

## SmBCO/IBAD-MgO Coated Conductors Fabricated by Reactive Co-evaporation

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Coated conductors (CCs) have been fabricated by various thin film processes such as pulsed laser deposition (PLD), metal organic deposition (MOD), metal organic chemical vapor deposition (MOCVD) and co-evaporation etc. to increase the critical current density. Thermal co-evaporation method is one of the candidates to develop high quality CCs with low-cost that has benefits to deposit wide area uniformly and use cheaper thermal evaporation source and raw materials. Good CCs have been usually made by using the Ion beam assisted deposition (IBAD) template. Recently, Superpower Co. reported that fabricated CCs using IBAD-MgO template with the highest electric performance ( $790 \text{ m} \times 190 \text{ A/cm-w} = 150,100 \text{ A}\cdot\text{m}$ ). IBAD-MgO process is the fastest biaxial texturing process in the IBAD processes.

In this study, we have used IBAD-MgO process to fabricate the biaxially textured template for CCs and co-evaporation method to deposit  $\text{Sm}_1\text{Ba}_2\text{Cu}_3\text{O}_y$  (SmBCO) superconducting layer on IBAD-MgO template. The batch type co-deposition system was specially designed and was named EDDC (evaporation using drum in dual chamber) that is possible to deposit superconducting layer with optimum composition ratio of materials at temperature over  $700^\circ\text{C}$  and several mTorr of oxygen. We have investigated the influence of SmBCO phase composition ratio on the critical current density of CCs. A higher  $J_c$  was measured at the composition ratio of Ba deficiency ( $1.8 \sim 1.9$ ) and Cu rich ( $3.1 \sim 3.4$ ) compared to the  $\text{Sm}_1\text{Ba}_2\text{Cu}_3\text{O}_y$  stoichiometry. Especially, highest  $J_c$  of  $2.6 \text{ MA/cm}^2$  was measured at the composition of  $\text{Sm}_1\text{Ba}_{1.85}\text{Cu}_{3.15}\text{O}_y$  that has dense surface morphology. And also, we have investigated the optimal oxygen partial pressure ( $p\text{O}_2$ ) and deposition temperature to increase the critical current density of SmBCO CCs. SmBCO CCs deposited at 15 mTorr  $p\text{O}_2$  and  $800^\circ\text{C}$  shown the highest  $J_c$  of  $2.58 \text{ MA/cm}^2$  ( $I_c=310 \text{ A/cm-w.}$ ) at 77 K, self-field. Long SmBCO CCs were fabricated and measured critical current using R2R hall probe measurement system and R2R transport  $I_c$  measurement system. Magnetic field property of CCs was examined by using high field magnet for the magnet applications.

Keywords : SmBCO, IBAD, coated conductor, biaxial texture, critical current

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