Influence of Preheating on SLM Processed EN AW 7075 Aluminium Alloy

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In this study, we aimed to investigate the influence of preheating temperatures on EN AW 7075 aluminium alloy processed by selective laser melting (SLM). SLM is a widely used additive manufacturing technique for the production of complex metal parts. However, the use of mentioned alloy in SLM processes often leads to crack formation, posing challenges to the structural integrity of the printed components.

To explore this phenomenon, we conducted a comprehensive analysis of the microstructure of SLM-produced samples under different preheating conditions. Specifically, we examined the samples without preheating and at preheating temperatures of 100, 200, and 400 °C. The microstructure of the non-preheated samples revealed a high density of cracks throughout the printed structure. These cracks are believed to be a consequence of the rapid solidification and resulting thermal stresses during the cooling phase of the SLM process. However, as we initiated preheating at temperatures of 100 and 200 °C, we observed a slight reduction in the number of cracks present in the microstructure. This suggests that the preheating process facilitated a more gradual temperature transition during solidification, thereby minimizing the thermal stresses and subsequent crack formation.

Interestingly, at the highest preheating temperature of 400 °C, we observed a distinct phenomenon within the microstructure. Instead of individual cracks, the microstructure exhibited pillar-like formations where cracks seemed to coalesce. This intriguing observation suggests that the higher preheating temperature induced alterations in the solidification behavior, leading to the formation of localized pillars as opposed to scattered cracks.

These findings shed light on the role of preheating temperatures in the SLM processing of AA EN 7075 aluminium alloy. Preheating was found to significantly impact the microstructural characteristics, with temperature variations resulting in varying crack densities and the formation of unique pillar structures. This understanding provides valuable insights for optimizing the preheating parameters in SLM processes to enhance the structural integrity and quality of printed components.

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