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Fabrication and Characterization of Epoxy resin-based tungsten metal particles reinforced composites

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ABSTRACT

Polymer matrix with metal reinforcements has gained much importance in manufacturing sector, owing to its superior mechanical properties that could be tailored for customized applications. In this regard, an attempt has been made to develop a novel epoxy resin based thermoset polymer matrix reinforced with tungsten metal particles with 3µm mean particle size. Accordingly, samples were prepared by hand lay-up method with filler content (W) varying from 1, 3, 5, 7 and 9 wt. %. Fabricated samples were tested, for its mechanical and morphological properties to study the behavior of the composites. Tensile strength of composite was found to exhibit an increasing trend with filler content up to 7 wt.% followed by a decreasing trend. In addition, flexural strength and impact strength exhibits the same trend. Tensile, flexural, impact strength and hardness were observed to be highest in the 7 wt. % sample. Tensile strength in 7 wt. % sample was found 103.57 % higher than the virgin polymer. Also, impact strength increased by 140.23% in comparison with pure epoxy. Dispersion studies of the composites were performed by SEM analysis, and micrographs shows that composites with 7 wt. % of tungsten particles shows uniform dispersion. However, agglomeration starts with increase in the filler content beyond 7 wt. % which resulted in the drop in tensile strength. In addition, results from water absorption test shows that, absorption rate increases with increase in filler content. The absorption rate for pure epoxy is found to be minimum at 3.23%, and composite with 7wt. % has a maximum absorption rate of 28.67%. SEM micrographs shows an increase in voids with increase in filler content which attributes to the increase in water absorption rate of the composites.

Keywords: polymer matrix metal composites; thermoset; scanning electron microscope