Understanding and Controlling Magnetic Coupling and Diffusion of Iron-Platinum Nanocrystals in One-Dimensional Channels

David Lui, Van Le and Sarah Tolbert

Rose-Hulman Institute of Technology

and

Department of Chemistry and Biochemistry, UCLA

Magnetic nanocrystals can potentially be used for magnetic recording and ultra data storage. In this work, we will examine the 1-D diffusion of magnetic nanoparticles into nanoscale channels in order to compare and contrast the filling fraction of magnetic and non-magnetic materials that incorporates into 1-D channels. We expect to see an increase in the concentration of magnetic material resulting in an increase of filling fraction, and thus an increase of magnetic moment. Particle incorporation was measured using Inductively Coupled Plasma – Atomic Emission Spectroscopy to determine the filling fraction of the magnetic particles, whereas X-Ray Diffraction showed that magnetic nanocrystals incorporated into a single crystalline orientation. We examined the crystalline domains to approximate the average number of particles incorporated per channel. Superconducting Quantum Interference Device (SQUID) magnetometry was used to measure magnetic properties of these nanocrystals. SQUID data suggest that coercive width increases with an increase in concentration until we get to a point where the coercive width is no longer dependent on the filling fraction. We believe that the coercive width is more dependent on the chain length of particles rather than the filling fraction, which may explain why the after a certain point, the magnetic properties of the nanocrystals were similar.

Since incorporation of nanoparticles in pores is highly dependent on 1-D diffusion, it is important to understand the diffusion process in order to control the stacking of nanoparticles and the extent of magnetic coupling.

The above sentence would be my conclusion of why my research is important, but if I add it, my abstract will come out to be 232 words. If that's ok, then can you please add it. But if not, you can just leave it off. Thanks for your wonderful comments and suggestions!!