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# Ultracur3D® SLA 7700

## SLA | General-Purpose | Ultraclear

# Extended TDS

## Complete Technical Documentation and Testing Summary

Version 2.0

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# Technical Data Sheet

## General-Purpose SLA resin, easy-to-print and exceptional part clarity.

| General Properties | Method | Typical Values |
|---|---|---|
| Appearance | - | Ultraclear |
| Viscosity, 25°C | Cone/Plate Rheometer[1)] | 490 mPas |
| Viscosity, 30°C | Cone/Plate Rheometer[1)] | 330 mPas |
| Density (Printed Part) | ASTM D792 | 1.15 g/cm³ |
| Density (Liquid Resin) | ASTM D4052-18a | 1.11 g/cm³ |

| Tensile Properties[2)] | Method | Typical Values |
|---|---|---|
| E Modulus | ASTM D638 | 2250-2550 MPa |
| Ultimate Tensile Strength | ASTM D638 | 46-51 MPa |
| Elongation at Break | ASTM D638 | 5-15% |

| Flexural Properties | Method | Typical Values |
|---|---|---|
| Flexural Modulus | ASTM D790 | 2250-2450 MPa |
| Flexural Strength | ASTM D790 | 85-90 MPa |

| Impact Properties | Method | Typical Values |
|---|---|---|
| Notched Izod (Machined), 23°C | ASTM D256 | 25 J/m |
| Unnotched Izod, 23°C | ASTM D4812 | 417 J/m |
| Notched Charpy (Machined), 23°C | ISO 179-1 | 1.77 kJ/m² |

| Thermal Properties | Method | Typical Values |
|---|---|---|
| HDT at 0.45 MPa | ASTM D648 | 51°C |
| HDT at 1.82 MPa | ASTM D648 | 50°C |
| Glass transition temperature (DMA, tan(d)) | ASTM D4065 | 61°C |

| Advanced Thermal Properties | Method | Typical Values |
|---|---|---|
| C.T.E. (-45°C to 0°C) | ASTM E831 | 62 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 | 181 µm/(m·K) |
| C.T.E. (100°C to 150°C) | ASTM E831 | 169 µm/(m·K) |

| Dielectric/Electric Properties | Method | Typical Values |
|---|---|---|
| Dielectric Strength | DIN EN 60243-1 | 34 kV/mm |

| Other | Method | Typical Values |
|---|---|---|
| Hardness Shore D | ASTM D2240 | 80 |
| Water Absorption, Short-Term (24 hours) | ASTM D570 | 0.36% |
| Water Absorption, Long-Term (>2500 hours) | ASTM D570 | 2.16% |

*Mechanical properties overview*

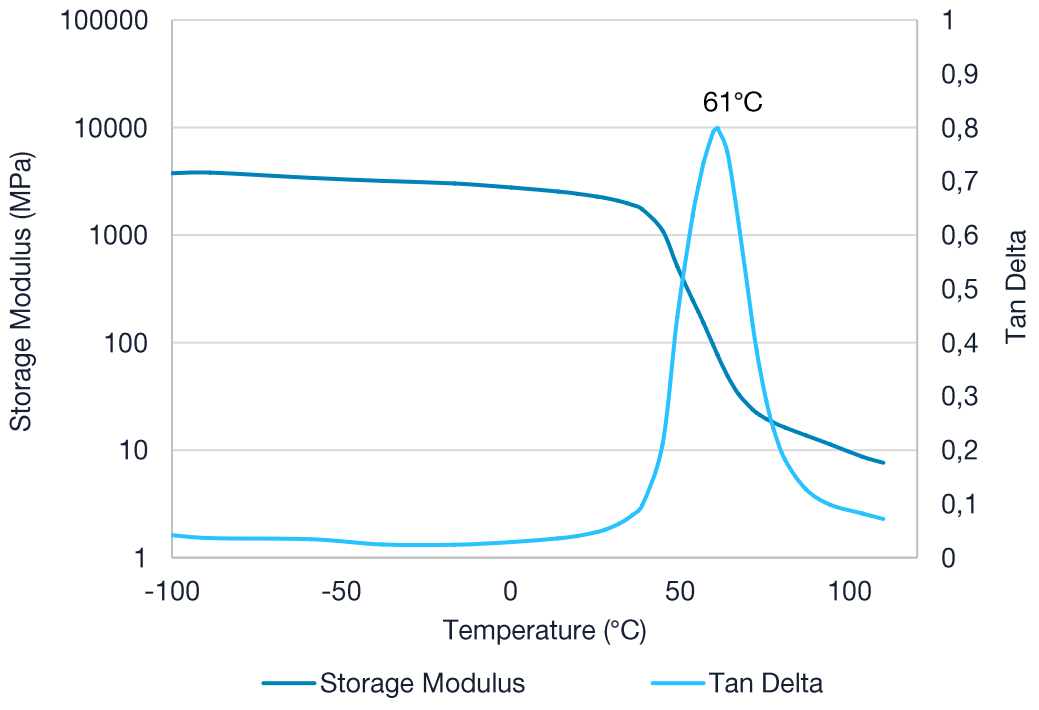
1) Determined with TA-Instrument DHR rheometer, cone/plate, diameter 60 mm, shear rate 100 $s^{-1}$
2) Tensile type ASTM D638 type IV, Pulling speed 5 mm/min
3) Data ranges are given because for SLA materials, there is a strong influence of the exact process used (printer, print settings and postprocessing) and properties may also still change during the first 1-2 weeks after printing. In our experience, this is mainly evident in tensile and flexural properties, not so much in the other properties listed above.
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 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.

# 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 | 0.028% (linear viscoelastic regime) |
| Type of loading | Dual cantilever |
| Frequency | 1 Hz |

*Testing conditions DMA*




*DMA curve*

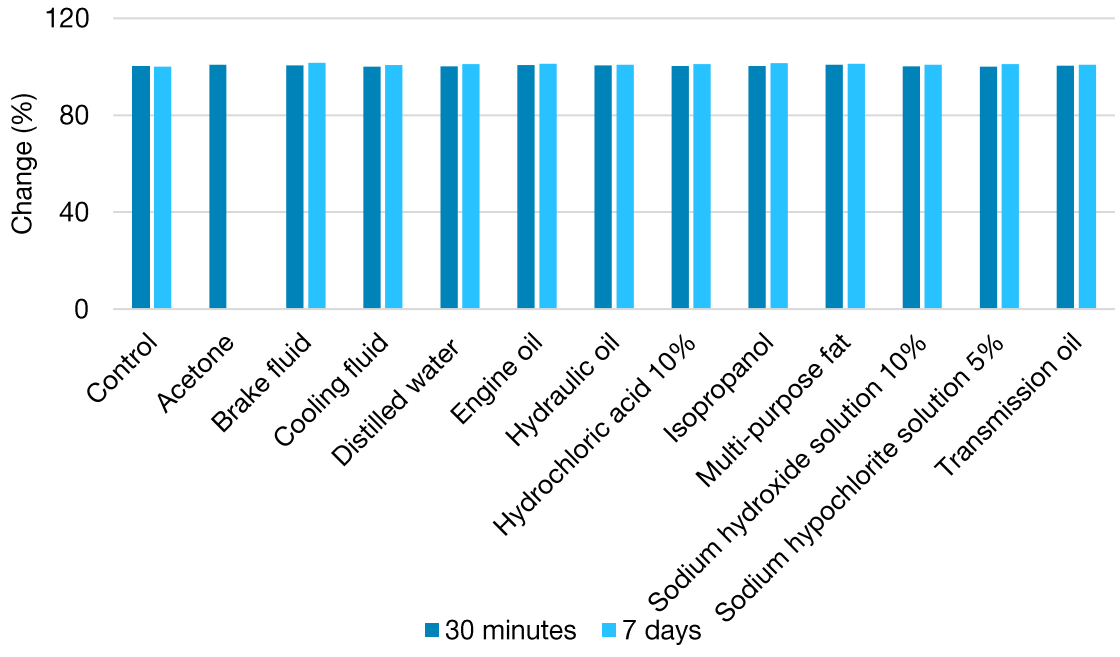
# Industrial Chemical Resistance

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, conditioned for 24 hours at 22°C before measuring the weight and the mechanical properties.

## Weight Measurement




*Change in weight after immersion time*



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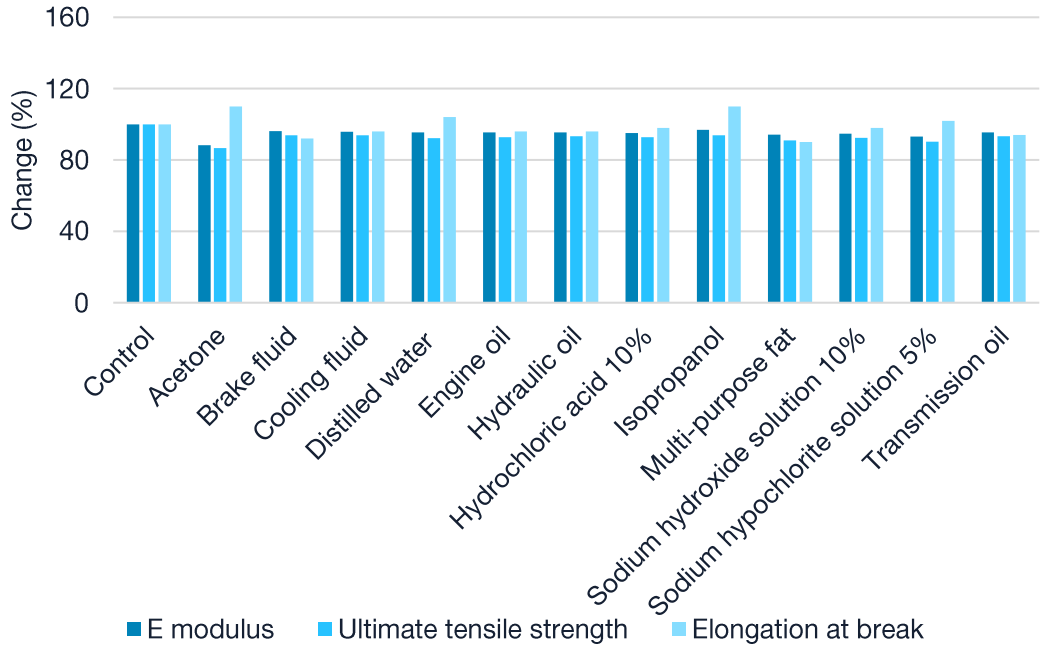
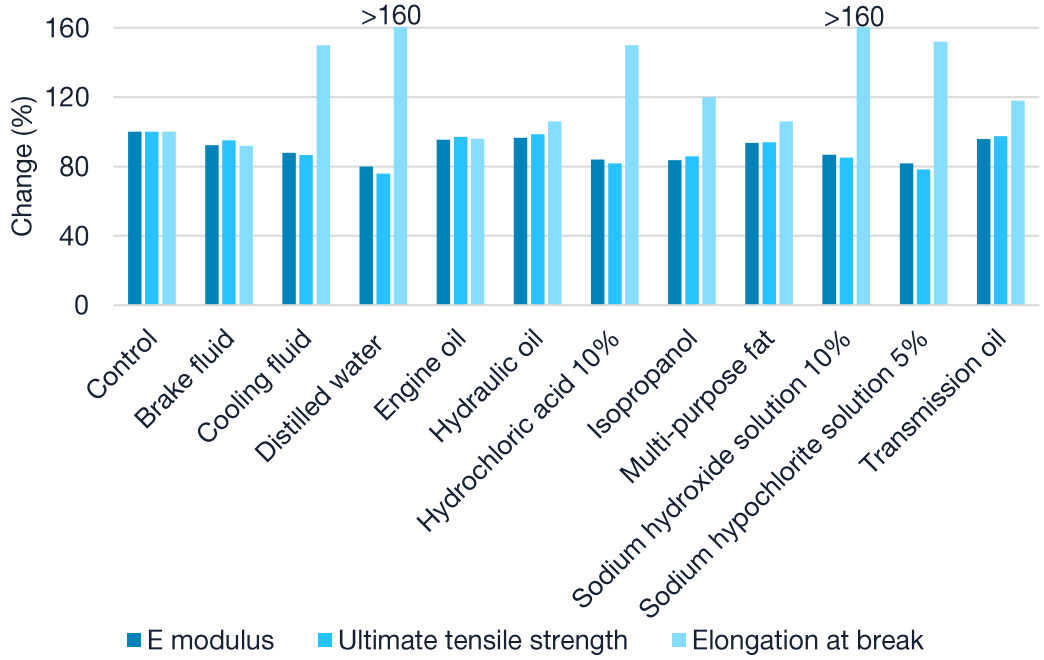
## Mechanical Testing

### 30 minutes




*Change in mechanical properties after 30 minutes immersion*

### 7 days




*Change in mechanical properties after 7 days immersion*

# 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.

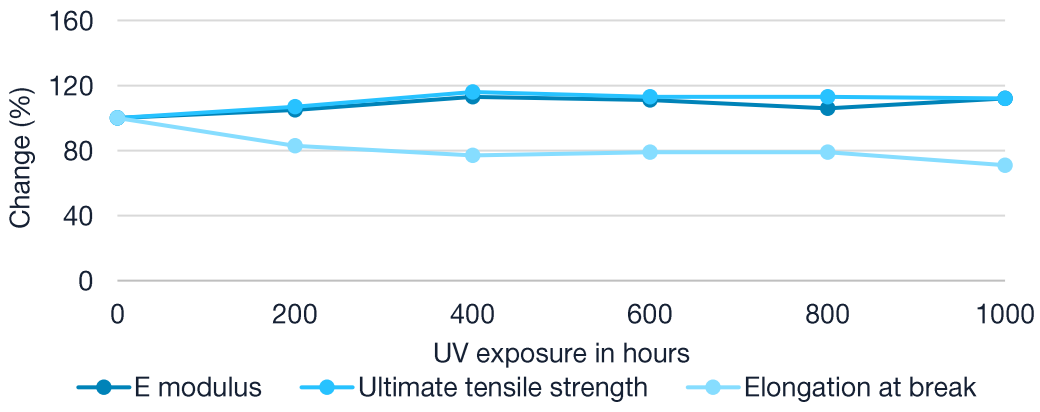
## Test Method and Specimens

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. 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*



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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 | 2450 MPa | 2740 MPa |
| Ultimate tensile strength | 47 MPa | 53 MPa |
| Elongation at break | 5.2 % | 3.7 % |

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

## Coloration

Similar to other epoxy acrylate-based SLA materials, the color of the material changes with time. If color stability is important for your application, we recommend using a transparent UV protective coating.



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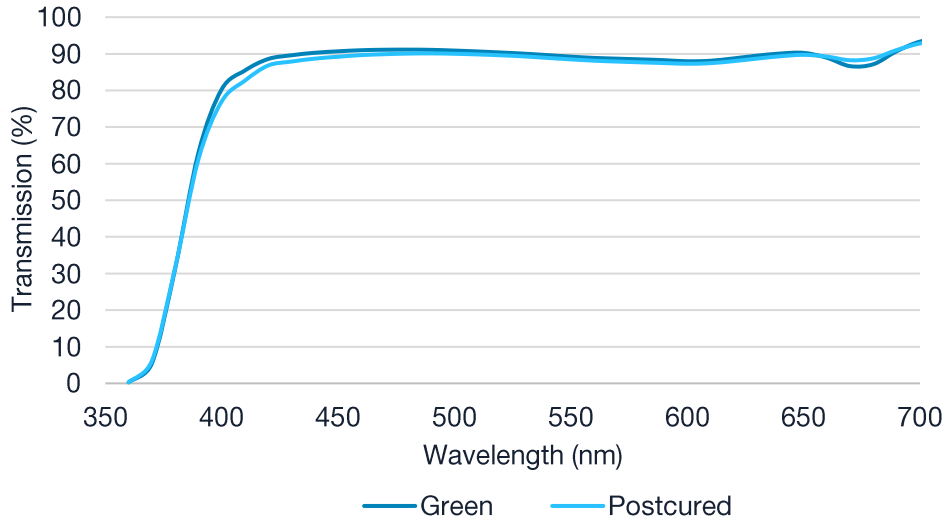
# Part color and clarity

Having truly transparent material can enable many specific prototyping and end-use applications. There are various ways to quantify the optical clarity of a material.

## Visible light transmission

This test looks at the light transmission of printed parts (thickness 3 mm) across the entire visual spectrum. In this scale, 0% transmission means completely opaque, no light is transmitted, whereas 100% means entirely clear, transmitting all light. The below results show that the transmission is around 90% for the entire visible light spectrum (400 to 700 nm), indicating a very high material clarity.




*Change in transmission across the entire visual spectrum*

## L*a*b* color measurement and stability over time

Another way to quantify part color and clarity is through an L*a*b* color measurement:

- L* represents lightness, ranging from black at 0 and white at 100.
- a* represents the red/green color specification, a value of 0 means neutral, negative a* is green and positive a* is red.
- b* represents the yellow/blue color specification, a value of 0 means neutral, negative b* is blue and positive b* is yellow.



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The L*a*b* values of the parts (thickness 3 mm) were measured directly after the printing. In addition, these parts were measured again after 5 weeks in office daylight to check the change in color of the specimens with time. No other extra post processing like polishing or coating was done. The measured values indicate a very clear, neutral color. In addition, the color difference (Delta E) calculated between the two data points is 1.32. Values below 2 are generally considered as not perceptible by regular observation, in this case indicating good color stability over time.

| Property | Directly after printing and post curing | After 5 weeks |
|---|---|---|
| L* | 95.44 | 95.39 |
| a* | -0.85 | -0.84 |
| b* | 1 | -0.32 |



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