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Magnetic properties of Fe/Fe_3O_4 core/shell nanostructure VIVEK SINGH, MOHINDAR SEEHRA, West Virginia University, S. BALI, E. EYRING, University of Utah, N. SHAH, F. HUGGINS, G. HUFFMAN, University of Kentucky — Magnetic properties of a core/shell nanostructure with spherical core of Fe/FeB and a shell of Fe_3O_4/γ-Fe_2O_3 are reported employing magnetometry, electron magnetic resonance (EMR) and Mössbauer spectroscopy. This nanostructure was produced by reducing $FeCl_3{\cdot}6H_2O$ with $NaBH_4$. Combining the results from XRD, TEM and Mössbauer spectroscopy showed the nanostructure to consist of a core of diameter D$\simeq$20 nm containing both α-Fe with D$\simeq$7 nm and amorphous Fe-B alloy and a shell of thickness 5 nm containing Fe_3O_4/γ-Fe_2O_3. Measurements of the magnetization M vs. temperature (2 K to 370 K) and in H upto 65 kOe show a blocking temperature $T_B \simeq$30 K associated with the oxide shell and ferromagnetism upto 370 K with nearly temperature-independent saturation $M_S \simeq$70 emu/g and coercivity $H_C \simeq$100 Oe. In EMR studies at 9.28 GHz, two lines are observed: a narrower line with linewidth ΔH$\simeq$600 Oe and g$\simeq$2 and a broader line with ΔH$\simeq$4200 Oe and g$\simeq$2.2. These parameters of the narrower line combined with its disappearance below 50 K suggests its origin to be the oxide shell whereas the broader line is due to Fe/FeB core. Research supported by U. S. Dept. of Energy, Contract #DE-FC26-05NT42456.

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