Creation of submicrometer sized domains by temperature-induced changes of magnetic anisotropy in ultrathin a Co/NiO bilayer

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Ultrathin films systems with Perpendicular Magnetic Anisotropy (PMA) consisting of alternating ferromagnetic and heavy metal layers have attracted a lot of attention, because of potential applications in spintronics and magnetic logic devices. For such applications, ultrathin FM layers in contact with oxides are very promising systems [1]. Here, we study the temperature-induced changes of magnetic anisotropy and magnetic domain structure and magnetization reversal processes of exchange-biased Au/Co/NiO/Au polycrystalline system [2], which shows strong perpendicular magnetic anisotropy of the Co layer [3] at room temperature (RT). The domain structure and its evolution were investigated under various temperature sample treatment (in the range of RT – 200 ^{0}C) without and under the external out-of-plane magnetic field (H_{oop}) by means of magnetic force and polar magneto-optical Kerr effect (PMOKE) microscopies. Using PMOKE based magnetometry we observed spin reorientation transition (SRT) from perpendicular to in-plane magnetization state around 150 ^{0}C. This temperature-driven SRT allows us to investigate the influence of magnetic state on domains structure at remanence after the zero-field cooling (ZFC) process. ZFC from temperature above 150 ^{0}C down to RT leads to the appearance of a domain structure with submicrometer size, while domains with sizes around 100 μm were found at RT after demagnetization under decreasing alternating H_{oop} fields. It is interesting that, after demagnetization by ZFC process, the small domains vanish by applying H_{oop} and large domain (100 μm) re-appear after field driven demagnetization [2]. This experimental results will be compared based on theoretical approach of domain structure evolution while approaching SRT [4].

References:

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