

M2 internship – IMP lab – Lyon

Preparation of green & hybrid colloids combining nanocellulose surface modification and heterogeneous polymerization

Context & goals: Nanocellulose is a unique building block for materials science. It is produced from renewable feedstocks and available as electrostatically stabilized aqueous colloidal suspensions, which are used in numerous applications including nanocomposites.¹ Therefore grafting polymer brushes onto/through the nanocellulose surface is a critical step, and heterogeneous polymerization is especially attractive to introduce hydrophobic polymer chains² and thus obtain hybrid colloids which can act as precursors for this kind of materials. Yet it has been almost exclusively evaluated on bare CNC, or without covalent bonds between the synthetic polymer chains and the CNC surface. Although some works have been devoted to CNC functionalization *via* the “grafting from” approach,³ they usually require organic solvents or complex preliminary surface derivatizations. Radical polymerization of vinyl monomers is a well-suited strategy to overcome these limitations due to its robustness and versatility: polymerization in water (or in dispersed media), access to elaborated architecture *via* reversible-deactivation radical polymerization and large scope of commercially available vinyl monomers. **The goal of this project** is to investigate aqueous chemistries to directly grow polymer chains by heterogeneous radical polymerization from CNC surfaces and to control the architecture of the resulting hybrid latexes.

Methodologies and tools: nanocellulose extraction and surface modification, “grafting from” and “grafting through” by radical polymerization. Techniques : FTIR, ssNMR, TEM, DLS.

Practical informations: The internship will be at the IMP lab in Lyon.⁴ It can start from early February and run up to late July. The internship indemnity is about 600 euros per month. If interested please send your CV, motivations and a reference contact to theo.pesenti@univ-lyon1.fr and matthieu.fumagalli@univ-lyon1.fr.

1. Thomas, B.; Raj, M. C.; B, A. K.; Joy, J.; Moores, A.; Drisko, G. L.; Sanchez, C., Nanocellulose, a versatile green platform: from biosources to materials and their applications. *Chemical reviews* 2018, 118 (24), 11575-11625.
2. Kedzior, S. A.; Gabriel, V. A.; Dubé, M. A.; Cranston, E. D., Nanocellulose in emulsions and heterogeneous water-based polymer systems: A review. *Advanced Materials* 2021, 33 (28), 2002404.
3. Wohlhauser, S.; Delepierre, G.; Labet, M.; Morandi, G.; Thielemans, W.; Weder, C.; Zoppe, J. O., Grafting polymers from cellulose nanocrystals: Synthesis, properties, and applications. *Macromolecules* 2018, 51 (16), 6157-6189.
4. <https://imp-umr5223.cnrs.fr/?lang=en>