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Non-Destructive Technique for Detection of Voids in the IC Package Using Terahertz-Time Domain Spectrometer

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Abstract : In recent years, Terahertz (THz) time-domain spectroscopy (TDS) imaging method has been received considerable interest as a promising non-destructive technique for detection of internal defects. In comparison to other non-destructive techniques such as x-ray inspection method, scanning acoustic tomograph (SAT) and microwave inspection method, THz-TDS imaging method has many advantages: First, it can measure the exact thickness and location of defects. Second, it doesn't require the liquid couplant while it is very crucial to deliver that power of ultrasonic wave in SAT method. Third, it didn't damage to materials and be harmful to human bodies while x-ray inspection method does. Finally, it exhibits better spatial resolution than microwave inspection method. However, this technology couldn't be applied to IC package because THz radiation can penetrate through a wide variety of materials including polymers and ceramics except of metals. Therefore, it is difficult to detect the defects in IC package which are composed of not only epoxy and semiconductor materials but also various metals such as copper, aluminum and gold. In this work, we proposed a special method for detecting the void in the IC package using THz-TDS imaging system. The IC package specimens for this study are prepared by Packaging Engineering Team in Samsung Electronics. Our THz-TDS imaging system has a special reflection mode called pitch-catch mode which can change the incidence angle in the reflection mode from 10 o to 70 o while the others have transmission and the normal reflection mode or the reflection mode fixed at certain angle. Therefore, to find the voids in the IC package, we investigated the appropriate angle as changing the incidence angle of THz wave emitter and detector. As the results, the voids in the IC packages were successfully detected using our THz-TDS imaging system.

Keywords : terahertz, non-destructive technique, void, IC package
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