

Evaluation of Tensile Strength of Natural Fibres Reinforced Epoxy Composites Using Fly Ash as Filler Material

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Abstract : A composite material is formed by the combination of two or more phases or materials. Natural minerals-derived Basalt fiber is a kind of fiber being introduced in the polymer composite industry due to its good mechanical properties similar to synthetic fibers and low cost, environment friendly. Also, there is a rising trend towards the use of industrial wastes as fillers in polymer composites with the aim of improving the properties of the composites. The mechanical properties of the fiber-reinforced polymer composites are influenced by various factors like fiber length, fiber weight %, filler weight %, filler size, etc. Thus, a detailed study has been done on the characterization of short-chopped Basalt fiber-reinforced polymer matrix composites using fly ash as filler. Taguchi's L9 orthogonal array has been used to develop the composites by considering fiber length (6, 9 and 12 mm), fiber weight % (25, 30 and 35 %) and filler weight % (0, 5 and 10%) as input parameters with their respective levels and a thorough analysis on the mechanical characteristics (tensile strength and impact strength) has been done using ANOVA analysis with the help of MINITAB14 software. The investigation revealed that fiber weight is the most significant parameter affecting tensile strength, followed by fiber length and fiber weight %, respectively, while impact characterization showed that fiber length is the most significant factor, followed by fly ash weight, respectively. Introduction of fly ash proved to be beneficial in both the characterization with enhanced values upto 5% fly ash weight. The present study on the natural fibres reinforced epoxy composites using fly ash as filler material to study the effect of input parameters on the tensile strength in order to maximize tensile strength of the composites. Fabrication of composites based on Taguchi L9 orthogonal array design of experiments by using three factors fibre type, fibre weight % and fly ash % with three levels of each factor. The Optimization of composition of natural fibre reinforces composites using ANOVA for obtaining maximum tensile strength on fabricated composites revealed that the natural fibres along with fly ash can be successfully used with epoxy resin to prepare polymer matrix composites with good mechanical properties. Paddy- Paddy fibre gives high elasticity to the fibre composite due to presence of approximately hexagonal structure of cellulose present in paddy fibre. Coir- Coir fibre gives less tensile strength than paddy fibre as Coir fibre is brittle in nature when it pulls breakage occurs showing less tensile strength. Banana- Banana fibre has the least tensile strength in comparison to the paddy & coir fibre due to less cellulose content. Higher fibre weight leads to reduction in tensile strength due to increased nuclei of air pockets. Increasing fly ash content reduces tensile strength due to nonbonding of fly ash particles with natural fibre. Fly ash is also not very strong as compared to the epoxy resin leading to reduction in tensile strength.

Keywords : tensile strength and epoxy resin. basalt Fiber, taguchi, polymer matrix, natural fiber

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