The Effect of Processing Parameters on Formability of 3D Printed AISI 316L

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Abstract. The formability of 3D printed (SLM) AISI 316L stainless steel with varying process parameters was studied using deep drawing and bending tests. Parameter tuning for 3D printing was made using approximately 50 different melting parameters and from those, three interesting parameters were chosen for mechanical testing based on the chemical and microstructural analysis. Printed specimens were tested in stress reliefed condition. Erichsen tests with 2 mm thick flat specimens were carried using an instrumented hydraulic loading machine to record the force-displacement values. The same loading machine was also used to determine the tensile properties of the selected structures according to the standard EN 10002-1 using a mechanical extensometer. Also the bending tests with 2 and 4 mm thick flat specimens were carried out with same machine using three point bending tools and varying bend radius. The results showed that the formability of the printed specimens is depended on the printing parameters, i.e. porosity, chemical homogeneity and microstructure. The optimal printing parameters for formability are a compromise of porosity and microstructural features.