

Long term UV tests on Ultracur3D® EPD 1086

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® EPD 1086. 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® EPD 1086

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/cm². 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	60 ± 2	0.51 ± 0.02	65 ± 3	38 ± 3	50 ± 10
	18 min water spray	60 ± 2	0.51 ± 0.02	-	-	-

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

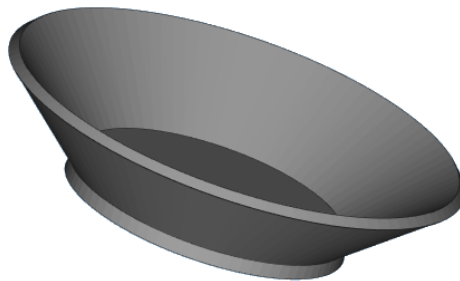


Figure 2 Color cone

Mechanical testing

The E modulus stays stable for 800 h of UV exposure and decreases at 1000 h of UV exposure. The decrease after 200 h might be due to an outlier. The same accounts for the tensile strength. The Elongation at break decreases 40 % from 0 to 400 h of UV exposure and stays stable for UV exposure up to 1000 h.

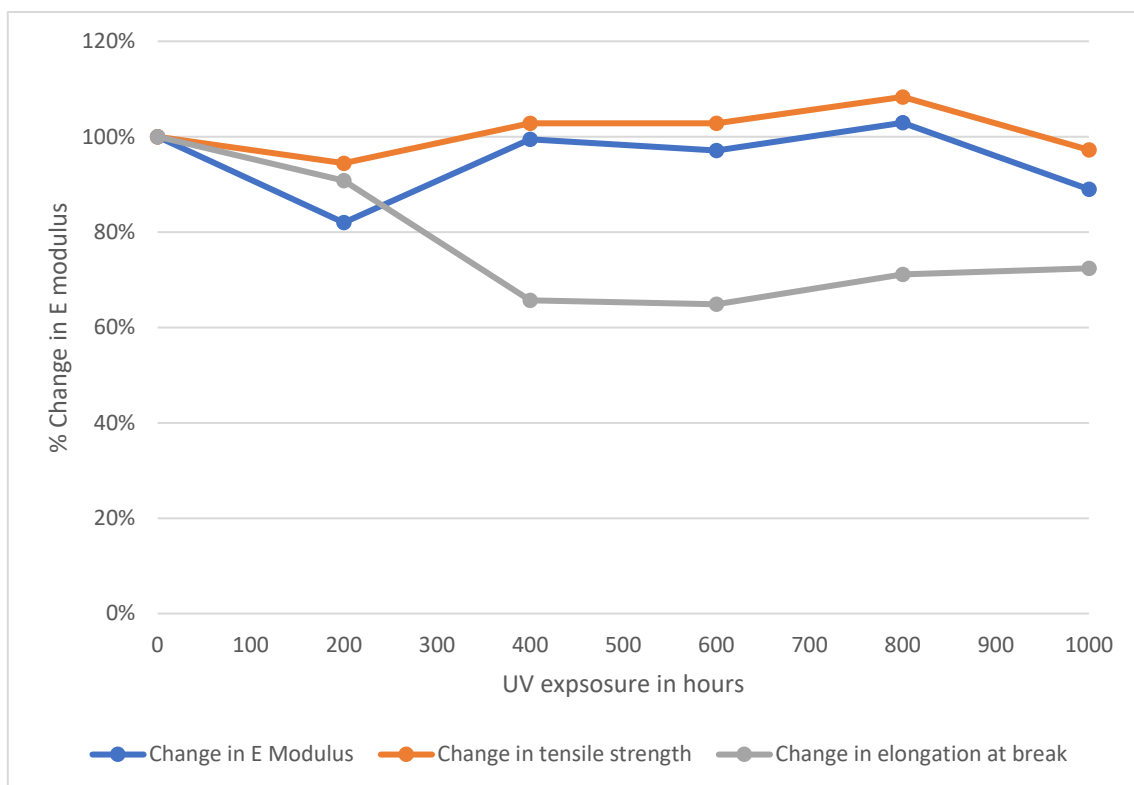


Figure 3 Change in mechanical properties over the course of 1000 hours of UV exposure

After around 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	1720 MPa	1530 MPa
Ultimate tensile strength	36 MPa	35 MPa
Elongation at break	24 %	17 %

Coloration

The material Ultracur3D® EPD 1086 does not change in color after being exposed to UV light for a prolonged period of time.

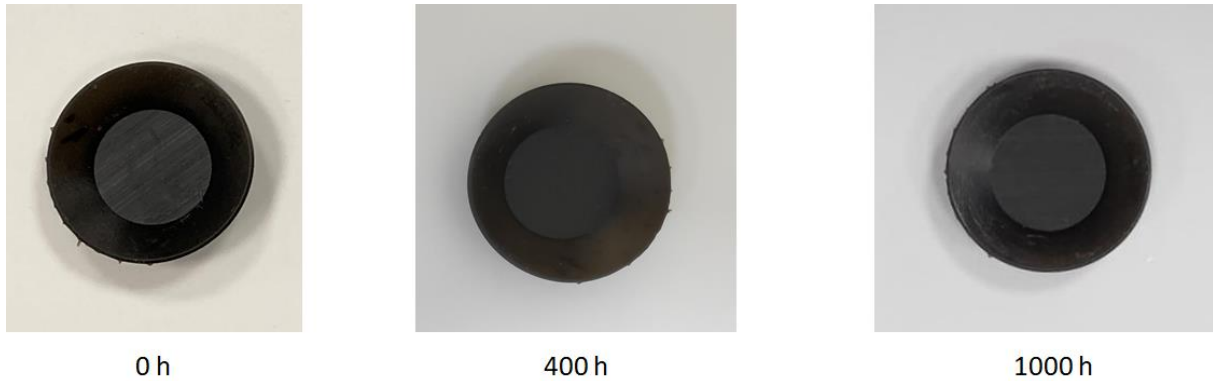


Figure 4 Effect of UV exposure on color of the specimens

Conclusion

The results of the performed tests on **Ultracur3D® EPD 1086** can be summarized in the table below.

Long term UV test behind the glass window	Ultracur3D® EPD 1086
Coloration	☺ The material stays stable
Mechanical properties	☹ Elongation at break reduces 40 % after 400 h of exposure to UV radiation and stays stable for prolonged exposure to UV radiation
	☺ The E modulus remained stable for 800 h exposure to UV radiation and then slightly decreases
	☹ The tensile strength remained stable for 800 h exposure to UV radiation and then slightly decreases

The data contained in this publication are based on our current knowledge and experience. They do not constitute an agreed contractual quality of the product and, in view of the many factors that may affect processing and application of our products, do not relieve processors from carrying out their own investigations and tests. The agreed contractual quality of the product at the time of transfer of risk is based solely on the data in the specification data sheet. Any descriptions, drawings, photographs, data, proportions, weights, etc. given in this publication may change without prior information. The customer and/or user is responsible to consider and respect all hazard and safety issues according to the MSDS of Ultracur3D® XXXX and take, implement and/or install adequate measures and precautions to avoid any personal injuries, property damages and/or environmental pollution. Therefore, BASF3D Printing Solutions GmbH shall not be liable for any personal injury, property damages and/or environmental emissions arising out of or related to the testing, handling or usage, storage and possession of Ultracur3D® EPD 1086. It is the sole responsibility of the recipient of our product to ensure that any proprietary rights and existing laws and legislation are observed (02/2020)

Version 2.0