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Processing-microstructure-property relationship in conductive polymer nanocomposites

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Abstract: The processing-microstructure-property relationship in conductive polymer nanocomposites was investigated. Nanocomposites of vapor grown carbon nanofiber (VGCNF)/high density polyethylene (HDPE) with different levels of nanofiber dispersion were formulated by changing the nanocomposites? compounding temperature. Direct (SEM and optical microscopy) and indirect methods (linear viscoelastic properties) were used to characterize the dispersion of nanofiller. VGCNF aspect ratio before and after mixing was measured. Increasing processing temperature was found to increase the nanofiller agglomeration and reduce the breakage of nanofiller because of the decrease in the mixing shear stress and energy. The electrical and electromagnetic interference (EMI) shielding properties of the VGCNF/HDPE nanocomposites decreased with increase in processing temperature from 180 ?C to 220 ?C because the increase in the agglomeration of VGCNF was more significant than the preservation of the VGCNF aspect ratio. This finding does not mean that the increase in processing temperature will always lead to decrease in the electrical conductivity and EMI shielding properties for all polymer composites. For some composites, it is possible to preserve the filler aspect ratio enough so that the increase in agglomeration is less of a factor.