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ABSTRACTS

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Fe_3O_4 hollow spheres with an average diameter of 395 nm and shell thickness of 100 nm(Fig.1A) was grown on the r-GO sheets by a facile solvothermal method. The hollow spheres are polycrystalline and composed of tiny Fe_3O_4 nanocrystals, and thus the composites present superparamagnetic with a saturated magnetization of 66 emu/g. An increased D/G intensity ratio in Raman spectra of the composites suggests a substantial increase in disorder degree in the r-GO sheets[2,3] possibly due to the outer shell of bowl-like Fe_3O_4 interacting with the r-GO surface. Compared with pristine r-GO[1], all the test samples containing 20 wt% composites with different layer thickness(1.0~3.0 mm) exhibit enhanced microwave absorption properties including a wider absorption band as well as a larger reflection loss(Fig.1B). As a result of co-contribution of Fe_3O_4 and r-GO, both the dielectric and magnetic losses of the composites have been greatly enhanced in the range of 8~18 GHz.

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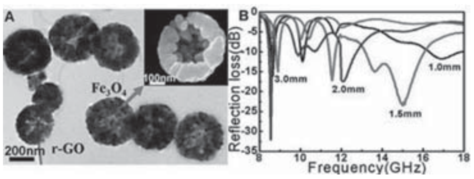

FIG. 1(A) TEM image of hollow Fe_3O_4<@>r-GO composites, the inset is a SEM image of an individual bowl-like Fe_3O_4 hollow sphere;(B) Reflection loss (R_L) of the composites with different sample layer thickness versus frequency in the range of 8~18 GHz .

DW-08. Investigation of magnetic properties of non-magnetic ion (Al, Ga, In) doped $Ba_2Mg_{0.5}Co_{1.5}Fe_{12}O_{22}$.

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$Ba_2Mg_{0.5}Co_{1.5}Fe_{12}O_{22}$ (non-doped) and non-magnetic ion (Al, Ga, In) doped $Ba_2Mg_{0.5}Co_{1.5}(Fe_{0.99}M_{0.01})_{12}O_{22}$ (M-doped) polycrystalline samples were prepared by the solid-state reaction method. The crystal structure and magnetic properties of samples were investigated with x-ray diffractometer (XRD), vibrating sample magnetometer (VSM), and Mössbauer spectroscopy. The crystal structures of non-doped and M-doped samples were determined as hexagonal structures with R3-m space group by the Rietveld refinement. The Bragg factor (R_B) and structure factor (R_F) of all samples were less than 5 %. The unit cell volume (V_u) of non-doped sample was V_u = 1298.0 Å^3, while those of M-doped samples (M = Al, Ga, In) were V_u = 1295.7, 1296.7 and 1299.9 Å^3, respectively, Suggesting the increase V_u with increasing ionic radius as expected. From the magnetic hysteresis curves at room temperature, the saturation magnetization (M_s) and coercivity (H_c) of non-doped sample were found to be M_s = 28.0 emu/g and H_c = 255.4 Oe, but those of M-doped samples (M = Al, Ga, In) were M_s = 24.7, 28.4, 28.6 emu/g, and H_c = 222.0, 215.9, 190.7 Oe, respectively. This shows that H_c decreases with non-magnetic ion doping. From the temperature dependence of magnetization curves under 100 Oe between 4.2 and 740 K, non-doped sample showed magnetic structure transitions from ferrimagnet to paramagnet around 587 K, and helimagnet to ferrimagnt around 200 K.[1-2] Also, we have observed the magnetic-filed dependence of magnetization in non-doped sample under 300 Oe between 4.2 and 740 K. In addition Mössbauer spectra of all samples were obtained at various temperatures ranging from 4.2 to 750 K. Isomer shift values of all samples show that the charge states are Fe^{3+} at room temperature.

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DW-09. Polyol synthesis and characterization of nickel and cobalt mixed metal ferrite nanomaterials for biomedical applications.

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The spinel ferrite nanoparticles of composition MFe_2O_4 where M is Co or Ni exhibit interesting magnetic properties that are potentially useful for a broad range of biomedical applications, especially in the field of magnetic resonance imaging. Changing the identity of M, and by changing the crystallite size of the ferrites can systematically produce nanocrystals with diverse magnetic properties. Once the preparation of the nanoparticles has been optimized, the particles need to be coated with a biocompatible material to prevent aggregation, sedimentation and to provide a scaffold for further functionalization. In this work, spinel ferrites of composition $CoFe_2O_4$, $NiFe_2O_4$, and $Ni_{.5}Co_{.5}Fe_2O_4$ were synthesized by a polyol method utilizing ethylene glycol as the solvent, reducing agent, and surfactant. The nanoparticles produced were surface coated with 3-aminopropyltriethoxy silane to increase solubility as well as to serve as an anchor for further conjugation with targeting substrates such as peptides and antibodies. Varying the reaction time from thirty minutes to one hour produced crystallite sizes of 20 nm and 40 nm respectively, as measured by X-ray diffraction. Magnetic characterization by vibrating sample magnetometry showed saturation values that ranged from 34.2 to 71.2 emu/g. Magnetic resonance imaging (MRI) was carried out to measure the transverse relaxation time (T_2) of the series of nanoparticles in order to investigate the size dependence and crystallite composition of the particles ability to affect the transverse relaxivity (r_2). Further understanding of how ferrite composition and crystallite size effect their magnetic properties and resulting MRI contrast abilities will provide insight into the best materials for the next generation of contrast agents.

DW-10. RF Heating Characteristics of (NixCo1-x)yZnzFe2O4 Ferrite Nanoparticles.

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Colloidal ferrofluids, which are physical mixtures of magnetic nanoparticles (MNPs) suspended in a fluid medium, have shown to be viable candidates as efficient heat sources under an applied radio frequency (RF) magnetic field. The unique advantage of this approach is the ability to heat locally and control the rate of heat transfer by eliminating conductive and/or convective heat transport resistances. The later is of great importance in miniaturized reactors that are mainly used for heat and mass transfer limited reactions. The present work investigates RF heating characteristics of sol-gel processed ferromagnetic (NixCo1-x)yZnzFe2O4 nanoparticles as heat sources for microreactors. Zinc substitutions and different calcination temperatures after sol-gel synthesis are employed to arrive at ferrite nanoparticles with different coercivity values and grain sizes. RF heating was accomplished through a 4-turn coil using a 1.0kW Ameritherm power supply with a variable frequency between 295-315kHz and maximum output of 100A. Table 1 summarizes magnetic properties, grain sizes and specific power loss values of the nanoparticles as a function of RF excitation current. Higher power losses are measured for nanoparticles that have lower coercivities. We discuss the effects of saturation magnetization, coercivity and grain size on the obtained power losses.

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