

Controlling the thickness of silicon dioxide shell of iron boride nanoparticles

Thursday, May 21, 2015 8:45 AM (15 minutes)

Iron boride nanoparticles are one of soft ferromagnetic materials which also contain boron. These properties combined the possibility of magnetically targeting the nanoparticles, use their hysteresis loop to cause thermal damage of tissue, as well as provide boron neutron activation medicine in cancer therapy applications. Unfortunately, iron boride may be easily oxidized under oxygen rich atmospheres. Thus, they must be coated with protecting layers such as silicon dioxide. In this project, we synthesized iron boride-silicon dioxide and enlarged the silica shell thickness by varying the concentration of the silica forming precursor tetraethyl orthosilicate (TEOS). The particle shape, and the silica shell thickness was then studied using transmission electron microscopy. The results showed that iron boride-silicon dioxide with spherical shape and well formed silica shell can be obtained with various thicknesses. After measurement, we got a mean size of the whole particle about 83 nm, the iron boride core size about 74 nm and the thickness of primary shell about 5 nm. The additional thickness of the silica shell was accomplished by further hydrolysis of TEOS using the primary Fe_2B nanoparticles as seeds. The use of concentrations of TEOS of 3.16×10^{-4} , 6.31×10^{-4} and 1.26×10^{-3} mol/l yielded 17 nm, 20 nm and 84 nm thick shell, respectively. We compared the experimental thickness of the silica shell with the expectation obtained from considering the amount of TEOS used and the initial particle size. In summary, silica shell thickness increased as the TEOS precursor concentration increased.

Primary authors: Prof. HODAK, Satreerat K. (Department of Physics, Faculty of Science, Chulalongkorn University, Bangkok, THAILAND 10330); Ms VAJANARAT, Tipnirin (Department of Physics, Faculty of Science, Chulalongkorn University, Bangkok, THAILAND 10330)

Co-author: Prof. HODAK, Jose (INQUIMAE-Departamento de Química Inorgánica, Analítica y Química Física, Facultad de Ciencias Exactas, University of Buenos Aires, Argentina)

Presenter: Ms VAJANARAT, Tipnirin (Department of Physics, Faculty of Science, Chulalongkorn University, Bangkok, THAILAND 10330)

Session Classification: Material Physics, Nanoscale Physics and Nanotechnology

Track Classification: Material Physics, Nanoscale Physics and Nanotechnology