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Interface magnetoelectric effect in ferroelectric/antiperovskite heterostructures PAVEL LUKASHEV, KIRILL BELASHCHENKO, EVGENY TSYMBAL, University of Nebraska - Lincoln, RENAT F. SABIRIANOV, University of Nebraska at Omaha — We present results of the first principles calculations of the magnetoelectric effect in thin film layered heterostructures of typical ferroelectric (FE), such as PbTiO3, with Mn-based antiperovskite (AP), such as Mn3GaN. Mn-based antiperovskite materials are interesting due to a non-trivial magnetic order and a linear magnetic response to applied strain that makes them piezomagnetic. The symmetry breaking produces a net magnetization at the FE/AP heterostructure interfaces. This magnetization can be controlled by reversing the polarization of the FE layer. Our calculations show that for the positive FE polarization the induced net magnetization is 3.8 μ_B at the PbO/GaMn and 0.6 μ_B at the TiO2/Mn2N interface, while the corresponding values are 1.6 μ_B and 1.2 μ_B for the negative FE polarization and 2.2 μ_B and 0.4 μ_B for the zero FE polarization. Thus, the FE/AP interface magnetization exhibits a strong dependence on the direction of the FE polarization, with difference as large as by a factor of 2. The presented novel approach to electrically control the magnetic properties of thin-film layered ferroelectric/piezomagnetic heterostructures may be interesting for practical applications. Therefore, we hope that our results will stimulate experimental work on the FM/AP thin-film layered heterostructures.

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