Chemical Synthesis of Magnetic Nanomaterials

Yanglong Hou*
Department of Materials Science and Engineering College of Engineering, Peking University, China
E-mail: hou@pku.edu.cn

Magnetic naonmaterials have attracted intensive interests due to their great applications in data storage and biomedical fields, including MRI, drug delivery and magnetic hyperthermia. It is a prerequisite to these kind of applications that these nanomaterials possess controlled size, shape and magnetic properties. It is worth noting that chemical methods offer an effective route to precisely control both phases at the nanoscale, and help understand magnetic interactions and develop advanced magnetic materials for various applications. In this talk, we will introduce our recent work on controlled synthesis of magnetic nanomaterials. We will first present a general protocol of chemical synthesis to monodisperse NPs, such as 0D Fe_3O_4, FePt, Fe_5C_2 nanoparticles, 1D FePt nanorods, 2D Fe_3O_4 nanoprisms, and nanocomposite magnets. And then, we willmove to exchange-coupled nanoparticles with magnetically hard $L1_0$-FePt as core and magnetically soft Co (or Ni, or Fe_2C) as shell. Finally, a facile chemical route to prepare 200 nm single domain $SmCo_5$@Co core/shell magnets with coercivity of 20.7 kOe and saturation magnetization of 82 emu/g. The single domain $SmCo_5$ core contributes to the large coercivity of the magnets and the exchange-coupled Co shell enhances the magnetization. This method can be further utilized in the synthesis other NdFeB based exchange-coupled magnets.

References

[1] F. Liu, Y. Hou*, and S. Gao*, Exchange-coupled Nanocomposites: Chemical Synthesis, Characterization and Applications, *Chem. Soc. Rev.*, **2014**, 43, 8098-8113.

[2] F. Liu, J. Zhu, W. Yang, Y. Dong,Y. Hou*, C. Zhang, H. Yin and S. Sun*, Building Nanocomposite Magnets by Coating a Hard Magnetic Core with a Soft Magnetic Shell, Angew. Chem. Int. Ed., **2014**, 53, 2176-2180.

[3] C. Yang, H. Zhao, Y. Hou*, D. Ma*, Fe_5C_2 Nanoparticles: A Facile Bromide-induced Synthesis and as an Active Phase for Fischer-Tropsch Synthesis (FTS), J. Am. Chem. Soc., **2012**, 134, 15814-15821.

[4] L. Yu, C. Yang and **Y. Hou***, Controllable $Nd_2Fe_{14}B$/α-Fe Nanocomposites: Chemical Synthesis and Magnetic Properties, *Nanoscale*, **2014**, 6, 10638-10642.

[5] C. Yang, L. Jia, S. Wang, C. Gao, D. Shi, **Y. Hou*** and S. Gao,* lSingle Domain $SmCo_5$@Co Exchange-coupled Magnets Prepared from Core/shell $Sm[Co(CN)_6]\cdot 4H_2O$@GO Particles: A Novel Chemical Approach, *Scientific Rep*ort, **2013**, 3, 3542.