Synthesis and Characterization of Cobalt Ferrite Powdered Materials

by Mr. Liu Binghai

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Abstract

Cobalt ferrites (CoFe$_2$O$_4$) are important hard magnetic materials which have a wide range of applications such as MEMS and magneto-optical devices. Achieving high coercivity in CoFe$_2$O$_4$ materials is essential for hard magnetic applications. This thesis project dealt with the synthesis and characterization of CoFe$_2$O$_4$ powdered materials, and studied the effects of phase, cation distribution and microstructure on the magnetic properties of CoFe$_2$O$_4$ powder materials. The major focus of the project is to explore the effective ways for achieving high coercivity in CoFe$_2$O$_4$ materials and to study coercivity mechanisms. The research work was carried out by studying the four major effects, i.e. the effects of average size and size distribution, the effects of cation distribution, the effects of chemical composition and the effects of the defects and microstrain. The results indicated that, besides the effects of phase and cation distribution, microstructure tailoring plays a key role in affecting coercivity of CoFe$_2$O$_4$ materials. With building-up high-level strain and introducing high-density defects, high coercivities of up to 5.1 kOe were achieved in CoFe$_2$O$_4$ powdered materials. The reversal magnetization studies based on the micromagnetic model and phenomenological model revealed the domain-wall pinning controlled coercivity mechanism.

Speaker Mr. Liu Binghai

Mr. Liu Binghai obtained his B. Eng. (Materials Science and Engineering) and M. Eng. (Materials Science and Engineering) from Wuhan University of Technology. He has been a part-time Ph.D. student under A/P Ding Jun in the Department of Materials Science and Engineering, National University of Singapore. Currently he is working in Chartered Semiconductor Manufacturing Ltd..

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Assoc Prof Li Yi Host