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Anodizing of cast and additively manufactured AlSi10Mg alloy

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TITLE

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ABSTRACT

Electrochemical surface treatments are one of the most popular surface modifications because of their relatively simple instrumentation and the quality of received coatings. For instance, anodizing, which is a relatively short process, guarantees high corrosion resistance, an increase in hardness and scratch resistance. However, there is still an ecological problem with acid electrolytes required to conduct traditional anodizing. The higher voltage of anodizing allows using alkalic baths which is more environmentally friendly.

Anodizing is a basic treatment for aluminium. Aluminium alloys usually are cast, however recently additive manufacturing (3d printing) is widely used to produce more advanced aluminium parts with enhanced properties. Laser Powder Bed Fusion (L-PBF) processes allow to melt metal powder layer-by-layer until obtaining whole parts, which have a fine-grain microstructure, while cast alloys have dendritic microstructure and larger grains. It has consequences in differences primarily in mechanical properties between cast and additively manufactured parts.

In this study, three types of anodizing were performed: traditional, hard and Plasma Electrolytic Oxidation on AlSi10Mg alloy manufactured by casting and L-PBF process. Received coatings were analysed by Scanning Electron Microscopy (SEM), Energy Disperse Spectroscopy (EDS). Moreover, a scratch test was performed. The results show many differences in surfaces, not only between each kind of anodizing, but mainly between cast L-PBF-manufactured alloy. Al- and Si-oxides are distributed in a reference to core microstructure. It yields e.g. higher LC1 value (Critical Load in scratch test) in additively manufactured specimens, especially in PEO case.

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