Vacant **Postdoctoral Position** on

Electron Channeling-based Defect Metrology for Beyond-Si Semiconductors

The heterogeneous integration of Germanium (Ge) and III-V compounds (InGaAs, InAlAs) can facilitate the design of next generation transistors operating at reduced supply voltage. Moreover, direct bandgap materials are promising building blocks for tunnel-FETs as well as photonics devices such as lasers and modulators. Although the aforementioned materials can be grown epitaxially on Si substrates, the large lattice mismatch can lead to extended defects such as dislocations and stacking faults. As the latter can deteriorate the final device performance and reliability, it is of utmost importance to assess the crystalline quality of epitaxial materials and device structures in order to provide adequate feedback to process and device integration engineers.

Although extended defects can be analyzed in great detail using transmission electron microscopy (TEM), the low defect density levels (< 10^5 defects/cm^2) one is targeting in routine production processes as well as its destructive nature, make TEM of limited usefulness for in-line monitoring. Electron channeling contrast imaging (ECCI) on the other hand is inherently non-destructive and can be used to investigate large areas thereby facilitating a lower detection limit.

Notwithstanding these early successes, ECCI is still far from a fast, quantitative metrology concept. Recently Imec has engaged with an SEM manufacturer to explore in more detail this concept targeting to derive solutions for sensitivity, quantification, defect identification and classification as well as speed of the analysis. Hence, in this Postdoc project we would like to explore the basics of ECCI and its application towards future nanoelectronic device structures such as FinFETs and nanowires. The project involves the understanding on how electron beams interact with defects and crystals such that the effects of electron diffraction and channeling can be interpreted relative to the presence of different defect types (threading dislocations, stacking faults) in the relevant semiconductor materials (Ge, III/V). Ultimately we will be able to identify optimum imaging conditions to visualize and analyze defects in various fin and nanowire structures experimentally. Improved measurement concepts need to be designed and explored in order to reach increased signal-to-noise ratio's and reduced measurement times.

We are looking for an expert in electron microcopy and crystallography, preferentially with experience related to semiconductor materials.

Supervisor: Dr. Andreas Schulze (Andreas.Schulze@imec.be)
Promoter: Prof. Dr. ir Wilfried Vandervorst