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Magnetic Properties of Core/Shell Structured Iron/Iron-oxide Nanoparticles Dispersed in Polymer Matrix ZOHREH NEMATI PORSHOKOUH, HAFSA KHURSHID, MANH-HUONG PHAN, HARIHARAN SRIKANTH, University of South Florida Physics — Iron-based nanoparticles (NPs) show interesting magnetic properties for a wide range of applications; however rapid oxidation of iron limits its practical use. Protecting iron with a thin layer of iron-oxide is a possible way to prevent oxidation, forming core/shell (CS) iron/iron-oxide. Due to the different diffusivity rates of the two materials, a gap appears between the core and shell after a period of time (Kirkendall effect), degrading the magnetic properties of the sample. We minimize the Kirkendall effect while retaining good magnetic properties of ∼12.5 nm CS iron/iron-oxide NPs by dispersing them into a polymer matrix. Magnetic measurements reveal that after a period of 3 months the blocking temperature (TB) of as-made CS NPs decreases from 107 K to 90 K. The change in TB marks the formation of a gap between the core and shell, which is also evident from HRTEM studies. By contrast, NPs dispersed in RP show no change in TB over the same time period. We repeated experiments with ∼10.5 nm CS NPs and the results are consistent. Our study shows the importance of dispersing CS NPs in polymers to preserve desirable magnetic properties for practical applications, ranging from RF sensors and microwave devices to bioengineering.

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