ABSTRACT

Anomalous Magnetoelastic Coupling on Ultrathin Shear-Strained Fe/BTO Films

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The continous search for energy efficient, high-density data storage devices has inspired a great deal of research on multiferroics, where the electrical and magnetic long range order can be both present and coupled [1,2,3], or composite multiferroic [4,5]. Thin FM films deposited on bulk FE substrates [6,7] are testbeds to study the electrical control of the FM magnetisation by means of converse magnetostriction. It has been shown that the FEL domain pattern of FE substrates can be fully transferred to a FM overlayer [8]. A strong and controlled magnetoelastic response of the FM is key and could be enhanced in ultrathin films. We made a combined Low Energy Electron Microscopy (LEEM) and X-ray Photoemission Electron Micrcrope (XPEEM) study of the magnetoelastic coupling on Fe bcc ultrathin films on BaTiO3(001). We have imaged the FM and FEL domain structures by means of X-ray Magnetic Circular Dichroism (XMCD) and X-ray Linear Dichroism (XLD). We found a complete transfer of the FEL domain pattern onto the FM layer, and observed, for the first time, a change of sign and magnitude of the shear-strain magnetoelastic constant (B_2) of the Fe film, where the relative orientation of the FEL and FM axis is governed by a competition between magnetoelastic (ME) and magnetocrystalline (MC) anysotropic energy. We argue that the anomalous value of B2 that we observed cannot be explained as a thickness-dependent "effective" magnetoelastic constant (B_(2, eff)), arising from the second-order magnetoelastic constants [9].

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