DS 18: Transport Properties

Time: Tuesday 11:45–13:00 Location: CHE 89

DS 18.1 Tue 11:45 CHE 89

Magnetoconductance of Bi quantum films in parallel magnetic fields — •Doaa Abdelbarey[1], Christoph Tegenkamp[1,2], and Herbert Pfnür[1] — [1]Institut für Festkörperphysik, Leibniz Universität Hannover — [2]Institut für Physik, TU Chemnitz

Bismuth has attracted a lot of interest because of its unique electronic properties such as low carrier concentrations and high carrier mobilities, In particular, strong Rashba splitting of the edge states appears in quantum films generated by epitaxial growth. Thus high-quality thin films open new pathways to tailor the electronic properties further. Magneto-conductance of films grown epitaxially on Si(111) with a thickness of 10 to 100 bilayers (BL) was measured at T= 9 K in parallel magnetic fields up to 4T. For B-fields in plane and parallel to the current direction only WAL is observed irrespective of thickness. However, if the B-fields are in plane, but perpendicular to the current, a crossover from weak anti-localization (WAL) to weak localization (WL) and back is seen for films up to 70 BL. For thicker films only WAL is observed. The observed coherent part of conductance in parallel B-fields perpendicular to current is characterized by an intriguing change from strong to weak coupling between edge states as a function of layer thickness and their hybridization with the quantized bulk states. For films thicker than 50 BL also incoherent scattering comes into play, which dominates above 80 BL.

DS 18.2 Tue 12:00 CHE 89

Layer by Layer Resistive Switching — •Jon-Olaf Krisponeit[1,3], Bernd Damaschke[2], Vasily Moshnyaga[2], and Konrad Samwer[2] — [1]Institute of Solid State Physics, University of Bremen, 28359 Bremen, Germany — [2]I. Physikalisches Institut, Georg-August-Universität Göttingen, 37077 Göttingen, Germany — [3]MAPEX Center for Materials and Processes, University of Bremen, 28359 Bremen, Germany

Beyond their complex magneto-resistive transport behavior, perovskite manganites have been shown to exhibit also memristive properties. Employing conductive atomic force microscopy (CAFM) on a $La_{0.85}Sr_{0.15}MnO_3$ thin film on MgO(100), we reveal a novel resistive switching mechanism which is based on the electric-field-induced healing of so-called "dead" layers.[1]

Under application of an electrical bias, these layers of highly resistive nature are switched to a bulk-like, conducting state. The switching process can be reversed by voltage pulses of the opposite polarity. Proceeding in a layer-by-layer fashion, the effect allows for multi-state functionality: The variable number of insulating layers, sandwiched between the conductive bulk and the cantilever tip, results in an electrically tunable tunnel barrier with multiple well-defined resistance states.

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[1] Krisponeit et al., *Phys. Rev. Lett.* **122**, 136801 (2019).

DS 18.3 Tue 12:15 CHE 89

Ac conductivity of nano-granular metals prepared via FEBID — •Marc Hanefeld and Michael Huth — Physikalisches Institut, Goethe Universität, Max-von-Laue-Str. 1

Focused Electron Beam Induced Deposition (FEBID) is a versatile technique to create nano-granular metals with tunable electronic transport properties [1]. In granular metals metallic nanoparticles are surrounded by a dielectric matrix which leads to a transport mechanism based on thermally assisted tunnelling. This opens up promising possibilities for sensing applications [1] and has triggered ongoing research concerning their response to a time-dependent ac stimulus [2].

Current research focuses mainly on two different material properties, namely an apparent universal power law and a temperature-independent scaling behaviour in the real part of the complex ac conductivity, both present in many disordered solids and recently reported in granular metals of palladium in zirconia [2].

We present recent results on the ac conductance response of nano-granular Pt(C)-FEBID deposits and show the capabilities of FEBID to create an ideal model environment for an in depth analysis of the ac conduction characteristics of granular metals. The focus in this talk will lie on generating a deeper understanding of links between the dc and ac conductance behaviour of nano-granular materials.

[1] Huth, et al., Microelect. Eng. 2017. doi:10.1016/j.mee.2017.10.012.
[2] Bakkali, et al., Sci. Rep. 2016;6:29676. doi:10.1038/srep29676.

DS 18.4 Tue 12:30 CHE 89

Quantum Corrections in Magnetotransport of $BaPbO_3$ thin films — •Robert Bartel, Patrick Seiler, Thilo Kopp, and German Hammerl — Experimental Physics VI, Center for Electronic Correlations and Magnetism, Institute of Physics, University of Augsburg, Germany

Recently metallic $BaPbO_3$ attracted attention as two-dimensional superconductivity was observed in bilayers of insulating $BaBiO_3$ and $BaPbO_3$ [1]. Here a detailed study of the transport properties of $BaPbO_3$ will be presented. Low temperature and magnetic-field dependent measurements of the sheet resistance of $BaPbO_3$ can be understood in terms of quantum corrections based on disorder, spin-orbit coupling or electron-electron interaction [2].

[1] B. Meir, S. Gorol, T. Kopp, G. Hammerl, Phys. Rev. B 96, 100507(R) (2017)

[2] P. Seiler, R. Bartel, T. Kopp, G. Hammerl, Phys. Rev. B 100, 165402 (2019)

DS 18.5 Tue 12:45 CHE 89

Calculating DC Conductivity in Substitutionally Disordered Graphene using the Kubo-Greenwood Formula — •Jacob Robbins and Jorge Sofo — The Pennsylvania State University, University Park, USA

We develop a method for calculating the electronic transport in monolayer graphene with a small percentage of carbon atoms substituted for nitrogen impurities. The Hamiltonian is treated in the tight binding approximation, with only nearest neighbor hopping included. While many authors find DC conductivity in such systems using the adiabatic electric field of Kubo (1957), we apply the perturbation theory approach of Greenwood (1958). This distinction allows us to find the DC conductivity of finite systems, without equilibrating to infinite time, at which point all conduction has ceased.