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M1Or2C-01: Impact of heat treatment on fracture behavior of additive manufactured 316L stainless steel at cryogenic temperatures

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Additive manufacturing is recognized as a potential technology to design and create complex geometries as well as a fast track to build prototype components. Different materials are possible to use, depending on the specific requirements of an application. Superconducting applications like magnets or rotating machines are demanding for the structural components. Either high and/or cyclic mechanical loads can be one of the limiting factors in design. In the cryogenic temperature regime austenitic steels are used due to the mechanical performance and the machinability.
In this work 316L austenitic steel samples were produced using laser powder bed fusion, also known as Selective Laser Melting (SLM). Followed by different heat treatments to systematically influence to the microstructure evolution. Focus for characterization is the fracture behavior and the fatigue crack growth rate. Having the cryogenic application in mind the tests are conducted at room temperature, liquid Nitrogen and liquid Helium temperature. The results are compared to industrial cast austenitic steels to qualify the overall performance of the additive manufactured samples.

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