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Deposition of thick superconducting YBCO films using the surface laser heating

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Cost reduction for $REBa_2Cu_3O_y$ (REBCO) coated conductors (CCs) are of interest in the recent applications such as magnets and motors. Establishment a technology to fabricate the thick REBCO layer with the larger I_c is one solution to reduce the amount of the REBCO CCs. However, the thickness of the REBCO layer is usually limited less than 3 μm in the CCs because the superconducting property of the REBCO layer significantly degrades at the large thickness due to the *a*-axis-oriented grains [1]. The deposition of the REBCO layer at a sufficiently high temperature suppresses the *a*-axis oriented grains [2]. Therefore, various heating methods have been studied such as the hot wall heating [3], the direct resistance heating [4], and the laser heating [5]. In this work, we combined the conventional resistance heating with the laser heating to the surface of the CCs by using an infrared CW laser.

YBCO films were deposited on IBAD-MgO tapes using the pulsed laser deposition with a KrF excimer laser. During the deposition, the tapes were heated with a SiC heater and a diode laser (wavelength: 915 nm). To stabilize the absorption of the heating laser, the diode laser turned on when the REBCO seed layer with 500 nm thickness was deposited.

Fig. 1 shows the film thickness dependence of the ratio of the *a*-axis oriented grains for the YBCO CCs fabricated using only the SiC heater and both the heaters. As results, the *a*-axis oriented grains are suppressed with the laser heating. Furthermore, this method is effective to fabricate the 5 μm thick REBCO films. In the future, we plan to evaluate the properties of the fabricated CCs and to fabricate further thick films.

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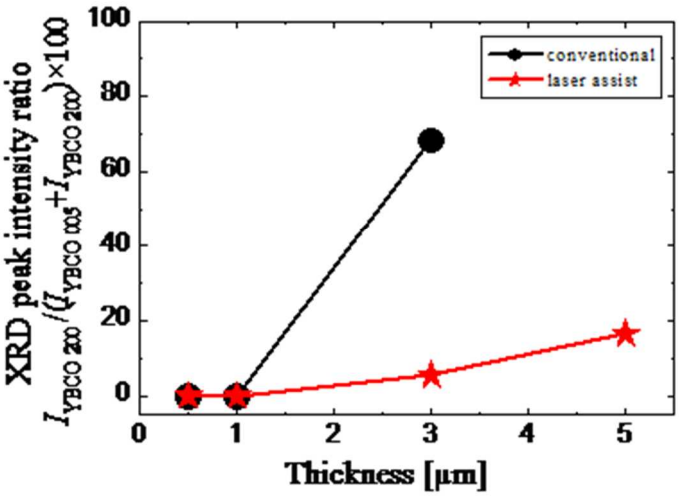

Fig. 1 The film thickness dependence of the ratio of *a*-axis oriented grains in the YBCO CCs fabricated with the conventional resistance heating and with the surface laser heating.

Keywords: YBCO, PLD, laser heating, thick film