Large Strain Control of Magnetization in Magnetostrictive Films on Single Crystal PIN-PMN-PT

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Magnetoelectric heterostructures, allowing the tuning of magnetism with an electric field or electric polarization with a magnetic field, are of interest for a wide range of device applications including random access memory, power harvesting or conversion, and sensors. In this presentation, we will demonstrate the possibility of generating substantial magnetic anisotropy changes through induced interfacial strains driven by applied electric fields by depositing magnetostrictive thin films on (0 1 1)-oriented $Pb(In_{1/2}Nb_{1/2})O_3$-$Pb(Mg_{1/3}Nb_{2/3})O_3$-$PbTiO_3$ (PIN-PMN-PT) relaxor ferroelectric single crystals. This ternary system has extended temperature and voltage ranges as compared to binary relaxors PMN-PT or PZN-PT. We realize a 90° in-plane rotation of the magnetic anisotropy and propagation of magnetic domains with low applied electric fields under zero electric field bias due to strain coupling at the interface. We also examine the effects on the magnetization of a uniaxial strain on the piezocrystal to drive a rhombohedral – orthorhombic inteferroelectric phase transformation that is accompanied by ~0.3% strain.

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