

Preparation of YBCO Superconducting Film by Hot-wall Type MOCVD Process

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YBCO films for coated conductors were fabricated by a metal organic chemical vapor deposition (MOCVD) system of hot-wall type using single source. The deposition condition was optimized using single crystal substrates such as (100) MgO and SrTiO₃ in steady-state, and then the substrates were replaced by moving IBAD templates (CeO₂/IBAD-YSZ/SS) of 40 cm/hr. Under the conditions of the mole ratio of Y(tmhd)₃:Ba(tmhd)₂:Cu(tmhd)₂ = 1:2.1:2.9 or 1:2.3:3.1, the deposition pressure of 10 Torr, the MO source line speed of 15 cm/min, and the Ar/O₂ flow rate of 800/800 sccm, YBCO films were prepared at the deposition temperatures of 780 ~ 890 °C. The a-axis growth was observed together with the c-axis growth up to 830 °C, while the c-axis growth became dominant above 830 °C. The top surface of the c-axis film was fairly dense and crack-free. In case of the YBCO films with 2.2 μm thickness deposited on SrTiO₃ substrate at 860 °C, the deposition rate of the film was as high as 0.37 μm/min. The critical current and critical current density of the film was 104 A/cm-width and 0.47 MA/cm², respectively. Two different types of IBAD templates with thin CeO₂ and thick CeO₂ layers were used. The YBCO film deposited on IBAD template with thin CeO₂ layer showed low critical current of 2.5 A/cm-width, while the YBCO film deposited on IBAD template with thick CeO₂ layer showed higher critical current of 50 A/cm-width. This result indicates that thick CeO₂ layer is thermally more stable than thin CeO₂ layer at the high processing temperature of the MOCVD.

keywords : MOCVD, YBCO film, SrTiO₃ substrate, IBAD template, critical current, CeO₂ layer

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