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P2004 Local Manipulation of Spin Domains in a Multiferroic Rashba Semiconductor

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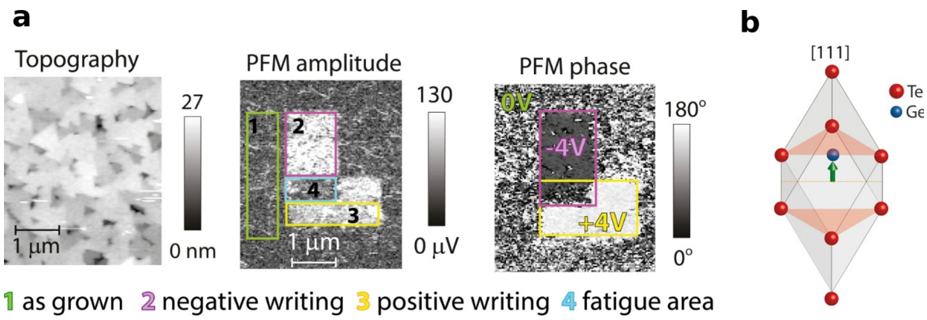
Multiferroic Rashba semiconductors (MuFeRS) are promising materials for future information technology as they exhibit a coupled magnetic, electric and elastic response to an applied external field. With such properties, they could, for example, constitute the active channel material in a spin field effect transistor that switches the spin polarization of the source-drain current under an applied gate voltage. In this class of



1 as grown 2 negative writing 3 positive writing 4 fatigue area

Ferroelectric switching of GeTe. (a) Surface imaging using piezoforce microscopy (PFM). The topography image shows the morphology of the thin film with 1 µm wide grains. The PFM amplitude and phase images show contrast due to electric polarization after the indicated writing protocol [1]. (b) Rhombohedral unit cell of GeTe. Ferroelectric polarization is connected to a displacement of the Ge sub-lattice from the symmetric position.

materials, ferroelectric α-GeTe combines several noteworthy properties: A strong Rashba spin-orbit interaction provides enhanced coupling between the electric field and the electron spin. By doping with Mn, the material can be made ferromagnetic, and a Zeeman gap separates the spin bands in energy. The polarization is connected to a shift of the Ge/Mn sublattice in the unit cell. The situation at the surface is even more complex due to surface lattice relaxation, surface states and surface resonances. Moreover, interface effects at grain and domain boundaries affect the polarizability and lead to fatigue. [1–3]

In this project, we study the atomic structure, the local electronic and magnetic structure as well as emergent cooperative properties in thin films of $Ge_{1-x}Mn_xTe$ by spectro-microscopy correlation methods on the nanoscale. In particular, we plan to polarize individual surface domains and read out their local spin density of states by spin-polarized scanning tunnelling spectroscopy (SP-STM). Complementary angle-resolved photoelectron spectroscopy (ARPES) and photoelectron diffraction (PED) measurements on the same samples will allow us to correlate the electronic and magnetic response of the surface domains with changes of the surface lattice relaxation.

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