I-1 13:00 ~ 13:40 Invited Talk I

Fabrication of New Magnetic Nanocrystallites and Nanoporous Carbon Materials

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We have developed new synthetic procedures to fabricate monodisperse magnetic nanocrystallites. Monodisperse and highly crystalline magnetic nanoparticles were fabricated without a size selection process, which is very important for large-scale production of the materials. Particle size can be varied from 2 nm to 20 nm by controlling the experimental parameters. TEM images of the particles showed 2-dimensional and 3-dimensional assembly of particles, demonstrating the uniformity of these nanoparticles. Electron diffraction, X-ray diffraction, and high resolution TEM images of the nanoparticles showed the highly crystalline nature of the γ-Fe_2O_3 structures. We fabricated novel iron nanorods with dimensions of 2 nm (thickness) * 8 nm (length), 2 nm * 12 nm, 2 nm * 20 nm, and 2 nm * 36 nm from the controlled growth of uniform 2 nm sized spherical nanoparticles. These iron nanorods exhibited high shape anisotropy. The synthesis and magnetic characterization of these nanoparticles will be presented.

We have developed new synthetic procedures to fabricate various nanoporous carbons using nanostructured silica materials as templates. Nanoporous carbons with extremely high mesopore volumes and surface areas have been produced using silica nanoparticles as templates. These nanoporous carbons exhibited excellent adsorption capacities for bulky dyes. Mesoporous carbons with regular 3-dimensionally interconnected ~2 nm pore arrays have been synthesized using aluminum substituted MCM-48 and HMS mesoporous silicas as templates. The mesoporous carbons exhibited excellent performance for electrochemical double layer capacitors (EDLC). Using mesocellular silica foams as templates, mesocellular carbon foams composed of uniform cells with diameter of ~30 nm and window size of ~15 nm were fabricated. We fabricated carbon capsules with hollow macroporous core/mesoporous shell structures using the submicrometer-size solid core/mesoporous shell silica spheres as templates.