Competitive accelerated weathering study between HP 3D High Reusability (HR) PA 12 W and SLS materials

Introduction

This study examines the impact of accelerated weathering on the new HP 3D High Reusability (HR) PA 12 W material printed on the HP Jet Fusion 5420W 3D Printing Solution and compares it with two of its main SLS competitors' materials.[1] [5]

Key Results

- In an accelerated test, HP 3D HR PA 12 W retains 80-90% of its initial mechanical properties and doesn't show any visible aesthetic changes. Overall, HP 3D HR PA 12 W performance is better than typical HP 3D HR PA 12 W's SLS competitors.
- Based on our testing, parts printed with HP 3D HR PA 12 W material may be functional for select outdoor applications.

	Color		Mech prop				Dimensions	
	ΔEmc after 1,000 hrs	b* after 1,000 hrs	% of change elongation at break	% of change Young's modulus	% of change tensile strength	% of change Charpy Impact	% change length	% change thickness
HP PA 12 W	3.5	- 1.0	- 9%	- 9%	0%	- 12%	+ 0.09%	- 0.55%
SLS 1	19.2	10.8	- 89%	+ 6%	- 22%	- 93%	+ 0.05%	+ 0.30%
SLS 2	22.9	15.3	- 71%	- 2%	- 45%	- 61%	- 0.24%	- 0.44%

Table 1: Summary of the data after 1,000 hours of exposure for the different materials

Color

SLS materials show a drastic color change compared to HP 3D HR PA 12 W material.

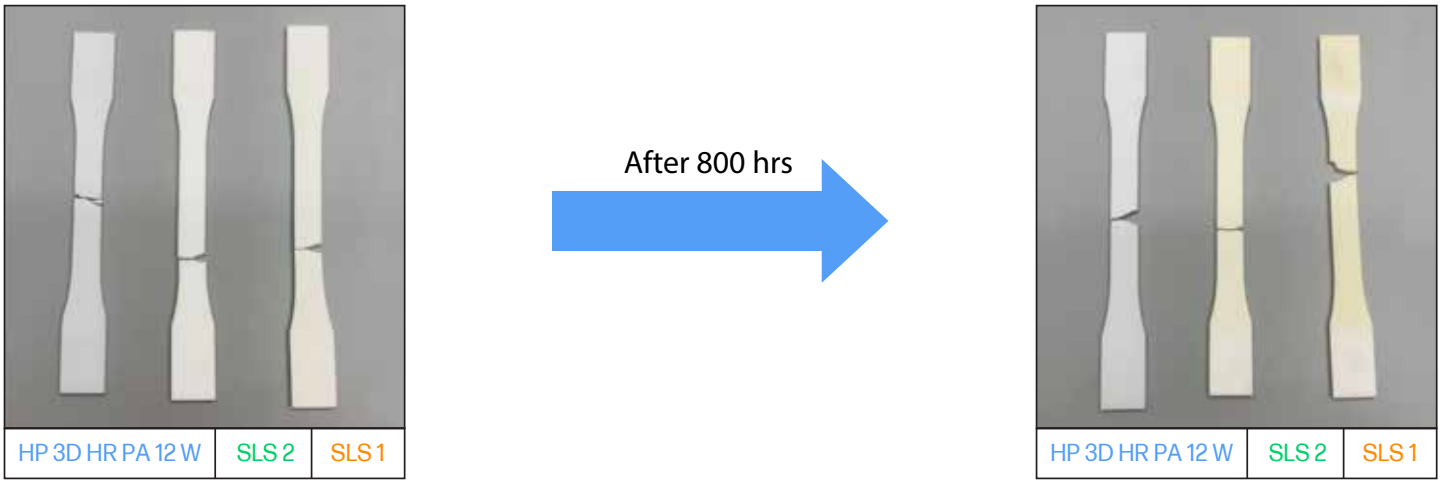

Figure 1: Each picture from left to right: HP 3D HR PA 12 W, SLS 2, and SLS 1.

Conclusion

Based on the data presented in this report and our engineering judgment, we can assume that parts printed with the HP 3D HR PA 12 W material will be more stable over time than the SLS materials tested. HP 3D HR PA 12 W material shows great color stability, while also retaining 80 – 90% of its ductility after accelerated conditions.

Disclaimer: These results are based on test conditions described above and the following specific printing conditions: 7.22% packing density, with a ratio of 75% used powder and 25% new powder. SLS parts were printed and provided by external vendors. Testing was performed by a third-party laboratory.

1. Following ASTM G154/ASTM D4329 method. The UV source lamp used was a Q-Panel UVA-340 at 0.89 W/m2 and the cycle used was 8 hours UV light uninsulated black panel temperature controlled at 60 ± 3°C then 4 hours condensation with uninsulated black panel temperature controlled at 50 ± 3°C.
2. The color of the samples was measured according to ASTM E1347-06 and ASTM D2244-16, using illuminant and observer F2/10
3. Mechanical properties were measured according to ASTM D638-14 using 5 XY/YX orientated ASTM D638 Type I Tensile Bars per data points.
4. Charpy impact properties were measured according to ISO 179-1:2010(E) with a modified number of tested specimens, using 5 XY/YX oriented ISO 179 Charpy Impact Bars.
5. PA 12 SLS parts provided by external vendors. The thermal history of the recycled powders used to print the PA 12 SLS competitor parts was unknown.

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