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Microstructure and Mechanical Properties of High Shear Material Deposition of Rare Earth Magnesium Alloys WE43

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In this work, microstructural characterization and mechanical properties are investigated for rare earth magnesium alloy, WE43, manufactured via a high-shear deposition process. The unique solid-state manufacturing process deposits feedstock via a hollow nonconsumable rotating cylindrical tool, thereby generating heat and plastically deforming the feedstock through controlled pressure as successive layers are metallurgically bonded upon a substrate. In this research, dynamic recrystallization and grain refinement is characterized for the as-deposited WE43 samples using Electron Backscattered Diffraction (EBSD). The EBSD results for as-deposited WE43 depict a refined grain structure formed by dynamic recrystallization (DRX). To quantify material properties, quasi-static tension tests were performed in three orthogonal directions to elucidate mechanical performance and isotropic behavior of as-deposited WE43.

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