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Investigation of morphological and structural changes in ultrathin Pt/Co/Pt trilayers induced by nanosecond pulses from EUV plasma source

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Ultrathin film systems containing a magnetic element, e.g. Fe, Ni or Co, sandwiched between nonmagnetic noble metals, with tunable magnetization orientation (in-plane and out-of-plane) are of particular importance for spintronics as well as for technology of magneto-optical memory devices [1,2].

The perpendicular magnetic anisotropy (orientation of magnetization easy axis perpendicular to the film surface) is considered in the systems to be related mainly to the structural details of magnetic film and interfaces.

In case of a Pt/Co/Pt trilayers irradiated by different light sources [3,4] and ions [5,6], an out-of-plane to in-plane magnetization reorientation phase transition together with an intermixing and disordering at the Co–Pt interfaces were observed.

The aim of this work is to study the detailed structural properties of trilayer systems containing ultrathin (a few nm) Co layer sandwiched between Pt films (of several nm thickness each). The structure of the studied samples was modified by irradiation with nanosecond EUV pulses, characterized by a Gaussian-like spatial intensity distribution, generated by a laser produced plasma source. The irradiations have been carried out both in the single shot and in multi shot modes, with various irradiation fluencies.

Morphological changes, together with structural modifications induced on the irradiated surface spots, have been studied by interference optical microscopy, atomic force microscopy and scanning electron microscopy. The irradiation's induced structural changes of the trilayer were characterized by means of TEM analysis of sample's cross-sections and X-ray standing wave experiment with fluorescence detection. The obtained morphological and structural modifications were compared with the changes of magnetization. Correlation between magnetic anisotropy and structure of the Co-Pt interfaces were observed. Moreover correlation of induced perpendicular magnetic anisotropy with the morphological changes on the top surface in the irradiated regions were found.

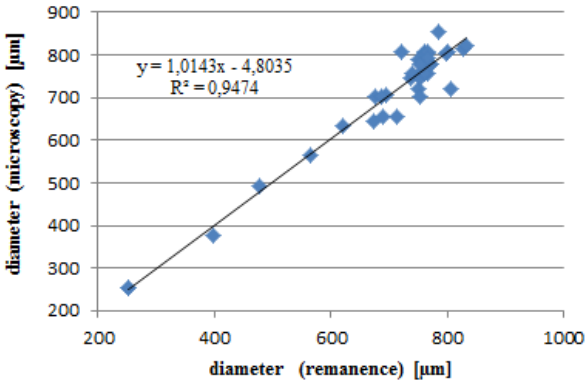

Figure 1. Correlation of the diameter of surface morphology and magnetical remanescence modifications regions measured at trilayer 250Pt/30Co/30Pt by means of interference-polaryzing microscopy and Magneto-optic Kerr effect, respectively.

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