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Dynamic Structural Analysis of Polyvinyl alcohol (PVA)/Carbon Nanochips (CNC) Fibers

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Nano-carbon reinforced polymer composites have been widely utilized in aerospace, automobile, and protective applications. Three major challenges that influence the mechanical properties include (i) dispersions of the nano-carbons, (ii) interfacial crystallization/load transfer efficiency, and (iii) fine alignment of nano-fillers/polymer chains. These issues need to be solved before the achievement of ideal properties in the composite can be attained. The current study focuses on the dynamic structural analysis of the composite fibers to understand how these three areas affect the final mechanical performance. The nano-carbons used here are stacked carbon nanochips. Fiber fabrication is achieved by solution dispersion of nano-carbons within the polymer, shear-flow assisted wet-spinning, and post-processing (i.e., drawing and annealing). For the composite fiber, through a series of processes including sonication, centrifuge and mechanical stirring, the nano-carbon dispersions are carefully controlled up to 1 wt% to understand this influence on the structural make-up of the polymer and the fiber final mechanical properties. Thermal-mechanical behavior and micro-structural interactions are characterized using a dynamic mechanical analyzer (DMA). These results show the ability of the nano-carbons at low concentration to improve mechanical properties without reinforcement. Static tensile tests are consistent with DMA results and show an increasing trend of mechanical properties with improved dispersion of the filler. In addition, the storage modulus and transition temperatures were both also improved in the composites as compared to the control fibers.

Biography

Kenan Song obtained his bachelor degree in 2010 and then joined Macromolecule Innovations in Nanomaterial utilizing Systems Laboratory (MINUS Lab) research group in Northeastern University. He is currently a Ph.D. candidate pursuing his degree on the topic "*Customizing Fiber-Spinning Approaches for Polymer/Nano-Carbon Composites*". He has published four articles in peer-reviewed journals, two of which are first-author papers in reputed journals. He has also presented two conference papers and posters. Kenan has also served as an active member in Society for the Advancement of Material and Process Engineering (SAMPE), American Chemical Society (ACS), Society of Plastics Engineers (SPE), and Materials Research Society (MRS).

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