Magnetic properties of $(Co/Au)_N$ multilayers with different number of repetition N

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Few series of Co/Au magnetic multilayers were prepared by dc magnetron sputtering in UHV conditions on oxidised silicon substrate with the following structure: (i) substrate Si(100); (ii) buffer Au(5 nm) or (permalloy(2 nm)/Au(2 nm))$_{10}$; (iii) multilayers (Co(thickness d_{Co}=0.6, 1, 1.5 nm)/Au(d_{Au}=1.5, 3 nm)$_N$ where number of repetitions N=1÷15. Samples composition was controlled by XRF technique.

Magnetic properties were studied using following techniques: (i) magnetooptical milimagnetometry for measuring of hysteresis curves as a function of magnetic field applied perpendicularly to sample plane (nucleation (H_n), saturation (H_{sat}) and coercivity (H_C) fields were determined from these curves); (ii) magnetooptical micromagnetometry for magnetic domain structure (DS) visualisation and (iii) AFM/MFM for DS imaging beyond the optical resolution.

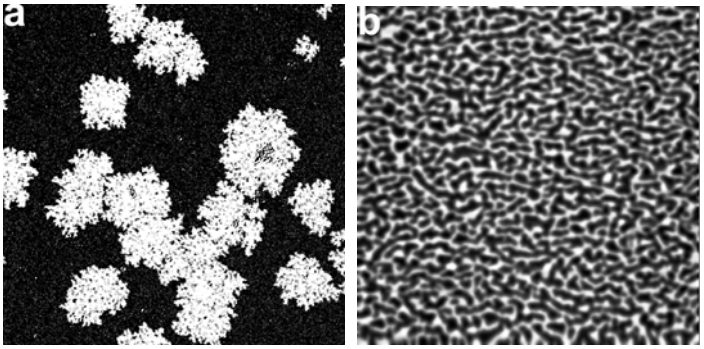

Fig. 1. a) Magnetooptical image 210x210 μm^2 for N=3 (after saturation and pulse magnetic field in opposite direction with 200 Oe during 2 sec) and b) remanent MFM image 20x20 μm^2 for N=10.

For N=1 square hysteresis loops were observed for structures deposited on the perm alloy/Au buffer. Following changes were observed with increasing N: (i) increase of H_{sat}; (ii) decrease of H_n (change of sign was found); (iii) the evolution of DS geometry from large size domains (determined by defects) into stripe like structures determined by magnetostatic forces. Submicrometer DS periods were measured for all samples with large N. Transition from hard magnet into soft magnet behaviour was observed as a function of the repetition number N. Exemplary of magnetic domain structures are presented in Fig. 1.

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