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Strongly Enhanced Critical Current in thickened $BaHfO_3$-doped $YBa_2Cu_3O_y$ Coated Conductors prepared by Vapor-Liquid-Solid Growth Technique

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In order to apply $REBa_2Cu_3O_y$ coated conductors (CCs) , it is indispensable to increase deposition rate and critical current (I_c). Therefore, to achieve a high deposition rate, Vapor-Liquid-Solid (VLS) growth technique, which combines PLD and LPE methods, has been proposed, [1]. Using VLS growth technique, it is possible to fabricate thin films with 5.3 nm/sec in the deposition rate [2]. In order to increase superconducting properties in magnetic fields, it is necessary to introduce Artificial Pinning Centers (APCs) in films. However, there are few reports of introduction of APC using VLS growth technique. Recently, we fabricated $BaHfO_3$ (BHO)-doped $YBa_2Cu_3O_y$ (YBCO) CC by using the VLS growth technique in 26.0 nm/sec of deposition rate and 1.4 μm in the thickness, and we confirmed the BHO-doped YBCO CC was increased I_c compared with that of pure YBCO samples[3]. In this study, we fabricated thickened BHO-doped YBCO CCs (1.4 – 4.2 μm) and investigated thickness dependence of crystallinities and I_c.

The VLS growth technique consists of the following three steps. The first step is to fabricate 3vol% BHO-doped YBCO layer as a solid layer. The second step is to form a liquid layer consisting of Ba-Cu-O on the solid layer. The last step is to supply BHO-doped YBCO through the vapor phase on the liquid and solid layers.

Fig. 1 shows thickness dependence of *a*-axis oriented ratio and FWHM of YBCO 006. Using VLS growth technique, there are no *a*-axis oriented grans in the thickened CCs. Moreover, it was confirmed that the FWHM of the YBCO 006 reflection decreases with increasing the film thickness. Fig. 2 shows applied magnetic field dependence of I_c in thickened CCs with the thickness of (a) 1.4μm (b) 2.8 μm and (c) 4.2 μm. I_c increased from 23 to 123 A/cm-w (77 K, 1 T) and from 7 to 56 A/cm-w (77 K, 3 T), respectively. We will discuss the superconducting properties in magnetic field at various temperature and investigate shapes of BHO nanostructures introduced into thickened YBCO CCs using TEM.

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[1] Y. Yoshida *et al.*: Appl. Phys. Lett., **69** (1996) 845 – 847.
[2] Y. Ichino *et al.*: Jpn. J. Appl. Phys., **45** (2006) 758 – 760.
[3] T. Ito *et al.*: The 66th JSAP Spring Meeting 2019

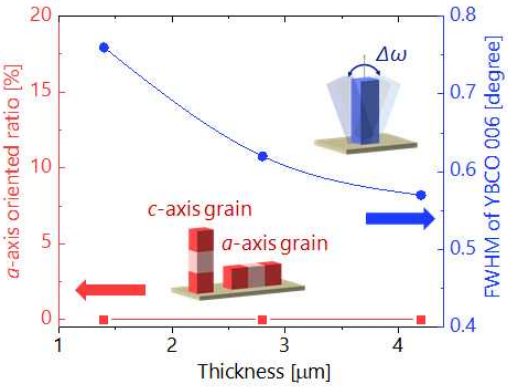

Fig. 1 Thickness dependence of *a*-axis oriented ratio and FWHM of YBCO 006

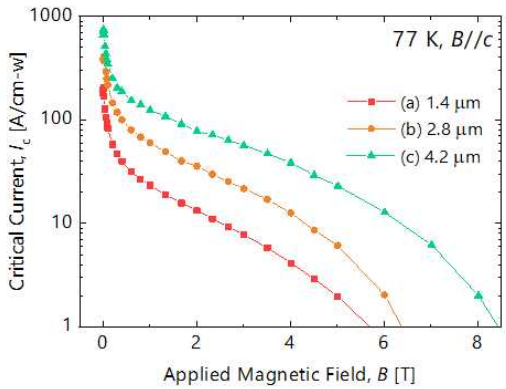

Fig. 2 Applied magnetic field dependence of I_c of (a) 1.4 μm (b) 2.8 μm (c) 4.2 μm thickened CCs.

Keywords: Vapor-Liquid-Solid Growth Technique, Thickened Film, High deposition rate, High magnetic field