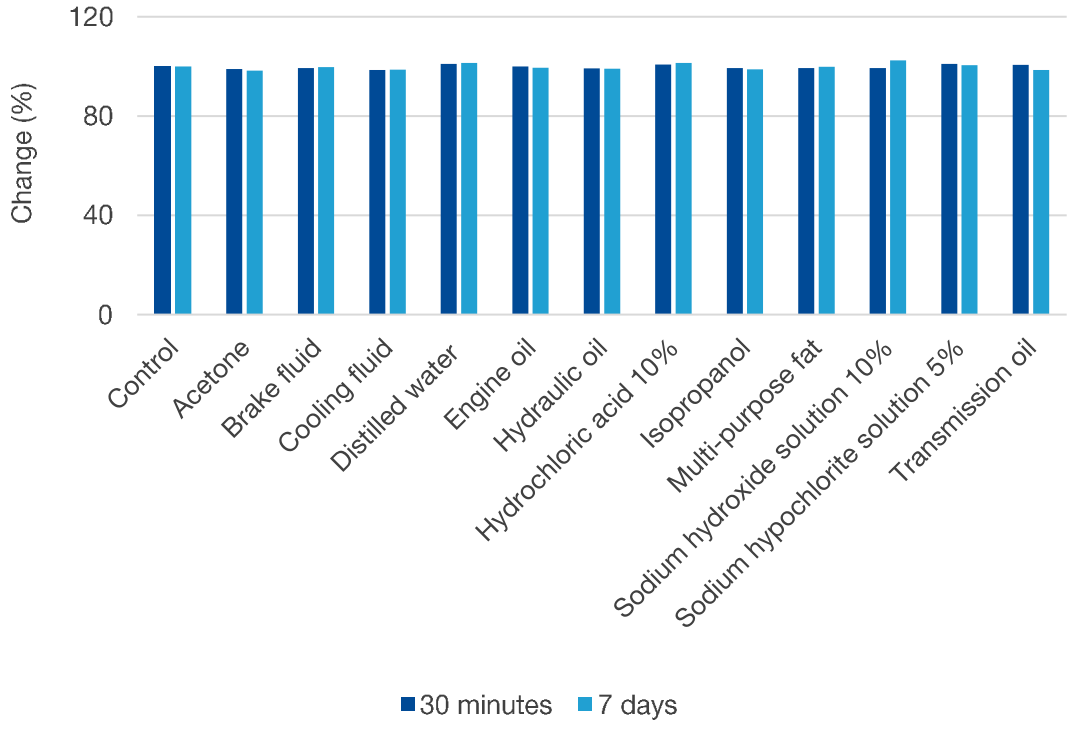
Industrial Chemical Resistance

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.

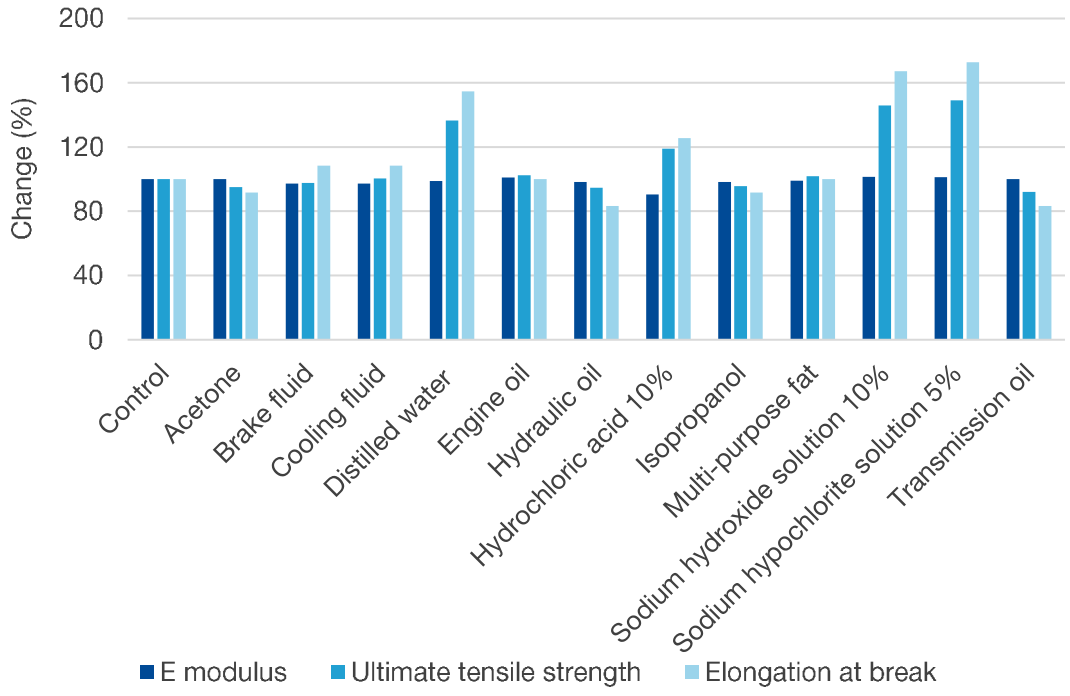
Weight Measurement



Change in weight after immersion time

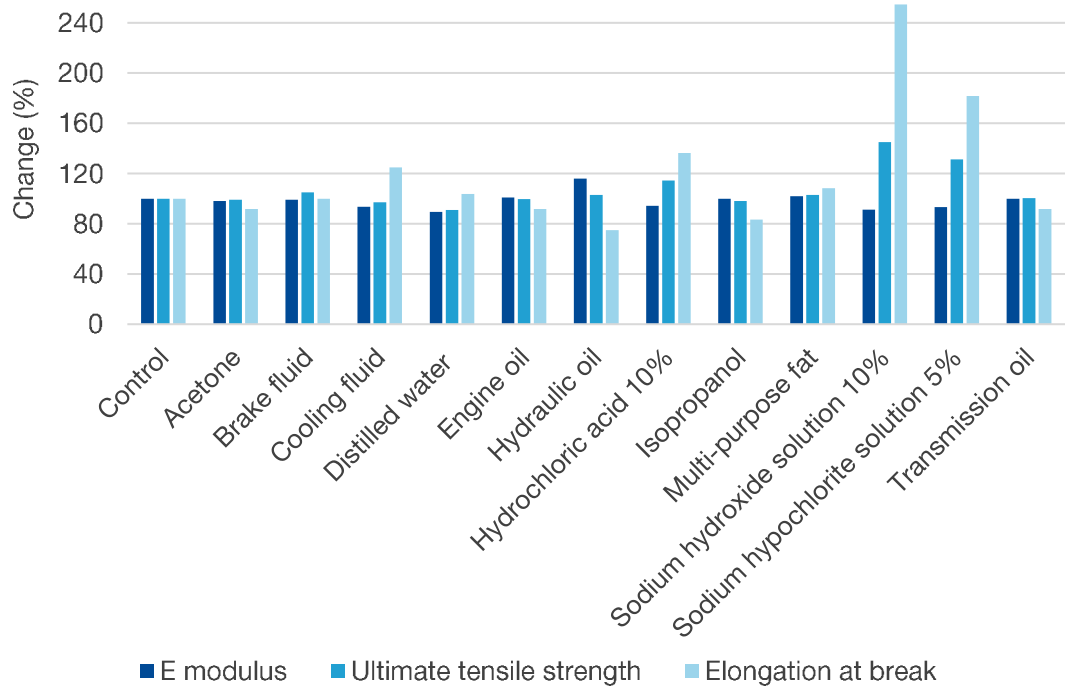
Mechanical Testing

30 minutes



Change in mechanical properties after 30 minutes immersion

7 days



Change in mechanical properties after 7 days immersion

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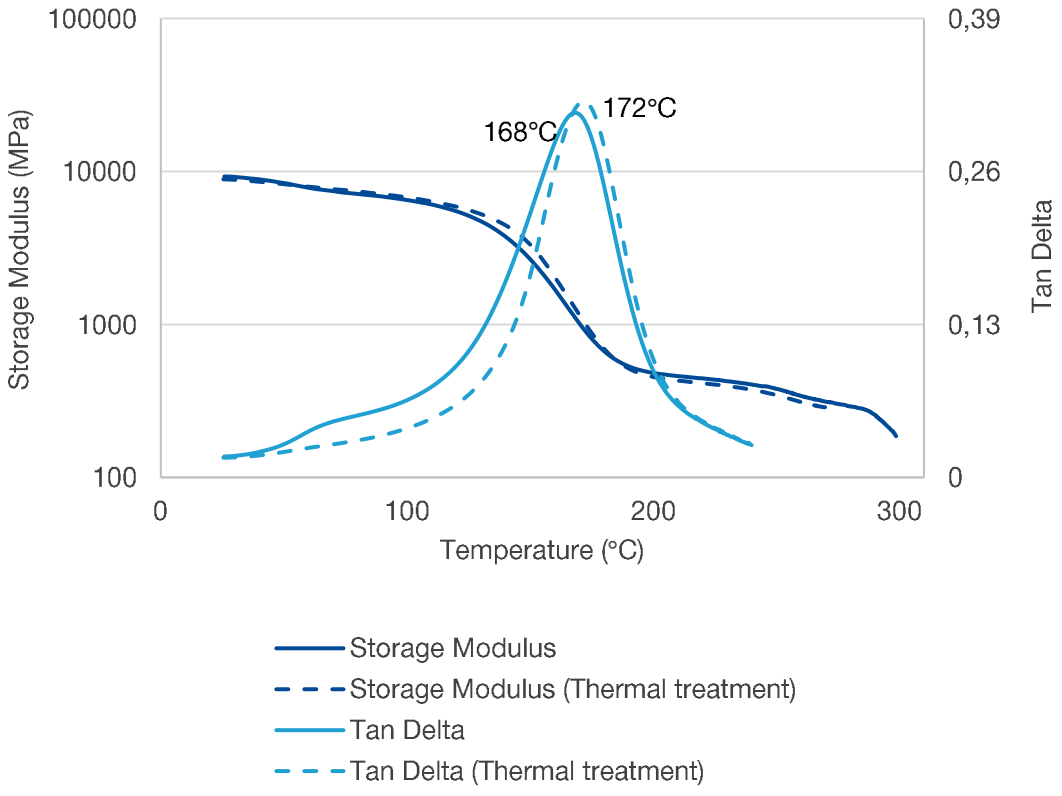
Dynamic Mechanical Analysis (DMA)

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	0.014% (linear viscoelastic regime)
Type of loading	Dual cantilever
Frequency	1 Hz

Testing conditions DMA



DMA curve

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Biocompatibility

Product: Ultracur3D® RG 3280

Revision: 27th of February 2023

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))

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.

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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.

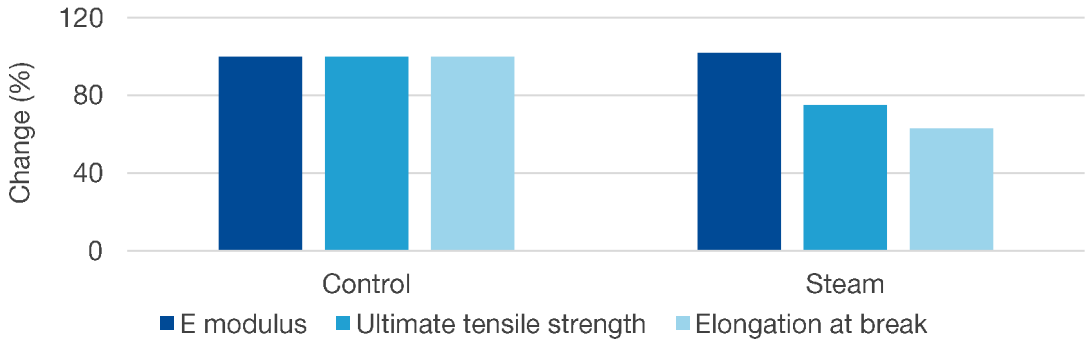
Test Method and Specimens

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

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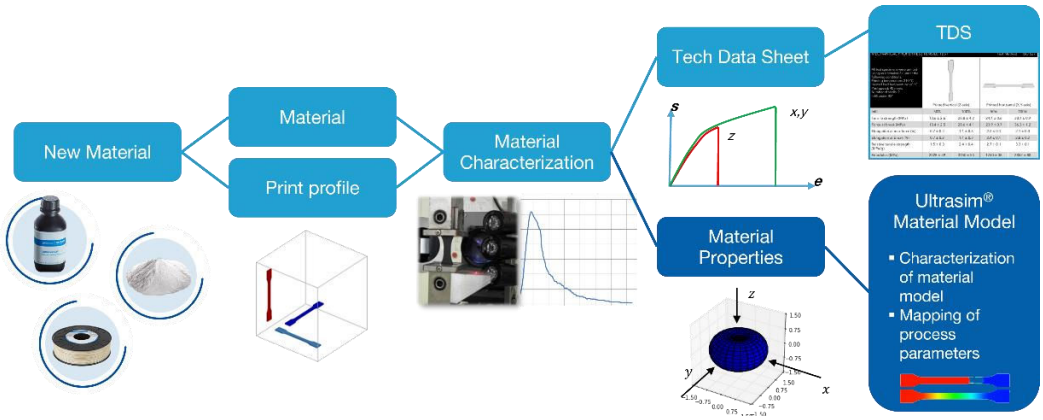
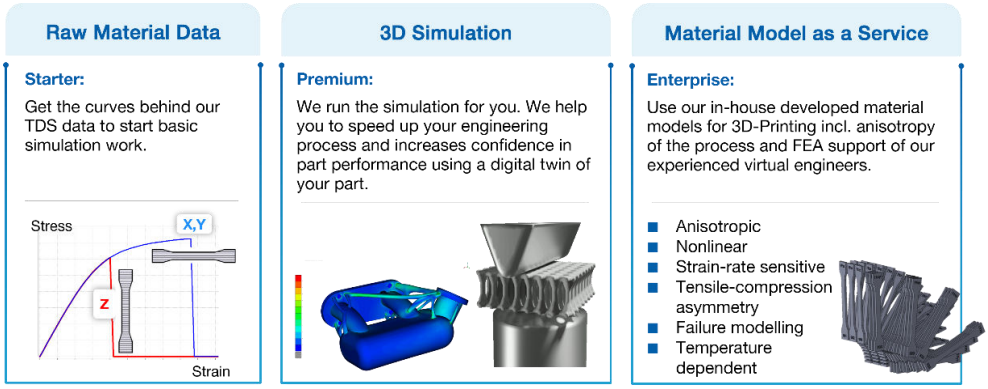
Material Model & FEA Simulation

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).



Material modeling workflow



Ultrasim® 3D simulation (FEA)

	Available temperatures			Strain rate / loads	
	Low	23°C	High	Quasi static	High speed
Ultracur3D® RG 3280		●	●	●	

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

● Validated, available via Ultrasim® Material Model

○ ○ Preliminary

Simulation material availability