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Static and dynamic magnetic properties of "dumbbell" and "flower" shaped Au-Fe_3O_4 nanoparticles N.A. FREY, S. SRINATH, H. SRIKANTH, Department of Physics, University of South Florida, Tampa, FL 33620, CHAO WANG, SHOUHENG SUN, Department of Chemistry, Brown University, Providence, RI 02912 — We report studies of the static (DC) and dynamic (AC, RF) magnetization of chemically synthesized Au-Fe_3O_4 nanoparticles with dumbbell and flower shaped configurations. Dumbbell particles form with Fe_3O_4 (18 nm) growing epitaxially on Au seed particles (4 – 8 nm). Multiple Fe_3O_4 particles also can be made to grow on Au particles with flower-like cluster geometry. While measurements on dumbbell particles revealed standard signatures of superparamagnetism, the flower-like nanoparticles exhibited remarkable novel features. Two magnetic transitions are observed –one representing the blocking temperature (∼88K) and the other (∼48K) likely associated with freezing of surface spins. Our experiments revealed the presence of exchange bias (EB), high field irreversibility as well as training and memory effects. EB was also confirmed through RF transverse susceptibility measurements that directly probe the effective magnetic anisotropy and switching fields. Our studies demonstrate how engineering the configuration of nanoparticle clusters in a controlled manner can result in dramatically different magnetic properties.

N. A. Frey
Department of Physics, University of South Florida, Tampa, FL 33620

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