Plasma Electrolytic Oxidation of AlSi10Mg alloy manufactured by selective laser melting of metallic powders

The origins of additive manufacturing, commonly called "3d printing", officially date back to 8th August 1984. Previous patent applications were rejected, because was no faith being put the"business success of the project". 3D printing was developed two-way – on the one hand stereolitographic technologies, and the laser technologies on the other. Among the methods of 3d printing is selective laser melting (SLM) which enables the production of metal elements. The metal powder is melted by the laser in areas previously inflicted by the CAD (Computer-Aided-Design). The resulting elements are characterized
by fine-grained microstructure and significant homogenization of phase components, which is their great strength compared to the structures produced by other techniques. Titanium, nickel and aluminium alloys are the most popular metals dedicated to SLM.

Regardless of the method of materials manufacture, it is essential to adequately protect their surface. In many cases, the material harmful processes begin on the surface, such as corrosion or friction. Especially in advanced applications (biomedical or aerospace) the reliability of the material surface or its specific properties are essential. In spite of the additive technologies spread it is worth to ask a question: Can the surface modifications, such as layering, be exactly the same for printed alloys as for cast alloys?

The aim of the project is to characterize the Plasma Electrolytic Oxidation (PEO) process for AlSi10Mg components made by additive methods. The work involves the production of simple samples and a slightly more complex shape, the selection of PEO process parameters for the above samples and the analysis of the properties of the resulting layers. At the same time, with the same parameters, oxide layers will be produced on the surface of the cast AlSi10Mg alloy. It is planned to study the microstructure and tribological properties of the obtained layers. The project also envisaged the creation of a PEO computer simulation.

This mentioned theme is chosen due to the importance of surface engineering in shaping material properties, especially for advanced applications because the number of the publications on shaping the surface layers properties of alloys produced by additive methods is not enough. Previous studies have shown presence of the different corrosive or tribological properties of layers produced at the same parameters on cast and printed alloys.

The project will provide knowledge on the Plasma Electrolytic Oxidation of alloys produced by additive methods. The optimum oxidation parameters for AlSi10Mg will be selected. The studies of oxide layers can be the starting point for the analysis of other surface treatment on printed elements. Project results can also be the basis for the design specific applied surface treatment of additively manufactured components.