Abstracts

The Measurement of Conductivity and Permittivity of Semiconductor Spheres by an Extension of the Cavity Perturbation Method

K.S. Champlin and R.R. Krongard. "The Measurement of Conductivity and Permittivity of Semiconductor Spheres by an Extension of the Cavity Perturbation Method." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 545-551.

A technique based on cavity perturbation theory is described with which one can determine the microwave conductivity and dielectric permittivity of a small sphere of completely arbitrary conductivity. These properties follow from the measured frequency shift and quality change occurring when the sample is inserted into a region of maximum electric field in a cavity resonator. The range of validity of the quasi-static internal field approximation is discussed, and curves are provided for extending the measuring technique beyond this range. The extended theory is valid for the entire conductivity range from zero to infinity. Measurements on several samples of known conductivity and permittivity in which the approximation is not satisfied are seen to agree with the theory. For highly conductive materials, the present method is closely related to the "eddy current loss" measuring technique discussed by others. The two methods are compared from the point of view of perturbation theory in order to determine their relative merits. Because the measuring technique employs a spherical sample, it may be applied profitably to materials with nonisotropic carrier nobilities and to semiconducting materials for which contact fabrication techniques are poorly known.

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