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Elektrische Ermüdung in Funktionswerkstoffen

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DIFFRACTION OF FERROELECTRICS DURING ELECTRIC FIELD APPLICATION: NEW APPROACHES YIELD NEW INSIGHT

In situ X-ray and neutron scattering measurements have seen recent pervasive application in the field of ferroelectrics. This is largely attributed to the development of new diffraction instruments, data acquisition electronics, and ancillary equipment at scattering facilities throughout the world. In this talk, we review recent experimental results using these approaches to study domain wall and lattice responses during electric field application in several different ferroelectric ceramic compositions including experiments completed at the European Synchrotron Radiation Facility, and Advanced Photon Source, the Spallation Neutron Source at ORNL, and OPAL at the Australian Nuclear Science and Technology Organisation. In all cases, direct measurements of the average contribution from the lattice (e.g., piezoelectric) and the motion of intragranular interfaces (e.g., domain walls, phase boundaries) are used to interpret the electromechanical coupling behaviour (e.g., piezoelectricity and strain-field hysteresis). It is first observed that the electric-field-induced lattice strain in donor-modified lead zirconate titanate (PZT) is dominated by domain wall motion contributions, suppressing piezoelectric distortions of the lattice. In contrast, the response of acceptor-modified PZT and tetragonal $BaTiO_3$ under similar conditions is not as strongly dominated by domain walls. The lead-free composition $Ba(Zr_{0.2}Ti_{0.8})O_3$-$x(Ba_{0.7}Ca_{0.3})TiO_3$ is shown to exhibit significantly enhanced domain wall motion contributions at compositions approaching the morphotropic phase boundary (i.e., 0.5), correlating with the very high d_{33} of 620 pC/N. The high-temperature piezoelectric ceramic $PbTiO_3$-$xBiScO_3$ also exhibits significant domain wall motion, contributing to the large strain-field hysteresis. These results are useful in designing new lead-free and high-temperature piezoelectric materials with enhanced electromechanical coupling.

Die Vortrag findet um **15:00 Uhr** im Gebäude der Materialwissenschaften, Lichtwiese, Petersenstr. 23, **Raum 77,** statt.