Microwave NDE of Defects in Glass Fiber Composites

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The attractive properties of Glass Fiber Composites have made it a very popular material for use in several industries including energy, oil & gas, healthcare, transportation and others. As with all materials, composites too have the inherent challenge of defects getting incorporated during manufacture and material getting degraded during service. This demands a reliable and robust nondestructive evaluation (NDE) technique to be used for inspection of this material. The search for newer and more advanced Nondestructive Evaluation (NDE) techniques is a constant endeavor in the industrial world. In the realm of electromagnetic NDE, Microwave NDE has been gaining a lot of attention in the last decade as a potential tool for inspection of various materials especially dielectrics like plastics, ceramics, composites, etc. Microwave NDE is non-contact, portable and fast in addition to offering imaging capability. These features make it an attractive option to be explored seriously as an advanced NDE tool. Glass fiber composites encounter a number of different types of defects such as foreign material inclusions, wrinkle / waviness, resin rich and resin starved areas, etc. Microwave NDE has the advantage of being able to penetrate more easily through dielectric materials, thus enabling detection of deeper defects vis-à-vis techniques like ultrasound or Infrared imaging. This paper explores the application of Microwave NDE to the detection and characterization of different type of defects. The effect of probe frequency and stand-off are explored. A comparative assessment of Microwave NDE capability with that of Ultrasound in terms of the depth of penetration, defect size resolution and signal contrast for the various defect types will also be reported.