

## **Application and Theory of Dielectric Materials in RF/Microwave Systems**

Maxwell's equations define two terms which determine the response of a material to electromagnetic fields. These are the electric permittivity  $\epsilon$  and the magnetic permeability  $\mu$ . If these quantities are known for a material, then the reaction of a wave to the material is completely determined.

The permeability is a measure of a material's response to the magnetic portion of an EM wave. This paper assumes the material has no magnetic properties therefore the permeability is equal to that of free space.

### **What are dielectrics?**

In the broad sense, dielectrics are materials that can influence and be influenced by the electric portion of an electromagnetic field. While all objects exhibit dielectric properties to differing degrees, this paper will concern itself with simple dielectric materials with low conductivity and no "semi-conducting" properties. Also, certain dielectrics have high loss and are used to attenuate a propagating wave. These dielectric absorbers will not be treated in this paper.

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