

METALONE

"OVERHANGS TOLERANCE STUDY ON SHAREBOT METALONE DMLS METAL 3D PRINTER"



CASE STUDY:

Sharebot metalONE
R&D Department

WEBSITE:

www.sharebot.it/en

3D PRINTER:

Sharebot metalONE

TECHNOLOGY:

DMLS
(Direct Metal Laser Sintering)

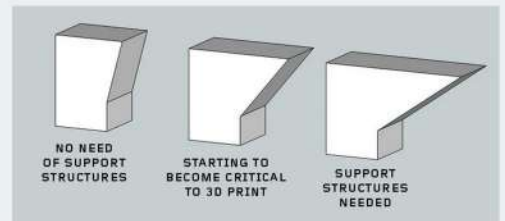
MATERIAL USED:

316L Steel

Introduction:

The fine tuning of the DMLS (Direct Metal Laser Sintering) printing process consists in a trial and error procedure based on precise measurements and adjustments taken after every job. Due to the physical limits of this technology it is important to define some design guidelines, and overhangs are one the major problems for engineers and designers who work in 3D printing so we decided to do some testing on them.

The definition of a 3D printing overhang is any part of a print that extends outward, beyond the previous layer, without any direct support. The main parameter that affect the overhangs correctness is the overhanging angle, in this test we wanted to see what is the limit for our machine.



Overhangs Sequence Analysis:

Our test is composed of a sequence of overhangs starting from 30° up to 70°, each overhang increased 5° from the previous one. The following pictures show the results:



fig. A) Front and back side of the test

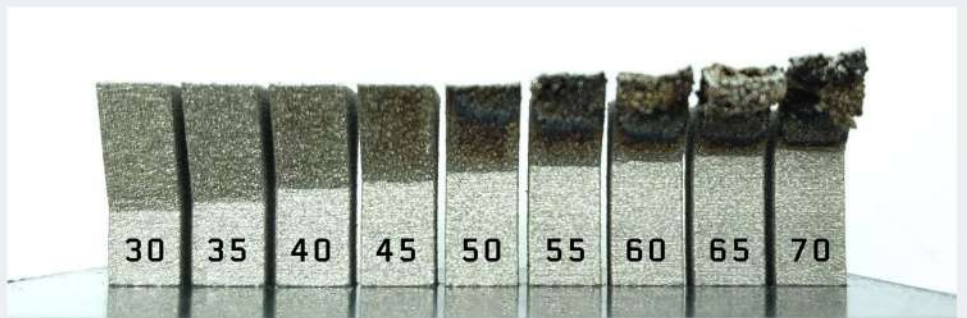


fig. B) Detailed view of the result

The test shows that the overhangs are correctly built up to 45°, they are starting to show over burnt marks at 50° because of the heat not drained by the previous layers then this effect prevent the metal to be correctly fused and the object is completely deformed.



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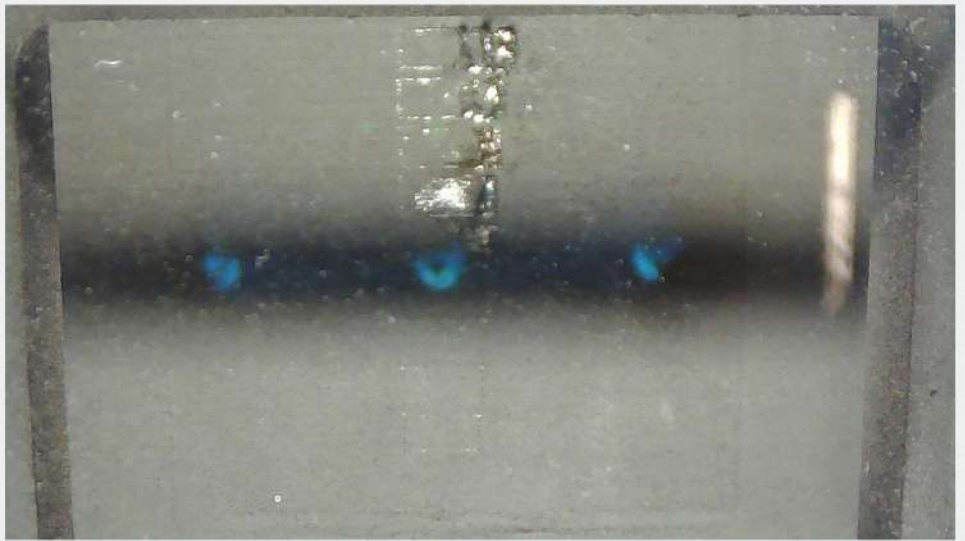
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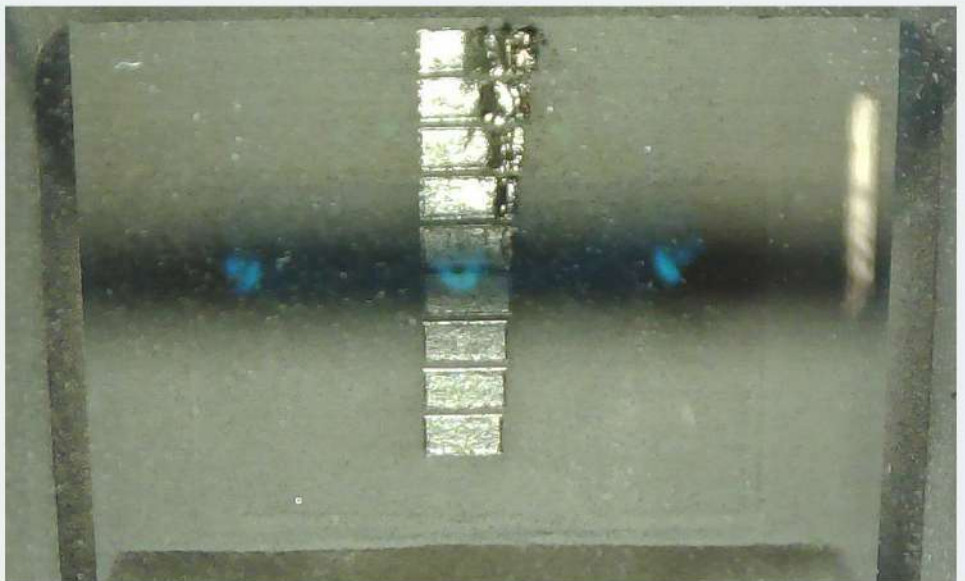
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As the machine takes pictures before and after each layer we can observe also what happened during the build process, these are the pictures at the 418th layer (shown below).

This one is just after the powder was spread across the build plate and we can see that where the overhangs were too high the melted steel of the underlying layers warped.



After the laser pass we can see the shape of all the pieces. And also in this case are clearly visible the overhangs that can't be built without supports.



Conclusions:

This test shows the physical limits that should be considered while using this technology. At the end of the day due to heat dissipation and steep overhangs it's mandatory to maintain a 45° limit on semi-vertical surfaces to obtain the best results when printing without support structures

