Development of a reliability evaluation technique for transmission electron microscopy measurements based on silicon lattice spacing

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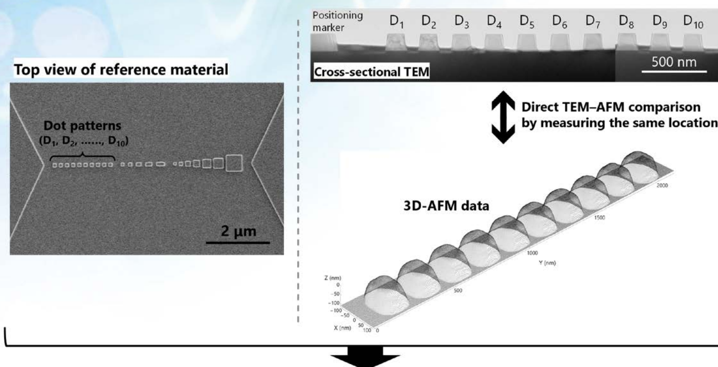
As semiconductor devices become smaller and more complex, reliable measurement of nanostructure dimensions is becoming increasingly important. The lattice spacing of silicon crystals is a promising length standard in the nanometer range. However, transmission electron microscopy (TEM) generally requires destructive thinning for specimen preparation, making it difficult to fully verify measurement reliability by TEM alone. In this study, we developed a fundamental technique that enables direct comparison between TEM measurements and atomic force microscopy (AFM) measurements with SI traceability ensured by laser interferometry, using the same specimen and the same structure. An originally developed reference material allows both methods to measure the same structure while avoiding conventional destructive specimen preparation, enabling evaluation of the relative difference between TEM and AFM results based on different principles. This makes it possible to assess the influence of TEM specimen preparation on measurement results and is expected to strengthen the technical basis for nanoscale length standards and improve the reliability of TEM-based measurements in semiconductor metrology.



Direct comparison measurement of the reference material by TEM and AFM

Reference:

R. Kizu and K. Kobayashi, *Measurement Science and Technology*, **36**, 055005, 13pp, 2025

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