

Ptychographic Microscope for Advanced Metrology and Inspection

Designing novel non-destructive nanometer-scale multidimensional imaging technology at high resolution and high field-of-view with depth information.

The Department of Electronics and Informatics ([ETRO](#)), an [imec research group](#) at the Vrije Universiteit Brussel ([VUB](#)), has an open research position funded by imec for a talented and motivated researcher.

Project

Ptychographic imaging offers valuable insights into both the properties of non-carbon materials and biological processes that are label-free. However, current microscope systems are often expensive, bulky, and have limitations in terms of accuracy, speed, and adaptability across various use cases. This project aims to develop a compact, scalable, and cost-effective microscope system based on coherent diffractive imaging technique using advanced optics and imaging techniques suitable for diverse applications, where conventional microscopes face challenges such as label requirement, short working distance, and limited Field of view and resolution, restricting their ability for label-free, high-accurate inspection. By integrating the Ptychographic method with advanced optics and illumination, this project aims to overcome these limitations and enable a superior imaging methodology.

The work will focus on enhancing optical components, designing custom spectral filters, and optimizing illumination settings. The candidate will take responsibility for the design, fabrication, and characterization of key elements of the system, with an emphasis on precision metrology to ensure reliability and reproducibility. The system should include a well-designed, extensible interface to support additional common sensor types, as needed by users.

The project includes building embedded processing pipelines that reduce raw data at the sensor level. The candidate will develop AI and machine learning algorithms for anomaly detection, pattern recognition, and efficient data compression. To ensure practical usability, these models will also be optimized to run efficiently on edge hardware, with support for cloud-based data storage and remote access when needed.

Real-world test cases will include semiconductor metrology for deep 3D trench inspection, biomedical breast cancer classification in pathology, and aquaculture water monitoring for microorganism detection. These scenarios provide practical environments to validate the system's performance. A similar architecture can be adapted for use in multiple sectors of environmental monitoring, food safety, and industrial inspection.

The PhD will be comfortable working across the imaging system, including optical design, simulation, embedded computing, and applied AI. The ideal candidate should be comfortable working at the intersection of hardware and software across various sectors and be interested in developing sensing systems that are accurate, efficient, and usable outside the laboratory.

Who you are: Master's degree in Photonics, Electronics, Physics, or Computer Science

Who we are: A university research group at imec-VUB in Brussels, with expertise in optical imaging systems and signal processing

Responsibilities:

- Design of optical setup
- Optical system analysis and simulation
- Material characterization
- Developing AI/ML algorithms
- Literature review and preparation of journal publications

Required background: Engineering Technology, Optical Engineering, Computer Engineering

Type of work: 40% setup and experiments, 40% modeling/simulation, 20% literature review and design

Supervisor: David Blinder

Co-supervisor: Peter Schelkens

Daily advisor: Hyun-su Kim

Interested? You can apply here on the VUB website: <https://jobs.vub.be/job/Elsene-Ptychographic-Microscope-for-Advanced-Metrology-and-Inspection/1266239401/>

This PhD is funded by **imec**, a global leader in nanoelectronics and digital technologies. **Please make sure to also apply on the imec website** for this position: <https://www.imec-int.com/en/work-at-imec/job-opportunities/ptychographic-hyperspectral-microscope-advanced-metrology-and-high>