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Synthesis and Structural Properties of YBa2Cu3O7−x Films/ZnO Nanorods on SrTiO3 Substrates

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The high-temperature superconductor YBa2Cu3O7−x (YBCO) have attached attentions because of a high superconducting transition temperature, low surface resistance, high superconducting critical current density (Jc), and superior superconducting capability under magnetic field. Moreover, the Jc of YBCO superconductors can be enhanced by adding impurities to the YBCO films for vortex-pinning. Understanding and controlling pinning centers are key factors to realize high Jc superconductors. We synthesized vertically-aligned ZnO nanorods on SrTiO3 (STO) substrates by catalyst-free metal-organic chemical vapor deposition (MOCVD), and subsequently, deposited YBCO films on the ZnO nanorods/STO templates using pulsed laser deposition (PLD). The various techniques were used to analyze the structural and interfacial properties of the YBCO/ZnO nanorods/STO hybrid structures. SEM, TEM, and XRD measurements demonstrated that YBCO films on ZnO nanorods/STO were well crystallized with the (001) orientation. EXAFS measurements from YBCO/ZnO nanorods/STO at Cu K edge demonstrated that the local structural properties around Cu atoms in YBCO were quite similar to those of YBCO/STO.

Keywords: structural property, YBa2Cu3O7-x, ZnO, film, SrTiO3, synthesis