

Metrology and Layout-based Automation for SEM Process Monitoring

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Nanofabrication processes and electron beam or laser beam lithography require SEM investigation (scanning electron microscope) for continuous improvement and monitoring. Micro and nanometer scale high fidelity structures can only be achieved with careful process calibration/ modeling and inspection of critical parts of a test pattern or device.

While lithography steps are conducted with highly sophisticated instrumentation in R&D prototyping and small batch production, conventional analytical SEMs still are used to measure resulting structures. On the other hand, CD-SEMs in semiconductor industry are more costly and do not provide the required flexibility. However, there is a demand for analyzing large numbers of SEM images, for example in resist calibration, large area/ array structures or prototype batches. Here SEM metrology capabilities need to catch up with the progress in applications and fabrication processes.

We will present a software package (ProSEM) that provides advanced metrology for SEM images as well as CAD layout-based automated SEM image acquisition. Key features will be introduced, such as algorithmic metrology, measuring arrays of similar features, batch processing of large image sets and employing contours and layouts for lithography applications. Moreover, we will explain a new functionality using interfacing to the SEM tool for remote control and image acquisition, which allows for layout-based SEM image scans to be acquired and measured automatically.

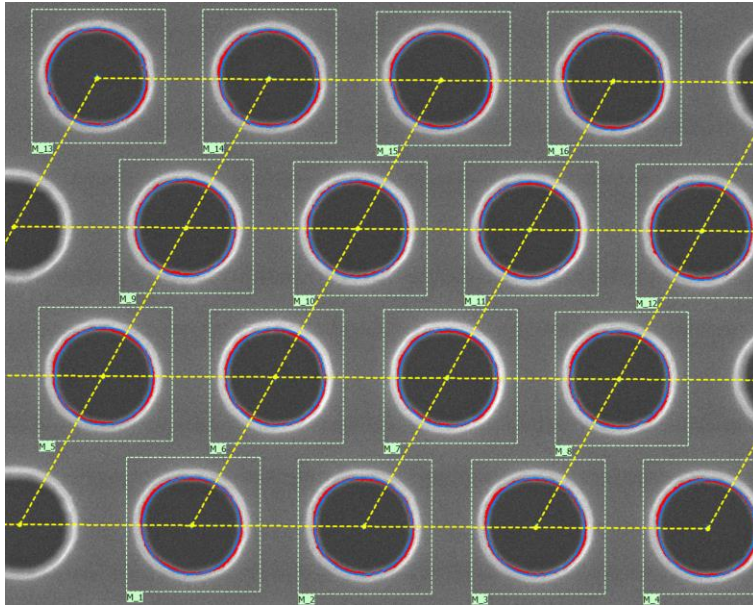


Figure 1: Analysis of a SEM image of circles (diameter 250 nm) by automatic edge detection and fitting of each circle as well as the underlying array. Statistical data and deviations from target or average results are reported.

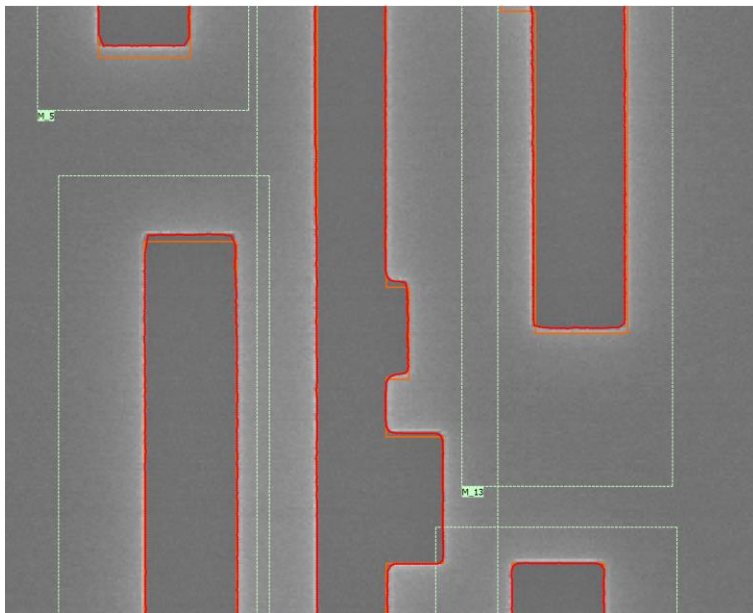


Figure 2: Contour detection (red dots) on a SEM image and comparison with the reference layout (orange lines). The extracted contours can be exported as GDS shapes in layout coordinates and used for further comparison or modeling.