

TT 10: Superconductivity: Fabrication and Characterization

Time: Monday 14:00–15:00

Location: H 3010

TT 10.1 Mon 14:00 H 3010

MOCVD and MOD process for Coated Conductors — ●OLIVER STADEL¹, RUSLAN MUYNINOV¹, JÜRGEN SCHMIDT⁴, HARTMUT KEUNE⁴, GEORG WAHL¹, GÜNTER KOTZYBA², ANITA WILL², RAINER NAST², ALEXANDRA JUNG², WILFRIED GOLDACKER², SERGEJ SAMOILENKOV³, OLEG GORBENKO³, and ANDREJ KAUL³ — ¹TU Braunschweig, IOT, Bienroder Weg 53, 38108 Braunschweig — ²Forschungszentrum Karlsruhe, ITP, Hermann von Helmholtz Platz 1, 76344 Eggenstein Leopoldshafen — ³Moscow State University V234, Department of Chemistry, Moscow 119 899 — ⁴PerCoTech AG, Bienroder Weg 53, 38176 Braunschweig

A MOCVD and a MOD process for continuous deposition of oxide buffer layers and YBCO at once on long metal tapes was developed. Textured Ni(W) tapes were coated with oxide buffer layers at low oxygen partial pressure without oxidation of the metal tape. YBCO films of 350-1000 nm thick were obtained using tape velocity of 4 m/h. MOCVD and MOD buffer layers, which were delivered from partners of the Virtual Institute, were covered by YBCO. Entirely obtained by MOCVD superconductive samples revealed a critical current density of 1MA/cm² at 77 K. The excellent in plane texture (FWHM = 5-6°) and out of plane texture (FWHM = 1.4-3°) of YBCO films may enable to increase the critical current density further. YBCO deposited on MOD obtained buffer layers reached the maximum critical current density 2MA/cm².

Acknowledgement - The authors thank the partners of the Virtual Institute Chemically deposited YBCO Superconductors.

TT 10.2 Mon 14:15 H 3010

Roebel Assembled Coated Conductor Cables (RACC): Ac-Losses and Application Potential — ●CURT SCHMIDT and WILFRIED GOLDACKER — Forschungszentrum Karlsruhe, Institut für Technische Physik

High temperature superconducting (HTS) cables for transport currents well above 1 kA, assembled from a number of tapes, are required for application in transformers, generators and for future fusion reactor coils. Coated conductor (CC) tapes are suitable candidates for an operation temperature between 50 and 77 K which is a crucial precondition for economical cooling costs. Ac-field applications require low ac-loss cables and hence transposition of the individual tapes. The in the plane inflexibility of the tapes doesn't allow classical twisting techniques. The problem can be solved using a modified Roebel technique where meander shaped tapes are assembled to a Roebel cable. The electrical connection between the tapes, necessary to allow current redistribution, and the mechanical stability is achieved by impregnation with a conductive epoxy resin. We prepared short lengths of cables with 11 and 12 structured tapes and measured ac-losses in an external ac field and coupling current time constants. In the interesting frequency range below 100 Hz the coupling losses are small compared to hysteresis losses in the tape. The possibility of hysteresis loss reduction by striating the tapes should therefore be taken into consideration. Finally we discuss the potential of this cable type with respect to ac-losses and current carrying capability as a function of operation temperature, as well as possible routes of long length cable fabrication.

TT 10.3 Mon 14:30 H 3010

Effect of rare earth and alkaline earth substitutions in the superconductor RuA₂RECu₂O₈ (RE=Gd, Eu, Nd, Pr; A=Ca, Sr, Ba): crystal structure and physical properties — ●EUGENIO CASINI^{1,4}, CONSIGLIA TEDESCO², ANTONIO VECCHIONE², THOMAS P. PAPAGEORGIOU³, HANS F. BRAUN⁴, MANUEL KEMPF⁴, and JOHANNES KRÄMER⁴ — ¹PANalytical, Almelo, The Netherlands — ²Università di Salerno, Italy — ³Forschungszentrum Dresden-Rossendorf, Germany — ⁴Universität Bayreuth, Germany

For small rare earth ions (RE=Gd, Eu), single phase compounds are obtained with the typical ordered layered structure and no significant changes of physical properties. With large rare earth ions (RE=Nd, Pr), polyphase samples were obtained and the phases in equilibrium at the nominal composition RuSr₂RECu₂O₈ were determined. In these cases, no ordered layered structure was observed. The disorder between Ru/Cu or Sr/RE is presumably due to the similar Ru/Cu and Sr/RE ionic sizes. Magnetization studies of these compounds are discussed.

The effect of substituting Sr⁺² with the smaller Ca⁺² and larger Ba⁺² is examined. The substitution with Ca⁺² results in a complex mixture. We cannot confirm the previously reported formation of the layered RuCa₂NdCu₂O₈. For Ba⁺² substitution, a binary mixture Ba₂RuNdO₆-CuO is obtained. A different number and different types of phases in equilibrium are found with different alkaline earths (A=Ca, Sr, Ba) at the nominal RuA₂NdCu₂O₈ composition. The variation in the mismatch of the A/Nd (A=Ca, Sr, Ba) size does not lead to the formation of an ordered layered RuA₂NdCu₂O₈ compound.

TT 10.4 Mon 14:45 H 3010

Growth and study of LuNi₂B₂C single crystals — ●ANKE KÖHLER¹, GÜNTER BEHR¹, BEATE BERGK², GÜNTER FUCHS¹, KONSTANTIN NENKOV¹, and JOACHIM WOSNITZA² — ¹IFW Dresden, D-1171 Dresden — ²Forschungszentrum Dresden-Rossendorf, D-01328 Dresden

Rare earth-nickel-borocarbides have attracted much interest in the last years because the compounds show the interplay of superconductivity and magnetic ordering. LuNi₂B₂C can be considered as non-magnetic reference system of such magnetic borocarbides as HoNi₂B₂C in which superconducting and antiferromagnetic ordering temperatures, T_c and T_N, are similar.

So far, LuNi₂B₂C crystals were only prepared by a flux method. For growing larger crystals we used an optical floating zone (FZ) technique, which already was successful in crystal growth of other RNi₂B₂C (R = Y, Tb, Ho, Tm, Er) compounds. In the case of LuNi₂B₂C, the primary crystallization field is far from the stoichiometric composition, and adjacent to the peritectic LuB₂C₂ phase field an extended region of LuNiBC occurs. Systematic studies of polycrystalline samples revealed that samples with nominal compositions LuNi₅B_{3.5}C and LuNi₅B₃C_{0.5} are free of the peritectic LuB₂C₂ and LuNiBC phases. Thus in the FZ crystal growth experiments we used a molten zone which corresponds to these compositions.

From the grown LuNi₂B₂C rods single crystalline pieces have been prepared to investigate Fermi surface peculiarities by magneto-resistance measurements and to study the electronic band structure.

TT 11: Superconductivity: Tunneling, Josephson Junctions, SQUIDS

Time: Monday 15:15–18:00

Location: H 3010

Invited Talk

TT 11.1 Mon 15:15 H 3010

Superconducting Quantum Interference Filters — ●NILS SCHOPOHL — Institut für Theoretische Physik der Universität Tübingen

Basic principles of Josephson junction based interferometer arrays are reviewed. Key features of parallel and also serial Superconducting Quantum Interference Filters (SQIFs) are explained in detail. It is shown that SQIF interferometers can be engineered to have a specific voltage output pattern vs. magnetic field that is well suited for applications in magnetometry and also microwave sensorics.

TT 11.2 Mon 15:45 H 3010

Tailored Josephson phase: 0, π and $0-\pi$ SIFS Josephson junctions — ●MARTIN WEIDES¹, ALEXEY BANNYKH¹, UTHAYASANKARAN PERALAGU¹, JUDITH PFEIFFER², MATTHIAS KEMMLER², DIETER KOELLE², REINHOLD KLEINER², and EDWARD GOLDOBIN² — ¹Institute for Solid State Research, Research Centre Jülich — ²Physikalisches Institut - Experimentalphysik II,

In superconducting/ferromagnet (S/F) systems the superconducting wave function extends into the ferromagnet with a damped oscillatory behavior. This results in novel and interesting physics, such as the possibility to realize a π Josephson junction (JJ) — a JJ with the phase drop of π in the ground state. Recently, we fabricated Nb/Al₂O₃/NiCu/Nb JJs with uniform as well as step-like ferromag-