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Enhancement of in-field critical current density of BaZrO3 added (Y, Gd)BCO coated conductors by reduced once-coat-layer-thickness in multi-coating TFA-MOD method

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The trifluoroacetate metal-organic decomposition (TFA-MOD) process is a non-vacuum process. Therefore, this process for REBa2Cu3Oy (RE: rare earth) coated conductors (MOD-REBCO) is useful from a cost point of view. Recently, it has been reported that the critical current density (Jc) in liquid nitrogen temperature can be increased effectively by reducing once-coat-layer-thickness in the multiple coating process of BaZrO3 (BZO) doped MOD-YGdBCO coated conductors. In this study, we have investigated the Jc properties of the BaZrO3 doped YGdBCO coated conductors obtained from the multi-thin-layer-coating process over a wide magnetic field and temperature region and an analytical expression for the Jc as a function T and B has been derived by using percolation transition model. We prepared two samples for comparison with the similar total thickness of 0.53 μm and 0.75 μm with the once-coat-layer-thicknesses of 30 nm and 170 nm, respectively. Transport critical current density was measured by the four-probe method with a micro-bridge by the photo lithography. The typical micro-bridge is about 70 μm wide and 500 μm long. The critical current density was determined using the criterion of E=1 μV/cm. We measured the in-field critical current density up to 27 T at temperature from 4.2 K to 77 K. The sample using the 30 nm once-coat-layer-thickness shows superior in-field Jc in the all measured conditions than that of the standard coating using 170 nm thick layer for each coating. Moreover, we found that the minimum Jc, which estimated from magnetic field angle dependence, shows even higher value than that of PLD processed EuBCO up to 5 T of magnetic field at 65 K and up to 3 T at 77 K. From these results, the new MOD-YGdBCO process using the thin once-coat-layer-thickness is very promising for the magnet applications.
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