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Oxygen diffusion processes and performance degradation in commercial REBCO-based coated conductors

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Coated Conductors (CCs) have gained interest in the superconductivity field due to their attractive properties for multiple applications, from high-field science to energy and healthcare. In this work we present an extensive study of the oxygen diffusion processes in REBCO films of commercial CCs through means of X-Rays, transport and magnetic measurements. We aimed to find out the conditions that cause the total or partial excorporation (out-diffusion) of oxygen from the REBCO films leading to a degradation of the superconducting properties or even to the loss of the superconductivity; and the ones that allow the incorporation (in-diffusion) of the oxygen restoring the original values of the critical temperature and critical current density. These results are very relevant from the application point of view since procedures like joining or soldering, in which a thermal treatment is applied, may degrade the performance of the REBCO films due to the oxygen out-diffusion. Moreover, although the oxygen diffusion process, both through intergrain and intragrain mechanisms, has been studied in the past in lab-scale REBCO films, this had not been extensively studied in commercial CCs until now. This work allows to shed some light on the mechanisms behind the oxygen diffusion processes in CCs.

[1] Marco Bonura, Pablo Cayado, Konstantina Konstantopoulou, Matteo Alessandrini, and Carmine Senatore, Heating-Induced Performance Degradation of REBa₂Cu₃O_{7-x} Coated Conductors: An Oxygen Out-Diffusion Scenario with Two Activation Energies. ACS Appl. Electron. Mater. acsaelm.2c00065 (2022) doi:10.1021/acsaelm.2c00065.