Selective laser melting of Mo-Si-Al alloy and MoSi2-Al alloy systems

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Additive Manufacturing (AM) processes, such as selective laser melting (SLM), enable the fabrication of arbitrary 3D-structures with unprecedented degrees of freedom. There is a wide variety of approaches for AM. This presentation will focus on Selective Laser Melting (SLM) process to produce metal-matrix composites. While AM is nowadays is a well-established method for fabrication of many metallic materials, the processing of metal-matrix and, especially, ceramic-based composites is far from mature. This talk will concentrate around aluminium alloys reinforced/added by molibdenium disilicides.

Aluminum alloys represent one of the most widely utilized structural and functional materials due to their low density, high specific strength, good corrosion resistance and excellent electric and thermal conductivity. The production of Al-alloy constructs of complex geometry, high dimensional accuracy and near-net shape is one of the major research direction in materials science. In the class of intermetallics, molybdenum disilicide $MoSi_2$ has received a great attention due to promising combination of properties, such as high melting point, moderate density, excellent intermediate and high temperature oxidation resistance, and metallic-like electrical and thermal conductivity. In addition, $MoSi_2$ exhibits a good alloying potential with metals, other silicides, and significant thermodynamic compatibility with ceramics. These properties open a prospect for the development of multiphase microstructures to overcome the series of problems associated with pure molybdenum disilicide.

The main processing routes explored so far for making compacts from $MoSi_2$-Al alloy system range from the classic casting methods, to hot pressing and reactive sintering. Application of AM techniques for the MoSi2-Al alloy system has not been explored yet. SLM may open a wide range of new opportunities for the processing and fabrication of various products in the system under study with complex constitutional design and shapes impossible to achieve via conventional methods.

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