Experimental Examination of Phase Transition in FePt Films Produced by Low-Temperature Annealing

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The high magneto-crystalline anisotropy $L1_0$ phase of $Fe_{50}Pt_{50}$ is an attractive material for the applications of magnetic storage media. In this work, we have investigated the variation of the electronic and atomic structures that occurs in $Fe_{50}Pt_{50}$ thin films. when the deposition temperatures were changed. Temperatures within the range 200-350°C were used for the deposition of films and the results show a transition is occur from a disordered fcc state to an ordered $L1_0$ (fct) state at 300°C.

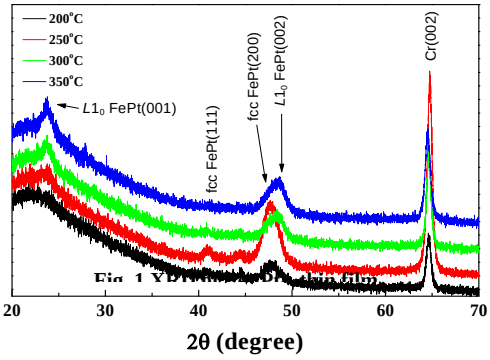

Figure 1 displays the x-ray diffraction (XRD) spectra of $Fe_{50}Pt_{50}$ thin films at different deposition temperature. We observed a clear difference near $2\theta = 23^o$ and $2\theta = 48^o$ when the deposition temperature is higher than 300°C. It's an evidence that shows the transition occurs from disordered fcc to an ordered $L1_0$ (fct) state at this temperature.

Figure 2 displays the x-ray absorption near-edge structure (XANES) spectra of the Fe *K*-edge and Pt L_3-edge and extended x-ray absorption fine structure (EXAFS) Fourier transform spectra, respectively. The XANES spectra of the upper part (the Fe *K*-edge) reflect the excitation from the Fe 1*s* core state. The main two prominent features (inset figure) seem not too many differences with the variation of deposition temperatures. It is implying that the electronic structure of the $Fe_{50}Pt_{50}$ thin film is almost the same when the phase transition occurs during changing the deposition temperature. This result may be due to very small lattice change when the structural transition occurs from a disordered fcc state to an ordered $L1_0$ (fct) state. From the EXAFS data, we can find that the Fourier transform result is almost the same with variation deposition temperature except the film deposited at 350°C. The right shoulder of the peak around the 2.5 Å of the 350°C deposited samples is larger than others that may be due to more ordered state and smaller Debye-Waller factor than others.

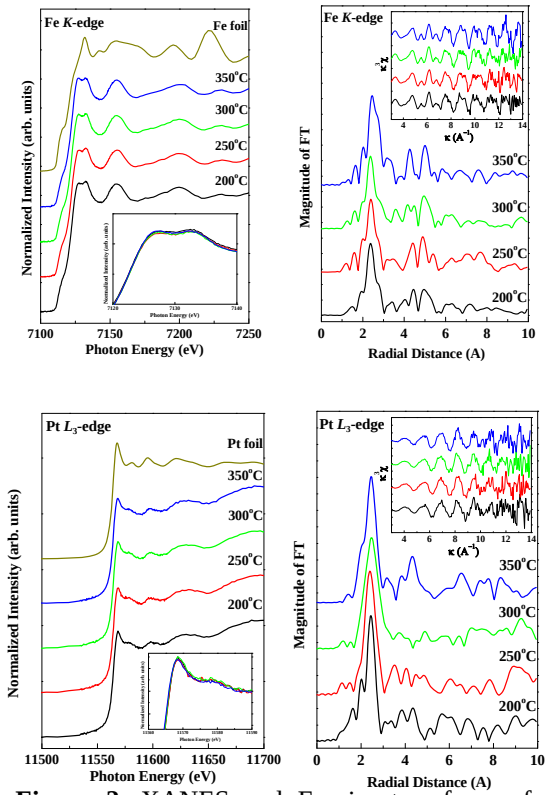

Figure 2. XANES and Fourier transform of $Fe_{50}Pt_{50}$ thin film