ALL-ELECTRIC MANIPULATION OF THE SPIN TEXTURE IN FERROELECTRIC AND MULTIFERROIC RASHBA SEMICONDUCTORS

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Abstract

Manipulating spin textures of multiferroics through magnetic or electric fields is a timely issue due to the potential applications in low power electronics. In our previous spin- and angle resolved photoemission studies we have established that the ferroelectric semiconductor α-GeTe(111) shows a Rashba-type spin splitting coupled to ferroelectricity [1], as theoretically predicted by S. Picozzi [2]. For moderate Mn-dopings the $Ge_{1-x}Mn_xTe$ diluted magnetic semiconductor takes these functional properties even further because its multiferroic properties entangle with the Rashba and Zeeman splitting [3]. Thus in this new class of materials called MUFERS (MUltiFErroic Rashba Semiconductors) the ferroelectricity and ferromagnetism influence the bulk Rashba-spin texture. We demonstrate *operando* electrostatic spin manipulation in FERS and MUFERS under gate control. First-principle calculations reveal structural changes inside the switched α-GeTe surface which affect the spin-switching endurance in alternating fields, in addition to unipolar ferroelectric fatigue and ferroelastic effects needed to overcome in the all-electric control. In addition, we show that $Ge_{1-x}Mn_xTe$ is characterized by a multitude of spin-switching paths typical for multiferroics in which the magnetic order is coupled to ferroelectricity through ferroelasticity.

References

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