WB1-1-INV

Development of BMO-doped REBCO Coated Conductor by Hot-Wall PLD Process on IBAD template

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During the past two decades, tremendous R&D efforts were concentrated on development of high-performance and high throughput processing for REBCO coated conductors. We had chosen combined process of vapour-phase production techniques by using large-area ion-beam-assisted-deposition (IBAD), and hot-wall type pulsed-laser-deposition (PLD), which realized quite homogeneous crystalline growth conditions for REBCO by furnace-like, nearly equilibrium substrate heating. As a results, reliable production line of non-doped REBCO tapes with lengths over 500 m was developed with typical Ic performances over 500 A/cm at 77 K in the self-field and over 1000 A/cm (Jc=5-6 MA/cm^2) at 30 K in 2 T[1].
Recently we applied the process for introduction of rod-like APC as $BaMO_3$ (BMO, M : Zr or Hf) - doped REBCO conductors, though multiplied deposition parameters come from nano-rod BMO growth should cause narrower process windows. We found a productive process condition of BMO-doped high-performance tapes with good longitudinal homogeneity[2]. 300m long class uniform BaHfO doped EuBCO tapes were formed with productive high growth rate of 20-30 nm/sec, being faster than commercial non-doped conductors, which had also large Ic of 1700-1800A/cm (Jc=7-8 MA/cm^2) at 30K, 2T. 600-1000m long run is now on-going. The angular dependence of in-field Jc properties were investigated in wide temperature range, and strongly c-axis correlated flux pinning were observed over 30K, especially in those films with the growth rate limited lower than 5 nm/sec, where the minimum values of J_c were not so different from high growth rate over 20 nm/sec. These results indicate reliable controllability of deposition parameters on high-rate APC introduction by using hot-wall PLD process.
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[1] Y. Iijima, et al., *IEEE Tran.s. Appl. Supercond.*, vol. 25, no. 3 (2015) , Art. no. 6604104.
[2] Y. Iijima, et al., *IEEE Tran.s. Appl. Supercond.*, vol. 27, no. 4 (2017) , Art. no. 6602804.

Keywords: Coated Conductor, REBCO, Artificial Pining Center, Pulsed Laser Deposition

WB1-2-INV

Recent progress on the development of RE-123 CCs in SuNAM

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SuNAM has been producing long-length coated conductors based on a proprietary process which consists of electron beam co-evaporation of constituent metals and subsequent conversion of precursor film to superconducting phase by carefully controlling temperature and oxygen pressure. After securing stable manufacturing routine for upto 1 km-long wires, with about 10 percent uniformity in critical current enabled by various quality control measures, we tried to further increase critical current above 1,000 A/cm-width. This goal should be achieved by increasing thickness of superconducting layer while retaining critical current density, or even enhancing it. We varied co-evaporation process to enhance composition uniformity, and also modify temperature and pressure profile in heat treatment furnace to better utilize conversion dynamics of $GdBa_2Cu_3O_{7-x}$ phase formation, and the results will be presented.
With these wire, we made 400 mH compact reactor with cryogen free operation. The reactor's operating current is over 1,500 A at temperature is around 10 K. Detailed design, construction, and operating results will be discussed. And first all HTS CC base commercial 18 T magnet result will be introduced. A 70 mm cold bore high temperature superconducting (HTS) magnet was developed for axion detector system of Center for Axion and Precision Physics (CAPP) research center in Institute for Basic Science (IBS) in the Republic of Korea. A key parameter for axion detector magnet is to generate high and longitudinally uniform magnetic field in RF cavity. Magnetic field strength on -100 mm < z < 100 mm in coil bore space should be larger than 90 % of it at magnet center.
Finally we'll summarize a commercialization & industrialization efforts in Korea, and suggest a key issues to open the true market.

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WB1-3-INV

Development and production of advanced 2G HTS wires at SuperOx

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Applications of high temperature superconductors (HTS) demand a supply of significant amounts of a superconducting wire. The group of SuperOx companies develops a technology route to the future high-volume market of these superconducting materials. We employ highly reproducible and scalable industrial vacuum technologies such as IBAD and PLD to fabricate 2G HTS wire with a superior quality. The advanced chemical processes help us to customize a superconducting wire, making it optimal for particular requirements of each application type. In this talk, the overview of the recent progress will be provided, including the increase of production capacity with the installation of a new production line, description of techniques used in SuperOx for in situ and ex situ quality control, as well as the results of the introduction of artificial pinning centers in SuperOx wire. Some examples of final products made from SuperOx 2G HTS wire will be shown demonstrating the viability of the company's approach to the advanced 2G HTS wire technology. Finally, the outlook will be given with the directions of a future work to make high quality 2G HTS wires readily available.

Keywords: 2G HTS wire, in situ quality control, customization, production

WB1-4-INV

Production and Development of ReBCO (2G-HTS) Conductors

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The potential applications of Rare-Earth Barium Cupper Oxide (ReBCO), Second-Generation High-Temperature Superconductors (2G-HTS), have been demonstrated in many projects for the last several years. This would indicate the ReBCO conductor is now being considered a robust and feasible solution to advanced devices and systems toward the future.
This paper describes recent approaches to improve the design and performance of ReBCO conductors. One of the key challenges is to best-align the design of films in terms of different operating conditions, by taking trade-off of many aspects into account; not only for the performances, but also for the manufacturability and reliability. The other approach is to provide compact and robust profiles to suit the various needs in assembly of high-field coils, or cable-conduit for larger scale devices. Authors will address to those issues and present the recent progress for ReBCO conductors.

Keywords: High Temperature Superconductors, ReBCO