

Fabrication Characteristics and Mechanical Behaviour of Fly Ash-Alumina Reinforced Zn-27Al Alloy Matrix Hybrid Composite Using Stir-Casting Technique

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Abstract : This paper reports the viability of developing Zn-27Al alloy matrix hybrid composites reinforced with alumina, graphite and fly ash (a solid waste byproduct of coal in thermal power plants). This research work was aimed at developing low cost-high performance Zn-27Al matrix composite with low density. Alumina particulates (Al_2O_3), graphite added with 0, 2, 3, 4, and 5 wt% fly ash were utilized to prepare 10wt% reinforcing phase with Zn-27Al alloy as matrix using two-step stir casting method. Density measurement estimated percentage porosity, tensile testing, micro hardness measurement, and optical microscopy were used to assess the performance of the composites produced. The results show that the hardness, ultimate tensile strength, and percent elongation of the hybrid composites decrease with increase in fly ash content. The maximum decrease in hardness and ultimate tensile strength of 13.72% and 15.25% respectively were observed for composite grade containing 5wt% fly ash. The percentage elongation of composite sample without fly ash is 8.9% which is comparable with that of the sample containing 2wt% fly ash with percentage elongation of 8.8%. The fracture toughness of the fly ash containing composites was, however, superior to those of composites without fly ash with 5wt% fly ash containing composite exhibiting the highest fracture toughness. The results show that fly ash can be utilized as complementary reinforcement in ZA-27 alloy matrix composite to reduce cost.

Keywords : fly ash, hybrid composite, mechanical behaviour, stir-cast

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