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Studies of Microwave Absorption Properties of Carbon Nanotubes/Epoxy Composites[1]

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Less weight, excellent mechanical properties, and high efficiency in absorbing electromagnetic (EM) wave make carbon nanotubes (CNTs) composites attractive for microwave technology applications. Multi-walled carbon nanotubes (MWNTs) have much higher performance-to-price ratio (PPR) than SWNTs do in the composite applications. In this work, we aim to study the effect of the outside diameter (OD) distributions of MWNTs on their microwave absorption properties. We have fabricated six groups of carbon nanotube/epoxy composite samples with various OD distributions. The weight percentages of MWNTs in the composites were controlled in the range from 1 to 10%. We utilized a microwave resonant cavity technique to measure the microwave absorption properties of all the sixty samples around the central frequency of 9.968 GHz. Our results have shown that the maxima of EM wave absorptions for the six groups of samples were all around 7% MWNTs weight percentage. We further studied the effective attenuations of the electric and magnetic fields in six groups of MWNT composite samples with the same (7 %) MWNT blend in epoxy. The results show that, in general, the MWNTs with smaller diameters have higher microwave absorption at 9.968 GHz. However, sample group M5 (OD<8nm) shows unusual results, a lower microwave absorption than the other samples. We then used a scanning electron microscope (SEM) to study the morphologies of the MWNT samples. Based on the SEM analysis and microwave absorption measurements, we found that the efficiency of the microwave absorption of MWNT/Epoxy composites is strongly affected by the morphologies/structures of MWNTs in individual bundles.

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