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Executive summary report - DeRiMM

The report presents the results of the DeRiMM project, which investigated the multi-material laser powder bed fusion process for the nickel base alloy Inconel® 625 and copper alloy CW106C using Aerosint's selective powder deposition (SPD) recoater. The novel process could significantly improve the manufacturing of combustion chambers and other space components. he de-risk project aimed to investigate the feasibility of the process and addressed the fact that processability of the desired material combination had not yet been studied, and the material properties of previous test build jobs did not yield quality levels comparable to mono-material LBM.

The main technical objectives of the de-risk project were to optimize the multi-material laser powder bed fusion process for the desired material combination to achieve parts with a crack-free transition zone and porosity levels comparable to mono-material parts. Also metallographic characterization of the transition, definition of the achievable mechanical properties, and determination of possibilities and limits of the multi-material laser powder bed fusion process were elaborated. The report details the six most relevant process parameters based on their effect strength and the process disturbances with the highest criticality for the process, which served as the basis for the experimental procedure. Six build jobs were conducted, split into three manufacturing campaigns, to produce metallographic and static tensile test pieces, which were analyzed and tested.

The report concludes that the process has the potential to produce multi-material parts with high fidelity that can meet combustion chamber material requirements. However, the low process robustness and accuracy in terms of powder deposition geometry and the alignment of powder deposition and scan vectors currently limit the process capability. The average powder deposition and variances currently exceed the size of the elaborated processability window of the transition zone by a factor of four. This is the most important development challenge that needs to be addressed during upcoming projects. The report also highlights the need to improve general process robustness, increase machine running time without necessary job interruptions, and scale up the build envelope if combustion chambers and other space components should be manufactured using multi-material laser powder bed fusion and the Aerosint SPD recoater. The findings of this report can serve as a basis for further research and development of the multi-material laser powder bed fusion process and its potential applications in the aerospace industry.