Application Note

High-Resolution Semiconductor Imaging with the SMAL Lens on the Nanoro Platform

Introduction

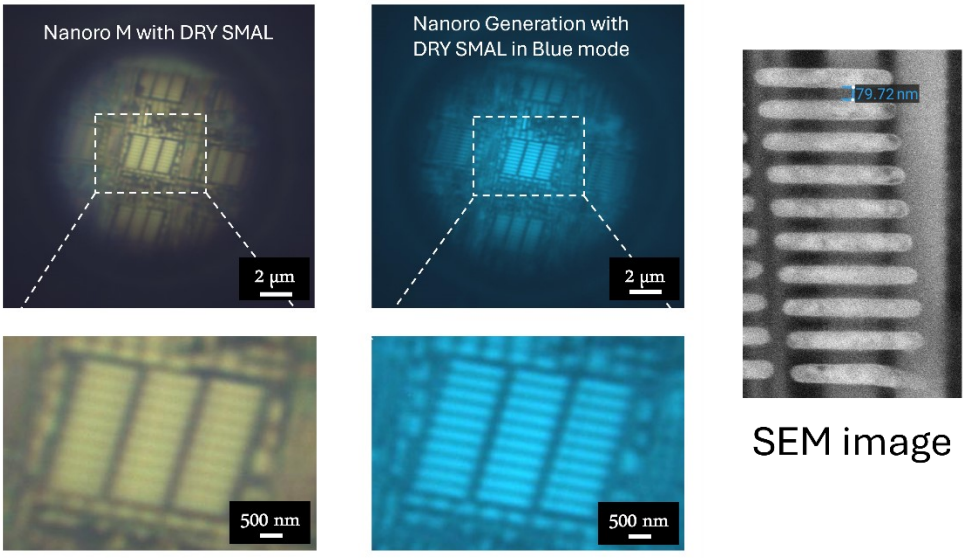
For decades, optical microscopy has been constrained by diffraction limits, making it difficult to resolve structures at the nanoscale. Electron microscopy (EM) has been the gold standard for achieving high resolution, but it comes with limitations such as complex sample preparation, high costs, and the inability to perform fast, routine scans.

The integration of the **SMAL (Super-resolution Microscopy Assisted Lens)** into the **Nanoro platform** overcomes these barriers, bridging the gap between optical and electron microscopy. This application note demonstrates the performance of the SMAL lens for semiconductor imaging, highlighting its ability to resolve features down to tens of nanometers with remarkable clarity.

Demonstration on a Semiconductor Sample

To evaluate the resolving power of the SMAL lens, a **semiconductor microchip from an Intel i5 processor** was selected as a test sample. This type of sample is well-suited for resolution demonstrations due to its nanoscale features, which are conventionally characterized using a scanning electron microscope (SEM).

- **80 nm features**, measured independently by SEM, were clearly visible using the **DRY SMAL lens** on both the **Nanoro M** and **Nanoro Generation** systems.
- When operated in **Blue Mode**, the Nanoro Generation delivered an even higher level of resolution, making nanoscale details stand out with unprecedented sharpness for optical microscopy.

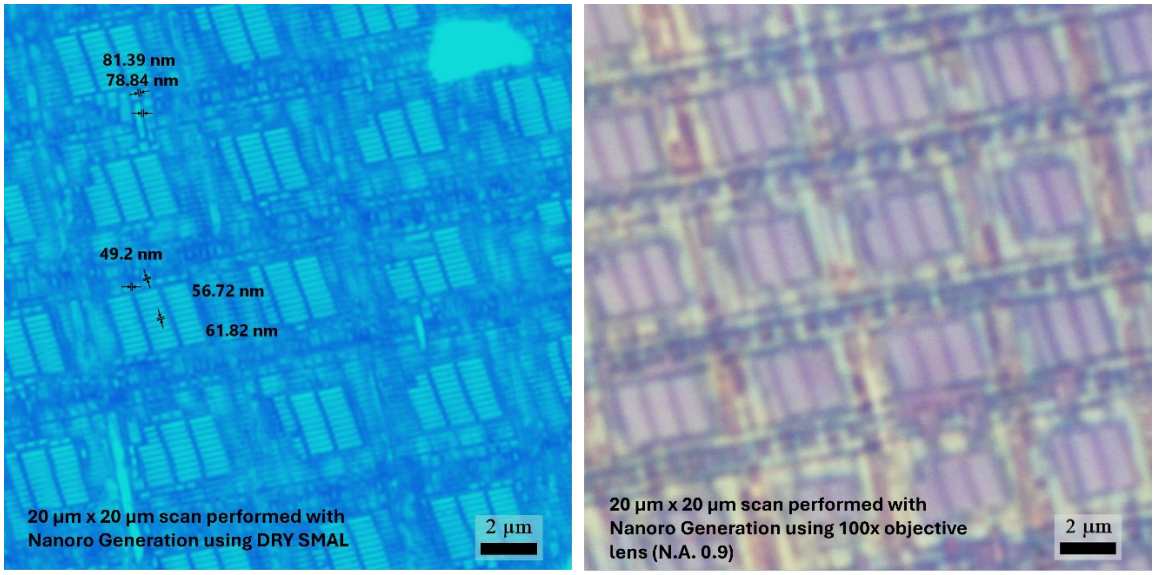


These results emphasize how optical microscopy, enhanced by SMAL technology, can approach the resolution range of electron microscopy while maintaining the ease and flexibility of light-based imaging.

Comparative Imaging Analysis

To further illustrate the advantages of the SMAL lens, a direct comparison was performed between two imaging setups:

1. A scan obtained using the **Nanoro Generation in Blue Mode with a DRY SMAL lens**.
2. A scan acquired with a **conventional 100x objective lens**.



The difference in detail and contrast is significant. While the 100x objective provides a recognizable image of the microchip surface, the SMAL lens reveals nanoscale features with much greater precision.

Another key advantage lies in the workflow. The **Nanoro software** enables users to capture **high-resolution scans within minutes**, significantly reducing the time required for nanoscale analysis. In addition, the software's **integrated measurement tool** allows for precise quantification of features, ensuring both reliability and reproducibility in data acquisition.

Conclusion

This demonstration highlights the potential of the SMAL lens to transform optical microscopy. By resolving features down to 80 nm and beyond, the technology pushes the boundaries of what can be achieved with light-based imaging systems.

When combined with the **Nanoro Generation in Blue Mode**, the SMAL lens offers:

- **SEM-like resolution** without the complexity of electron microscopy.
- **Fast acquisition times**, enabling efficient workflows.
- **Integrated, high-precision measurement tools** for robust analysis.

The ability to perform nanoscale imaging rapidly and accurately makes this solution particularly valuable for **semiconductor research, materials science, and advanced manufacturing** applications where both speed and resolution are critical.