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Because of the chemical stability and the small lattice mismatch, strontium titanate (STO) is a widely used substrate material for many perovskite oxides. In addition the conductivity can be tuned by doping with Nb from insulting to a low-resistance behaviour. Therefore Nb:STO is not only of particular importance for deposition of perovskites, but also for the fabrication of novel devices like heterostructures, tunnel- or pn-junctions. In order to examine devices like this, it is important to understand the electrical contact to Nb:STO.

In the vicinity of metallic contacts Schottky barriers are formed, which give rise to a highly non-linear current-voltage relation in two-point configuration. However, the interface resistance not only depends on the work function of the involved materials, but also on the detailed defect structure, e.g. related to the deposition method. In this contribution we summarise our results concerning the fabrication of metallic contacts like Ti, Au, Ag on Nb:STO prepared by sputter deposition techniques with respect to pre-treatment of the substrates, choice of electrode materials and additional post annealing steps.

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Transmission electron microscopy study of the interface $Pr_{1-x}Ca_xMnO_3$ / $YBa_2Cu_3O_{7-d}$ — •Jonas Norpoth[1], Thilo Kramer[1], Christian Jooss[1], Hiromi Inada[2], and Yimei Zhu[2] — [1]Institut für Materialphysik, Universität Göttingen — [2]Institute for Advanced Electron Microscopy, Brookhaven National Laboratory

Interfaces between highly correlated electron systems may exhibit novel electronic properties that are absent in the isolated materials. Especially, complex oxide interfaces often feature nontrivial electronic behaviour, the understanding of which needs a careful analysis of the relation between interface structure and electronic properties at the atomic scale. In this work we study the interface between the high-T_c superconductor $YBa_2Cu_3O_{7-d}$ and the hole-doped perovskite $Pr_{1-x}Ca_xMnO_3$. Thin film multilayers fabricated with pulsed laser deposition on epitaxial substrates exhibit atomically sharp interfaces as was demonstrated by high-resolution transmission electron microscopy. Electron energy loss spectroscopy indicates electron transfer across the interface from PCMO to YBCO according to a band bending scenario from the difference in the materials' workfunctions. Furthermore, short-range interdiffusion of Ca and Y cations is observed. These charge transfer processes establish doping gradients in the interfacial region capable of affecting both the polaronic transport in the manganite and the characteristics of the superconductivity.

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Line stress from step edges and its impact on cantilever bending — •Weina Li[1,2], Huiling Duan[2], Maxim Smetanin[1], and Jörg Weissmüller[1,3] — [1]Forschungszentrum Karlsruhe, Institut für Nanotechnologie, Karlsruhe — [2]Peking University,Beijing,P.R.China — [3]Universität Des Saarlandes, Saarbrucken

It is well known that the surface of a solid exerts a mechanical force on the underlying volume phase. This force has important ramifications for the behaviour of nanoscale objects. It is quantified by the surface stress, the derivative of a suitably defined surface excess free energy function with respect to the projection of the bulk strain tensor onto the local tangent plane. By analogy, the line elements at solid surfaces, such as triple lines, edges, or steps may also interact mechanically with the bulk. The relevant forces may be derived by taking the derivative of the line tension - an excess in energy per line length - with respect to the strain. Dimensional considerations might suggest that the line stress will emerge as a vector directed along the local line orientation. Yet, it is well known that parallel step edges interact by lateral dipole forces, so that a more general state of stress may be associated with line elements on a surface. Cantilever bending experiments provide sensitive probes for changes in the elastic interaction of the matter at the surface of a solid with the bulk. We discuss how the presence of step edges impacts the bending of cantilevers. Of particular interest are changes in the bending, either due to the creation of steps or due to the change in line stress during electrochemical cycles or reversible adsorption.

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In-situ TEM and STM studies of dislocations in nano-scale metal samples — Burkhard Roos[1], •Sönke Schmidt[1], Daniel S. Gianola[2], Gunther Richter[3], Astrid Pundt[1], and Cynthia A. Volkert[1] — [1]Institut für Materialphysik, Universität Göttingen — [2]Insitut für Materialforschung II, Forschungszentrum Karlsruhe — [3]Max-Planck-Institut für Metallforschung, Stuttgart

Metals at the nano-scale exhibit mechanical properties that are different from those at the macro-scale. The best known effect is the increase in strength with decreasing crystal size. However, present dislocation-based models fail to explain this effect. It is the goal of the studies described here to directly observe dislocations in small volumes in order to understand how they contribute to size dependent mechanical response. Two different experimental approaches are being taken. In the first approach, in-situ TEM is used to observe dislocation nucleation and storage during tensile testing of metal nano-wires. Initial results from ˜100 nm diameter, single crystal Cu whiskers will be presented. In the second approach, in-situ STM will be used to observe the dislocation traces left at the surface of freshly deposited metal films. Results from deformed Cu films will be presented to show the feasibility of this method for providing quantitative information on dislocations during deformation.

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Effect of Surface Roughness on the Deformation of Micron-Sized Specimens of Cu — •Matthias Büchsenschütz-Göbeler and Cynthia A. Volkert — Institut für Materialphysik, Georg-August-Universität Göttingen

A variety of studies on deformed small scale metal specimens (100 nm to 10 μm) have shown that dislocation storage becomes rarer as the crystal size is decreased. This implies that plastic deformation, which is usually controlled by dislocation interactions, changes to a dislocation nucleation limited mechanism in sub-micron samples. In the study presented here, the effect of surface roughness on the mechanical behavior of single crystal Cu pillars is investigated. It is expected that surface roughness at the 10-100 nm length scale will influence the ease of dislocation nucleation and thus the mechanical behavior in sub-micron specimens. One and 4 μm diameter Cu pillars with varying degrees of surface roughness have been fabricated using a focused ion beam and then compressed using a flat punch tip in a nanoindenter. No effect of the ripples on the stress-strain behavior of the columns was observed, suggesting that deformation is not limited by dislocation nucleation at this length scale. Further tests on even smaller pillars are underway.

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Zerstörungsfreie Beobachtung der räumlichen Verteilung von elastischen Konstanten in weicher Materie — •Jessica Mende, Marcus Radicke, Ole Oehms und Karl Maier — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn, Nussallee 14-16, 53115 Bonn, Germany

Mit Ultraschall (US), der während einer Spin-Echo-Sequenz in einem medizinischen Tomographen eingestrahlt wird, können verschiedene elastische Konstanten in weicher Materie dreidimensional und zerstörungsfrei dargestellt werden. In Proben mit unterschiedlichen Festigkeiten werden Kugeln aus einer Öl-in-Gelatine-Mischung eingebracht. Die Proben bestehen aus Agar-Agar und Kieselerde. Agar ist ein biologisches Geliermittel. Die Kieselerde dient zur Absorption des US. Die Kugeln besitzen ein höheres Elastizitäts- und Schubmodul als die Umgebung aus Agar-Agar und Kieselerde.

Von den Proben werden Phasenbilder gemacht, die die Phase der Spins in Grauwerten kodiert darstellen. Die Verschiebung innerhalb der Probe durch den Schallstrahlungsdruck ist abhängig von den elastischen Eigenschaften innerhalb der Probe. Die Darstellung der Verschiebung im Bild erfolgt durch ein Paar von magnetischen Feldgradienten. Während einem dieser Gradienten wird der US mit einer Frequenz von ca. 2,5 MHz und einer Länge von 20 ms eingestrahlt. In den Bildern wird eine Phasenverschiebung durch eine Verschiebung auf der Grauskala sichtbar. In Differenzbildern mit und ohne US können Rückschlüsse auf die räumliche Verteilung der elastischen Eigenschaften der Probe und der darin befindlichen Fremdkörper gezogen werden.

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Deformations of auxetic periodic strut frameworks — •Holger Mitschke, Klaus Mecke, and Gerd E. Schröder-Turk — Institut für Theoretische Physik, Universität Erlangen-Nürnberg, Staudtstr. 7, D-91058 Erlangen

We study the deformation behaviour, in particular Poisson ratios, of planar periodic strut frameworks with rigid struts connected at flexible joints. We systematically search for yet unknown auxetic frameworks (i.e. with negative Poisson ratio) and to understand the relationship between structure morphology (quantified by integral geometric