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Electric field control of magnetism and metal-insulator transition in multiferroic superlattices from nonmagnetic polar metals[1] SAURABH GHOSH, Vanderbilt University, USA, Oak Ridge National Laboratory, USA, ALBINA Y. BORISEVICH, Oak Ridge National Laboratory, USA, SOKRATES T. PANTELIDES, Vanderbilt University, USA, Oak Ridge National Laboratory, USA
— $LiOsO_3$ is a ferroelectric metal and $LiNbO_3$ is a prototype ferroelectric insulator, whereas $(LiOsO_3)_1$/ $(LiNbO_3)_1$ is predicted to be a correlated mott multiferroic [Danilo Puggioni et.al. Phys. Rev. Lett. 115, 087202 (2015)]. According to this paper, tuning the degree of electronic correlation in this system leads to a phase transition from an antiferromagnetic polar metal (APM) phase to an antiferromagnetic ferroelectric insulating (AFI) phase. In view of the interest for technological applications and for fundamental understanding, the important question that remains open is whether electric-field control of such an APM-AFI phase transition is possible. Here, using first-principles density functional theory (DFT) and DFT+U (static $d-d$ Coulomb interaction), and considering $(LiOsO_3)_m$ / $(LiNbO_3)_n$ superlattices, we have investigated possible electric-field control of magnetism and band gap in the AFI phase. We found that these systems are weak ferromagnetic (with net magnetic moment of $\sim 0.15\mu_B$/Os) and strong magnetoelectric. Thus, electric field control of magnetism is possible in these systems. Further, we discuss the possibility of tuning the band gap with an electric field.

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