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EMSL In Brief
Environmental Molecular Sciences Laboratory

EMSL Capabilities Instrumental in Nanoparticle Size Study

A research team from the Environmental Molecular Sciences Laboratory (EMSL), Pacific Northwest National Laboratory (PNNL), and University of Idaho has used room-temperature methods, instead of traditional high temperature methods, to create metallic-iron nanoparticles with varying shapes. Oxide and metallic iron nanoparticles with size dependent properties could be valuable for applications such as medical imaging, drug delivery, information storage, and groundwater remediation.

EMSL capabilities such as transmission electron microscopy were instrumental in studying nanoparticles created at room temperature. The particle size dependent properties can be valuable in applications such as drug delivery and remediation. EMSL researcher Chongmin Wang, shown above, was lead author in the study.

The research, featured on the cover of the June 25, 2007, issue of *Nanotechnology* [18(25):255603], involved formation of the particles using a sputter-gas-aggregation method at room temperature in labs at the University of Idaho. The particles were then delivered to EMSL and analyzed using transmission electron microscopy, electron diffraction, and Wulff shape construction.

The room-temperature-deposited nanoparticles were found to have three distinct structures: (1) a simple six-sided cube, a shape not seen in high-temperature formations; (2) a truncated cube, which looks like a cube with each of the edges shaved off; and (3) a rounded shape composed of 12 hexagons and 6 squares, a shape researchers have seen when particles are formed at higher temperatures.

"These new shapes expose high-energy surfaces to the environment," said EMSL Lead Scientist for Interfacial Chemistry, Don Baer, who is co-author of the paper. Particles created at high-temperature expose low-energy surfaces. The high-energy surfaces change the reactivity and magnetism of the particles.

The results, combined with those already reported, suggest that by using a low-temperature process, the synthesis parameters can be altered to select particle shape with the possibility of optimizing particles for specific chemical or magnetic properties.

The researchers are now working to produce enough particles in specific shapes so that they can examine the particles' magnetic and chemical properties. The research is supported by DOE's Office of Basic Energy Sciences and Office of Biological and Environmental Research.