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Designing crystalline micro-structures at the polymer-CNT interphase via process control for composite fabrication

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Controlling the structural development in the interphase region during composite processing is significantly important for improving stress transfer between the polymer matrix and the nano-fillers. The formation of the polyacrylonitrile (PAN) interphase in the presence of the SWNT is studied as a function of processing conditions. By coupling both processing and crystallization, three distinct interfacial PAN coating morphologies are observed on SWNT and characterized using electron microscopy and X-ray diffraction. In the semi-dilute polymer concentration regime subjected to shearing, PAN extended-chain tubular coatings are formed on SWNT. Dilute PAN/SWNT quiescent solutions subjected to cooling yields hybrid periodic shish-kebab structures (first observation for PAN polymer); and dilute PAN/SWNT quiescent solutions subjected to rapid cooling results in the formation of an irregular PAN crystalline coating on the SWNT. The synergistic effect between shear-flow in polymer solution and SWNT was also found in poly(vinyl alcohol) (PVA)/SWNT systems to induce interfacial tubular coating with extended-chain crystalline structure. In addition, these highly crystalline tubular coating structures of PAN and PVA have been successfully grown in the macroscopic composite systems by incorporating specific crystallization procedures into material processing steps.

Biography

Yiyng Zhang is a Ph.D. candidate in Department of Mechanical and Industrial Engineering at Northeastern University and a graduate research assistant in MINUS (Macromolecular Innovations in Nanomaterial Utilizing Systems) Laboratory. To date, she has published four papers in peer-reviewed journals, and presented five conference papers and posters.

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