Spin Reorientation Transition in Fe(110)/W(110) induced by surface oxidation.

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

The in-plane thickness dependent Spin Reorientation Transition (SRT) in Fe films grown on W(110) is one of the most interesting phenomena discovered for the Fe/W system. Below certain critical thickness (several tens of angstroms), magnetization rotates from [001] (bulk easy axis) to [1-10].The critical thickness of this SRT strongly depends on the Fe/W(110) capping, e.g. Au or Ag coverage shifts it to a lower thickness. Moreover, the transition can be induced by varying temperature, so that one can follow the magnetic easy axis phase diagram in the Fe film thickness-temperature plane.

In the present study we report on a new experimental procedure of driving in-plane SRT by surface oxidation of Fe(110) films MBE grown on W(110) single crystal. The 100Å thick Fe layer was grown on the atomically clean W(110) surface. *In-situ* longitudinal MOKE measurements on as-deposited Fe layer confirmed that easy direction is parallel to [001], whereas along [1-10] a "hard" magnetic hysteresis loops were observed. The Fe(110) film was then oxidized by annealing in $1 * 10^{-7}$ Tr O_2 at 200 ^{o}C for several hours. The total oxygen exposure was 1300L and the constant oxidation rate amounted to about 6L/min. During oxidation, the magnetic hysteresis loops were measured with longitudinal MOKE along W[001] direction to directly monitor evolution of magnetic properties as a function of increasing oxygen exposure. From a change of the magnetic hysteresis loops we deduced that at the exposure of about 1000 L the in-plane SRT takes place. *Ex-situ* CEMS measurements enabled determination of the final sample composition. The oxide layer was identified as ideally stoichiometric magnetite and the thickness of the underlying Fe layer was estimated to about 44Å. These results show that SRT thickness for Fe/W(110) covered by Fe_3O_4 is lower than for Au or Ag capped samples.