Materials Science

CHARACTERIZATION OF IRON NANOPARTICLES PRODUCED BY VACUUM EVAPORATION ON RUNNING LIQUIDS (VERL) TECHNIQUES; Robert A. Parada[1]; Elaine M. Kirkpatrick[1]; Dane E. Crawford[2]; Catherine F.M. Clewett[2]; Diandra L. Leslie-Pelecky*[3]; Rose-Hulman Institute of Technology[1], Department of Physics and Optical Engineering, Terre Haute, IN 47803; Fort Hays State University[2], Department of Physics, Hays, KS 67601; University of Nebraska – Lincoln[3], Department of Physics & Astronomy and Center for Materials Research & Analysis, Lincoln, NE 68588; kirkpatr@rose-hulman.edu

Nanomagnetic particles are emerging in many new and promising applications, most prominently in the biomedical field. Applications include targeted drug delivery systems, bioassays, resonance imaging, cell sorting/isolation, and memory storage. Iron nanoparticles were produced using a vacuum evaporation on running liquids (VERL) technique modeled after a procedure outlined by M. Wagener and B. Günther. Iron nanoparticles were sputtered into an oil carrier liquid and surfactant mixture inside an argon environment. In addition to samples collected from the carrier liquid, solid samples were taken from depositions around the chamber. Magnetic and structural properties of the nanoparticles were analyzed using alternating gradient force magnetometry (AGFM), transmission electron microscopy (TEM), and electron diffraction measurements. Samples from the carrier liquid characteristically exhibited supermagnetic behavior; whereas, solid samples collected from the chamber exhibited ferromagnetic properties. Structurally, the majority of the samples collected were identified as cubic or rhombohedral Fe_2O_3 ranging from 15-60 nm in diameter. Particle agglomeration was always present, although the surfactant in the carrier liquid suppressed the degree of agglomeration and oxidation in the samples by surrounding the particles in micellular structures. Particle production techniques were modified to investigate the effects on magnetic and structural properties in an effort to produce nanomagnetic particles with the desired properties for applications.