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Title: Analysis of processing parameters and characteristics of selective laser melted high strength Al-Cu-Mg alloys: From single tracks to cubic samples

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Abstract: The ever-increasing demands for lightweight alloys parts with complex shapes in the aerospace industries lead the development of selective laser melting (SLM) technology. The effect of changing scanning speed on the formation of single track, as well as the overlapping rate to form multi tracks during SLM processed (SLMed) Al-Cu-Mg alloy was investigated. A processing map for SLMed single track of Al-Cu-Mg alloys was developed. Under different processing parameters, the single track can be characterized as unstable, stable with cracks and stable without cracks. For geometrical characteristic of melt pool of single track, the width and remelted depth are positively correlated with energy input, whereas the height and the contact angle are contrary. As for multi tracks, four typical morphologies have been identified, and a processing map was established to select the optimum processing parameters for the SLMed parts without defects. Finally, high density cubic samples (99.91%) without imperfections and microcracks were obtained using optimum processing parameters. In addition, the relationship between microstructure and hardness was discussed. The results provide an important experimental guidance for obtaining high-strength Al-Cu-Mg alloys dense parts with good performance.

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