The Fabrication of a Single-Phase Fe_3O_4 Film on W(110) Using a Co-Deposition Method

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We report on the growth of single-phase magnetite (Fe_3O_4) thin film n W(110) substrate by using the co-deposition method of Fe and oxygen as we control the substrate temperature. Furthermore, we confirmed the formation of various Fe-oxide films at various annealing temperature after the fabrication of magnetite (Fe_3O_4) thin film. The characterization of magnetic properties was performed by using soft X-ray adsorption spectroscopy (XAS) and soft X-ray magnetic circular dichroism (XMCD). The O K-edge and Fe $L_{2,3}$-edge XAS spectra reveal that the couplings of the O 2*p* with Fe 3d orbitals highly rely on the growth processes. The XMCD data of well-characterized thin films exhibit characteristic contributions from Fe^{3+} ions in a tetrahedral site(A-site) and Fe^{2+} and Fe^{3+} ions in octahedral sites(B-sites) and shows some different spectral features to those of the Fe$_{3}$O$_{4}$ single crystal. The annealing-temperature dependence of the XMCD line-shapes and the Oxygen K-edge spectra show the change of the phase and magnetic character of Fe oxide films. These investigations demonstrate the experimental conditions for controlled growth of magnetite (Fe_3O_4) thin film on W(110) substrate and suggest that Fe_3O_4 might be a promising spintronics materials for future technology.