GROWTH AND MAGNETISM OF Fe ON FLAT AND STEPPED W(110)

M. Slezak[1], T. Slezak[1,2], K. Matlak[1], M. Zajac[1], N. Spiridis[2], K. Freindl[2], J. Korecki[1,2]
[1] Faculty of Physics and Applied Computer Science, AGH University of Science and Technology, Al. Mickiewicza 30, 30-059 Kraków, Poland
[2] Institute of Catalysis and Surface Chemistry, Polish Academy of Sciences, Niezapominajek 8, 30-239 Kraków, Poland

Iron films on tungsten have become an archetypal system for studying magnetism in two dimensions and substrate steps play important role for the magnetic properties. In the present study bifacial tungsten single crystal was used as a substrate to directly observe the influence of atomic steps on structural and magnetic properties of Fe thin films. Half of the crystal was polished to yield the W(110) surface, the other half was polished to yield a 6.4° angle to the (110) surface. After standard cleaning procedure, consisting of many cycles of annealing at 1600K in oxygen atmosphere of 10^{-7} mbar and flashing at 2300 K, atomically clean and well ordered (1x1) surface was monitored on the flat part of the crystal using AES and LEED. On the miscut part, very pronounced and regular step structure with the density corresponding to an ideal W(540) surface (terrace width of about 20Å) was obtained as seen by splitting of the LEED spots. The growth and magnetic properties of Fe on the vicinal W(540) surface were studied by LEED and magnetooptic Kerr effect (MOKE). Fe layers with the thickness up to 40 ML, grown at 150°C, were analyzed. The diffraction patterns characteristic for misfit dislocations superimposed on the step structure (on the vicinal part of the sample) were found for coverages below 30 ML. For 40 Fe monolayers, we observed iron to be entirely relaxed, with misfit dislocations absent and the substrate step structure still clearly reflected. Longitudinal *ex-situ* MOKE measurements were performed on Ag covered sample to investigate the thickness dependent in-plane Spin Reorientation Transition (SRT). Easy direction of magnetization was found to rotate from [1-10] in plane direction for thin films, to [001] ("bulk-like") in-plane direction with increasing film thickness. SRT thickness differs for films the flat and stepped surfaces, which is interpreted in terms of step-induced magnetic anisotropy. Polar plots of the remanence magnetization allowed us to determine symmetry of the magnetic anisotropy.

This work was supported by the European Commission in the FP6 framework via STRP No. NMP4-CT-2003-001516 (Dynasync).