Magnetic nanodots forced in an ultrathin Co film by a structured buffer

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The properties of monodomain magnetic dots with a lateral size of hundred nanometers induced in a Co layer deposited on a structured buffer in a form of self-assembled Au islands on a Mo layer surface [1] are investigated by polar magneto-optical Kerr effect (PMOKE) magnetometry and magnetic force microscopy (MFM). Due to a strong dependence of magnetic anisotropy on the type of buffer/Co-film interface we have obtained a system of elevated magnetic dots (Co layer grown on the top of the Au islands) embedded in the magnetic matrix (Co layer deposited between the Au islands on the Mo layer surface) [2, 3]. Comparison of the PMOKE hysteresis loops shows that magnetic properties of the patterned sample are not a simple superposition of the properties of the Au/Co/Au and Mo/Co/Au reference sandwiches with continuous buffers. The MFM measurements reveal a monodomain structure of the dots at the remnant state, upon magnetization reversal in the external field and in a demagnetized state. The preferred monodomain state of the dots suggests that magnetization reversal proceeds by nucleation of a reversed domain followed by a rapid and unpinned domain wall propagation. This mechanism determines a relation $H_N > H_W$ between a reversed domain nucleation field H_N and a domain wall propagation field H_W. The high crystalline quality of the studied epitaxial patterned structures, which are not exposed to any post-growth treatment, explains a monodomain character of the dots. The reversed domain nucleation field is the main parameter determining the rate of dot magnetization reversal. The bi-stable behavior (magnetization up or down) of the dots is promising for potential numerous applications.

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References

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