NONDESTRUCTIVE SUBSURFACE IMAGING WITH THE REFLECTION ACOUSTIC MICROSCOPE

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ABSTRACT

The Reflection Acoustic Microscope, operating at a microwave frequency near 400 MHz, has been used to image and examine subsurface detail in a multilayer ceramic chip capacitor (MCCC). Bulk examination of the 0.9 mm thick MCCC is at present not possible with this high resolution acoustic microscope because of the short depth of focus of the particular lens designed for the system and because of the short wavelength ($_w$ 4 m).

However, the interdigitally layered structure of the ceramic-metal capacitor permits the subsurface examination of either a metallic or ceramic layer, once the surface coating has been physically removed. Acoustic micrographs, obtained in the scanning mode of the acoustic microscope under these conditions, were analyzed for subsurface defects in the acoustically exposed layers. Comparison was made with optical images of the same area after removal of an optically opaque 15 um thick layer by planar surface grinding.

Finally, the Acoustic Material Signature (AMS)[1] mode was used to interpret the observed contrast reversals in these images. Periodic image contrast reversal occurred as the specimen was translated axially from the focal plane toward the acoustic lens. The period of this transducer output voltage variation has been shown to be proportional to the square of the Rayleigh velocity in the region near the surface.[1] Thus, this measurement may be used to obtain information of the elastic properties in this surface region. The small surface area required for this measurement permits the surface to be characterized elastically with good lateral resolution.

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1. R. D. Weglein, "A Model for Predicting Acoustic Material Signature." Appl. Phys. Letters, Vol. 34, No. 3, 1 Feb. 1979, pp. 179-181.