

# **Development and realisation of a metal additive manufacturing pilot line and post-processing of parts via laser ablation and polishing**

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The presentation reports recent activities at the School of Engineering of Cardiff University on the development and realisation of a metal additive-subtractive hybrid manufacturing pilot line. Firstly, a summary of the achievement of the Horizon 2020 project Manuela is provided. The project centres on the development and realisation of a metal additive manufacturing (AM) pilot line service covering the full AM development cycle including simulation, robust AM manufacturing and on-line process control, characterisation, real-time feedback, post-treatment, AM qualification protocols and associated business model. In this context, the research team focusses on the development of machine learning based real-time feedback tools and methods that are planned to be adapted for laser ablation.

The development of the AM stage is followed by post-processing of AM parts that comprises of the subtractive manufacturing (SM) stage of the production line. In particular, pulsed laser polishing (LP) of AM aluminium alloy parts, a challenging material for laser polishing due to the high thermal diffusivity, is carried out. A multi-stage LP process involving alternate steps of laser ablation and re-melting is designed and implemented. Comparative analyses are subsequently undertaken on the as-built and heat-treated AM parts with and without LP, with regard to their tensile and fatigue properties, and to the extent of sub-surface porosity. The results are correlated with the SEM/EDS/EBSD characterisation data obtained at the interfaces of the LP-affected regions and the bulk bodies.