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Processing and Characterisation of Epoxy–SiC Functionally Graded Polymer Matrix Composites

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Abstract
This paper proposed preparing and investigating the Epoxy–Silicon carbide composite for aerospace applications. In recent years aerospace industries concentrated in low weight, high strength and high thermal resistance materials. Polymer matrix composite can provide a better solution for the statement mentioned above. This study thermosetting study Epoxy and SiC materials have mixed in centrifugal casting with the ratio of 5%-SiC and resin. The microstructural evaluation is carried by Scanning Electron microscopic and investigating the tensile and hardness properties of the Epoxy– SiC Functionally Graded Polymer Matrix Composites. The wear and fracture analyse were investigated, and the results were discussed. the results show the SiC has provided the higher strength for composite, and its mixing percentage has control the weight of the polymer composite.

Keywords Polymer · Epoxy · Silicon carbide · Wear analysis · Hardness

1 Introduction

Polymer composites are geometried combinations of polymers with inorganic or organic additions [1]. Polymers are the new grade of materials Polymeric Gradient material (PGMs) are a class of functionally graded material in which at least one of the constituent phases, mostly matrix, is a polymer. Centrifugal casting helps in providing a continuous grading in the Functionally Graded Polymer matrix composite (FGPMC) being produced [2]. Inhomogeneous materials made up of two (or more) distinct materials with a constantly variable spatial composition profile are known as functionally graded composite materials (FGCMs). FGC are classified as (i) functionally graded coating type, (ii) functionally graded type and (iii) functionall graded type [3]. The FGC can be manufactured by the processes like centrifugal casting, chemical vapor deposition, physical vapour deposition and powder metallurgy techniques. Among the above mentioned techniques centrifugal casting method is commonly used one [4]. In this method, the difference in the material densities and the spinning of the mould aids in forming functionally graded material [5]. The diffusion of the reinforcement particles is affected by several factors like centrifugal force, shape, the size of the reinforcements, density difference of reinforcement and the matrix [6].

Epoxy resins form the common matrix for a wide range of applications due to their low shrinkage, excellent adhesion, high strength, processing versatility, and good corrosion resistance [7, 8]. They have a range of operating temperatures 353–413 K (80–1400 °C), which is better than polyesters. They also have the added advantage that their processing does not evolve any toxic gases like styrene [9]. In PGMs, the location-specific concentration change and graded distributions can be achieved by controlling the centrifugation time. Proper reinforcement's addition can increase hardness, wear resistance, and the rheological behaviour of PGMs [10]. The wear of polymers based on the environment, lubrication, third body factor (which appears in the form of transfer film) and the different wear mechanisms have been reported with the effects of the size of the fillers,

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