Comparison of Hybrid Additive Manufactured Parts Properties for Three Different Alloys

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It is often desirable to produce a component with different technologies to achieve unique properties or a combination of good mechanical properties and productivity. Recently, hybrid additive manufacturing has gained attention, where multiple technologies can be combined or linked in a process chain. The primary motivation is to exploit the benefits of various technologies in one product. Hybrid additive manufactured parts were produced from Inconel 718, 625 and titanium alloy Ti6Al4V in the scope of this study employing powder bed fusion and direct energy deposition in a process chain. The focus of the study was the metallurgical and mechanical characterisation of the hybrid parts compared to individual technologies. The hybrid sub-parts were built first by powder bed fusion and then finished by DED. Samples were made with longer axes in vertical and horizontal x orientation. X-ray computed tomography, microstructural examinations, and tensile testing coupled with digital image correlation were employed to assess the parts. Results showed that the mechanical properties of hybrid additive manufactured parts relate to DED materials' properties. In addition, local changes in the temperature proved to cause problems with porosity generation at the interface and below standard mechanical properties with parts having small cross-sections.