구두발표 I-3

Growth and Magnetism of Fe overlayer on Pt(110)

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Tough the ultrathin magnetic films have drawn a lot of attention for the last two decades, there has still been a lot of interests in the area of low dimensional magnetc nano-structures. It is quite recently that magnetic surface has been studied by various scanning probes such as scanning tunneling microscope(STM). The structure and morphology of these thin film determine various characteristics concerned with magnetism. Especially magnetic anisotropy is well known to depend on the atomic structure and film morphology for long time, but still not quite completely understood. Recently, first principles calculation based on the experimentally determined atomic structure of the overlayer shed light on the full understanding on this magnetic property. For the complete understanding of the magnetic anisotropy, it is quite essential to have the proper structure determination.

We have chosen Pt(110) surface since it can be used as a template to make magnetic nano wires using its missing low structure. There are three types of the overlayer structure in our concern based on the thickness and the temperature(LT, RT, HT where LT is the one deposited at low-temperature of liquid nitrogen, RT deposited at room temperature, and HT is the one deposited at room temperature followed by proper annealing) of the substrate.

(a) half monolayer phase at LT and RT
(b) 1.0ML and above at RT
(c) 1.0 and 2.0 ML at HT

We have applied surface magneto-optic Kerr effect(SMOKE) to study the magnetic property of our system, Low energy diffraction spectrum(LEED) and STM has been applied to study the atomic structure. While many transition metals on Pt(111) are known to exhibit PMA at the monolayer regime, we could see only the longitudinal Kerr effect starting at 1.0ML if deposited at room temperature. We have checked two substrate crystal axes(001, 1-10) for the determination of the easy axis. It is quite interesting that even at high coverages such as 10ML, the easy axis is parallel to the missing row direction. When we grow half monolayer at LT, weak polar signal has been observed. The difference between LT and RT phases at half monolayer deposition is that the (1x2) structure is not maintained at RT deposition. It means that there could be a mixing of Fe ovelayer at low coverages to form a surface alloy. This result is quite contradictory to the controversial results of Co on Pt(110) surface. Our STM results would explain the difference between Co and Fe. For the case of (c),where (1x2) structure has been recovered, we have seen no Kerr signal at all. This would suggest the possibility of the formation of anti-ferromagnetic phase near the surface or possibly paramagnetic phase due to the bulk diffusion. More detailed image of this structure will be presented.