Abstracts

Microwave Measurement of High-Dielectric-Constant Materials

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A particularly severe source of error in the microwave measurement of high dielectric constants has been the presence of small air gaps between dielectric surfaces and metal walls. In this paper, two precise measurement techniques are described that eliminate the effect of air gaps through the use of resonant modes, for which E/sub n/=0 at the dielectric-to-metal interface. In one method a cylindrical sample is resonated within a closely fitting circular waveguide, and in the other a cylindrical sample is placed at the center of a radial waveguide. Both methods utilize a circular-electric-mode whose electric field is parallel to the metal walls. The waveguides are dimensioned to be cut off in their air regions at the resonant frequency of the dielectric sample. Formulas yield epsilon/sub r/ as a function of the resonant frequency, and of diameter and length of the dielectric cylinder. Measured data on samples having epsilon/sub r/ /spl ap/ 85 show the two methods to agree within a few tenths of one percent. The accuracy of the methods is on the order of 0.5 percent maximum error and 0.2 percent probable error when /spl int//sub 0/ is measured within 0.1 percent and D and L within 0.0005 inch (for D/spl ap/ 0.3 inch and L /spl ap/0.1 inch).

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