LABORATOIRE
DE CHIMIE
ENS DE LYON

Master 2 Internship Opportunity

Two-photon microprinting of hierarchical nanostructures

Context: In the ENS Lab Chimie, our research team is involved in the development of photoinitiators and photoresists for high-resolution two-photon inducedphotopolymerization for 3D microfabrication. The two-photon-induced microfabrication technique exhibits significant advantages over other additive manufacturing methods due to its sub-micron resolution, a consequence of the confined reaction volume generated by two-photon absorption. The application of two-photon 3D microfabrication techniques carries considerable promise for the advancement of emerging technologies in areas such as microoptics, metamaterials, robotics, and biotechnology. Currently, a major challenge in 3D microfabrication consists in designing microstructures that feature hierarchical nanostructures, while maintaining the high fabrication speeds required to produce large printed structures.

Research objectives: In the above context, our research group is currently seeking a Master 2 candidate to investigate the underlying chemical mechanisms and processes in two-photon microfabrication, with a view to developing novel nanostructured materials. This objective can be achieved by leveraging the unique properties of the confined sub-micron reaction volume generated by the two-photon excited voxel.

The recruited intern will conduct a comprehensive investigation of the reaction parameters that are critical for triggering polymerization-induced phase separation during the fabrication process. This involves formulating photoresists, studying adapted photoinitiators, and evaluating 3D structures using electron microscopy analysis. Furthermore, the obtained materials will be analyzed by the project partners to elucidate their nanostructured content.

Candidate profile: We are seeking a highly motivated and skilled Master's or engineering degree holder with a strong background in polymer chemistry, and physical chemistry. Although not mandatory, advanced notions in photochemistry would be an asset, The successful candidate will possess excellent reliability, autonomy, motivation, and strong capacity to work in a highly collaborative and competitive environment.

PhD opportunity: A highly motivated and accomplished Master 2 student will have the opportunity to obtain a PhD grant in the framework of a CIFRE project.

Location: Laboratoire de Chimie, École Normale Supérieure in Lyon, France
Contact: Akos BANYASZ, akos.banyasz@ens-lyon.fr
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Duration: 5-6 months;
Start date: February 2026
Allowance: *ca*. 600 Euros/month*
*Applicants from EU member countries outside France are advised to apply for an ERASMUS internship as well.

References:

[1] Garcia Andujar, L.; Brocas, A.-L.; Bourrigaud, S.; Cazaumayou, S.; Derail, C.; Save, M.; Rubatat, L. Controlled Asymmetric Lamellar Nanomorphology Obtained through Nitroxide-Mediated Polymerization-Induced Microphase Separation. Macromolecules 2024. DOI: 10.1021/acs.macromol.3c02482

[2] Barner-Kowollik, C.; Bastmeyer, M.; Blasco, E.; Delaittre, G.; Muller, P.; Richter, B.; Wegener, M. 3D Laser Micro- and Nanoprinting: Challenges for Chemistry. Angew Chem Int Ed Engl 2017, 56 (50), 15828. DOI: 10.1002/anie.201704695

[3] Arnoux, C.; Konishi, T.; Van Elslande, E.; Poutougnigni, E.-A.; Mulatier, J.-C.; Khrouz, L.; Bucher, C.; Dumont, E.; Kamada, K.; Andraud, C.; et al. Polymerization Photoinitiators with Near-Resonance Enhanced Two-Photon Absorption Cross-Section: Toward High-Resolution Photoresist with Improved Sensitivity. Macromolecules 2020, 53 (21), 9264. DOI: 10.1021/acs.macromol.0c01518

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