Measurements of the Intrinsic Surface Impedance of HTS Films by Using Dielectric Resonators

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In the current measurement standard for the surface resistance (R_S) of superconductor films as published by International Electrotechnical Commission (IEC), it is essential to prepare superconductor films with the thickness about three times the penetration depth (λ) at the measured temperature. Recently we proposed a new measurement standard for the intrinsic surface impedance (Z_S) of high-T_C superconductor (HTS) films to IEC which enables to measure not only the intrinsic R_S but also the λ regardless of their thicknesses. The new standard is based on a modified two-tone resonator method and is expected to realize the target uncertainty of less than 10%, a value about half of that as described in the current IEC standard.

The new method enables to measure the Z_S of HTS films with the diameter as small as 10 – 14 mm, with the value significantly smaller than that required by the current IEC standard. This will very useful for investigating the Z_S of relatively small HTS films as well as homogeneity in the Z_S of large HTS films prepared for making microwave filters.

We discuss applicability of the new method for quality control of HTS films used for making microwave devices such as filters, resonators, etc. and for investigating fundamental properties of superconductor films.

Keywords : surface resistance, penetration depth, HTS films, IEC standard, microwave filter