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Printing parameter optimisation of additively manufactured ER120S-G steel using neutron tomography

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Additive Manufacturing (AM) has become a viable manufacturing technique, because of its remarkable ability to manufacture parts with intricate shapes and superior mechanical properties. Wire laser additive manufacturing (WLAM) is a kind of Direct Energy Deposition (DED) technology where a wire is fed through a nozzle and deposited onto a substrate or an existing part and is melted by focussing one or more laser beams onto it. This technique is especially advantageous for local repair as well as printing large and complex 3D parts. This has driven the commercial development of both technology and steel wires for automotive applications among others. Like most AM techniques, this involves rapid heating and cooling of samples, leading to specific microstructures and defects, which are influenced by both: the type of technique and the process parameters used. A proper characterization of these defects is imperative for optimal manufacturing process development.

In this work neutron tomography -performed at the NEUTRA instrument of SINQ (PSI, Switzerland) has been used to image the pores and defects in approximately cm-sized ER120S-G steel samples manufactured via Wire DED using three different printing strategies. These results have been linked with the assessment of the mechanical properties to arrive at suitable printing conditions. Additionally, different build strategies for the formation of complex shapes for this alloy have also been similarly characterized. The results from thermal neutron tomography will be duly presented.

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