Material and Vacuum Characterization of 3D Printed Stainless Steel

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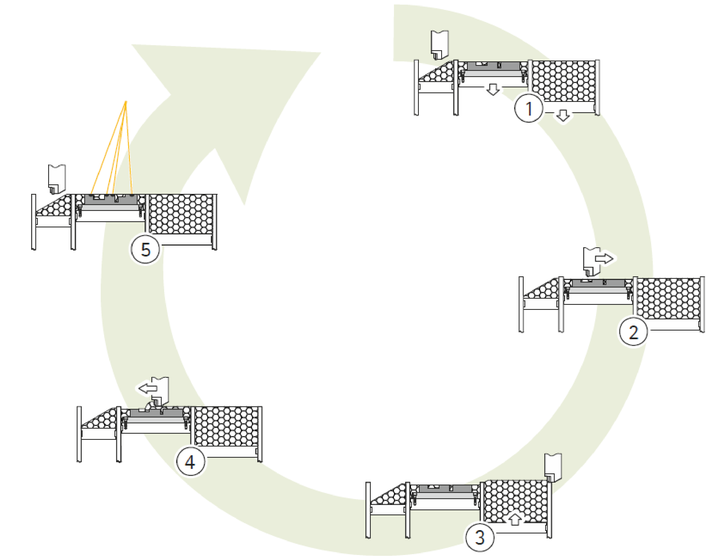
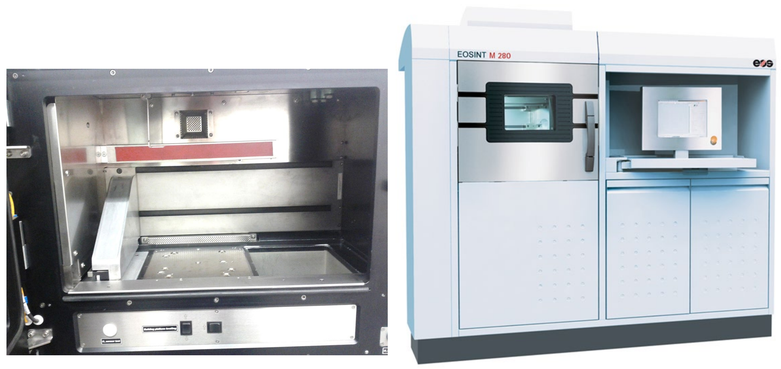
Definition:

"The process of joining materials to make objects from three-dimensional model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies".



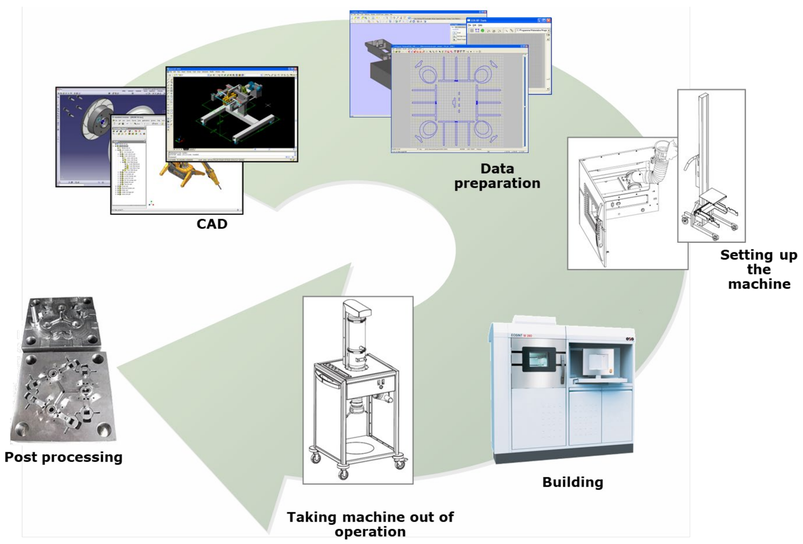
Additive manufacturing building process *

Objective: investigate the suitability of 3D printed parts for ultra-high vacuum application.

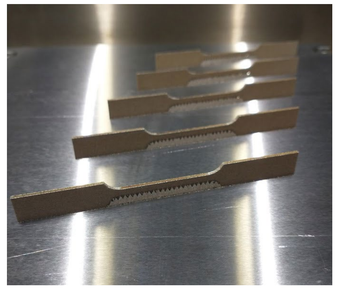


Metal 3D printer *

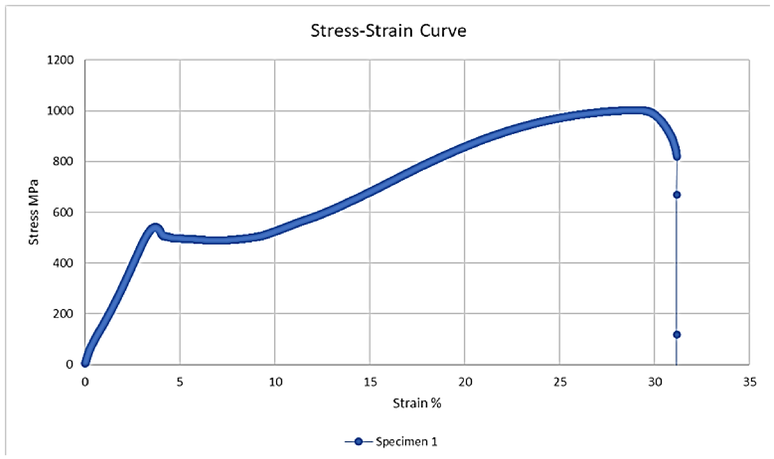
Process sequence*:



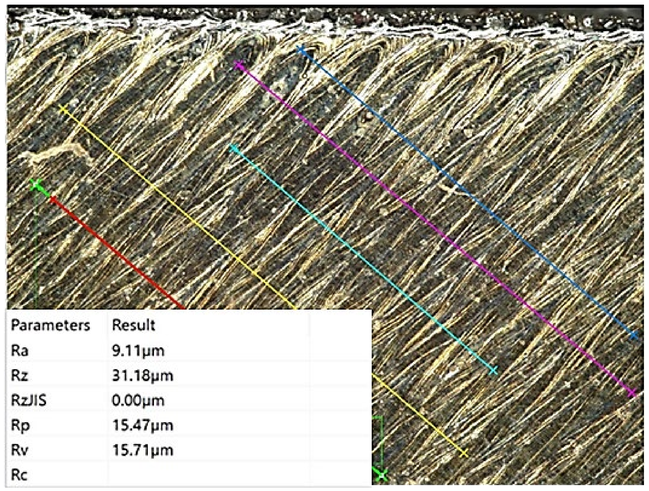
3D printed Tensile Specimens



Results:



Stress-Strain Curve



Parameters	Result
Ra	9.11µm
Rz	31.18µm
RzJIS	0.00µm
Rp	15.47µm
Rv	15.71µm
Rc	

Surface roughness analysis for 3D printed specimen.

Conclusion:

- The yield strength for 3D printed tensile specimens was around 540 MPa.
- The ultimate tensile value is around 1000 MPa.
- The surface roughness for the printed parts varies based on the surface orientation relative to the surface of the building plate.

Future Work:

- Perform fatigue test on additive manufactured parts.
- Investigate the effects of hot isostatic pressure and electropolishing on vacuum properties.
- Test the mechanical and vacuum properties of aluminum alloys.

* Reference: EOS user manual