Nanotube conductive networks in microinjected polymer and polymer blends

Abbasi Samaneh, Derdouri Abdessalem , Carreau Pierre J.

In this study the electrical conductivity and percolation behavior of composites of PP/MWCNT and PC/MWCNT and the nanocomposites of MWCNT in PP/CBT blend were investigated and compared. The effects of microinjection conditions on the morphology, microstructure and properties of composites were also studied. Samples of various MWCNT loadings were prepared by diluting commercial masterbatches of nanotubes using optimized melt-mixing conditions. SEM and TEM techniques were then used to examine the quality of dispersion and formation of nanotube networks within the polymer matrix. In PP and PC composites TEM and Raman spectroscopy results showed that nanotubes are well aligned in microinjected samples although the level of alignment is less in crystalline polymer. FTIR and XRD results revealed that the orientation of both polymer chains and crystalline phase in sheared samples decreased with incorporation of nanotubes into polypropylene. The conductivity properties were also significantly altered by nanotube alignment in both PP and PC nanocomposites; electrical conductivity decreased and percolation threshold rose in microinjected samples; however the presence of crystalline phase improved the conductivity even at high shear condition through the concept of double percolation threshold. The electrical conductivity of PP/CBT blend was also improved through a double percolation that is the basic requirement for the conductivity of the blends. It is also found that the nanotubes affected the morphology of the blends resulted in a smaller and more elongated dispersed phase which is more favorable for the formation of co-continues structure in the nanocomposites.