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Institut d'Electronique, de Microélectronique et de Nanotechnologie
UMR CNRS 8520

Master2 and Engineer Internship: 2026-2027

Proposed by : Yannick Coffinier in collaboration with Vaisala Phone number : 0320197987

E-mail : Yannick.coffinier@univ-lille.fr Research group : NCM

Title : Development of Transparent, Nanostructured, and Self-Cleaning Surfaces for the Protection of LiDAR Systems in Harsh Environments.

Abstract : LiDAR systems are widely used for atmospheric monitoring and wind resource assessment. When deployed outdoors for extended periods, these instruments are exposed to harsh environmental conditions, including dust, rain, humidity, condensation, frost, and snow. The accumulation of contaminants on optical windows can reduce laser transmission and compromise measurement accuracy. Current mechanical cleaning solutions, such as wipers, have limitations, particularly in remote locations and extreme environments.

This internship aims to develop transparent micro/nanostructured surfaces with anti-fouling and self-cleaning properties to improve the reliability and durability of LiDAR optical windows while maintaining high optical transparency. This project is in collaboration with Vaisala (https://www.vaisala.com/fr).

Building on IEMN's expertise in micro/nanofabrication and multifunctional biomimetic surfaces, the project will explore different nanostructured architectures, including nanoneedles, nanocones, and hierarchical structures fabricated on glass or quartz. Surface chemical functionalization may also be investigated to optimize wettability and contaminant adhesion.

The main challenge will be to achieve an optimal balance between self-cleaning performance, optical transparency, and environmental durability, while also exploring anti-fogging and anti-frosting properties.

The internship will involve:

- Design and micro/nanofabrication of transparent structured surfaces.
- Morphological, physicochemical, and wettability characterization.
- Evaluation of dust adhesion and self-cleaning efficiency.
- Measurement of optical transmission and light scattering.
- Assessment of surface performance under harsh environmental conditions and repeated contamination/cleaning cycles.
- The project combines surface engineering, nanotechnology, materials characterization, and optical applications, with the objective of developing durable, low-maintenance optical surfaces for LiDAR systems.

Profile:

We are seeking an M2 Master's student or final-year engineering student with a background in materials science, nanotechnology, surface chemistry, physics, or micro/nanofabrication. Experience or interest in surface engineering, cleanroom processes, materials characterization, wettability, or optics is appreciated. The candidate should be motivated, rigorous, independent, and enjoy experimental research at the interface between academia and industry. Short visits to Vaisala (Paris area) are expected.