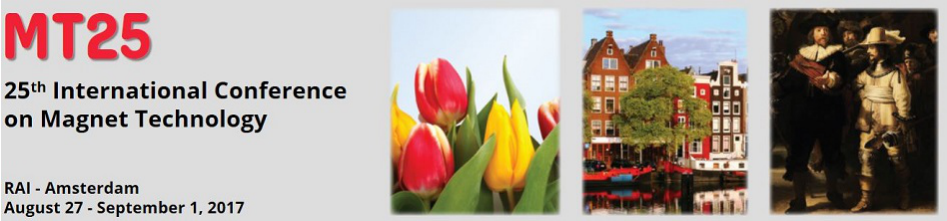

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Superconducting properties of 2G HTS wires with artificial pinning centres fabricated using production scale PLD equipment

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State of the art high field and ultra-high filed magnets demand HTS conductors with ever-increasing critical current. SuperOx is conducting an industrial R&D effort, in order to improve the performance of 2G HTS wire in magnetic field by introducing perovskite artificial pinning centres into the HTS film matrix. This paper will report the results of critical current measurements of BaZrO3 and BaSnO3 doped GdBCO 2G HTS wires fabricated using a production scale PLD system at the 100-200 Hz laser pulse frequency. Angular dependencies of the critical current of the samples were measured by the 4-probe transport technique at 77 and 65 K in 1 T magnetic field and derived from magnetic hysteresis curves measured in PPMS in the 4.2-77 K temperature range and 0-9 T magnetic field range. The crystal structure and texture parameters of the HTS layer and perovskite inclusions were characterised with XRD. The HTS layer microstructure and morphology were studied with TEM. TEM studies revealed the typical microstructure with BaZrO3 and BaSnO3 nano-rods incorporated into the GdBCO film matrix, with an average nano-rod diameter of about 5 nm. There was a systematic shift in Tc to lower temperatures with increasing dopant concentration. All doped samples exhibited much lower angular anisotropy of in-field critical current and higher lift factors than undoped samples. Doped samples had higher minimum critical current for all field orientations than undoped samples at 65 K and at lower temperatures. These results demonstrate a positive impact of artificial pinning centres introduced into 2G HTS wires fabricated at production throughput. In the on-going work we will optimise the PLD growth parameters, in order to maximise the improvements in specific temperature and field conditions, and verify the reproducibility of the improvements in production wires.

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