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In-Situ Studies of Ferroelectric Domain Dynamics

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Ferroelectric materials are characterized by a spontaneous electric polarization that can be reversed by an applied electric field. The ability to reversibly switch the spontaneous polarization between energetically equivalent polar states of very small size provides the underlying storage mechanism for a novel class of high-density non-volatile ferroelectric random access memories. However, polarization switching via nucleation and growth of one polar region at the expense of another – with the concomitant lateral domain wall motion – is a highly inhomogeneous process, which is largely controlled by defect centers, interfaces and pre-existing domain walls. Thus, a major challenge is its investigation at high spatial and temporal resolution.
Thanks to recent advances in microelectromechanical (MEMS) technology for miniaturized transmission electron microscopy (TEM) in-situ specimen holders as well as to the better spatial and temporal resolution of modern TEMs, exciting new opportunities to probe ferroelectric domain dynamics are now possible. In this talk, I will show some recent in-situ heating and biasing results of domain wall dynamics in selected ferroelectric thin film systems.

Marta D. Rossell studied geology specializing in crystallography in the University of Barcelona (Spain) and received her doctoral degree from the University of Antwerp (Belgium) in 2006. Thereafter she carried out postdoctoral studies at the National Center for Electron Microscopy (NCEM), Lawrence Berkeley National Laboratory and at the University of California, Berkeley. In 2009, she moved to Switzerland where she worked at the Swiss Federal Institute of Technology Zurich (ETH Zurich) and at the Swiss Federal Laboratories for Materials Science and Technology (Empa). At present, Marta D. Rossell is group leader at the Electron Microscopy Center of Empa and her current research focusses in in-situ heating/biasing electron microscopy of ferroelectric/magnetoelectric oxides.