

A Comparative Study on the Microwave Surface Resistance of $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ Films Grown on CeO_2 -buffered r-cut Sapphire and LaAlO_3 Substrates

J. H. Lee^a, V. A. Komashko^b and Sang Young Lee^{a, c}

^a *Department of Physics and Center for Emerging Wireless Transmission Technology, Konkuk University, Seoul 143-701, Korea*

^b *Institute of Metal Physics of Academy of Science of Ukraine*

^c *Department of Advanced Technology Fusion, Konkuk University, Seoul 143-701, Korea*

Availability of high-temperature superconductor (HTS) films with the critical temperature of ~ 90 K and the surface resistance of $\sim 300 \mu\Omega$ at 10 GHz and 77 K enabled to use superconducting microwave devices for mobile communications.

We investigated the microwave surface resistance of $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ (YBCO) films grown on CeO_2 buffered r-cut sapphire substrate (CbS) and LaAlO_3 (LAO) substrate measured at temperatures of 7 - 88 K. The intrinsic surface resistance (R_s) and the penetration depth (λ) of the YBCO films were measured using a rutile-loaded resonator and a sapphire-loaded resonator at the respective resonant frequencies of ~ 8.5 GHz and ~ 19.5 GHz at temperatures below 90 K, for which effects of finite film thickness were considered. The R_s of $\sim 105 \mu\Omega$ was observed at 77 K and ~ 8.5 GHz for YBCO film on CbS substrate, with the value appearing comparable to that of YBCO films on single-crystal LAO. However, at temperatures below 20 K, the R_s of YBCO films on LAO still remained lower than that of YBCO films on CbS. Attempts were made to address the reasons by examining the temperature dependences of quasiparticle density and scattering time for the YBCO films.

keywords : Surface resistance, penetration depth, CeO_2 buffered r-cut sapphire, YBCO.