

## High Temperature Superconductor 2<sup>nd</sup> Generation Wire Fabricated by IBAD and Reactive Co-evaporation Method

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High Temperature superconductor (HTS) 2<sup>nd</sup> generation (2G) wire is a key element for advanced superconducting electric power system such as power cable, motor and transformer. HTS 2G wire's various physical properties – critical current density, mechanical strength, upper critical field – are superior to 1G wire, but still relatively high cost is an obstacle to real applications. We have made a long length 2G wire with high speed cost effective methods. Long length template tapes with architecture of epi-MgO/IBAD-MgO/Y<sub>2</sub>O<sub>3</sub>/Al<sub>2</sub>O<sub>3</sub> were fabricated on hastelloy metal substrate using IBAD system with multi-turn reel-to-reel device with the effective speed of 600 m/hr. LaMnO<sub>3</sub> buffer was deposited using pulsed laser deposition (PLD). 300 m-long IBAD-MgO template tape was successfully fabricated and a good in-plane texture with the FWHM of 6 ~ 6.5° was confirmed. Reactive co-evaporation process using batch type EDDC (Evaporation using Drum in Dual Chambers) system was selected to scale-up HTS 2G wire. A higher production speed is realized due to wider deposition range and fast cyclic conversion process in the system. In addition to this, a lower material cost is expected because metal sources are used instead of high price metal-precursor. Evaporated atoms are deposited on template tape, which was wound on metal drum, and the deposited part of the tape passes through high temperature region with oxygen partial pressure of 5 to 20 mTorr in reaction chamber by the rotating drum. SmBCO was selected for the superconducting material because it is widely known to have superior in-field property of J<sub>c</sub>, wider deposition window and relatively low cost raw material compared with YBCO. In order to get the high I<sub>c</sub> SmBCO film, the experimental parameters of deposition rate, reaction temperature and oxygen partial pressure in reaction chamber were varied. 93 m-long SmBCO coated conductor with 4 mm-width was fabricated using IBAD-PLD-EDDC systems and protection Ag layer was coated by dc sputtering. Critical currents at 77 K in self field were measured on the 1 to 5 m –long sections of the tape. The I<sub>c</sub> over 500 A/cm was obtained for the 1 m-long tape. I<sub>c</sub> of 305 ~ 412 A/cm was confirmed in the 27 m-long tape.

keywords : HTS 2G wire, IBAD, EDDC, MgO, SmBCO

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