Development of Zr-doped CeO_2 single buffer layers for YBCO coated conductor applications

Li Lei Xi'an University of Technology [1], Japan Advanced Institute of Science and Technology [2], Limin Li [1], Shasha Wang [1], Gaoyang Zhao [1], Yoshifumi Oshima [2], Lihua Jin Northwest Institute for Nonferrous Metal Research [3], Chengsha Li [3] and Pingxiang Zhang [3]

E-mail: leili@xaut.edu.cn

Since $YBa_2Cu_3O_{7-\delta}$ (YBCO) coated conductors (CCs) have better current carrying performance under magnetic field, it is considered as the unique candidate for heavy current and strong magnetic applications at liquid nitrogen temperature. However, the architecture of YBCO CCs developed in recent years is quite complicated, which leads to the difficulty of manufacturing technology and high costs. In this work, a novel zirconium doped ceria (CZO) single buffer layer architecture grown on RABiTS-NiW tapes will be developed to fabricate YBCO CCs. XRD results show that the as-prepared CZO buffer layers have excellent (001)-preferred orientation as well as sharp in-plane and out-of-plane texture. According to XPS depth profile analysis, the width of element diffusion region between CZO film and NiW tape is only around 35 nm, indicating that the as-prepared buffer layer has an ability to prevent the element diffusion effectively. To verify the feasibility for developing novel CCs with simplified architecture, we attempt to fabricate epitaxial YBCO/CZO bilayer films on (001)-oriented yttria stabilized zirconia (YSZ) single crystal substrates via all chemical solution deposition processes. Cross-sectional (S)TEM results show that high dense stacking faults appear in YBCO matrix, which serve as effective pinning centers to enhance the flux-pinning performance of YBCO film. The maximum pinning force of the YBCO film grown on CZO buffered YSZ substrate is up to 17.67 GN/m^3 @ 65 K. It is believed that CZO single buffer layer architecture can be considered as a potential candidate to develop high performance CCs.