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Influence of silicon dioxide reinforcement on mechanical behavior of carbon fiber epoxy composites

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ABSTRACT

Laminated composites made of continuous fibers generally tend to possess good in-plane properties but the through thickness properties of these composites especially delamination resistance are found to be weak. Conditions such as poor roughness of fiber surface, poor wettability, viscosity of the matrix, unavailability of reactive functional groups results in poor interfacial bonding between the matrix and fiber. Infusion of nano fillers in to the matrix can overcome the poor interfacial interaction between matrix and fiber.

Silicon dioxide nanoparticles were incorporated in to matrix of carbon fiber epoxy composite (CFRP) through solvent assisted dispersion technique. Hand layup with vacuum bag setup was used for fabrication of CF/epoxy composites to study the influence of silica nano particles on the interfacial adhesion. Surface chemistry and morphology of silica nano particle were studied through scanning electron microscopy (SEM), fourier transform infrared spectroscopy (FTIR) and x-ray diffraction (XRD) techniques. Mechanical properties of the composites were studied through flexural strength analysis through a three-point bend test as per ASTM standard D7264. Incorporation of silicon dioxide in epoxy matrix showed improvement in mechanical properties. Increase in strength is as a result of enhancement in shear modulus of epoxy matrix and also, silica nano particles act as bridge in transferring load from matrix to fiber.

Keywords: Silicon Dioxide; Carbon fiber reinforced polymer composite (CFRP); Flexural Strength; Scanning electron Microscopy (SEM); Fourier Transform Infrared Spectroscopy (FTIR); X-ray Diffraction (XRD)