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Ultracur3D® ST 1400

Tough | High Impact | Clear

Extended TDS

Complete Technical Documentation and Testing Summary

Version: 3.0

Contents

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

Technical Data Sheet

Multi-purpose resin with superior toughness and durability.

General Properties	Norm	Typical Values
Appearance	-	Clear
Viscosity, 25°C	Cone/Plate Rheometer[1)]	390 mPas
Viscosity, 30°C	Cone/Plate Rheometer[1)]	280 mPas
Density (Printed Part)	ASTM D792	1.2 g/cm³
Density (Liquid Resin)	ASTM D4052-18a	1.12 g/cm³

Tensile Properties[2)]	Norm	Typical Values
E Modulus	ASTM D638	1900 MPa
Ultimate Tensile Strength	ASTM D638	45 MPa
Elongation at Break	ASTM D638	43%

Flexural Properties	Norm	Typical Values
Flexural Modulus	ASTM D790	1540 MPa
Flexural Strength	ASTM D790	80 MPa

Impact Properties	Norm	Typical Values
Notched Izod (Machined), 23°C	ASTM D256	43 J/m
Unnotched Izod, 23°C	ASTM D256	930 J/m
Notched Charpy (Machined), 23°C	ISO 179-1	4.6 kJ/m²

Thermal Properties	Norm	Typical Values
HDT at 0.45 MPa	ASTM D648	57°C
HDT at 1.82 MPa	ASTM D648	48°C
Glass transition temperature (DMA, tan(d))	ASTM D4065	75°C

Biocompatibility	Norm	Typical Values
Cytotoxicity – Neutral Red	ISO 10993-5 (2009)	PASS[4)]
Cytotoxicity – MTT	ISO 10993-5 (2009)	PASS[4)]
Human Skin Irritation[3)]	ISO 10993-10 (2013)	PASS[4)]
In vitro Sensitization Testing-KeratinoSens™	prEN ISO 10993-10 (2020)	PASS[4)]

Other	Norm	Typical Values
Hardness Shore D	ASTM D2240	78
Water Absorption, Short-Term (24 hours)	ASTM D570	0.33%
Water Absorption, Long-Term (>600 hours)	ASTM D570	>5%

Mechanical properties overview

1) Determined with TA-Instrument DHR rheometer, cone/plate, diameter 60 mm, shear rate 100 s^{-1}
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 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

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.

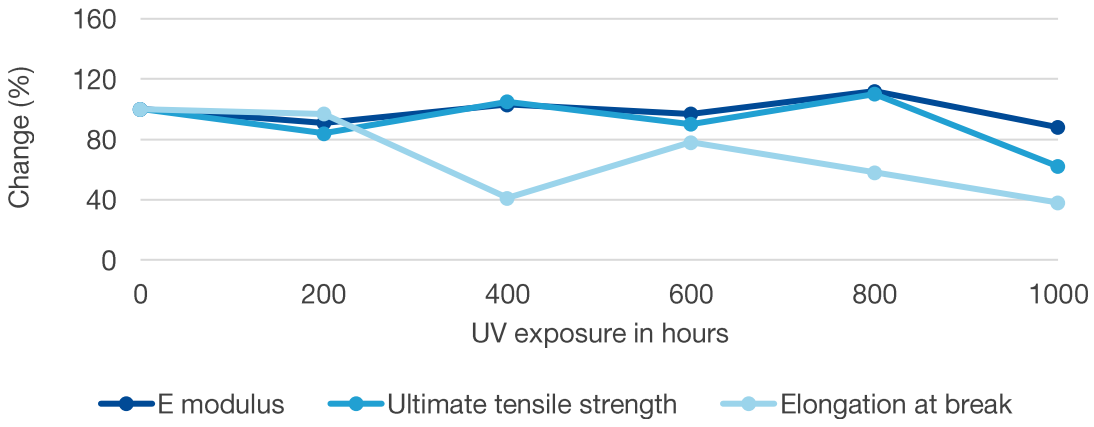
Test Method and Specimens

The ageing tests were performed with ASTM D638 type IV tensile bars and color cones as per ISO 4892-2:2013 method A, 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/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

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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
E modulus	1880 MPa	1650 MPa
Ultimate tensile strength	45 MPa	28 MPa
Elongation at break	43%	16%

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, the color shows some yellowing but overall stays fairly stable.

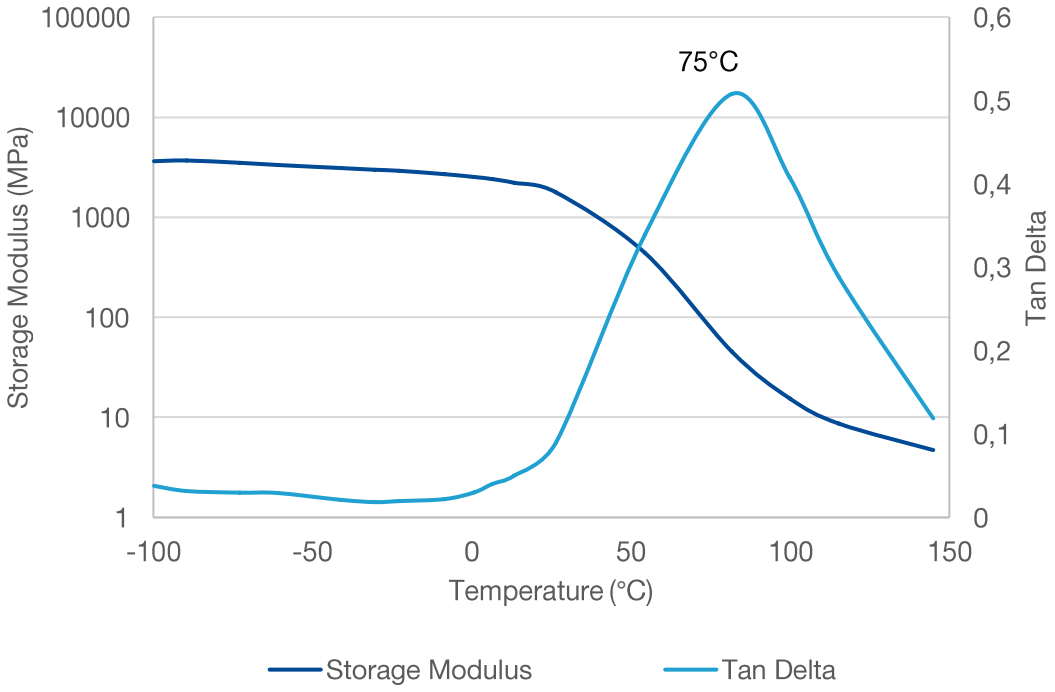
Effect of UV exposure on color of the specimens

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 1400

Revision: 02nd of May 2022

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))

Cytotoxicity Testing- MTT:

(ISO 10993-5 (2009))

Human Skin Irritation Test:

(ISO 10993-10 (2013))[6)]

In vitro Sensitization Testing- KeratinoSens™

(prEN ISO 10993-10 (2020))

6) 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.

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.

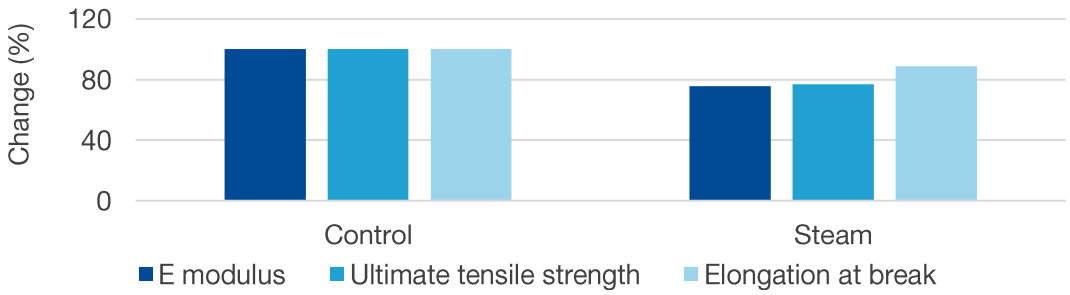
Test Method and Specimens

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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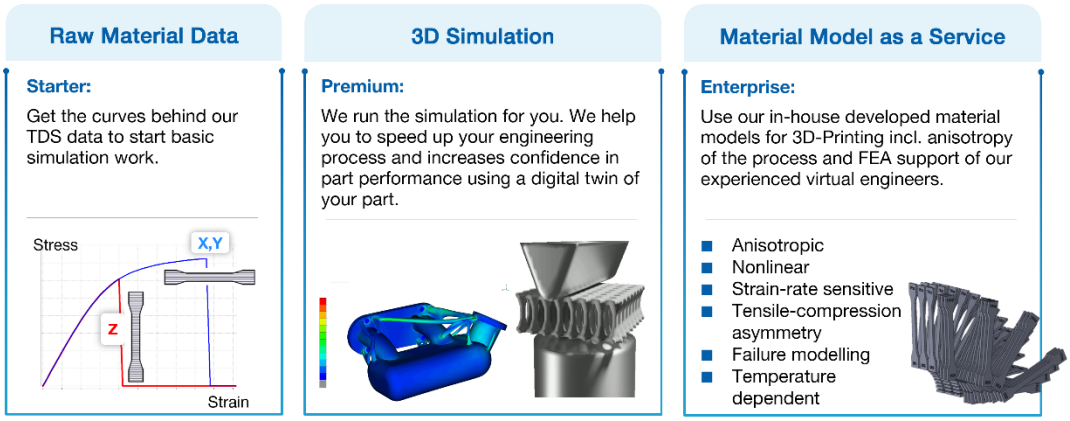
Material Model & FEA Simulation

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.

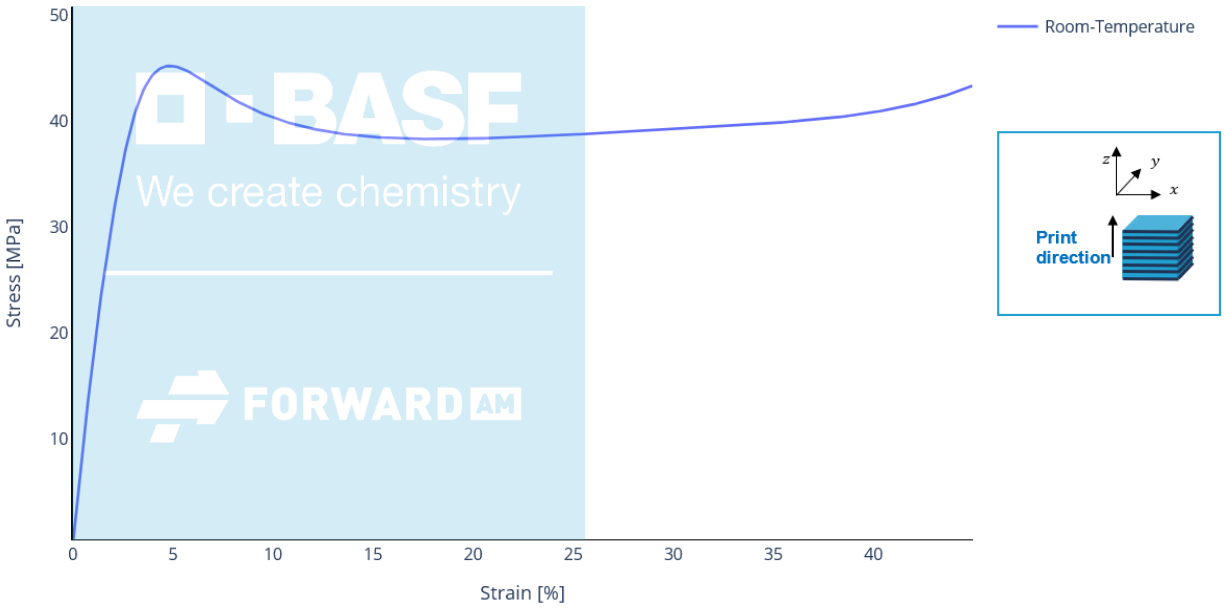
We can support you with 3D simulation in different ways, ranging from simply supplying you with raw test data, to doing the full simulation for you. These are the 3 options we offer:



For Ultracur3D® ST 1400, below you can find some of the data 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® ST 1400		●		●	

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



Stress-strain response of Ultracur3D® ST 1400 under quasi static load, loaded in x direction, at room temperature.

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)