

Mechanical Engineering Thesis Defense

Design, Fabrication & Characterization
Of Pva/Nanocarbon Composite Fibers

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abstract

Fibers have broad applications in wearable electronics, bullet proof vest, batteries, fuel cells, filters, electrodes, conductive wires, and biomedical materials. The main focus of this thesis is to design, fabricate, and characterize the polymer/nanocarbon composite fibers. The extraordinary success of nanocarbon materials with their amazing properties has paved the way for their use in fabricating continuous, strong, and functional composite fibers. One of the main reasons for using nanoparticles is the large surface to volume ratios which increase the particle-matrix interactions, thereby increasing the material properties. A well dispersed system generally yields more desirable composite properties, while the particle agglomerates decrease material performance by the inclusion of voids that act as preferential sites for crack initiation and failure. In this research graphene nanoplatelets (GNPs) have been incorporated in polyvinyl alcohol (PVA) matrix for improved mechanical and thermal properties in composite fibers. The fibers were fabricated using dry jet wet spinning method with engineered spinneret design. Three different structured fibers were fabricated namely, one-phase polymer fiber (1-phase), two-phase core shell composite fibers (2-phase), and three-phase co-axial composite fibers (3-phase). Different techniques have been used including Wide Angle X-Ray Diffraction (WAXD), Scanning Electron Microscope (SEM), Thermo Gravimetric Analysis (TGA), Thermal Scanning Calorimeter (DSC), and Dynamic Light Scattering (DLS).

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