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Nanostructural Characterization of Jointed $GdBa_2Cu_3O_y$ Coated Conductors Using $YBa_2Cu_3O_y$ Intermediate Layer

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Recently a high temperature superconducting joint between $GdBa_2Cu_3O_y$ (GdBCO) coated conductors (CCs) was achieved using a GdBCO intermediate layer [1,2]. Using this joint technique and GdBCO coated conductors, a nuclear magnetic resonance (NMR) system was developed [3]. The NMR system was operated in a persistent-current mode in a magnetic field of 9.39 T at 4.2 K and detected NMR signals clearly. Instead of the GdBCO intermediate layer, an $YBa_2Cu_3O_y$ (YBCO) intermediate layer were applied to GdBCO jointed CCs to investigate the interface structures between CCs and the intermediate layer. An alcoholic solution of fluorine-free metallo-organic complexes with a Y:Ba:Cu molar ratio of 1:2:3 was spin-coated on one GdBCO CC. A spin-coated film was decomposed at 500℃ and microcrystallized at 800℃. The microcrystallized film and another GdBCO CC were pressed together and heated up to 800℃ for 20 min in an oxygen atmosphere to make superconducting joint named iGS® (intermediate Grown Superconducting) joint. We observed nanostructures of the GdBCO jointed CC using the YBCO intermediate layer by scanning electron microscopy (SEM) and (scanning) transmission electron microscopy ((S)TEM). Both of the GdBCO layers were connected to the YBCO intermediate layer. In addition, the *c*-axis of both the GdBCO layers and the YBCO grains composed of the intermediate layer were well aligned. Energy dispersive X-ray spectroscopy analysis indicated that the YBCO grains included Gd elements, which were considered to replace with Y elements in the YBCO. In addition, high angle annular dark-field image suggested that the distribution of the Gd elements in Y site in the intermediate layer was inhomogeneous. Those Gd elements were considered to be diffused from the GdBCO layers into the microcrystallized film (precursor of the intermediate layer) on the GdBCO layers during the iGS® joint process at 800℃. YBCO grains containing Gd in the intermediate layer would grow epitaxially on the GdBCO surfaces at the same time.
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[1] T. Nagaishi, et al., Abstract of 1st Asian ICMC and CSSJ 50th Annive. Conf., (2016) 3A-p02.
[2] K. Ohki et al., Supercond. Sci. Technol., **30** (2017) 115017.
[3] H. Maeda, Applied Superconductivity Conference (ASC), (2018) 4PL1B-01.

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