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Using cyomilling technique to prepare carbon nanotube-reinforce nanocomposites

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The combination of high aspect ratio, small size, very low density, and more importantly, excellent physical properties, such as extremely high mechanical strength and stiffness, high electrical and thermal conductivity, make carbon nanotubes (CNTs) perfect candidates as ideal reinforcing fillers in high strength, lightweight polymer nanocomposites with high performance and multi-functions. A cryogenic ball-milling process to produce polymer/CNT nanocomposites was investigated. Linear Low density Polyethylene (LLDPE) was used as the matrix material, and 1wt % of Multi-walled carbon nanotubes was used as reinforcement; the influence of the milling time and balls size was evaluated. The morphology of the nanocomposite, and the degree of dispersion of the MWCNTs were studied using SEM, visual inspection and light transmission microscopy; ropes as well as aggregates of MWCNTs were observed, and there was evidence of wetting of the nanotubes by the matrix polymer. Through tensile testing, an increase of up to 28% in elastic modulus was observed with respect to the matrix material. The main change in the thermal properties,assessed by differential scanning calorimetry (DSC), was in the crystallization enthalpy (ΔH_c); all the nanocomposites have higher ΔH_c than as-received LLDPE, with increases of between 3 and 9%. This is associated with increase in the degree of crystallinity. The degradation temperature of the nanocomposites does not show significant variations with respect to the unfilled polymer.

Biography

Kwabena A. Narh is a Professor and Associate Chair of Mechanical Engineering, and Director of the National Science Foundation funded NJIT Research Experiences for Teachers Site (RET) at the New Jersey Center for Engineered Particulates. His research interests encompass several areas of plastics engineering and processing, including crystallization kinetics and phase transitions in plastics processing, self-reinforcing composites, nanocomposites, thermal contact resistance in material processing. His research activities on these topics involve experiments as well as numerical modeling. Professor Narh has published over 100 papers (both journal and conference).

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