

Distribution of TiC Nanoceramic Particles and Microstructural Properties of 7075 Aluminum Alloy

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Abstract

In this study, we aim to create aluminum matrix composites by incorporating TiC nanoceramic particles and utilize additive manufacturing to print 7075 aluminum alloy with fine grains and high mechanical performance. We utilized X-ray fluorescence (XRF) analysis and X-ray nano diffraction (XND) to observe the distribution of TiC nanoceramic particles in the aluminum alloy matrix, as well as to analyze the grain size and orientation of the material. Furthermore, we conducted projection X-ray microscope (PXM) and transmission X-ray microscope (TXM) experiments to reconstruct the 3D structure of defects such as pores and cracks in the aluminum alloy. The results show that TiC ceramic particles are uniformly distributed within the aluminum alloy, with some Ti elements aggregating around the ceramic particles to form clusters. Higher element concentrations were observed around the defects.

Keywords - Additive manufacturing, Aluminum matrix composite, X-ray nano diffraction, X-ray nanoprobe, Projection x-ray microscope and Transmission x-ray microscope