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 Stadel[1], Ruslan Muydinov[1], Jürgen Schmidt[4], Hartmut Keune[4], Georg Wahl[1], Günter Kotzyba[2], Anita Will[2], Rainer Nast[2], Alexandra Jung[2], Wilfried Goldacker[2], Sergej Samoilenkov[3], Oleg Gorbenko[3], and Andrej Kaul[3] — [1]TU Braunschweig, IOT, Bienroder Weg 53, 38108 Braunschweig — [2]Forschungszentrum Karlsruhe, ITP, Hermann von Helmholtz Platz 1, 76344 Eggenstein Leopoldshafen — [3]Mowcow State University V234, Department of Chemistry, Moscow 119 899 — [4]PerCoTech AG, Bienroder Weg 53, 38176 Braunschweig

A MOCVD and a MOD process for contiuous deposition of oxide buffer layers and YBCO at once on long metal tapes was developed. Texured 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/cm^2 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/cm^2.

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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 $RuA_2RECu_2O_8$ (RE=Gd, Eu, Nd, Pr; A=Ca, Sr, Ba): crystal structure and physical properties — •Eugenio Casini[1,4], Consiglia Tedesco[2], Antonio Vecchione[2], Thomas P. Papageorgiou[3], Hans F. Braun[4], Manuel Kempf[4], and Johannes Krämer[4] — [1]PANalytical, Almelo, The Netherlands — [2]Università di Salerno, Italy — [3]Forschungzentrum Dresden-Rossendorf, Germany — [4]Universität 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 $RuSr_2RECu_2O_8$ 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 $RuCa_2NdCu_2O_8$. For Ba^{+2} substitution, a binary mixture Ba_2RuNdO_6–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 $RuA_2NdCu_2O_8$ 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 $RuA_2NdCu_2O_8$ compound.

TT 10.4 Mon 14:45 H 3010

Growth and study of $LuNi_2B_2C$ single crystals — •Anke Köhler[1], Günter Behr[1], Beate Bergk[2], Günter Fuchs[1], Konstantin Nenkov[1], and Joachim Wosnitza[2] — [1]IFW Dresden, D-1171 Dresden — [2]Forschungszentrum 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. $LuNi_2B_2C$ can be considered as non-magnetic reference system of such magnetic borocarbides as $HoNi_2B_2C$ in which superconducting and antiferromagnetic ordering temperatures, T_c and T_N, are similar.

So far, $LuNi_2B_2C$ 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 RNi_2B_2C (R = Y,Tb,Ho,Tm,Er) compounds. In the case of $LuNi_2B_2C$, the primary crystallization field is far from the stoichiometric composition, and adjacent to the properitectic LuB_2C_2 phase field an extended region of LuNiBC occurs. Systematic studies of polycrystalline samples revealed that samples with nominal compositions $LuNi_5B_{3.5}C$ and $LuNi_5B_3C_{0.5}$ are free of the properitectic LuB_2C_2 and LuNiBC phases. Thus in the FZ crystal growth experiments we used a molten zone which corresponds to these compositions.

From the grown $LuNi_2B_2C$ rods single crystalline pieces have been prepared to investigate Fermi surface peculiarities by magnetoresistance measurements and to study the electronic band structure.