Novel synthesis of Al-Mg-Si alloy matrix hybrid composite reinforced with bean pod ash and alumina using a two-step stir casting method

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Abstract

Hybrid reinforced composites using synthetic particulates and agro-waste ash is attracting global research interest owing to the promising benefits of lightweight, improved ductility, toughness, corrosion resistance, etc. This study reports for the first time the synthesis of bean pod ash (BPA) and alumina (Al_2O_3) as complementary reinforcements for Al-Mg-Si alloy matrix hybrid composites using a two-step stir casting method. The Al-Mg-Si alloy matrix was reinforced with BPA and Al_2O_3 particulates of respective sizes 50μm and 28μm and prepared in varying weight ratios of 0:10, 2:8, 4:6, 5:5, 6:4, 8:2, and 10:0. The surface morphology and the mechanical properties of the fabricated hybrid composites was examined. The study reports the production of a lightweight composite with improved mechanical properties such as hardness, tensile strength, and ductility. An even distribution of the BPA in the Al-matrix as observed in the microstructure increased the hardness and tensile strength of the fabricated hybrid composite to a respective maximum value of 105 BHN and 207 MPa. A high ductility value of 12% was also estimated from the study. The results show a promising application for the use of BPA as complementary reinforcements in the synthesis of high-performance aluminium hybrid composites.

Keywords: Bean pod ash, hybrid composites, Al-Mg-Si alloy, double stir cast, reinforcements

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