MM 44 Mechanical Properties II

Time: Friday 11:00–12:00 Room: IFW A

MM 44.1 Fri 11:00 IFW A

Bolometric detection of strain solitons in Sapphire, Si and GaAs — •Anthony Kent and Nicola Stanton — School of Physics and Astronomy, University of Nottingham, Nottingham, NG7 2RD, UK.

We show that superconducting bolometers possess sufficient temporal resolution to detect strain soliton pulses propagating over mm distances in c-axis Sapphire and [001] Si and GaAs crystals. Using imaging techniques we show that the soliton pulses propagate as a narrow collimated beam. Strain pulses of up to 1% amplitude were generated by absorption of 100 fs light pulses from a Ti:Sapphire regenerative amplifier in a Cr-film deposited on the crystal surface. As these travel in the crystal, the combined effects of nonlinearity and dispersion results in the formation of a train of strain solitons. We use superconducting Aluminium bolometers to detect the pulses reaching the back surface of the crystal (opposite the Cr film). When the fluence of the laser pulse exceeds a certain threshold value, a sharp pulse arrives just ahead of the leading edge of the longitudinal phonon heat pulse. The speed of the sharp pulse is slightly faster than the normal speed of sound, as predicted for soliton propagation. The advantage of bolometers is that they can be used for high-resolution phonon imaging. Using this technique we find the solitons propagate as a collimated wavefront over cm distances in Sapphire and Si, but only mm in GaAs due to strong scattering.

MM 44.2 Fri 11:15 IFW A

Advances in Neutron Tomography — •Wolfgang Treimer[1,2], Nikolay Kardjilov[2], Andre Hilger[1,2], Ingo Manke[2,3], and Markus Strobl[1,2] — [1]University of Applied Sciences (TFH) FB II Berlin — [2]Hahn-Meitner-Institut Berlin — [3]Technical University Berlin, Faculty III

The experimental possibilities of neutron tomography at the BER II reactor in Berlin were improved by several options: The *classical* cold neutron radiography and tomography facility *CONRAD* got a parallel option for CT with monochromatic neutrons in the range of 0.23nm<lambda<0.65nm. With this option the same beam line geometry, sample and detector system can be used as for the whole cold spectrum. The extracted energies cover the most interesting range of 15.5meV<E<1.94meV, that contains the Fe, Cu, ß-Tin and Al Bragg edges, which are important for e.g. investigations of textures or more complex materials. Real time radiography and tomography can be performed at two different sample positions, having either a high neutron flux of 3x10ˆ9n/cmˆ2.s but low L/D˜70 or 5x10ˆ7n/cmˆ2.s and a L/D ˜500 as well as phase contrast imaging either with polychromatic or with monochromatic neutrons. With two high resolution double crystal systems refraction tomography and ultra small angle scattering tomography can be performed with a constant wave length of 0.524nm, USANS-CT shows clusters and inhomogeneities of 10nm - 500nm particles in a sample, both work with a spatial resolution of <1mm.

MM 44.3 Fri 11:30 IFW A

X-rays and Positrons Compared: Plasticity Studies on Deformed Carbon Steel — •Matz Haaks[1], Stephan Roth[2], and Karl Maier[1] — [1]Helmholtz-Institut für Strahlen und Kernphysik, Nußallee 14-16, 53115 Bonn — [2]Hasylab/Desy, Notkestraße 85, 22607 Hamburg

Plastic deformation is based on the movement and multiplication of dislocations, leading to jumps out of the glide plane. The movement of these jogged dislocations is always accompanied by the production of vacancies. In X-ray diffraction pattern the presence of dislocations causes a broadening of the diffraction reflexes. Using a high energy X-ray source with sufficient luminosity, powder-like Debye-Scherrer conditions can be achieved in a polycrystalline carbon steel with optimized geometry by diffracting in a volume containing 20000 grains. Positron Annihilation Spectroscopy (PAS) is used as a complementary method. It is non-destructive and highly sensitive for the detection of the vacancies associated with the dislocations.

We analyzed samples deformed in a three-point bending test with scanning X-ray diffraction in transmission at the high-energy beam line at Petra II/Hasylab as well as with scanning positron microscopy at the Bonn Positron Microprobe. The results from both methods are presented and compared.

As a practical application of transmission X-ray diffraction, the fabrication method of a historical cannon was investigated. We were able to decide between casting and forging.

MM 44.4 Fri 11:45 IFW A

Correlation between acoustic and electromagnetic emissions in plastically deformed LiF — •Konstantin Chishko[1], Tatiana Antsygina[1], Claire Mavromatou[2], and Vassilios Hadjicontis[2] — [1]B.Verkin Institute for Low Temperature Physics and Engineering, 47 Lenin Ave., Kharkov 61103, Ukraine — [2]University of Athens, Panepistimiopolis, Zografos, TK 157 84, Athens, Greece

The experiments on plastic deformation (PD) of compressing LiF ionic monocrystals are performed with simultaneously registration of the acoustic emission (AE) and electromagnetic field (EF) near the sample surface measured with piezoelectric transducer and monopole coaxiale antenna, respectively. It has been found that jump-like deformation observed on promoted (rather late) stages of work hardening is accompanied by exclusive powerful AE bursts which can be associated with the break-through and emergence on the crystal free surface of large dislocation pile-ups formed due to evolution and intersection of different slip systems. Most of the acoustical events of such kind are accompanied by the measurable electromagnetic pulse whose appearance is strongly correlated with the front of the corresponding AE burst. The obtained phenomenon is obviously connected with the ionic lattice charge re-distribution controlled by interaction between dynamic dislocations and charged vacancies of the ionic crystal. The theory is proposed to interpret the electromagnetic emission during PD of an ionic crystal and the shape of EF pulse generated by a dynamical dislocation pile-up releasing from vacancy atmosphere is calculated. The theory predictions are in good agreement with the experimental observations.