

Manufacturing Science and Technology Room Central Exhibit Hall - Session MS-ThP

Manufacturing Science and Technology Poster Session

MS-ThP-1 Novel Inspection Technology for Detecting Via Open Using Parallel E-beam Scanning and Graphic Design System, *Chihoon Lee*, SSIT (Samsung Institute of Technology), Republic of Korea

As dual-damascene Cu interconnect technique is currently being employed for on-chip interconnect fabrication, and will continue to be used for next technology generations due to significant cost advantage [1]. In this process, however, it has been challenging to detect via open defects occurring in the underlying layer after the completion of the Cu metal line. A viable in-line monitoring to detect via open defects in the back-end of line (BEOL) has been challenging due to the complex multiple via structures connected to the metal line. Today's conventional inspection method do not meet the requirements of a true in-line monitoring strategy [2]. Despite detecting the dark voltage contrast (DVC) signal as a via open defect in the conventional electron beam (E-beam) inspection system, it was not genuine defects in most cases by the transmission electron microscopy (TEM) analysis for detected via open defects. We guess that it is attributed to the complexity of the vertically designed BEOL metal/via structures, which makes it difficult to separate exact via open location in the upper and lower layers. Figure 1 shows exactly detected via open defect image and related metal/via layout with E-beam inspection system. Early in-line detection of these via open defects prior to the electrical die test is crucial for yield improvement. In this talk we demonstrate a novel inspection technology to detect the critical BEOL via open defects using parallel E-beam scanning and graphic design system (GDS). Parallel E-beam scanning is an inspection technique that can detect more electrons by adjusting the stay time of electrons according to the shape of the metal line pattern. It was controlled by the landing energy (LE), scan direction in the E-beam inspection system. In addition, the detecting locations of via open were restricted near single via layout using die to database (D2DB) inspection system to improve the detectability. It can effectively capture the signals of via open defects compared to the conventional E-beam inspection in the complex high dense metal/via structures.

[1] A. V. Vairagar et al., *Appl. Phys. Lett.* 87, 2005

[2] M. Daino et al., *28th Annual SEMI Advan. Semiconductor Manuf. Conference (ASMC)*, 2017

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