TT 17: SC: Fe-based Superconductors - 1111

Time: Monday 18:15–20:00 Location: HSZ 301

TT 17.1 Mon 18:15 HSZ 301

Structural trends from a consistent set of single-crystal data of *R*FeAsO (*R* = La, Ce, Pr, Nd, Sm, Gd, and Tb) — •Fabian Nitsche[1], Anton Jesche[2], Ellen Hieckmann[3], Thomas Doert[1], and Michael Ruck[1,2] — [1]Department of Chemistry and Food Chemistry, Technische Universität Dresden, D-01062 Dresden, Germany — [2]Max Planck Institute for Chemical Physics of Solids, D-01187 Dresden, Germany — [3]Institute of Applied Physics, Technische Universität Dresden, D-01062 Dresden, Germany

A new crystal growth technique for single crystals of RFeAsO (R = La, Ce, Pr, Nd, Sm, Gd, and Tb) using NaI/KI as flux is presented. Crystals with a size up to 300 μm were isolated for single-crystal X-ray diffraction measurements. Lattice parameters were determined by LeBail fits of X-ray powder data against LaB_6 standard. A consistent set of structural data is obtained and interpreted in a hard-sphere model. Effective radii for the rare-earth metal atoms in RFeAsO are deduced. The relation of the intraplane and interplane distances of the arsenic atoms is identified as limiter of the phase formation, and its influence on T_c is discussed.

TT 17.2 Mon 18:30 HSZ 301

Ferromagnetic correlations and Pauli limit behavior of As-deficient $LaO_{0.9}F_{0.1}FeAs_{1-\delta}$ — •V. Grinenko[1], G. Fuchs[1], K. Nenkov[1], F. Hammerath[1], B. Holzapfel[1], K. Kikoin[2], and S.-L. Drechsler[1] — [1]IFW-Dresden, D-01171 Dresden, Germany — [2]Tel Aviv University, Tel Aviv, Israel

The field and T-dependence of the static magnetic susceptibility χ of As-deficient $LaO_{0.9}F0_{0.1}FeAs_{1-\delta}$ (with δ 0.05-0.1) and $LaO_{0.9}F_{0.1}FeAs$ is analysed basing on recent ^{75}As NMR spectroscopy data [1]. The analysis of the Curie-like contribution to the spin-lattice relaxation rate T_1 and $\chi(T)$ together with specific heat data reveals that As vacancies induce local moments. We ascribe the appearance of uncompensated magnetic moment to reconstruction of valence bonds with 4 Fe atoms neighboring to the As-vacancy. These local moments do not suppress superconductivity (T_c increases compared to $LaO_{0.9}F_{0.1}FeAs$) but contribute to the Pauli susceptibility χ_P via an enhanced Stoner factor. We estimated an enhanced χ_P for $LaO_{0.9}F_{0.1}FeAs_{1-\delta}$ by a factor of 3-4 in the clean reference sample. This high χ_P is responsible for the Pauli limiting (PL) behavior observed in As-deficient $LaO_{0.9}F_{0.1}FeAs_{1-\delta}$ [2]. A thermodynamic critical field $B_c(0) \approx$1T was estimated for $LaO_{0.9}F0_{0.1}FeAs_{1-\delta}$, using the measured χ and the PL field $B_p(0)$=88 T from $B_{c2}(T)$ data. In contrast, no PL was found for stoichiometric $LaO_{0.9}F_{0.1}FeAs$ which is consistent with its small Pauli susceptibility.

[1] F. Hammerath *et al.*, Phys. B. **88**, 140504(R) (2010).
[2] G. Fuchs *et al.*, Phys. Rev. Lett. **101**, 237003 (2008).

TT 17.3 Mon 18:45 HSZ 301

Gd^{3+} electron spin resonance spectroscopy on $LaO_{1-x}F_xFeAs$ superconductors — •A. Alfonsov[1], F. Murányi[2], V. Kataev[1], N. Leps[1], R. Klingeler[1], A. Kondrat[1], C. Hess[1], S. Wurmehl[1], A. Köhler[1], G. Behr[1], and B. Büchner[1] — [1]IFW Dresden, D-01171 Dresden, Germany — [2]Universität Zürich, CH-8057 Zürich, Schweiz

In this work we have studied by means of electron spin resonance (ESR) spectroscopy polycrystalline samples of $LaO_{1-x}F_xFeAs$ (x = 0, 0.1) with small levels of Gd doping (2% and 5% with respect to La). The Gd^{3+} ion is an established spin probe to study local magnetic and charge environments in the crystal lattice. In the parent compound the Gd ESR signal is found to be sensitive to the magnetic phase transition from the paramagnetic to the spin density wave (SDW) state taking place at a temperature $T_{SDW} \sim$ 130 K. Here, the analysis of the low-T ESR spectra gives evidence for the occurrence of magnetically non-equivalent Gd sites and possibly sites with different local charge environments. In the case of the superconducting samples with 10% of the F doping (T_c = 25 K) the Gd ESR gives no indication of the SDW order.

TT 17.4 Mon 19:00 HSZ 301

Inelastic neutron scattering on iron arsenide high T_c superconductor $CaFe_{1-x}Co_xAsF$ — •Stephen Price[1], Yixi Su[2], Yinguo Xiao[1], Shibabrata Nandi[1], Ranjan Mittal[3], and Thomas Brueckel[1,2] — [1]Institute of Solid State Research Forschungszentrum Jülich , Jülich, Germany — [2]Jülich Centre for Neutron Science IFF Forschungszentrum Jülich , Jülich, Germany — [3]Solid State Physics Division, Bhabha Atomic Research Centre, Trombay, Mumbai, India

Recent discoveries of iron pnictide superconductors such as $LaFeAsO_{1-x}F_x$ and $Ba_{1-x}K_xFe_2As_2$ have generated a huge amount of interest in the studies of high-T_c superconductivity. In a way very similar to cuprates, superconductivity in iron pnictides is in the proximity to magnetism. Prominent features in the spin excitation spectra such as the *spin gap* and *spin resonance* are characteristic to this class of high-T_c superconductors and therefore are believed to be intimately connected to superconductivity. Here we present our recent results on studies of the magnetic excitation spectrum of Co doped $CaFe_{1-x}Co_xAsF$, a member of the 1111-family of pnictide high-T_c superconductors, obtained via time of flight neutron spectroscopy on powder samples. We successfully detected the resonance mode of the short range two dimensional spin dynamics in superconducting $CaFe_{0.88}Co_{0.12}AsF$ and therefore can report the first direct observation of this characteristic feature for a member of oxygen-free 1111 pnictide superconductors.

TT 17.5 Mon 19:15 HSZ 301

Nanoscale electronic order and ground-state coexistence in iron pnictides — •Guillaume Lang[1], Hans-Joachim Grafe[1], Dalibor Paar[1,2], Franziska Hammerath[1], Katarina Manthey[1], Alexey Alfonsov[1], Ferenc Murányi[1], Richard Zahn[1], Vladislav Kataev[1], Günter Behr[1], Jochen Werner[1], Saicharan Aswartham[1], Sabine Wurmehl[1], and Bernd Büchner[1] — [1]IFW Dresden, Institute for Solid State Research, P.O. Box 270116, D-01171 Dresden, Germany — [2]Dept. of Physics, Faculty of Science, Univ. of Zagreb, P.O. Box 331, HR-10002 Zagreb, Croatia

Controversial issues in the iron-based superconductors are the extent to which static magnetism and superconductivity can coexist, and whether intrinsic electronic inhomogeneities can show up as in related transition metal oxides. Using nuclear quadrupole resonance at the arsenic sites, we investigated the local charge distribution in "1111" pnictides [1]. Underdoped samples are shown to present systematically two different local charge environments, irrespective of the ground state. Spin-lattice relaxation measurements show their coexistence at the nanoscale. Together with the quantitative variations of the spectra with doping, they point to an intrinsic local electronic order, which is likely to impact the interplay of static magnetism and superconductivity. The latter will also be briefly discussed from the point of view of high-field ESR measurements revealing short-range spin correlations [2].

[1] G. Lang *et al.*, Phys. Rev. Lett. **104**, 097001 (2010)
[2] A. Alfonsov *et al.*, arXiv:1010.5070

TT 17.6 Mon 19:30 HSZ 301

Critical current density and scaling behavior of oxypnictide thin films — •Martin Kidszun, Silvia Haindl, Jens Hänisch, Alexander Kauffmann, Thomas David Thersleff, Ludwig Schultz, and Bernhard Holzapfel — IFW Dresden, Institute for Metallic Materials, PO - Box 270116, D-01171 Dresden, Germany

The successful growth of epitaxial LaFeAs(O,F) and SmFeAs(O,F) thin films opens the way to study intrinsic properties of this novel superconductors. Exploring the magnetic phase diagram up to 42 T we were able to investigate the temperature dependence and anisotropy of the upper critical field as well as the irreversibility field in these iron oxypnictides. The anisotropy of the irreversibility field was determined using a combination of resistive measurements in high magnetic fields and critical current density measurements. We have demonstrated that critical current densities can be scaled using the approach described by the anisotropic GL formalism.

TT 17.7 Mon 19:45 HSZ 301

Epitaxial thin films of arsenic free pnictide superconductors grown by molecular beam epitaxy — •Alexander Buckow, Jose Kurian, and Lambert Alff — Institute of Materials Science, TU Darmstadt

Within the family of superconducting pnictides, arsenic containing compounds not only are the largest in number, but also the materials

with the highest critical temperatures, T_c, obtained so far (up to 55 K). However, from the viewpoint of applications As free superconductors are more desirable, and from the fundamental point of view, the role of other pnictogens is of interest. For Bi as pnictogen, 1111 structure bulk superconductors have been found with T_c up to 9 K [1]. Here we report on the growth of arsenic free superconducting thin films by reactive molecular beam epitaxy as a generic synthesis route. Besides the successful growth of superconducting thin films of LaONiBi, we have also grown the 122 phase $LaNi_2Bi_2$. These thin films were fabricated on MgO substrates from elemental sources in a custom designed UHV chamber ($\approx 10^{-8}$ mbar). A streaky RHEED pattern during deposition clearly indicates epitaxial growth. The observed Laue oscillations in the X-ray diffraction patterns reveal the high crystallinity of the films. So far, however, we could not observe superconductivity in the Bi based 122 epitaxial thin films.

[1] V. L. Kozhevnikov *et al.*, JETP Lett. **87**, 649 (2008).