Flux Pinning Characteristics of Y-Ba-Cu-O Thin Films with Vertically Aligned ZnO Nanorods

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For wide applications of high-temperature superconducting materials, large critical current density(J_c) in high applied magnetic fields are required. A number of methods have been reported to introduce artificial pinning centers(APCs) in $YBa_2Cu_3O_{7-\delta}$(YBCO) films for enhancement of their J_c. We studied the superconducting properties of YBCO thin films with vertically aligned ZnO nanorods. ZnO nanorods were grown on sapphire substrates by thermal CVD method. YBCO films and CeO_2 were deposited by on-axis RF sputtering on sapphire substrates with grown nanorods. Improvement in in-field J_c was achieved by incorporation of vertically aligned ZnO nanorods within YBCO films. Microstructural analysis of the obtained YBCO films was performed by using cross-section transmission electron microscopy(TEM). Phase and textural analysis was done using X-ray diffraction. According to the cross-sectional TEM images, the columnar defects comprised of vertically aligned ZnO nanorods along c-axis are clearly observed in the films.

Key words: YBCO, flux pinning, nanorods