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Effect of Melt Mixing Conditions on Electrical Conductivity and Rheology of MWCNT / Polycarbonate Composites

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Vaper Grown Carbon Fiber (VGCF) having ultra thick multi-walled carbon nanotube (MWCNT) structure with its diameter around 80-150nm is, due to its extraordinary mechanical and electrical properties, a most promising filler for polymer composites. VGCF/polycarbonate (PC) composites are mostly prepared through melt mixing. However, little is known about the effect of melt mixing conditions on the electrical conductivity and rheological properties of composites. We have prepared various compositions by varying melt mixing time and screw speed. Here, we studied the relationship the electrical conductivity in the solid state and the rheology in the molten state for VGCF / PC composites. We used a batch type twin-screw kneader, to prepare VGCF/PC composites at 260 Å and 300 Å by varying VGCF concentration, mixing time, and screw speed. The percolation property as a function of concentration was strongly affected by mixing time. When the mixing time became longer, the electrical surface resistivity increased at each concentration. When the screw speed became faster at a constant concentration, the surface resistivity increased and then reached saturated value. To analyze these tendencies, we have examined the dynamic melt rheological properties to get deeper insight of VGCF dispersion. In addition, VGCF length as a function of mixing time was also analyzed. A systematical understanding about the effect of mixing on electrical conductivity and rheology for VGCF/PC composite will be presented.