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Multilayer FeRh/MgO: controllable magnetocrystalline anisotropy for an antiferromagnetic system GUOHUI ZHENG, ODKHUU DORJ, California State University Northridge, SANHUANG KE, Tongji University, Shanghai, China, RAMMOORTHY RAMESH, University of California Berkeley, MAOSHENG MIAO, NICKOLAS KIOUSSIS, California State University Northridge — Controlling the magnetocrystalline anisotropy (MCA) of ferromagnetic (FM) thin films by tunable strain and electric field has been pursued as an effective method of achieving low-power and highly scalable memory. Comparing with FM materials, AFM are much less sensitive to external magnetic field, a substantial advantage for memory devices. Inspired by recent work on AFM memory resistors based on FeRh, we carried out a systematic first principles study of the MCA of multi-layer FeRh, either stand alone, or combined with MgO layers. FeRh is a unique material that undergoes a transition from AFM (type-II) to FM at elevated temperature of 370 K. Our calculations for thin films of FeRh from 5-15 atomic layers reveal that AFM is always the most stable configuration for Fe terminated films; while for Rh terminated films, there is a transition from FM to a configuration featured AFM at the center layers and FM at the surface layers (reconstructed). While applying the spin-orbit interactions (SOI) for the valence electrons, we found Fe-terminated films exhibit a relatively small MCA that varies and may change sign with film thickness, substrate and strain, providing a possibility of spin reorientation via the control of strain and electric field. The k-resolved MCA values reveals that the region around Gamma point adds the major contribution to the MCA.

Maosheng Miao
California State University Northridge

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