Abstracts

Microwave Measurement of Temperature and Current Dependence of Surface Impedance for High-T/sub c/ Superconductors

Y. Kobayashi, T. Imai and H. Kayano. "Microwave Measurement of Temperature and Current Dependence of Surface Impedance for High-T/sub c/ Superconductors." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1530-1538.

Perturbation formulas for TE/sub 011/ mode dielectric rod resonator and for a TE/sub 011/ mode circular cavity resonator are derived to determine the surface impedance Z/sub s/(= R/sub s/ + jX/sub s/) of superconductors from measured values of resonant frequencies and unloaded Q. Also, the relation between the maximum surface current density of a superconductor, J/sub s/ (A/m), and output power from a signal generator P/sub O/ (W), is derived. On the basis of these analytical results, a measurement technique is proposed to evaluate the temperature and J/sub s/ dependences of Z/sub s/ for superconductors. The measured results of the temperature dependence of Z/sub s/ for YBCO and copper plates, which are obtained from the f/sub 0/ and Q/sub u/ values measured for the dielectric resonator and for the cavity resonator, are presented. From these results, it is verified that the dielectric resonator is suitable for measuring X/sub s/ for YBCO. Furthermore, from these Z/sub s/ values the temperature dependence of the skin depth delta and the penetration depth lambda, and those of the complex conductivity sigma/sub r/ - j sigma/sub i/ are obtained on the basis of the two-fluid model. These measured values agree well with the theoretical curves calculated by introducing the concept of the residual normal state conductivity sigma/sub res/ into sigma/sub r/. From the J/sub s/ dependence of Z/sub s/ measured for the YBCO and copper plates, it is shown that the R/sub s/ of copper does not depend on J/sub s/, that the value for YBCO has a strong J/sub s/ dependence, and that X/sub s/ of YBCO has little dependence on J/sub s/. It is verified that a dielectric resonator is preferred for measuring the J/sub s/ dependence of Z/sub s/, because of energy concentration, compared with a cavity resonator.

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