

Final Report

Project acronym: *HiPA^{2l}*

Project number: *4240*

M-ERA.NET Call 2016

Period covered: 01/06/2017 to 30/09/2019

Publishable project summary

Ever increasing demands of industrial manufacturing with regard to mechanical properties require the development of novel alloys designed towards the respective manufacturing process. The M-era.Net project HiPA²l focussed on High Performance Additive manufacturing of Aluminium alloys customized for wire arc additive manufacturing (WAAM). The consortium selected Aluminium alloys with additions of Zn, Mg and Cu to be designed concerning the requirements of good mechanical properties and limited hot cracking susceptibility. The samples were produced using the CMT (Cold Metal Transfer) metal inert gas (MIG) welding process technique known for its ability to produce lower porosity parts with smaller grain size in parallel to high deposition rates. After material simulations to determine the optimal heat treatment procedures, several samples were solution heat treated, quenched and aged to enhance their mechanical performance. Chemical analysis, mechanical properties and microstructure evolution were evaluated using optical light microscopy, scanning electron microscopy, energy dispersive X-ray spectroscopy, X-ray fluorescence analysis, X-ray radiography, tensile testing, fatigue testing and hardness tests. The objective of this research was to evaluate the mechanical properties and microstructure of the newly designed high-performance Al-Zn-based alloy before and after ageing heat treatment in detail. The only defects found in the parts built under optimised conditions were small dispersed porosities. Furthermore, the mechanical properties are superior to the ones found in commercial 7xxx alloys. The presented analyses are promising regarding additive manufacturing of high strength aluminium alloys.