Numerical Analysis of C18400 Copper Alloy / AlSi10Mg Aluminum Alloy Powder Beds Deposited with Bi-Directional Multi-Track Selective Laser Melting

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Abstract:

With the increased use to Additive Manufacturing (AM) in industry, the Selective Laser Melting (SLM) method has been widely used to fabricate parts with complex geometries. Despite this, the majority of attention in industry has been paid to the use of a single material for each printed component. This material may not have superior thermal and mechanical properties at one time. There is some evidence of work undertaken using two metals in AM together to print a part with excellent properties, so called bimetallic structures. These composites such as C18400 Copper alloy/AlSi10Mg Aluminum alloy combine the higher conductivity from one material and the corrosion resistance and light weight from the other material in one AM part. To investigate this, 3D Finite Element Models, using ANSYS codes, have been developed to study the thermal evolution during micro-manufacturing for multi layers of C18400 and AlSi10Mg deposited on powder beds. To strengthen the metallurgical bond between layers, SLM process was simulated by altering the direction of the laser beam at 90° orientations from one layer to the next top layer. Furthermore, the laser beam moves over the layers through axial and transverse multi tracks to melt the powder.

Keywords:

Additive manufacturing; Selective laser melting; Multi-material; Powder bed; Finite element models.