DF 5: Electrical, mechanical and electromechanical properties

Time: Monday 16:05–16:45 Location: EB 107

DF 5.1 Mon 16:05 EB 107

Calibrated real time detection of nonlinearly propagating giant strain waves — •André Bojahr[1], Marc Herzog[1], Daniel Schick[1], and Matias Bargheer[1,2] — [1]Institut für Physik und Astronomie, Universität Potsdam, Karl-Liebknecht-Str. 24-25, 14476 Potsdam, Germany — [2]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Wilhelm-Conrad-Röntgen Campus, BESSY II, Albert-Einstein-Str. 15, 12489 Berlin, Germany

Epitaxially grown metallic oxide films excited by femtosecond laser pulses can generate giant strain amplitudes on the order of 1% strain. We calibrate these transient strain amplitudes by ultrafast X-ray diffraction (UXRD). In addition we use picosecond reflectivity measurements to determine the speed of the propagating strain fronts by interference effects which are equivalent to stimulated Brillouin scattering [1]. For high strain amplitudes we observe two components of the sound pulses which travel at different sound speeds. We conclude that at giant strain amplitudes the compressive and tensile strain components travel at different sound velocities [2]. This is indicative of an anharmonic interaction between the atoms forming the crystal lattice which give rise to nonlinearities in the wave equation.

[1] Thomsen *et al.*, Phys. Rev. B 34, 4129 (1986)

[2] P. J. S. van Capel and J. I. Dijkhuis, Appl. Phys. Lett 88, 151,910 (2006).

DF 5.2 Mon 16:25 EB 107

Piezoelectric properties of single ceramic fibres: Comparison of two methods — •Sabine Kern, Christoph Pientschke, and Ulrich Straube — Institut für Physik, Martin-Luther-Universität Halle-Wittenberg, D-06099 Halle

Composites containing piezoelectric fibres embedded in a polymer matrix are used for sensoric, actuatoric and ultrasonic applications. Accurate knowledge of the piezoelectric properties of the fibres is desirable to optimise these materials. In this work, the determination of the small-signal piezoelectric coefficient d_{33} of ceramic PZT-fibres was realised with two methods by using a capacitive displacement sensor. On the one hand, the effective d_{33} of 1-3 fibre composites is measured. Then the d_{33} of the fibres can be calculated using the ceramic's and polymer's elastic properties and the fibre volume content. Independently, the d_{33} of the fibres was determined directly by measuring the longitudinal piezoelectric strain. PZT-fibres with $250\,\mu$m in diameter and 1-3 composites with a fibre volume content ν of 35% and 65% that contain these fibres were studied. The measurements at single fibres show well-reproducible values with a small standard deviation for the d_{33}, whereas the local measurements at composites show a larger range of variation in their effective d_{33}, especially for composites with lower ν. This higher variance is mainly influenced by the locally highly varying fibre volume content and less by the fibre properties themselves. Moreover, composites with larger ν show higher d_{33} than composites with lower ν. Finally, the d_{33} of single fibres derived from the composites' properties was compared with the directly measured values.