Seeing Through Semiconductors

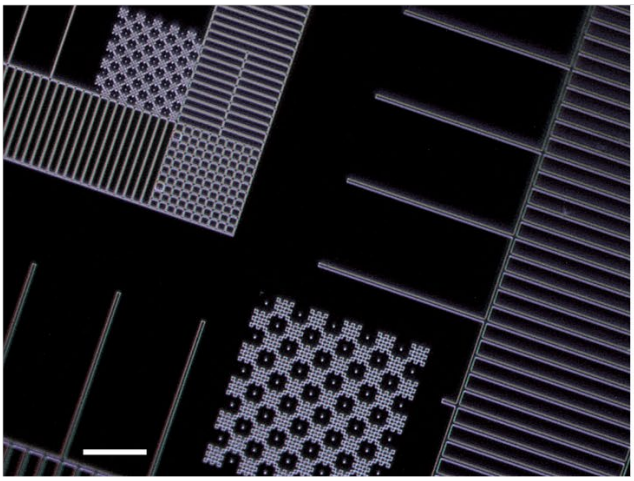
Patterned semiconductor chips are used in diverse fields beyond computing. They power medical diagnostics through advanced biosensors and lab-on-a-chip systems, enhance optical sensors for environmental and aerospace applications, and improve solar cell efficiency. In wearable and flexible electronics, they enable low-power, responsive circuits, while consumer products benefit from their use in anti-reflective and self-cleaning surfaces.

To check the accuracy of semiconductor patterns, several high-resolution imaging tools are used. Scanning Electron Microscopy (SEM) provides sharp images and good depth but needs a vacuum and a conductive coating, which can affect delicate samples and slow down inspection. Atomic Force Microscopy (AFM) gives detailed surface maps, but it's slow, scans only small areas, and the tip can damage soft materials. Optical microscopy is fast and gentle but has limited resolution.

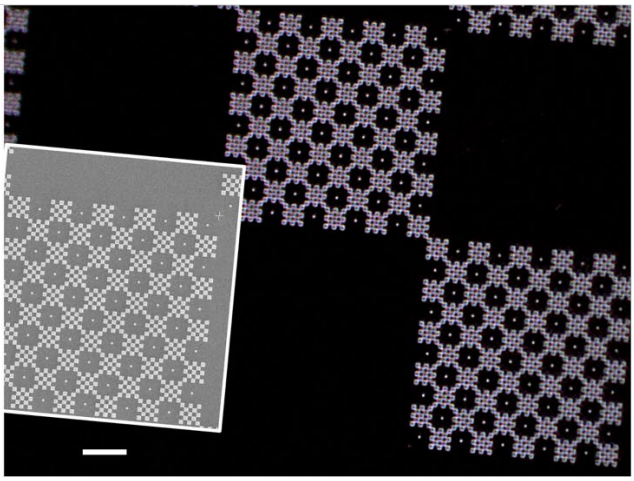
HaloMicroscopy provides detection and inspection of nanoscale patterns on semiconductors in air or liquids without the need of coatings for large areas using visible light without the size limits of traditional optical microscopy.

Gold Patterns on Silicon Wafers in Liquid or Air

High-resolution imaging of pattern fidelity typically relies on SEM, while liquid environments are usually limited to lower-resolution optical methods. HaloMicroscopy reveals the crisp nanofabricated gold patterns on silicon wafers for a set of precision microscopy calibration gratings in both air in liquid. In a comparison to SEM for the same sample, HaloMicroscopy offers similar visualisation of nanoscale patterns yet differs from SEM in that the HaloImages provide edge detection of the pattern, shown in the comparison with SEM below.



A precision microscopy calibration grating designed for SEM with multi-scale 200 nm tall gold patterns on silicon wafer fabricated using electron beam lithography imaged in water using the HaloElement. (Scale bar: 20 µm)



A HaloImage of a field of view (FOV) microscopy calibration grating. The central dots are 500 nm in size. The inset is an SEM image of the same sample with the SEM image aligned to the FOV features. (Scale bar: 10 µm)

HaloMicroscopy delivers real-time, detection and visualisation of semiconductor surfaces in both liquid and air, eliminating the need for vacuum conditions—ideal for biomedical and microfluidic contexts. Providing fine detail in a widefield of view with minimal sample preparation makes HaloMicroscopy attractive for defect detection and quality control during semiconductor prototyping and fabrication, while also preserving samples for further use.