IEEE-CSC, ESAS and CSSJ SUPERCONDUCTIVITY NEWS FORUM (global edition), Issue No. 55, January 2024

High-Rate and Homogenous Production of BMO-Doped REBCO Coated Conductor by IBAD and Hot-Wall PLD Process

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***Abstract*—REBCO coated conductors are advancing steadily as the unique practical wires available for emerging applications used in large field, or severe thermal conditions, etc. Above all, IBAD/PLD process can form wires which have excellent and uniform in-field J_c properties with robust mechanical strain strength, which are so suitable to current practical applications attained with extremely high field as high-end NMR systems, and "compact" nuclear fusion, etc., which could not be reached by LTS wires as Nb_3Sn.**

Pulsed-laser-deposition (PLD) is a non-equilibrium vapor process characterized to be much supersaturated high-rate growth, though it has also excellent controllability of varied deposition conditions for multi-element oxide films even in high enough oxygen pressure. It allows to control high density dislocations and small-size secondary phase particles, dispersed inside good textured REBCO films growing at extremely high rates.

To obtain longitudinal stability of thus optimized process conditions, we had designed and developed "Hot-Wall Type" reel-to-reel PLD apparatuses, which realized quite robust and reproducible temperature uniformity by furnace like heating system. As a result, we succeeded in commercialization of long length and uniform REBCO wires including $BaHfO_3$ nano-rods. Eu has been chosen as RE element for good growth stability enough for high-rate production of long length $BaHfO_3$ doped REBCO wires. Almost no dependence on growth rate was observed of I_c/I_{c0} properties at 20K 20T, as far as using industrial excimer laser currently available.

Transport tests of 16-layered pancake coils have conducted to assess the longitudinal uniformity of in-field J_c for $BaHfO_3$ doped REBCO wires and the I-V characteristics of the coils

agreed very well with numerical estimations of angular dependent in-field J_c [1].

We are now investing to develop productivity and quality control of those wires toward cost reduction and increase of production capacity, without spoiling uniformity for long piece length over 1 km long. Optimization of conductor thickness are also under way with varied width from 2 to 12 mm.

***Keywords (Index Terms)*—REBCO coated conductor, mass-productivity, high growth rate, longitudinal uniformity**

Acknowledgments

A part of this work is based on results from a project subsidized by the New Energy and Industrial Technology Development Organization (NEDO), and results performed at the High Field Laboratory for Superconducting Materials, IMR, Tohoku University.

References

[1] S. Muto, et.al., "Evaluation and analysis of a 10T-class small coil using REBCO coated conductors laminated with thick copper tapes", submitted to *IEEE Trans. Appl. Supercond.*