Synchrotron Light Applications for Characterizing Advanced Thin Films

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Half metallic ferromagnetic materials, characterized by 100% spin polarization and having only one spin-subband at the Fermi level, have being actively investigated. Magnetite is the oldest known magnetic material and has attracted enormous attention due to its half metallic ferromagnetic nature, high Curie temperature (858 K), and the presence of a metal-insulator transition at 120 K (Verwey transition). These properties make magnetite a promising material for applications in spin electronic devices such as magnetic tunnel junctions for magnetic random access memory.

Recently, we have succeeded in fabricating single phase magnetite films on sapphire substrate with a saturation magnetic moment of $\sim 500$ emu/cm$^3$ by pulsed laser deposition and have found that properties of the iron oxide films depend strongly on iron oxide phases in the film [1]. For device applications a deeper knowledge on the structure and the stability of the iron oxide thin films is essential. X-ray absorption fine structure (XAFS) has been proved to be a powerful method to understand the electronic structures about a target atom in a material [2]. In this invited talk, we report a systematic investigation on iron oxide films fabricated by pulsed laser deposition at various growth temperatures using XAFS measurements at the Fe K-edges. Synchrotron light applications for characterizing other advanced thin films will also be reported.

References