

Enhancement of Critical Current Density of Y-Ba-Cu-O Thin Films Grown on STO Substrates with Assembled Au Nanoparticles

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For many large-scale 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 $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ (YBCO) films for enhancement of their J_c . We report measurements of critical current in $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ films fabricated by PLD on SrTiO_3 (100) substrates whose surfaces were modified by the introduction of Au nanoparticles. Au nanoparticles were synthesized on STO substrates with self assembled monolayer. The density of Au nanoparticles is approximately $200 \mu\text{m}^{-2}$ with diameters of 15 nm. J_c s of YBCO films grown on STO substrates with Au nanoparticles were more increased than those of pure 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. The surface morphology and surface roughness (R_a) of the layers was measured by atomic force microscopy (AFM).

Keywords: Flux pinning, Au particle, YBCO