Non Destructive Testing of Redistribution Layer (RDL) using Acoustic Microscopy

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Redistribution layer (RDL) is one of the essential elements of advanced semiconductor packaging for chip-to-chip or chip-to-substrate interconnect. Therefore, the mechanical reliability of RDL is one of the very important performances. A typical RDL is a structure in which the copper wire is within the polymer-based dielectric and is generally composed of multi-layers. Non-destructive testing (NDT) of typical defects of RDL such as submicron crack and delamination is a very challenging task, as the width and spacing of the copper line inside the RDL are generally a size of several µm to tens of µm and a thickness of several µm. The commonly used scanning acoustic microscopy (SAM) becomes useful for defect detection in multilayered structures with a thickness of dozens of µm by assuring low time-consuming (a limit for other NDT techniques) and quantitative analysis based on measurements. However, since the inside of the RDL, which is composed of polymer-based dielectrics, is a highly attenuative material, there are many difficulties in high-frequency ultrasonic testing to obtain a resolution of several µm. In this work, a pulse echo ultrasound NDT technology is presented to detect internal defects in chips with redistribution layer (RDL) technology. Through the V(z) technique, which is mainly used for scanning acoustic microscopy, is aims to develop and algorithm that can determine the presence or absence of internal defects and build a system that can evaluate quality. Converting the amplitude voltage of the reflective signal into a complex form, which varies depending on the distance between the probe and the target sample, can constitute a fourier transform relationship between the reflective function. By removing the geometric pupil function of the focusing transducer, it can be reconstructed into a reflection coefficient function for incident angle and frequency and reconstructed into an inversion algorithm. This technology can detect changes in the ratio of the Lamb wave mode conversion and reflection function in the high frequency region due to the occurrence of defects of several µm, and can determine defects through c-scan images. The results indicate that the high-frequency focused ultrasound transducer used in acoustic microscopy is a good choice for visualizing interface quality. The developed post-processing algorithm performs well in independent defect detection.