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Hollow Dielectric Pipe Polyrod Antenna

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Intellectual Property Status

Patent pending

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Background

Microwaves have a wide use in telecommunications, radar, semiconductor, industrial and biological applications. Hence, a precise knowledge of the microwave properties of materials is critical for efficient design and operation of microwave systems. In the measurement of microwave constitutive properties of a material, two standard approaches are followed. The first approach is to create an aperture on a metal screen placed between a source and receiver. A thin sheet of the test material is then placed over the aperture. The change in the transmitted field can be used to measure the properties of the material. However, the presence of reactive fields alters the admittance of the aperture and hence creates errors. In the second approach, a system of lenses is used to focus the signal into a region approximately Π λ/ in diameter. However, manufacturing inhomogeneties in the material may result in significant errors. Hence, there exists a need for a method to measure the material properties in a small region under plane wave incidence condition.

Invention Description

Researchers at Arizona State University have developed a method and an apparatus for measuring the microwave constituent properties of a material. A hollow dielectric pipe is coupled to the extended ridges of a ridge waveguide. The guided wave is launched into free space by tapering the wall thickness of the dielectric pipe. This creates a plane wave essentially confined to the cross section of the dielectric pipe. The electromagnetic field is nearly uniform in the plane and decays exponentially outside the pipe as required. This direct contact facilitates effective and well matched coupling of the TEM transmission lines. By using this technique, we can approximate plane wave conditions in a very small region. This technique also eliminates the errors due to echo from ridge termination and reflection of the electromagnetic radiation.

Potential Applications

- Useful in the telecommunication industry to test the performance of materials
- Better design of domestic appliances such as microwave ovens
- Efficient design of remote sensing, defense and space equipments
- Useful in semiconductor processing techniques that use microwaves

Benefits and Advantages

- Accurate modeling of plane wave conditions in a small region
- Generates smooth and consistent results
- Facilitates the measurement of microwave properties of metals without errors due to reactive fields
- Efficient transfer of the energy from the source to the surface wave
- Minimizes the echo due to ridge termination and reflection
- Eliminates the errors due to manufacturing inhomogeneties