Long term UV tests on
Ultracur3D® ST 7500 G

This document is intended to provide guidance for manufacturers regarding ageing of the 3D printed materials under Ultraviolet radiation or UV. BASF3D Printing Solutions GmbH has performed specific ageing tests for the material Ultracur3D® ST 7500 G. Indications on material changes that can occur during the ageing process were studied. 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

Material
Ultracur3D® ST 7500 G

Norm

The Ageing tests were performed at BASF lab as per the ISO Norm ISO 4892-2:2013 Method A. The specimens were kept under UV light in the range of 300 – 400 nm and intensity of 60 W/cm^2. The parts were kept at 38°C with 50% relative humidity. The parts were kept inside the chamber for up to 1000 hours. This method refers to artificial weathering condition where water is sprayed on the specimens at regular intervals. In addition to the UV exposure, the parts were exposed to 18 minutes of water spray followed by 102 minutes of dry phase. The table below describes the testing conditions.

Table 1 Testing conditions for ISO 4892-2 method A

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^2	Narrowband (340 nm) in W/(m^2 nm)			
1	102 min dry 18 min water spray	60 ± 2 60 ± 2	0.51 ± 0.02 0.51 ± 0.02	65 ± 3 -	38 ± 3 -	50 ± 10 -

Test Specimens

30 tensile bars and 18 color cones were printed with the material and were kept under high intensity UV light for longer period. The parts were also exposed to periodic water sprays as described above. After the tensile bars were inside the UV oven for a stipulated time, the change in color as well as the mechanical properties like E modulus, Tensile strength and Elongation at break were measured. The tensile bars were used for mechanical testing and color cones were used to determine the color after Prolonged UV exposure.

Figure 1 Tensile bar

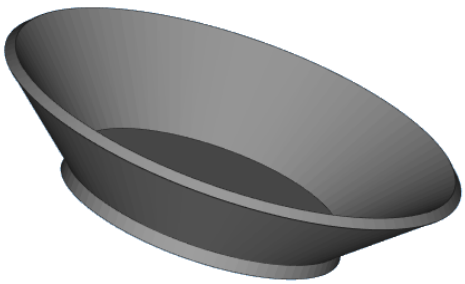

Figure 2 Color cone

Mechanical testing

When looking at the mechanical properties of the material, the elastic modulus and ultimate tensile strength show some fluctuations, but overall they stay stable with practically no net loss after 1000h. The drop in elongation at break is more significant though, but seems to plateau after 400h.

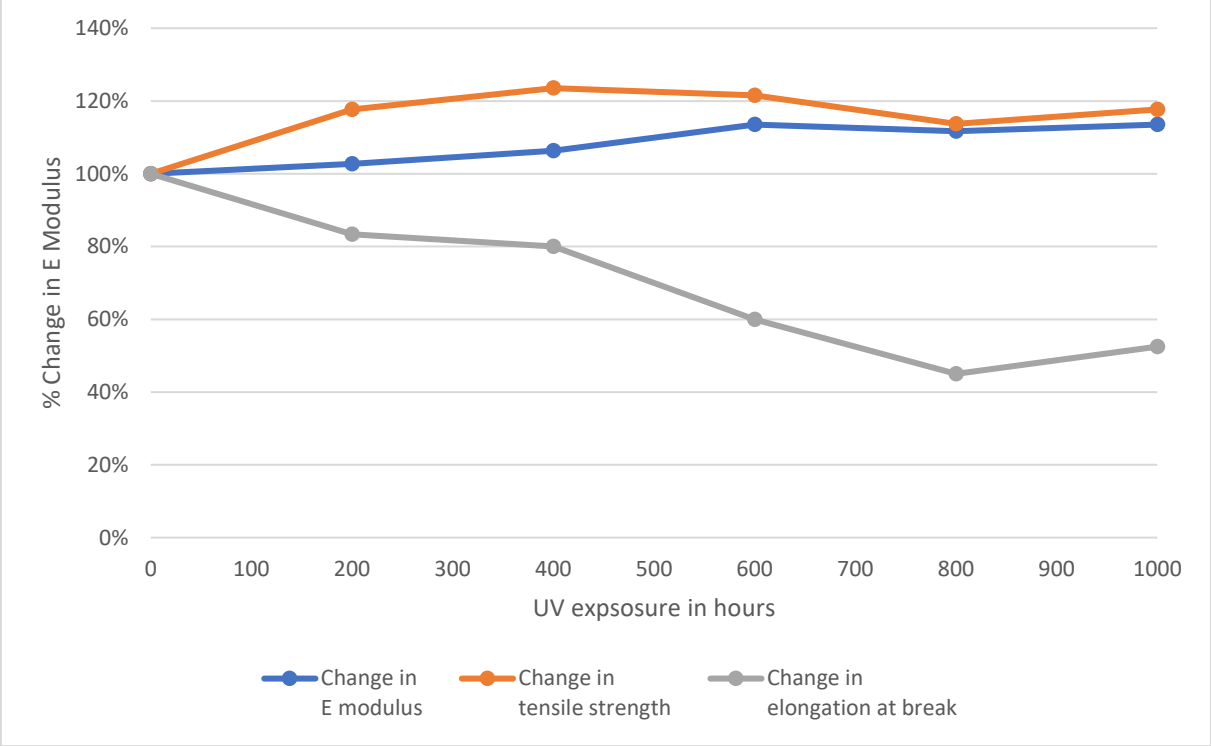

Figure 3 Change in mechanical properties over the course of 1000 hours of UV exposure

After 1000 hours of long-term UV exposure, the final values can be seen in the table below:

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

Property	Before Long term UV exposure	After 1000 hours of UV exposure
Elastic modulus	2220 MPa	2520 MPa
Ultimate tensile strength	51 MPa	60 MPa
Elongation at break	12 %	6 %

Coloration

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

Figure 4 Effect of UV exposure on color of the specimens

Conclusion

The results of the performed tests on **Ultracur3D® ST 7500 G** can be summarized in the table below.

Long term UV test behind the glass window	Ultracur3D® ST 7500 G
Coloration	😊 The material is stable
Mechanical properties	😐 Elongation at break reduces after prolonged exposure to UV radiation
	😊 The E modulus remained fairly stable after prolonged exposure to UV radiation
	😊 The E modulus remained fairly stable after prolonged exposure to UV radiation