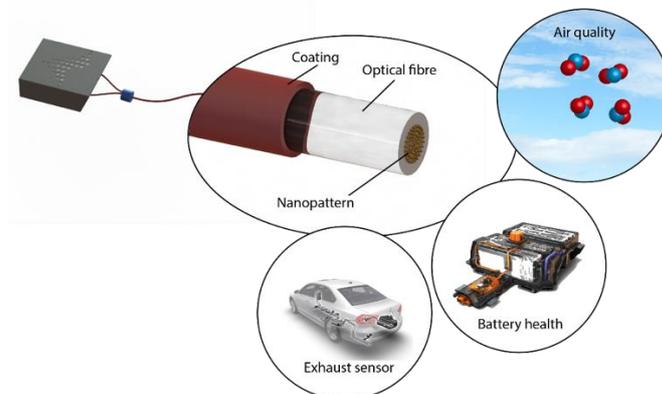


## Master Thesis (30/60 ECTS)

### Nanofabrication for applications in optical fibre sensor systems



**Aim:**

To develop and evaluate methods for fabrication of plasmonic nanostructures on an optical fibre for applications in optical sensor systems.

**Background:**

Insplorion AB is a Swedish company based in Gothenburg that develops and internationally markets its proprietary optical sensor technology. The sensor technology is based on a phenomenon known as Localized Surface Plasmon Resonance (LSPR) wherein noble metal nanostructures are used as optical antennas to detect minute changes in refractive index. This technology can be employed in various sensor applications, for example for monitoring the status of battery cells in electrical vehicles, to measure concentrations of gas molecules in exhaust systems and in the environment, and for sensitive detection in biochemical interaction analysis. Traditionally, the nanostructured sensors are manufactured in a clean room environment using thin film deposition or a combination of self-assembly and top-down nanofabrication. This method of fabrication is best suited for well-defined planar substrates that can withstand the conditions during the different steps of manufacture. Such substrates are not always well suited for miniaturization and system integration. Therefore, there is a need to investigate complementary self-assembly based methods of nanofabrication that can be applied to curved surfaces of different materials, (e.g. the outside of an optical fibre).

The Molecular Materials research-group at the department of Chemistry and Chemical Engineering at Chalmers has a wide knowhow and experience of the deposition of nanoparticles on different surfaces and will contribute with their knowledge with surface treatments, deposition methods and fabrication methods. The group consist of more than 10 researchers with experience within different disciplines such as organic chemistry, materials/surfaces, nanochemistry/physics and in nanofabrication. Research topics includes photon up-conversion and energy storage as well as nanoparticle based sensor systems. One of the PhD students in the group (Johnas Eklöf) will be involved in this master thesis project, acting as the daily supervisor at Chalmers. Johnas has a background within material/nano science and works with deposition of nanoparticles on different surfaces towards nano-electronics.

**Project description:**

The project is based on previous work in nanofabrication performed at the group of Molecular Materials and on the optical sensor technology developed by Insplorion. During the project a method of depositing colloidal nanoparticles on an optical fibre will be evaluated and the performance of the nanostructure as an optical sensor will be tested. Special emphasis will be put on evaluating the robustness and reproducibility of the fabricated nanostructures. As the project progresses it is possible to increase the level of complexity by investigating multiple types of colloidal particles and/or various functional coatings.

The project includes the following activities:

1. Establish method to deposit nanoparticles on different types of substrates (glass, plastic).
2. Evaluate and investigate different methods of embedding the nanoparticles with protective and/or functional coatings.
3. Test different types of nanoparticles (different sizes, various materials).
4. Functionalize an optical fibre, at the fibre end, and on the side of the optical fibre.
5. Perform test measurements using the functionalized fibre and a model system for a relevant sensor application.

**Qualifications:**

We are searching for a student that is well focused, motivated and self-going with some of the following master programs as background: Nanotechnology, Material Chemistry or Biomedical Engineering. The student must be enrolled at a Swedish university.

**Additional information:**

The Master Thesis work will be performed in the Molecular Materials group at the Department of Chemistry and Chemical Engineering at Chalmers and at Insplorion AB, Sahlgrenska Science Park, Gothenburg. Insplorion AB will provide remuneration to the student when the finished thesis has been successfully defended.

**Supervisors:**

Johnas Eklöf, PhD Student, Department of Chemistry and Chemical Engineering, Chalmers University of Technology, and Olof Andersson, Product Manager, Insplorion AB.

**Examiner:**

Kasper Moth-Poulsen, Associate Professor, Molecular Materials, Chalmers.

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