



Contribution ID: 294

Type: **Contributed Oral**

M2Or4B-05: Charge carrier density and critical current density variations of superconducting layers of GdBCO and EuBCO coated conductors as a result of high pressure oxygenation

Tuesday 20 May 2025 17:30 (15 minutes)

Oxygen overdosing may be a way to further increase the critical current density of coated conductors. It has recently been shown that overdosing of YBCO thin film coated with an Ag layer was achieved by processing at low temperature and 1 bar oxygen pressure, which allowed increasing the charge carrier density and achieving whatever high critical current $90 \text{ MA}\cdot\text{cm}^{-2}$ at 5 K, which corresponds to a fifth of the depairing current. We used commercial GdBCO and EuBCO with BHO nanorods coated conductors (CC) from Fujikura Ltd with model numbers FYSC-S12 and FESC-SCH12 to study the effect of subsequent high pressure oxygenation (in the pressure range 1-160 bar) at temperatures 250-800 oC on charge carrier density, lattice parameters of superconducting phase and critical current density variations. Before the treatment GdBCO and EuBCO CC were all chemically treated for removing the protective Cu or Cu and Ag layers.

The evidences of overdoping were observed about what were witnessed an increase of $nH(100 \text{ K})$, reduction of c-lattice parameters of RE123 (RE=Eu, Gd) of superconducting layers, behavior of normalized resistivity before superconducting transition, and J_c variation, however, the conditions to achieve optimal doping were not found yet. Treatment under 100 bar of oxygen for 3 h of GdBCO_CC (with Ag layer) at 600 °C led to an increase in $J_c(77 \text{ K}, 0 \text{ T})$ from 2.57 to 2.67 MA/cm², $nH(100 \text{ K})$ increased from 6.55×10^{21} to $6.91 \times 10^{21} \text{ cm}^{-3}$, and $J_c(5 \text{ K}, 0 \text{ T}) = 28.94 \text{ MA/cm}^2$ was observed after the treatment. The increase in $J_c(77 \text{ K}, 0 \text{ T})$ from 2.10 to 2.28 MA/cm² for GdBCO_CC (without Ag layer) was observed after treatment at 300 °C under 100 bar of O₂ for 3 h. In the both cases c-parameter of Gd123 decreased from 1.1735(1) to 1.1731(0) nm. For EuBCO_CC after treatment a decrease in c-parameters of Eu123 was observed: from 1.1738(8) to 1.1734(5) nm (for the Ag-coated sample under 100 bar O₂ at 300 °C) and from 1.1740(2) to 1.1736(3) nm (for the sample without Ag under 160 bar O₂ at 800 oC). The studies are still ongoing.

This work was supported in part by the funds from MICIU/AEI/FEDER for SUPERENERTECH (PID2021-127297OB-C21), FUNFUTURE "Severo Ochoa"(CEX2019-000917-S); MUGSUP (UCRAN20088) project from CSIC scientific cooperation with Ukraine; Catalan Government 2021 SGR 00440; and NAS of Ukraine Project III-7-24 (0788).

Authors: PRIKHNA, Tetiana ((1) V. Bakul Institute for Superhard Materials of the National Academy of Sciences of Ukraine, (2) Institut de Ciencia de Materials de Barcelona, CSIC, (3) Leibniz-Institut für Festkörper- und Werkstoffforschung Dresden e. V.); Ms KETHAMKUZHI, Aiswarya (Institut de Ciencia de Materials de Barcelona, CSIC); VLAD, Roxana (ICMAB-CSIC); Prof. KARPETS, Myroslav (National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute»); Mr KLUGE, Robert (Leibniz-Institut für Festkörper- und Werkstoffforschung Dresden e. V.); Mr PONOMARYOV, Semyon (V.E. Lashkaryov Institute of Semiconductor Physics of the National Academy of Sciences of Ukraine); Dr MOSHCHIL, Viktor (V. Bakul Institute for Superhard Materials of the National Academy of Sciences of Ukraine); Prof. OBRADORS, Xavier (Institut de Ciencia de Materials de Barcelona, CSIC); Prof. BÜCHNER, Bernd (Leibniz-Institut für Festkörper- und Werkstoffforschung Dresden e. V.); Dr GUTIERREZ ROYO, Joffre (ICMAB - CSIC); Prof. WURMEHL, Sabine (Leibniz-Institut für Festkörper- und Werkstoffforschung Dresden e. V.); PUIG MOLINA, Teresa (Institut de Ciencia de Materials de Barcelona, CSIC)

Presenter: PRIKHNA, Tetiana ((1) V. Bakul Institute for Superhard Materials of the National Academy of Sciences of Ukraine, (2) Institut de Ciencia de Materials de Barcelona, CSIC, (3) Leibniz-Institut für Festkörper- und Werkstoffforschung Dresden e. V.)

Session Classification: M2Or4B - Growth & Characterization of REBCO and Iron-based Superconductors