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Diameter Dependence of Magnetic Properties in Nanoparticle-Filled CNTs KRISTEN STOJAK, SAYAN CHANDRA, HAFSA KHURSHID, MANH-HUONG PHAN, HARIHARAN SRIKANTH, University of South Florida-Physics, ESTER PALMERO, MANUEL VÁZQUEZ, Instituto de Ciencia de Materiales de Madrid — In past studies we showed magnetic polymer nanocomposites (MPNCs) with ferrite nanoparticle (NP) fillers to be magnetically tunable when passing microwave signals through films under the influence of an external magnetic field. We extend this study to include NP-filled multi-walled carbon nanotubes (CNTs) of various diameter ($\sim$300nm, $\sim$100nm, $\sim$40nm) synthesized by a catalyst-free CVD method, where the outer diameter of the CNTs is determined by a porous alumina template. These high-aspect ratio magnetic nanostructures, with tunable anisotropy and tunable saturation magnetization, are of particular interest in enhancing magnetic and microwave response in existing MPNCs. CNTs with $\sim$ 300nm diameter have been uniformly filled with cobalt ferrite and nickel ferrite NPs ($\sim$7nm). NP-filled CNTs show an increase in blocking temperature of $\sim$40K, as well as an increase in relaxation time, τ_0. The enhancement of these properties indicates that enclosing NPs in CNTs increases interparticle interactions. The magnetic properties are also tunable by varying the diameter of CNTs. Characterization was completed with XRD, TEM and Quantum Design PPMS, with VSM and ACMS options.

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