

Converging AFM Solutions: Pioneering Nanotechnology for Advanced Industries

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The rapid advancement of industries, particularly the semiconductor sector, has outpaced the traditional research methods and technological developments of academia. To sustain this momentum, the evolution of research methodologies and technological innovations must keep pace. This necessity has brought scanning probe microscopy technology, capable of providing detailed nanometer-scale information, into the spotlight. Among these technologies, the versatile Atomic Force Microscopy (AFM) has already found numerous applications within the semiconductor industry.

As device dimensions continue to shrink, nanometer-sized defects on wafer substrates increasingly limit device performance. Detecting and accurately classifying these defects necessitates additional characterization methods with nanometer-scale resolution, which are crucial not only in the front-end-of-line (FEOL) processes but also in the back-end-of-line (BEOL) processes. While it is well known that AFM can measure mechanical and electrical properties as well as surface morphology, its full potential remains underutilized in industrial applications due to various limitations, including low throughput, limited tip lifespan, and operational complexity.

In Korea, advancements in AFM technology are being made to overcome these limitations. These developments aim to provide high-throughput, high-resolution, and non-destructive methods for obtaining 3D information for nm-scale defect review and classification, with enhanced mechanical and electrical characterization capabilities. For instance, AFM solutions integrated with White Light Interferometry (WLI) have been identified as particularly beneficial in advanced packaging applications, including Through Silicon Via (TSV), Backside Via Stack (BVS), interconnects, and Cu pad measurements.

Through advanced automation processes and comprehensive measurements, including AFM-based physical property assessments, AFM technology will complement manufacturing control tools and offer diverse inspection solutions, thereby contributing significantly to the future development of advanced industries.