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# Aperture Matched Polyrod Antenna

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 test material is then placed over the aperture. A change in a transmitted electromagnetic signal can be used to measure the properties of the test material. However, the response of the test material to a plane wave (i.e., a specific type of electromagnetic signal) can not be measured using this first approach. In the second approach, a system of lenses is used to focus an electromagnetic signal onto a specific region of the test material. However, manufacturing inhomogeneities of the test material may result in significant errors in the results. Hence, there exists a need for a method to measure material properties in a small region of test material under plane wave incidence condition.

Researchers at Arizona State University have developed a method and an apparatus (a polyrod antenna) for measuring microwave constituent properties of a material. The dielectric polyrod minimizes end reflection and phase variation across a beam of electromagnetic radiation as well as minimizes the diameter of the beam. An antenna system that includes the dielectric polyrod and a waveguide provides a substantial plane wave at a sample location at an operation frequency ranging from 7GHz to 20GHz. The properties of the test material can be measured as function of the position on the material by physically scanning the antenna over the material. The antenna can be used to measure samples of areas less than 2.5 inches X 2.5 inches. The apparatus can be used in a wide range of frequencies and different dielectric materials can be used for the design of the antenna.

Issued Patent: U.S. Pat. No. 7,889,149

Potential Applications:

- Measuring sheet conductance of resistively-loaded sheet goods
- Testing performance of materials

- Determining constitutive properties of materials as a function of position
- Non-destructive inspection and quality testing of materials
- Determination and verification of impedance and resistance gradients of impedance cards

Benefits and Advantages:

- Accurate modeling of plane wave conditions in a small region
- Smooth, reliable, and consistent results
- Facilitates the measurement of microwave properties of metals without errors due to reactive fields
- Operates on a wide range of frequency from 7GHz to 20GHz and for any wavelength of the electromagnetic spectrum