How Do CNT affect the branch and crosslink reactions in CNT-epoxy

Abstract
Carbon nanotube (CNT)-epoxy composites were prepared using carboxyl, amino and raw CNTs. The results of differential scanning calorimetry (DSC) showed that the effect of CNTs on the cure of epoxy resin is strongly dependent on the temperature and time. Raw and carboxyl CNTs accelerated the formation of branched chains (pre-cure at 80 degrees C), consuming the polymerization sites and leading to lower rates of crosslinking reaction (cure at 120 degrees C), resulting in lower storage modulus according to dynamic mechanical analysis (DMA). These results were explained by the catalysts of pre-cure (carboxylic groups and metallic residue of CNTs) and by CNT agglomerates, which could slow the crosslinking due to the consumption of epoxy sites. However, neat epoxy and amino-CNTs nanocomposites showed lower pre-cure rates and higher cure rates, resulting in higher storage modulus. Amino CNTs were the only nanotubes that increased the storage modulus of neat epoxy, due to the good homogeneity and adhesion of their composites. (AU)