

Acoustic Imaging for Materials Characterization

B. Boro Djordjevic
Center for NDE, Johns Hopkins University,
Baltimore, MD, USA

Ultrasonic scanning and array imaging of the subsurface materials features is commonly used for nondestructive evaluation (NDE) and nondestructive materials characterization (NDC). Formation and interpretation of the ultrasonic scan images is often complex and hidden process involving signal processing and wave propagation issues. The signal propagation time and acoustical signal loss are utilized to develop acoustical image maps of a material. In modern composites and in multi-layer complex structures, the image presentation and data interpretation is dependent on proper acoustical signal analysis and processing. Frequency dependent attenuation and sound path distortion due to material in-homogeneity directly influence imaging process. Furthermore, different scanning transducer types render different acoustical information and imaging fidelity (1,2). This paper reviews historical development of acoustical imaging such as C-scan and evolution of conventional immersion and contact ultrasonic imaging methods.

Application of ultrasound to in process or in-situ measurements requires development of new sensors and measurement technology that cannot be meet using traditional ultrasonic devices. Laser ultrasonic and gas coupled ultrasonic transduction enables imaging in the environments that cannot support conventional coupled transducers. These new ultrasonic methods have been demonstrated to be very effective tool in characterization of composite materials and structures.

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2. B. B. Djordjevic, Henrique Reis, editors, G. Birnbaum, B. A. Auld, Technical editors, „Sensors for Materials Characterization, Processing, and Manufacturing“ ASNT Topics on NDE Vol. 1, published by ASNT, Columbus OH, 1998.