구두발표 I-2

Exchange bias down to monolayer limit: Surface Magnetism of Fe/Pt(110)

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Magnetism at the surface has been focused for the last three decades. Early seventies, people had interests in low dimensional magnetic phenomena where the magnetization in reduced dimension were characterized by the different critical exponent expected in bulk. While there has still been a lot of interests towards the one dimensional magnetism, we need a lot of experimental results for the unified picture. The main difficulties in full understanding the low dimensional phenomena are due to the difficulties to get the clear atomic picture of the system in interests. For example, we have totally different scenario on Fe/Cu(001) after the clear picture from the STM by Varga.

Recently there have been several trials to make magnetic nano wires. Using vicinal surface with the step-flow growth is one of the method to make the nano wire as in Co on Cu(111) and Co on Pt(997). When it comes to a wire problem in magnetic materials, one of the most fundamental question on this is the magnetic anisotropy in this system. Where is the easy axis located in this system? The energy of a ferromagnet depends on the direction of the magnetization relative to the structural axes of the material so that magnetic anisotropy can be changed by the presence of surface and interface due to its modified electronic structure. Also the strain applied to the overlayer can change its magnetic anisotropy via the magneto-elastic interaction. Reversibly, this anisotropy can be controlled by the substrate structure that we use.

Surface Magnetism has been studied systematically on Fe overlayers on Pt(110) surface using surface magneto-optic Kerr effect(SMOKE). Using the Pt(110) substrate is based on the possibility of making Fe nano wires at low coverage(0.5ML) since this surface shows missing row (2x1) reconstruction. If the Fe atoms are filled in this missing row at this coverage, mono-atomic Fe wires can be formed though it one Fe atom is surrounded by three neighboring Pt atoms. At room temperature (growth and measurement), the SMOKE signal starts to show up at the coverage of 1.0ML only at longitudinal geometry. When we grow at low temperature, weak polar signal has been observed down to 0.5ML at 120K. Annealing process after the 1ML deposition of Fe can leads to the formation of antiferromagnet so that further deposition of Fe layers can be exchange biased upon field cooling. We will show the interesting exchange bias in monolayer limit. The exchange bias has not been studied in atomic scale at all so that there are still lots of controversies on the origin. We believe this system can be served as a model system to study its origin.