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Microstructure and Microhardness of Wire-based Laser Metal Deposited AA5087 using an Ytterbium Fibre Laser

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Abstract

Wire-based additive manufacturing has been increasingly investigated in recent years. Although it is possible nowadays to manufacture structures that are free from inner defects such as porosity and cracks using wire and arc additive manufacturing, there is still a lack of knowledge regarding wire-based laser metal deposition of aluminium and its alloys. In order to be able to produce locally tailored part properties, it is necessary to understand the process parameter to material property relationship. Using laser energy source, it becomes possible to analyse in detail the heat input and to observe occurring microstructural evolutions. This work includes a microstructural and mechanical characterization of an AA5087 wall structure. Detailed analyses of the chemical composition, texture, and microhardness of the structure have been performed. The microstructure contains different grain orientations as well as grain shapes and sizes along the structure, resulting in locally different material properties. The results have been analysed and discussed in reference to fundamental theories such as the Hall–Petch and Orowan mechanisms.

Keywords: laser additive manufacturing; laser metal deposition; aluminium alloy; microstructure; EBSD; mechanical properties.

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