TT 17 Superconductivity: Thin Film Preparation

Time: Tuesday 14:00–14:45 Room: HSZ 02

TT 17.1 Tue 14:00 HSZ 02

Growth of superconducting $Na_{0.3}CoO_2{\cdot}1.3D_2O$ thin films — •Y. Krockenberger[1,2], I. Fritsch[1], G. Cristiani[1], C. Bernhard[3], L. Alff[2], and H-U. Habermeier[1] — [1]Max Planck Institut for Solid State Research, 70569 Stuttgart, Germany — [2]Technische Universitaet Darmstadt, 64287 Darmstadt, Germany — [3]Universite de Fribourg, Ch. du Musée 3, CH-1700 Fribourg

Layered cobaltates attracted much interest since superconductivity was found in hydrated samples [1]. The electronic and structural analogies between $Na_{0.3}CoO_2{\cdot}1.3H_2O$ and high T_c copper oxides suggests that their superconductivity may have a similar origin based on strong electron correlation. Furthermore, Terasaki et al. [2] reported large thermoelectric power values for Na_xCoO_2 with metallic resistivity behavior suggesting a promising material for thermoelectrical applications. Here, we report, that Na_xCoO_2 can be stabilized as a thin film by pulsed laser deposition technique in the doping range from $x = 0.25$ up to $x = 1.0$. In order to achieve superconducting thin films (with $T_c \approx 4.4\,K$) a new process involving slow waterizing in a constant humidity is required. The sodium content has been decreased after depositing a $Na_{0.6}CoO_2$ thin film by soft chemical methods. These thin films have been characterized by x-ray diffraction, and resisitivity measurements. Additionally, the surface quality enabled us to perform far infrared spectroscopy in the range of λ =100 to 1000 cm^{-1} for various doping levels. (1) K. Takada *et al.*, Nature 422, 53 (2003). (2) I. Terasaki *et al.*, Phys. Rev. B 56, R12685 (1997). (3) Y. Krockenberger *et al.*, APL 86, 191913 (2005).

TT 17.2 Tue 14:15 HSZ 02

New method to obtain superconducting $Sr_{1-x}La_xCuO_2$ thin films by PLD — •V. Leca[1], G. Visanescu[1], G. Rijnders[2], D. H. A. Blank[2], S. Bals[3], R. Kleiner[1], and D. Koelle[1] — [1]Physikalisches Institut–Experimentalphysik II, Univ. Tübingen, Germany — [2]Univ. Twente, Faculty of Science and Technology, Enschede, The Netherlands — [3]EMAT, Univ. Antwerp (RUCA), Antwerp,Belgium

Difficulties in fabricating single-phase infinite-layer (IL) type $Sr_{1-x}La_xCuO_2$ thin films with good superconducting characteristics hampered the investigation of basic properties such as the pairing symmetry of this class of electron-doped superconducting cuprates. A new synthesis approach to obtain single-phase $Sr_{1-x}La_xCuO_2$ ($x = 0.10 - 0.175$) thin films grown by pulsed laser deposition (PLD) on $KTaO_3$ and $SrTiO_3$ substrates will be presented. The IL phase is obtained after oxidation of the as-deposited oxygen-deficient $Sr_{1-x}La_xCuO_{2-\delta}$ films having a $2\sqrt{2}a_p \times 2\sqrt{2}a_p \times c$ structure (a_p, c represent the perovskite subcell parameters). An increased stability of the IL phase for the entire studied La doping range (x=0.10-0.175) was achieved by applying this synthesis approach. Superconductivity was obtained for the $x = 0.15 - 0.175$ films, with the highest transition temperature $T_{c,zero} = 17\,K$ for $x = 0.15$. This result indicates a shift of the superconducting region towards a higher La doping level as compared to previous studies. For the $Sr_{1-x}La_xCuO_2$ films grown on $BaTiO_3/SrTiO_3$, superconductivity was observed for x=0.15 only when the $BaTiO_3$ buffer layer is relaxed, following an *in-situ* annealing step, confirming that tensile strain is required in order to induce superconductivity in the $Sr_{1-x}La_xCuO_2$ films.

TT 17.3 Tue 14:30 HSZ 02

$YBa_2Cu_3O_{7-\delta}$ Thin Films Prepared by Polymer-Assisted Deposition (PAD) — •Claudia Apetrii[1], Heike Schlörb[1], Irene von Lampe[2], Ludwig Schultz[1], and Bernhard Holzapfel[1] — [1]IFW Dresden, P.O. Box 270116, D-01171 Dresden, Germany — [2]TU Berlin, Englische Str. 20, 10587 Berlin, Germany

The Polymer-Assisted Deposition (PAD) route is a deposition route towards an inexpensive, non-vacuum approach for growing long $YBa_2Cu_3O_{7-\delta}$ (YBCO) tapes. The polymer used in this technique is a synthetic organic polymer (polyacrylic acid) that has functional groups with strong complexation affinities for metal ions. The distribution of the metal ions is very homogeneous and, thus, processing times are shorter, leading to good continuous film preparation conditions. The metal polymer precursor films were produced by spin coating a stoichiometric solution (Y:Ba:Cu = 1:2:3) onto $SrTiO_3$ single crystal substrates and subsequently dried at 170 °C in air. The heat treatment was performed in a tube furnace at reaction temperature of 775 °C in a nitrogen atmosphere containing small amounts of oxygen. The quality of the films strongly depends on the precursor solution stability. Furthermore, the effect of metal ions (Sm, Dy) introduced by chemical substitution on the Y site is discussed. The YBCO films were routinely analysed by X-ray Diffraction and Scanning Electron Microscopy. The inductively measured critical current density J_c reached values up to 3.5 x 10^6 A/cm^2 (at 77 K).