Material scarcity and sustainable semiconductors

Sustainability is one of the key challenges of our society and it is therefore important to control and reduce the ecological impact of the technologies under development. The evolution of semiconductor technologies has however been driven for several decades by other factors: increase of performance, reduction of the consumed power, the area and the cost. The exponential deployment of electronics in almost all application domains has also been enabled by the introduction of various materials along with Silicon. The deployment of mmWave 5G and 6G radio systems rely for instance on compound semiconductors, which offer very high-power efficiency at mmWave frequencies. Other applications in photonics and power electronics are also using III-V compounds, such as Ga or In. **The ecological impact of using these (rare) materials in present and future development of semiconductors needs to be clarified**. For that purpose, life cycle assessment methods must be applied in the semiconductor field.

In this PhD thesis, **you will evaluate the environmental impact of fabrication process** of modern and future semiconductor technologies that are using critical materials. You will study tradeoffs between fabrication footprint, in-use energy consumption and material usage. **You will develop semiconductor processes that are robust and that minimize usage of critical materials**.

You will work in close collaboration with imec experts in the field of semiconductor technology and life cycle assessment.

Required background: Master's degree in Engineering Science, Material science, or equivalent

Type of work: 60% modelling / 40% literature

Supervisor: Bertrand Parvais (VUB, imec)

Daily advisor: Cedric Rolin (imec)