INTERNSHIP OFFER – Master/Projet de fin d'étude

Eco-design and development of innovative sustainable methods for the fabrication of efficient optically active systems

Location of the internship:

HOST Laboratory : LGP2 Laboratory – *Laboratory of process engineering for biorefinery, bio-based materials and functional printing - FunPrint ResearchTeam*
461 rue de la Papeterie - Domaine Universitaire - 38 400 St Martin d'Hères
https://lgp2.grenoble-inp.fr/en
Aurore Denneulin / Julien Bras

PARTNER Laboratory : LMGP Laboratory - *Laboratory in Materials Science and Physical Engineering - Research Team*
3 Parvis Louis Néel (bâtiment Grenoble INP – Phelma) – 38000 Grenoble
https://lmgp.grenoble-inp.fr/en
Daniel Bellet

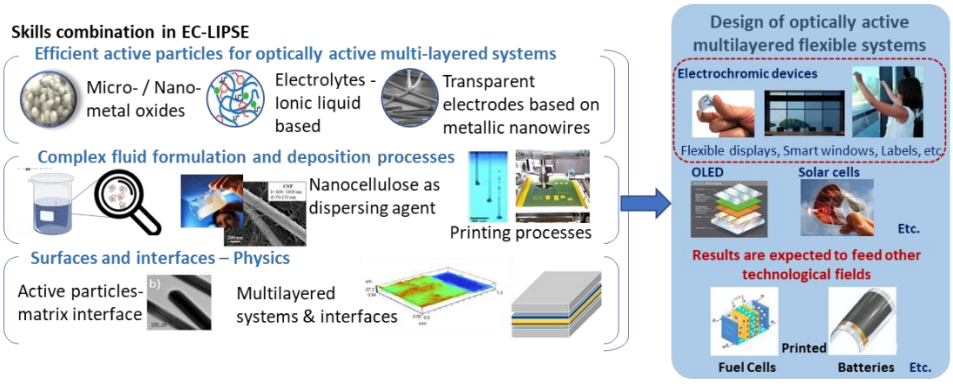
Duration of the internship: 5 to 6 months. Start: February/ April 2025

Internship tutors: Lilou Boutarin -- Aurore Denneulin

Background and objectives of the project:

This internship is part of a national collaborative project called EC-LIPSE that aims at the development of Eco-design of optically active multi-layered systems by full-printed approach.

Optically active materials and devices are found in numerous applications related to energy, environment or health, with multiple examples of semiconductors, photovoltaics, catalysts, sensors, etc. Many optical and/or electronic applications still require non-toxic processing media (non-volatile solvents), low-temperature and additive deposition techniques such as coating/printing to meet the needs of large-scale continuous production on flexible substrates. Numerous developments have already been carried out and allowed the emergence of **functional fluids** (inks) to produce thin multi-layered active system (solar cells, OLEDs, sensors, displays, antennas, etc.). Regarding optically active systems, efforts are still needed to develop more eco-designed and easy-process approaches. Indeed, in order to foster an eco-designed and manufacturing strategy towards the production of low energy consumption systems, it is essential to promote the processing of aqueous functional fluids integrating highly-efficient particles, so to propose a full-printing approach of the architecture. In that purpose, ***EC-LIPSE*** proposes to address the eco-design and development of innovative sustainable methods for the



fabrication of efficient optically active systems (with a first concrete focus on electrochromic devices (ECDs)).

Internship objectives: The development of a Metal Oxide-based fluid will be the main objective of this internship subject. Fluid formulation from micro- and nano-sized particles processing is a complex task requiring the fine control of physico-chemical and rheological properties as well as high colloidal stability, so to suit the targeted deposition technique requirements (coating, screen-printing) without damaging the targeted function. Relying on the expertise of the ICMCB laboratory (project partner) on the synthesis of metallic oxides particles, Metal Oxide-based fluid formulation will be proposed and characterized (colloidal stability, flow properties, etc.). The use of nanocellulose as bio-sourced additives will be implemented to fulfil the functions of dispersing agents, viscosity modifier, film forming agent and adhesion promoter. Water-based ink solutions will be targeted. Different blending processes will be evaluated to determine the most efficient method that does not damage the active properties.

Key parameters such as raw material morphology, active particle network density/interconnections or formulation processing, and their influence on the suspension properties will be investigated. Imagery observations will be performed to investigate the nanocellulose-metal oxides NP network and particles size distribution. Understanding of stabilization mechanisms between nanocelluloses and active particles, particle dimensions and surface chemistry impact as well as cross correlation between suspension characteristics and resulting transparency and electrical resistance will be innovative results to achieve in the field of optically active multi-layered system.

Required skills:

A taste for multidisciplinary projects, as well as motivation will be important selection criteria. An interest in the printed electronics sector is an asset. The desired skills for the candidate are:

- ⊃ Autonomy / Rigor
- ⊃ Interest in applied research, and innovation
- ⊃ Taste for experimental work
- ⊃ Materials Science Knowledge
- ⊃ Fluency in English

For any further information and to apply for this offer, please send a CV with a cover letter to lilou.boutarin@grenoble-inp.fr, aurore.denneulin@grenoble-inp.fr