

Effects of Proton Irradiation on the Microwave Surface Resistance of $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ Films

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Enhanced J_C observed for proton-irradiated high-temperature superconductor (HTS) films has been attributed to stronger vortex pinning due to increased defect density. Recently correlation between J_C and the surface resistance (R_S) has been reported for HTS films both theoretically and experimentally, which, however, has not been reported for proton-irradiated HTS films. We report effects of proton irradiation on the R_S of $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ (YBCO) films on LaAlO_3 . The YBCO films were irradiated with proton beams of 2 – 40 MeV, for which the intrinsic surface, resistance, the penetration depth and the complex conductivity were measured at temperatures of 7 – 90 K at 8.5 GHz by using a TE_{011} mode rutile resonator. Two-fluid model was used to observe the changes in the impurity scattering time after proton irradiation. Dependences of the R_S on proton fluence and the impurity scattering time as well as possibilities of improving nonlinear properties of YBCO films by proton irradiation are discussed.

Keywords : Surface resistance, proton irradiation, YBCO film, conductivity