

Establishment of a Possible Measurement Standard for the Surface Impedance of Various Superconductor Films and Tapes

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Due to the importance of the microwave surface resistance of superconductors for industrial applications as well as for basic research, setting up a measurement standard for the surface impedance of superconductor films has been an international issue. In 2002, IEC-TC90 published an international measurement standard that can be applied to relatively thick superconductor films with the thickness of more than three times the penetration depth. However, no measurement standard has been prepared yet for superconductor films having the thickness less than three times the penetration depth.

Here we present a method that could be useful for obtaining the intrinsic surface impedance R_S of superconductor films regardless of the film thickness. Our method is based on a rigorous field analysis for the TE_{01p} mode dielectric-loaded cavity resonator with its endplates made of superconductor films grown on various dielectric substrates. Results for thin HTS superconductor films/tapes and MgB_2 films are compared with those by impedance transformation method as reported by Klein et al.¹ Usefulness of this method is discussed with regard to i) characterization of the intrinsic properties of superconductor films/tapes including MgB_2 films and HTS coated conductor tapes, and ii) investigations for homogeneity in the high-frequency properties of large superconductor films and long HTS coated conductor tapes in a nondestructive way.