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Synthesis and Characterization of Magnetic $La_{1-x}Sr_xMnO_3$ ($0 \leqq x \leqq 0.5$) Nanoparticles Using a Simple Thermal Hydro-Decomposition of Acetate Precursor

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ABSTRACT

This study reports the synthesis of magnetic nanoparticles of $La_{1-x}Sr_xMnO_3$ (LSMO) (LSMO) with x = 0, 0.1, 0.2, 0.3, 0.4 and 0.5 by a simple thermal hydro-decomposition method by using acetate salts of La, Sr and Mn as starting materials. To obtain the LSMO nanoparticles, the metal acetate salt are dispersed in deionized water and then thermally decomposed at the temperatures of 900°C for 6 h. The obtained LSMO nanoparticles are characterized by XRD, FT-IR, TEM and SEM Structural characterization show that the prepared particles consist of two phases of $LaMnO_3$ and LSMO with crystallite sizes ranging from 20 to 87 nm. All the prepared samples had a perovskite structure with changing from cubic to rhombohedral with increasing the thermal decomposition temperature. The results of room temperature magnetic properties show a paramagnetic behavior for all the LSMO samples with x = 0, and a ferromagnetic behavior for the other samples having the M_S values of ~ 20 - 47 emu/g and the H_C values of ~ 10 – 40 Oe. Both M_S and H_C values depend on the crystallite size and thermal decomposition temperature. The relationship between the crystallite size and the magnetic properties is discussed.

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Synthesis of Fe_3O_4-AuPt Core-shell Nanoparticles

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Convergent interdisciplinary integration of biology and medicine with physical sciences and nanotechnology shows diverse merits and offers great application potentials [1]. In our research programs, we have focused on the preparation of various multifunctional nanoparticles in alloy and core-shell nanoarchitectures, to accomplish multiple purposes in a single moiety [2]. In this work, highly crystalline, monosized Fe_3O_4/AuPt core-shelled nanoparticles were synthesized using the one-pot polyol process [3]. The formation of the core-shell structure was achieved in two consecutive steps, seeding the Fe_3O_4 core followed by coating the AuPt shell adjustable via temperature and time. The XRD patterns show the crystal structure of the core-shell nanoparticles, while TEM gives the information on the nanoparticle size and uniformity (Fig. 1a), manifesting a monosized distribution and an average diameter of ~10 nm. The lattice images demonstrate unambiguously the high crystallinity of the nanoparticles. The magnetic measurements reveal the superparamagnetism and enhanced susceptibility of the nanoparticles, which is preferable for biomedical applications (Fig. 1b). The surface plasmon resonance from the nanostructured Au as a result of the AuPt shell is further studied by UV-Vis spectroscopy, whereas the stability of the nanoparticles has been tested in various solutions. In conclusion, the nanoparticles have proved successful integration of the magnetic component promising for rapid location and targeted delivery to the sites of interest under an external magnetic field with the unique optical and surface properties of nanostructured AuPt.

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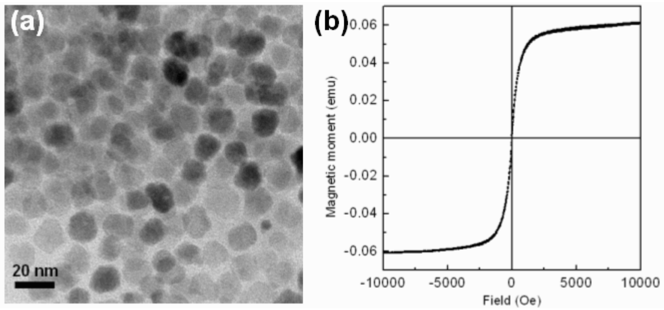

Fig. 1. Fe_3O_4-AuPt core-shell nanoparticles. (a)TEM and (b) Hysteresis curve.

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