

Automation of Quality Control (QC) After Dicing

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Abstract

DIS200 is an equipment that performs fully automated measurement of chipping by capturing images of both sides of a wafer after dicing. Rapid full-wafer inspection is achieved by automating the QC process which has been conventionally performed manually by operators. DIS200 also improves measurement accuracy and traceability through 100% image-based inspection, replacing conventional visual sampling inspection.

1. Introduction

Automation has been advancing in semiconductor back-end manufacturing. In addition to automating wafer transfer between processing equipment, automation of inter-process quality control (QC) is also essential for achieving fully automated production lines. Semiconductor inspection standards are particularly stringent for devices that have high quality assurance requirements, such as automotive devices. Conventional manual visual inspection suffers from operator-dependent variability and considerable time is required to inspect an entire wafer. Automated inspection provides an effective solution to these challenges.

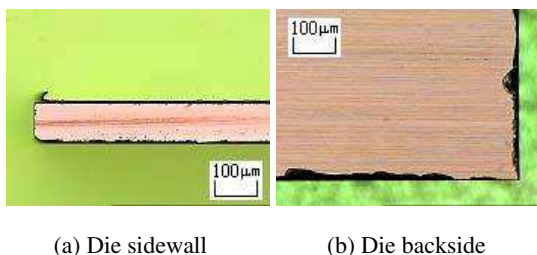


Fig. 1 Examples of chipping after blade dicing

One of the key back-end processes is wafer dicing using a diamond blade. During blade dicing, localized chipping is generated at die edges due to the mechanical cutting action of diamond abrasives

(Fig. 1). Since excessive chipping can result in defective die, inspection of the entire wafer is important. DIS200 enables comprehensive automated inspection by measuring not only front side chipping but also backside chipping.

2. Equipment

DIS200 performs a fully automated chipping inspection requiring only the loading of a cassette containing diced wafers. A line scan camera acquires full-wafer images of both the front and back sides (Fig. 2), and chipping is measured automatically.

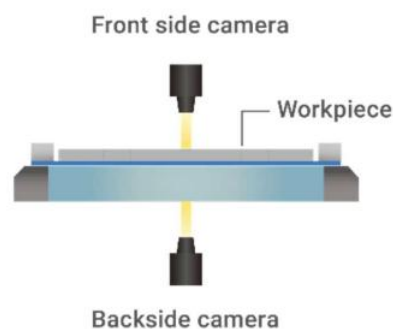


Fig. 2 Measurement schematic

Visible-light imaging is used for the front side inspection. For the backside inspection, images are captured through a glass table and the dicing tape using a visible-light or infrared camera selected

according to the inspection target. (Fig. 3, visibility through the tape depends on the tape material.)

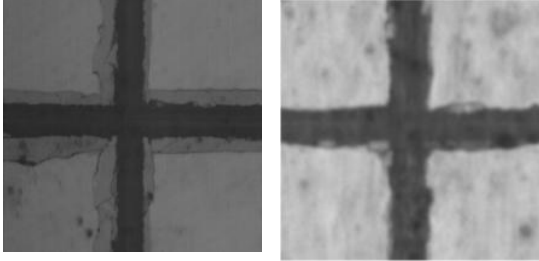


Fig. 3 Examples of backside chipping image acquisition

In addition to displaying the acquired images, DIS200 measures the chipping size from the captured images and visualizes the results as a color-coded wafer map (Fig. 4). Comparison of chipping distributions among wafers enables identification of process-related trends. Similar distribution patterns observed across multiple wafers suggest systematic, process-related causes, whereas localized defects or defects appearing only on specific wafers are more likely to originate from sporadic events. Such mapping analysis facilitates efficient root-cause investigation.

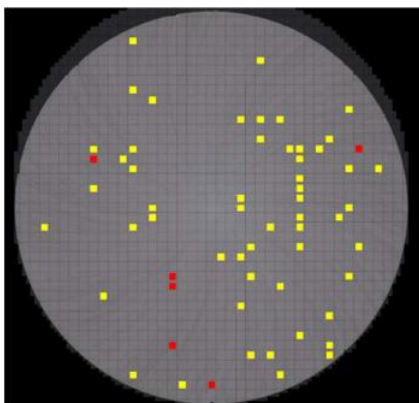


Fig. 4 Color-coded wafer map indicating the chipping size of each die

3. Analysis Examples

This section presents several application examples of chipping data acquired by DIS200.

The first example focuses on variation analysis. Conventional manual visual inspection makes it difficult to obtain sufficient statistical data for quantitative evaluation. In contrast, full-wafer inspection by using DIS200 provides statistically meaningful datasets, enabling quantitative comparison of chipping size and its occurrence frequency among wafers and process conditions. Fig. 5 shows an example comparing wafer-to-wafer variation in chipping size.

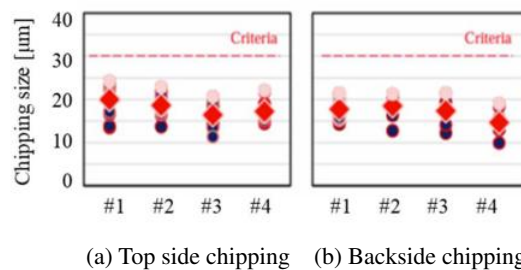


Fig. 5 Wafer-to-wafer variation in chipping size

The chipping data acquired by DIS200 can also be analyzed together with each type of sensor data collected by the dicing saw. KKM-Link is a DISCO proprietary system that enables data integration among various DISCO equipment. By connecting DIS200 to KKM-Link, inspection results can be correlated with sensor data such as spindle current, pressure, temperature, and AE (Acoustic Emission) signals.

Such correlation analysis enables quantitative evaluation of the influence of processing conditions and blade condition on chipping. Furthermore, it facilitates the identification of root causes and the optimization of processing

conditions. By combining sensor data with inspection results, predictive models for processing quality can also be developed. These models enable inline quality management by predicting quality abnormalities during processing without waiting for post-process inspection results.

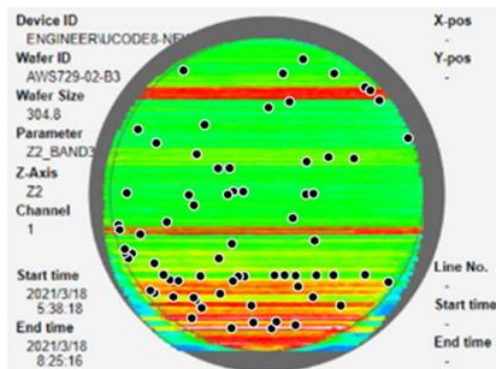


Fig. 6 Overlay map of AE signal and chipping distribution

4. Conclusion

This review presents DIS200, an automated quality control system for post-dicing inspection. DIS200 improves inspection efficiency, measurement accuracy, and traceability. Statistical analysis of chipping data enables quantitative evaluation of process variation and efficient identification of defect mechanisms. Furthermore, integration with KKM-Link enables correlation analysis between processing conditions and inspection results, providing a foundation for process optimization and predictive quality control. By combining automated inspection with process data analysis, DIS200 contributes to more advanced quality management in semiconductor back-end manufacturing.