

## Magnetic properties and dispersion stability of carbon encapsulated Fe nano particles

Young Rang Uhm<sup>1</sup>, Hi Min Lee<sup>1</sup>, Chang Kyu Rhee<sup>1</sup>, and Chul Sung Kim<sup>2</sup>

<sup>1</sup>Nuclear Materials Research Division, Korea Atomic Energy Research Institute, Daejeon, 305-353 Korea

<sup>2</sup>Department of Nano-electro Physics, Kookmin University, Seoul 136-702, Korea

The carbon encapsulated Fe nanoparticles has attracted much attention, because of the technological potential applications such as magnetic storage media, lubricant, and ferrofluids, etc. The nano particles were synthesized by a levitational gas condensation (LGC) method. The starting material was the metal Fe wire with diameter of 0.4 mm. The mixed Ar and CH<sub>4</sub> gas pressure in chamber was 86 torr. The morphologies of the carbon-coated Fe nanocrystallites were characterized by transmission electron microscopy. The results indicated that all of the as-made materials were composed of only nanocapsules with the uniform particle size at and below 10 nm. The nanocapsules consisted of outer multi-shells of carbon. The Mössbauer spectroscopy reveals that the Fe@Cs materials are made of the bcc-Fe core, closed packed cubic  $\gamma$ -Fe and the amorphous graphitic shell structure. The magnetization curves were measured at 60 and 300 K. The hysteresis loop demonstrated that the carbon-coated metal nanocrystallites exhibited a superparamagnetic behavior at room temperature. The magnetic performance of the Fe@C sample was demonstrated in a liquid phase (ethanol, and poly ethylene glycol) by placing a magnet bar near the glass bottle. The dispersion stability kinetics of the solvents increased in the following order: water, ethanol, and ethylene glycol. The polarity of the solvent affected the dispersion stability kinetics.

www.icamd.or.kr



# ICAMD 2009

The 6<sup>th</sup> International Conference on  
Advanced Materials and Devices

December 9 ~11, 2009  
Ramada Plaza Jeju Hotel, Jeju, Korea

## Program and Abstracts

### Organized by

Applied Physics Division, The Korean Physical Society  
Quantum Metamaterials Research Center  
Asia Pacific Center for Theoretical Physics  
Center for Nanotubes and Nanostructured Composites  
Quantum Photonic Science Research Center  
National Core Research Center for Extreme Light Applications  
Center for Subwavelength Optics  
Center for THz-Bio Application Systems  
Center for Cross-coupled Complex Materials Research  
WCU-QPD, School of Physics, KonKuk University  
New and Renewable Energy Research Center, Ewha Womans University  
Center for Subwavelength Nanowire Photonic Devices

### In cooperation with

The Japan Society of Applied Physics  
The Physical Society of Republic of China

### Sponsored by

Korean Ministry of Education, Science and Technology  
National Research Foundation of Korea  
BK21 Department of Physics, Ewha Womans University  
Jeju Convention & Visitors Bureau