구두발표 I-2

Pt(100)면 위에 성장시킨 Co 박막에서의 수직자기이방성의 관찰
(Observation of perpendicular magnetic anisotropy of ultrathin Co film grown on Pt(100))

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1. Introduction.

Co thin films grown on Pt or Pd substrate attract a great attention in magnetic nanostructure research. For Co/Pd system, experiments show that all of the three (100), (110), and (111) surfaces exhibit perpendicular magnetic surface anisotropy whose magnitude is independent of the crystal orientations [1]. The similarity of Pd and Pt makes it attempting to search for the perpendicular magnetic anisotropy of Co/Pt systems in (100), (110), and (111) orientations. The experimental results, however, show that the Co/Pt system behaves very differently from Co/Pd system. For example, while Co films grown on Pt(111) substrate exhibits perpendicular magnetization below a critical thickness [2], Co film grown on Pt(100) has in-plane magnetization [3]. Detailed structural characterizations reveal that the variation of the magnetic anisotropy for different Co/Pt surface orientations is probably related to the different interfacial properties [4]. In this paper, we report the discovery of the perpendicular magnetic anisotropy in Co/Pt(100) system. We show that room-temperature growth Co/Pt(100) has an in-plane magnetization, but annealing the film at 400 °C leads to a perpendicular magnetic anisotropy.

2. Experimental details

The experiments are performed in an home-made ultrahigh vacuum system (1×10^{-10} Torr base pressure) equipped with Low Energy Electron Diffraction (LEED), Scanning Tunneling Microscopy (STM), and Surface Magneto-Optic Kerr Effect (SMOKE). After cleaning of a Pt(100) single crystal with cycles Ar ion sputtering at of 1 keV and annealing at 700-900 °C, Co films are grown on the Pt(100) substrate at room temperature either into a uniform thicknessfilm or into a wedged shape to facilitate a continuous change of the film thickness. After finishing the film growth, the structure of the sample is characterized in situ by LEED and STM. All STM images reported here were recorded at room temperature. SMOKE measurements are performed *in situ* at room temperature.

3. Results and Discussion.

The magnetic ordering of Co/Pt(100) films grown at room temperature was measured by *in situ*

SMOKE. In the thickness range studied (0-5ML), the film displays only longitudinal hysteresis loop. The linear extrapolation of the Kerr signal gives a non-zero intercept of the Kerr signal at zero Co thickness. This result shows that Pt also contributes to the Kerr signal. After annealing the film at 400 ℃, the magnetic properties of the film changes dramatically. The in-plane magnetization switches to out of plane below 2.5 ML thickness after annealing. Fig. 1 shows in details the polar and longitudinal Kerr remanences as a function of the Co film thickness. From the figure, the spin reorientation transition can be clearly identified. The spin reorientation transition thickness is ~2.7M which is thinner than the Co/Pt(111) case, showing that the perpendicular magnetic anisotropy of the annealed Co/Pt(100) is weaker than that of Co/Pt(111). STM images show enhanced intermixing at film interface after annealing.

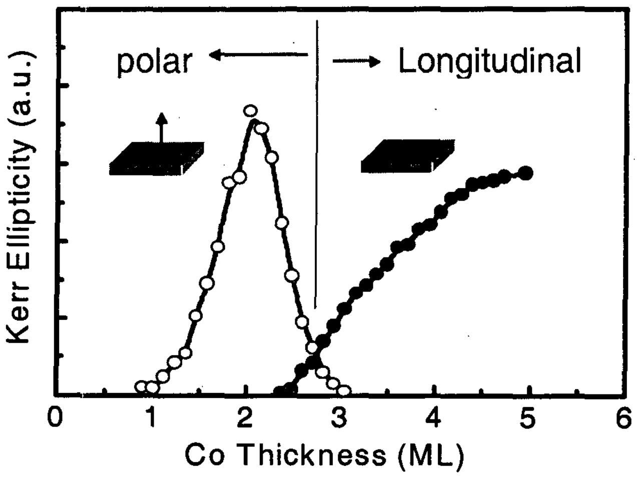

Fig. 1. Polar and longitudinal Kerr remanence versus the Co film thickness after annealing the Co/Pt(100) film at 400°C. Spin reorientation transition occurs at ~2.7ML

4. Conclusion.

Co ultrathin films are grown on Pt(100) and are investigated by LEED, STM, and SMOKE. Room temperature growth Co film shows in-plane magnetization. Annealing the film at 400 °C results in a perpendicular magnetic anisotropy which leads to a SRT at ~2.7 ML thickness. We attribute the perpendicular magnetic anisotropy to the Co-Pt alloy formation at the Co/Pt(100) interface.

5. References

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