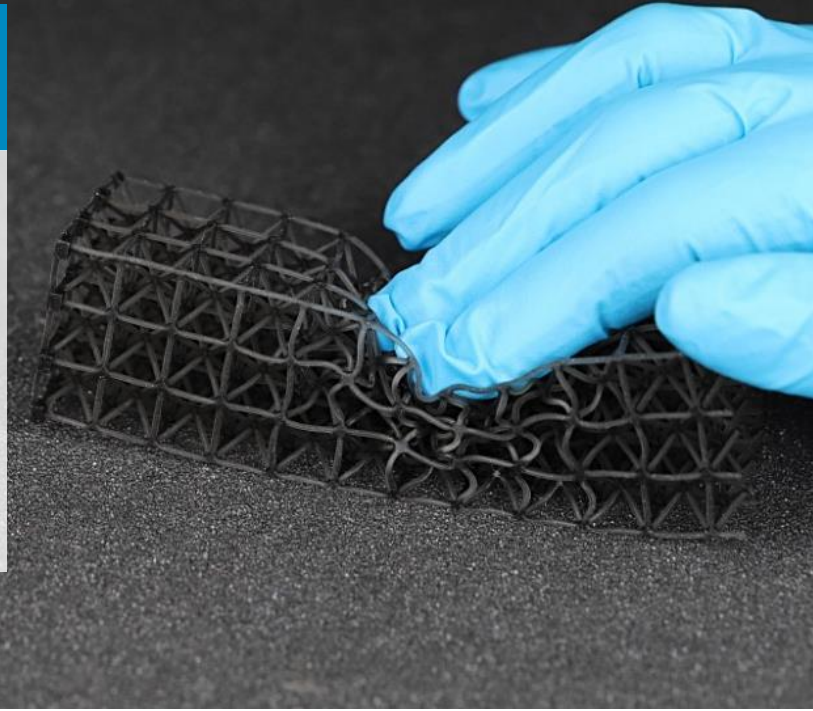# Design Guidelines for Lattices Structures of Ultracur3D® Resins

User Guideline

DESCRIPTION

One of the most common applications for flexible materials in 3D printing are lattice structures.

3D printed lattices are repeated patterns comprised of a network of cells, beams, and nodes. The definition of this network will influence the overall entity's mechanical performance, resulting in a lightweight structural design with high strength.

It is essential to know what type of structures and cells each material is capable of printing, as such complex structures may not always be possible to print with all materials or with all printers. The same as with rigid and tough materials, this is not the characteristic of the material itself, but a combination of the material and the 3D printer.

During the evaluation of Ultracur3D® portfolio, the printability of unit cells was studied. All the lattices were printed in bottom-up DLP/LCD printers.

The evaluation included three different types of lattices designs. Each design with a beam thickness of 1 and 2 mm and lengths of 40 mm (short lattice) and 120 mm (long lattice). The short lattice comprises of 3 x 3 x 4 unit cells. Long lattice comprises of 3 x 3 x 12 unit cells.
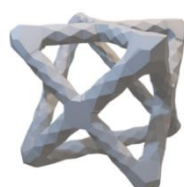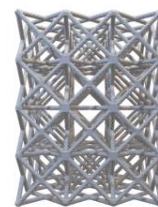

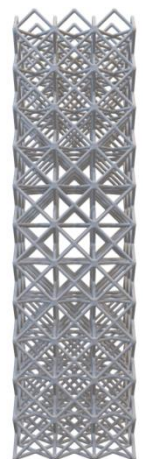*Fig. 1. Cell unit 1mm*   *Fig. 2. Cell unit 2mm*   *Fig. 2. Short lattice*   *Fig. 1. Long lattice*

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EVALUATION

The combination of material and the 3D printer is a deciding factor on the success of printing lattices. The images on the right side are showcasing examples of lattices considered as successful prints and fail prints.
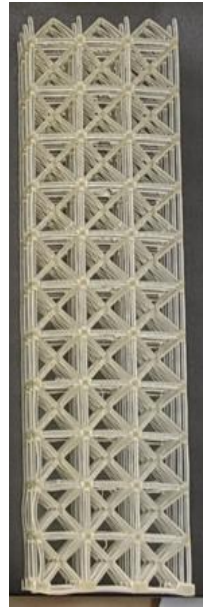

Fig. 5. Success long lattice EL 4000 - BCC – 1mm

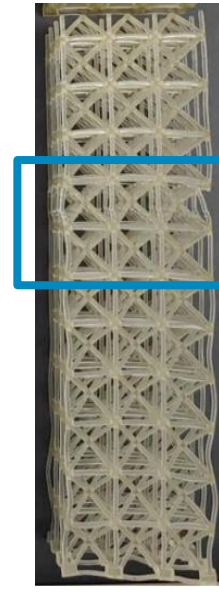*Fig. 6. Fail long lattice EL 60 - BCC - 1mm*

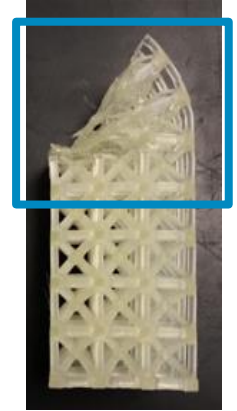*Fig. 7. Fail long lattice FL 60 - BCC - 1mm*

Fig. 8. Fail long lattice FL 300 - BCC - 1mm

The success rate for a given 3D printer material combination is showed in a heat map below. For example, the combination of Ultracur3D® EL 4000 with the octet cell unit, short length and both thicknesses was printable on all evaluated 3D printers. In contrast, the lattices with the octet cell unit and 1mm thickness printed with Ultracur3D® FL 300 works on 0-25% of the evaluated printers.

	Short lattices						Long lattices					
	Cross		Octet		BCC		Cross		Octet		BCC	
[mm]	1	2	1	2	1	2	1	2	1	2	1	2
EL 4000	100%	100%	100%	100%	100%	100%	26-50%	76-99%	26-50%	76-99%	51-75%	76-99%
EL 4000 B	100%	100%	100%	100%	100%	100%	0-25%	76-99%	0-25%	76-99%	76-99%	76-99%
EL 60	51-75%	76-99%	51-75%	76-99%	76-99%	76-99%	76-99%	76-99%	76-99%	76-99%	0-25%	51-75%
FL 60	51-75%	76-99%	51-75%	76-99%	76-99%	76-99%	0-25%	26-50%	26-50%	76-99%	26-50%	51-75%
FL 300	26-50%	51-75%	26-50%	76-99%	51-75%	76-99%	26-50%	26-50%	26-50%	26-50%	0-25%	26-50%

● 0-25%   ● 26-50%   ● 51-75%   ● 76-99 %   ● 100%