MM 18: Electronic properties I

Time: Tuesday 11:45–12:45 Location: H6

MM 18.1 Tue 11:45 H6

Energy Loss Magnetic Chiral Dichroism: theory and experiments — •Stefano Rubino[1], Michael Stöger-Pollach[1], Cécile Hébert[1], Peter Schattschneider[1], Jan Rusz[2], and Pavel Novak[2] — [1]Institute for Solid State Physics, Vienna University of Technology, Wiedner Hauptstrasse 8-10/138, A-1040 Vienna, Austria — [2]Institute of Physics, Academy of Sciences of the Czech Republic, Cukrovarnickà 10, 162 53 Prague 6, Czech Republic

The Transmission Electron Microscope (TEM) has been able to detect Linear Dichroism since many years, yet the possibility to use it to measure circular dichroism as well was only predicted in 2003 and experimentally verified recently with TEM and synchrotron measurements on the same specimen. Angle resolved Electron Energy Loss Spectrometry (EELS) offers several experimental setups able to detect the dichroic signal in the TEM. The choice of the experimental setup influences the achievable spatial resolution as well as the signal to noise ratio. In the experiment, a coherent superposition of two momentum transfer vectors perpendicular to each other is set up, tuning the phase difference between the two interactions to 90°. The inelastic interference term carries the dichroic signature. Experimental details and recent experimental results on Ni, Fe and Co will be presented, as well as simulations. Calculations were done with a full-potential, fully-relativistic Augmented Plane Wave code based on Density Functional Theory. The EMCD technique provides a new analytical tool for the element specific study of local magnetic moments.

MM 18.2 Tue 12:00 H6

Electromigration in Ag(Cu) lines — •R. Emling, U. Schoepka, M. Becherer, and D. Schmitt-Landsiedel — Technical University Munich, Institute for Technical Electronics

Degradation of conducting lines in integrated circuits due to stress by high current density is referred to as electromigration. Voids and hillocks build up by flow of material and increase resistivity until the line breaks or builds a short with an adjacent line. It is well known that small quantities of impurity in a metal can reduce electromigration significantly while resistivity increases only slightly.

In this work thin films of pure Ag and Ag(Cu) with 1.2 % and 2.0 % of Cu were sputter deposited and patterned by a hybrid etching process to produce NIST electromigration test patterns with 5 μm width, 500 μm length and 300 nm thickness. Deposition of the Ag(Cu) alloy was performed by magnetron sputtering using a process newly developed at the institute: Cu wires were attached in parallel to the surface of a pure silver target which resulted in sputtering both, silver and copper, at the same time. The amount of sputtered copper was controlled by the number and thickness of wires. EDX measurements showed a homogeneous dispersion of copper in the layer.

Electromigration measurements were performed at a constant current density of 22 MA/cm^2 until the lines failed within up to 16 days. In this process Ag(Cu) lines with 1.2 % Cu turned out to endure three times longer and lines with 2.0 % Cu up to four times longer than pure Ag lines. In conclusion we can assert a significantly higher electromigration resistance of Ag(Cu) lines.

MM 18.3 Tue 12:15 H6

Pressure effect on the electrical transport and structural properties of TiOCl — •Martin K. Forthaus[1], Timo Taetz[2], Angela Möller[2], and Mohsen M. Abd-Elmeguid[1] — [1]II. Physikalisches Institut, Universität zu Köln, Zülpicher Str. 77, 50937 Köln — [2]Institut für Anorganische Chemie, Universität zu Köln, Greinstr. 6, 50939 Köln

We have investigated the effect of pressure on the electrical transport and structural properties of the quasi one dimensional Mott insulator TiOCl which exhibits an unconventional spin-Peierls transition at low temperatures. The analysis of the temperature dependence of the electrical resistivity as a function of pressure up to 22 GPa reveals that the energy gap E_g (at 300 K) decreases with increasing pressure with a sudden drop of about 40 % above 12 GPa. However, no metallic state is observed up to 22 GPa. The investigation of the pressure effect on the lattice parameters of TiOCl up to 8 GPa shows an extreme anisotropic decrease with increasing pressure, indicating a structural instability. These results are discussed in terms of a pressure-induced change of the electronic properties which is possibly driven by lattice instabilities under high pressure.

MM 18.4 Tue 12:30 H6

Resistance and magnetoresistance of CuAg alloys — •Jens Freudenberger, Julia Lyubimova, Elias Mohn, Alexandre Gaganov, Nadezda Kozlova, and Ludwig Schultz — IFW Dresden, Institute for Metallic Materials

The resistance of cold worked Cu − x wt.-%Ag alloys (x = 7 and x = 24) is measured in dependence of magnetic field and temperature. The influence of impurities (such as vacancies, dislocations, second phases, precipitates, grain boundaries) as well as the size effect on the electrical conductivity of a Cu − 7 wt.-%Ag − 0.05 wt.-%Zr alloy wil be discussed. The magnetoresistance (MR) in the field range 0 T $\leq B \leq$ 50 T is positive and increases with magnetic field. Whereas an increase of MR is found for $I \perp B$, no significant change is observed for $I \parallel B$.