

Five Mistakes Made When Taking Semiconductor Wafer Measurements

Semiconductor wafer measurement requires a high degree of precision. The right metrology equipment and inspection processes are important, but so is procedural consistency and attention to detail.

If you're not getting the results you want, it's time to look beyond the measurements. With bare semi-conductor wafers, users need to avoid these... **five common mistakes**.



Mistake #1 | Turning the Device Off

Most users turn on metrology devices only when it's time to use them. As soon as semiconductor wafer measurement is complete, the devices are turned off. This reduces electricity consumption but also introduces thermal instability that can cause measurement swings or changes. That's because inside of the device, there are heat-generating electronics that need to interpret precise signals from sensors.

To prevent fluctuating temperatures from causing fluttering measurements, it's best to leave metrology devices turned on. If that's not possible, then turn on the device 30 to 60 minutes before taking any new measurements. By allowing the amplifier boards to achieve temperature stability, you'll increase the likelihood of getting a stable reading right away and use the same parameters with each tool to achieve greater consistency.

Mistake #2 | Failing to Prepare the Wafers

Many semiconductor wafer manufacturers do not locate their quality control area inside of a strict clean room. To ensure that wafers are free from debris that can skew measurements, users need to perform visual inspections. Fingerprints and the oils from a user's hands can also affect the results. Before performing any measurements, users need to understand their organization's policies for handling and cleaning wafers. For example, MTI Instruments uses air cannisters, isopropyl alcohol, and a lint-free cloth.

Mistake #3 | Neglecting Calibration

Measurement tools and devices that aren't calibrated properly can provide inaccurate measurements. Because environmental conditions such as temperature and humidity are subject to change, users need to perform in-situ calibrations using calibration standards provided by the equipment manufacturer. Performing a weekly in-situ procedure takes just a few seconds but helps to ensure that measurements remain within tolerances.

Users also need to ensure that calibration was performed at the facility where the tool or device was made. Look for a label or sticker on the back that indicates NIST traceable calibration. ISO standards require factory calibration but remember that calibration is time limited. For each of the units that you measure, it's necessary to perform periodic calibrations even if environmental conditions remain relatively constant.

Mistake #4 | Comparing Results from Different Tools

Different measurement technologies can provide different results for the same semiconductor wafer. That's not a problem; it's to be expected. For example, consider that a capacitance sensor averages a larger area than a confocal sensor. An interferometer uses a different methodology for data acquisition. Across different tools and machines, the spacing and the points taken often differ.

What matters most isn't the absolute value, although the results between different devices should be reasonably close. Instead, it's important to establish a baseline for starting measurements and then observe changes relative to this point. Most users are interested in slight changes in process, however, so they monitor a delta from process X to process Y. Yet these measurements will never be the same.

Mistake #5 | Inconsistent Processing

As with any manufacturing process, all users need to follow the same procedures for measuring semiconductor wafers. Consider what happens if one user measures a wafer side-up and another user measures it side-down. The result is two very different shape measurements. A positive bow becomes negative and the warp measurement may vary given that the wafer stress is different on each side.

Inconsistent processing also occurs when there are different parameters for different tools. Examples of these variations include the number of points to collect, which averaging factor to use, and how to report the data. For best results, develop a well-defined process for semiconductor wafer measurement and use the same parameters with each tool to achieve greater consistency.

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