# Electric field modulation of magnetic state in ferromagnet/antiferromagnet bilayers grown on PMN-PT(001) piezosubstrate

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Antiferromagnetic materials (AFMs) are robust against external magnetic fields, generate large magnetotransport effects, and exhibit terahertz spin dynamics. These features make them excellent candidates for the future spintronic applications [1]. To date, the manipulation of magnetic state in AFM has been carried out by four groups of methods: magnetic, optical, electrical and strain manipulation [2]. Recently, the piezoelectric strains induced by electric field were demonstrated to modify AFM spin structure in AFM/piezoelectric heterostructures. A major advantage of this approach is low power consumption which is crucial for spintronic devices [3]. In this study we use piezoelectric strain to modulate the magnetic state of ferromagnetic/AFM bilayers grown on PMN-PT(001) piezoelectric substrate. We used Magneto-Optic Kerr Effect (MOKE) technique to investigate the magnetic properties of Fe(5nm)/CoO(10nm)/PMN-PT(001) system as a function of the applied electric field. The MOKE measurements obtained at 80 K showed an increase (decrease) in Fe coercive field after applying negative (positive) voltage across the substrate (Fig.1). Moreover, the states of the Fe coercivity at +300 V and -300 V were stable after the removal of the voltage, which proves non-volatility of the observed phenomenon. Once the system was heated up to 330 K, which is above the Néel temperature of bulk CoO ($T_N$ = 293 K), the dependence of coercive field on applied voltage disappeared. This suggests that the observed voltage-induced changes in coercivity in Fe/CoO are related to the piezoelectric strain-induced modification of magnetic state in AFM.

**References:**

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