Micromagnetic properties of Co/Pt multilayers deposited on different buffer layers

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A study on the buffer layer dependence of film texture, surface roughness, and magnetization reversal process in Co/Pt multilayers prepared by dc magnetron sputtering is presented. Substrate – oxidized Si(100) wafer - is covered with a buffer layer. Four different buffers are used: (A) 10 nm Cu, (B) 5 nm Ta/10 nm Cu, (C) 5 nm Ta/10 nm Cu/5 nm Ta, and (D) 5 nm Ta/10 nm Cu/5 nm Ta/10 nm Cu. The growth of [2 nm Pt/0.5 nm Co]x5/2 nm Pt on top of these buffer layers results in a large variation in film texture and surface morphology. All films have the perpendicular magnetic anisotropy but magnetization relaxation process strongly depends on used buffer. Samples prepared on a Cu buffer (A) exhibit a low degree of film texture and disordered polycrystalline waviness. MOKE and MFM measurements on these films reveal that the magnetization reverses by the nucleation of numerous small submicron sized domains, indicating a large dispersion of activation energy barriers. Buffer layer structures where the first layer consists of Ta, on the other hand, result in well-textured Co/Pt multilayers. In these samples, magnetization reversal occurs by fast domain wall movement, although MFM measurements revealed small non-reversed remains, which are the origin of the irreversible process. The usage of MFM in external magnetic field allows us to follow the dynamics of magnetisation reversal process up to submicrometer scale.

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