Poster-2-33

Phase diagram and domain wall properties in $PbTiO_3$ ferroelectric thin films

Ludovica Tovaglieri, Marios Hadjimichael, Jean-Marc Triscone, and Céline Lichtensteiger

Department of Quantum Matter Physics, University of Geneva, 24 Quai Ernest-Ansermet, 1211 Geneva, Switzerland

$PbTiO_3$ is a material that exhibits a bulk paraelectric-ferroelectric phase transition at a critical temperature T_c of 765 K, with a polarisation that develops along the c-axis mostly due to ionic displacements. Theoretical studies of domain structures in $PbTiO_3$ thin films have revealed complex phase diagrams with regions of distinct domain configurations as a function of different parameters [1]. It has been demonstrated that it is possible to control the intrinsic domain pattern in terms of size and shape by tailoring the electrostatic boundary conditions, the film thickness, the deposition temperature, and the epitaxial strain of the substrate. In a $Pb_xSr_{1-x}TiO_3$ solid solution there is also the possibility to adjust the critical temperature T_c and to tune the domain configuration and domain walls by varying the composition (x) [2]. Moreover, $PbTiO_3/SrTiO_3$ and $Pb_xSr_{1-x}TiO_3/SrTiO_3$ superlattices can exhibit more complex domain structures and novel phenomena like negative capacitance [3]. The objective of this research is to study the domain structures and domain walls in $PbTiO_3$ thin films as a function of thickness and deposition temperature on various substrates. We also explore $Pb_xSr_{1-x}TiO_3$ solid solutions with various compositions, as well as more complex structures, such as bilayers and superlattices.

[1] D. G. Schlom, L. Q. Chen, C. B. Eom, K. M. Rabe, S. K. Streiffer, and J. M. Triscone, Strain tuning of ferroelectric thin films, Annu. Rev. Mater. Res., vol. 37, no. March, pp. 589–626, 2007.

[2] S. Fernandez-Peña, C. Lichtensteiger, P. Zubko, C. Weymann, S. Gariglio, and J. M. Triscone, Ferroelectric domains in epitaxial PbxSr1- xTiO3 thin films investigated using X-ray diffraction and piezoresponse force microscopy, APL Mater., vol. 4, no. 8, pp. 1–8, 2016.

[3] P. Zubko et al., Negative capacitance in multidomain ferroelectric superlattices, Nature, vol. 534, no. 7608, pp. 524–528, 2016.