

TT 15: Superconductivity: Poster Session

Time: Tuesday 14:00–18:00

Location: Poster B

TT 15.1 Tue 14:00 Poster B

Superconducting MgB_2 films with introduced artificial pinning centers — ●ANATOLI SIDORENKO^{1,2}, VLADIMIR ZDRAVKOV¹, ANDREI SURDU¹, GÜNTER OBERMEIER³, CHRISTOPH FROMMEN⁴, STEFAN WALHEIM⁴, THOMAS KOCH^{2,4}, and THOMAS SCHIMMEL^{2,4} — ¹Institute of Electronic Engineering and Industrial Technologies ASM, Kishinev MD2028, Moldova — ²Institute of Applied Physics, University of Karlsruhe, D-76128 Karlsruhe, Germany — ³Institute of Applied Physics, University Augsburg, 86159 Augsburg, Germany — ⁴Institute of Nanotechnology, Forschungszentrum Karlsruhe, D-76021 Karlsruhe, Germany

High quality superconducting magnesium diboride films were prepared using DC-magnetron sputtering and post annealing in Mg vapor within a specially designed Nb reactor. The influence of embedded gold nano particles on resistive transition broadening in external magnetic field has been investigated. The transition broadening in strong magnetic fields could be explained by the change of the effective dimensionality of superconductivity nucleation in magnesium diboride, because of the dimensional crossover of fluctuations.

The work was supported by the BMBF project 01/007 Superconducting Magnesium Diboride Films for Technical Application, and the project Poziționarea forței de pinning și creșterea curentului critic în MgB_2 și aplicațiile tehnice.

TT 15.2 Tue 14:00 Poster B

Carbon doping as an effective way of changing the superconducting properties of MgB_2 — ●MARKO HERRMANN¹, WOLFGANG HÄSSLER¹, MARGITTA SCHUBERT¹, WOLFGANG GRUNER¹, MANFRED RITSCHEL¹, BERNHARD HOLZAPFEL^{1,2}, and LUDWIG SCHULTZ^{1,2} — ¹IFW-Dresden, Institute for Metallic Materials, P.O. Box 270116, D-01171 Dresden, Germany — ²Dresden University of Technology, Department of Physics, D-01062 Dresden, Germany

Up to now, carbon doping is the only reliable way to enhance the superconducting properties of MgB_2 significantly. Precursor powders of carbon-doped and undoped MgB_2 were prepared by mechanical alloying. This very effective preparation method imparts an enormous quantity of energy to the material and produces a partially reacted, nanocrystalline powder with enhanced reactivity. The high reactivity of the milled powders promotes the formation of MgB_2 at reduced temperatures around 600°C to 650°C. Very high critical current densities of $J_c = 1.1 \times 10^6 \text{ A/cm}^2$ in self-field at 4.2 K and critical fields $B_{c2} = 15.5 \text{ T}$ at 10 K of undoped bulk samples of mechanically alloyed precursors were measured. In comparison to results of other in-situ preparation techniques this values exceed most of the superconducting properties by far and even keep up with results on optimized carbon doped samples reported so far. Starting from this high performance powders a comparison of promising carbon dopants will be presented. We show the influence of these dopants on the lattice parameter, the superconducting transition, critical field and critical current density of the bulk samples.

TT 15.3 Tue 14:00 Poster B

Film growth and anisotropic behaviour of the critical field in epitaxial $\text{Lu}_x\text{Ho}_{1-x}\text{Ni}_2\text{B}_2\text{C}$ thin films — ●TIM NIEMEIER, RUBEN HÜHNE, LUDWIG SCHULTZ, and BERNHARD HOLZAPFEL — IFW Dresden, P.O. Box 270116, 01171 Dresden

The research on Rare Earth Nickel Borocarbides has led to a number of new conclusions about superconductivity, particularly in regard to the interdependency with magnetic influences. Recently, it was concluded by Wälte *et al.* from specific heat measurements and thermodynamic simulations that $\text{LuNi}_2\text{B}_2\text{C}$ provides a non-magnetic corresponding partner of $\text{HoNi}_2\text{B}_2\text{C}$ [1].

Complementary to single crystal growth, we use pulsed laser deposition for the sample preparation. In the past, particularly the anisotropy of the upper critical field could be successfully measured using thin film samples [2]. We prepared epitaxial thin films of alloys of $\text{Lu}_x\text{Ho}_{1-x}\text{Ni}_2\text{B}_2\text{C}$ for different x for the investigation of the transition temperature and the upper critical field. Especially we discuss the anisotropic behaviour above as well as below the magnetic ordering temperature known from $\text{HoNi}_2\text{B}_2\text{C}$ providing numerical fitting results for different simple models.

[1] Wälte, A: Doctoral thesis, TU Dresden 2007

[2] Wimbush, S. C., L. Schultz, and B. Holzapfel: Angular anisotropy of the upper critical field in $\text{YNi}_2\text{B}_2\text{C}$. Physica C 408-10 (2004): 83-84.

TT 15.4 Tue 14:00 Poster B

Electrical properties of thin $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ films with embedded gold nano clusters — ●SEBASTIAN ENGMANN, UWE SCHINKEL, VEIT GROSSE, CHRISTOPH BECKER, ALEXANDER STEPPKE, FRANK SCHMIDL, and PAUL SEIDEL — Institut für Festkörperphysik, Friedrich-Schiller-Universität Jena, Helmholtzweg 5, D-07743 Jena

High temperature superconducting devices such as magnetometers or gradiometers are usually made from a single thin film, although each part of the device needs to fulfill special requirements. These are for example a low flux noise in antenna structures and a low contact resistance to the bonding pads. These requirements can be achieved by embedding gold nano clusters in thin films of $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ (YBCO), since they can act as flux pinning centers and they increase contact area to the film.

We present studies on the formation of gold nano clusters during the pulsed laser deposition of thin YBCO films in dependence on the gold film thickness. We verified the high crystalline quality of the films by measuring Rocking curve widths. Size and distribution of the gold clusters were determined from AFM measurements. We compare the superconducting and noise properties of bridge structures and gradiometers with devices made of conventional YBCO films.

TT 15.5 Tue 14:00 Poster B

Preparation and Characterization of $\text{YBa}_2\text{Cu}_3\text{O}_7/\text{PrBa}_2\text{Cu}_3\text{O}_7$ Superlattices — ●AYMAN EL TAHAN, GERHARD JAKOB, and HERMANN ADRIAN — Institute of Physics, University of Mainz, 55099 Mainz

High T_c superconductor/insulator superlattices offer the possibility to create artificial superconductors with variable strength of the interlayer Josephson coupling. We want to investigate the interlayer coupling strength by measuring the transport properties perpendicular to the layers.

Our presented films are prepared from stoichiometric targets by high pressure sputter deposition in pure oxygen atmosphere. As substrates we used (100) oriented SrTiO_3 and LaAlO_3 . Using x-ray diffraction we confirmed the c-axis oriented epitaxial growth of the superlattices. The superlattice quality is determined by comparison to simulated diffractograms using the program SUPREX. AC magnetic susceptibility was used for characterization of the critical temperature for our $\text{YBa}_2\text{Cu}_3\text{O}_7$ samples and $\text{YBa}_2\text{Cu}_3\text{O}_7/\text{PrBa}_2\text{Cu}_3\text{O}_7$ superlattices.

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TT 15.6 Tue 14:00 Poster B

Synthesis and characterisation of superconducting and magnetic properties of $\text{RuSr}_2\text{Gd}_{1-x}\text{Y}_x\text{Cu}_2\text{O}_8$ — ●JOHANNES KRÄMER, EUGENIO CASINI, and HANS F. BRAUN — Physikalisches Institut, Universität Bayreuth, D-95440 Bayreuth

It is well known that the formation of RuRE_{1212} (RE = rare earth) under ambient pressure is strongly affected by the size of the rare earth ion. The 1212 structure type forms just with RE = Gd, Eu and Sm. Under high pressure, the synthesis has been successful with the smaller elements Tb - Er and Y [1]. Under ambient conditions, the phase has been reported in solid solution systems $\text{RuSr}_2\text{Gd}_{1-x}\text{RE}_x\text{Cu}_2\text{O}_8$ with RE = Dy - Er, Yb and Lu up to a maximum content of $x = 0.7$ [2].

In our work we investigated the partial substitution of Gd with the non-magnetic rare earth Yttrium. The samples were characterised using x-ray powder diffraction, scanning electron microscopy (SEM) and ac-susceptibility measurements. We observed a dependence of the superconducting transition temperature T_c as well as the lattice parameters on the Yttrium content. However, single-phase samples were not obtained.

[1] L.T. Yang *et al.*, J. Solid State Chem. 177 (2004) 1072

[2] M. Abatal *et al.*, Physica C 408-410 (2004) 185

TT 15.7 Tue 14:00 Poster B

Effect of variable Ru content on superconducting and magnetic properties of $\text{RuSr}_2\text{GdCu}_2\text{O}_8$ — ●MANUEL KEMPF, EUGENIO CASINI, and HANS F. BRAUN — Physikalisches Institut, Universität