Magnetization reversal dynamics in magnetically coupled trilayer systems

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Abstract

Throughout this dissertation, the spin dynamics from the nanosecond (ns) range to infinitely long time scales has been studied. A combination of x-ray magnetic circular dichroism and photoelectron emission microscopy was used to investigate the magnetic domain structure with element selectivity. In addition, a micro-coil, which can supply ns-short magnetic field pulses, was employed to study either the magnetic domain evolution induced by single pulses (so called single-pulse technique) or the domain dynamics during pulses (pump-probe technique).

The magnetization reversal in the ns range of the magnetically soft layer in spin valve and magnetic tunnel junction like trilayer systems has been investigated. The influence of magnetic anisotropy and interlayer magnetic coupling between the two ferromagnetic layers on the magnetization reversal have been studied. Also the surface/interface roughness and micromagnetic effects related to the domain wall energy and stray fields from a domain wall in the hard magnetic layer influence the reversal. Magnetization reversal in the timescale of seconds range was observed in a region with an out-of-plane easy axis of magnetization of a Co/Ni double layer epitaxially grown on a Cu(001) clean surface. The driving forces for the magnetization reversal were the thermal energy, upon heating the sample, or the change in anisotropy energy with time by depositing Co.