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From molecules to functional, pi-conjugated materials *via* supramolecular self-assembly

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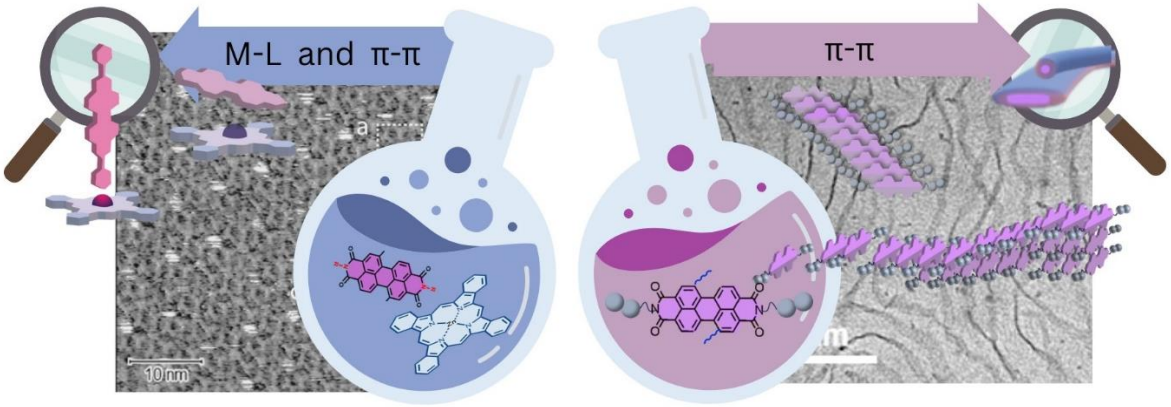
Supramolecular self-assembly is a key technique for arranging molecular components across scales, offering traits like self-healing and responsiveness to external stimuli. This method leverages non-covalent interactions to create ordered systems with diverse architectures, enabling efficient nanomaterials engineering.

This talk will focus on two examples of our work showing how we exploit supramolecular assembly to create novel, π-conjugated, nanostructured materials. The first is a bottom-up strategy to achieve a "functional" patterning of graphene via the use of molecular dyads, held together via non-covalent interactions, which enable us to easily mix & match the components, resulting in a highly tunable system. This relatively simple design allows us to control the orientation and distance of an emissive component above a graphene-like substrate through different supramolecular interactions and opens up an accessible route to electronically de-couple an optically-active molecule from graphene.[1]

Next, we will present a direct method for fabricating polymeric nanoribbons and cylinders in water using perylenediimide (PDI) as a supramolecular structure directing unit.[2] We demonstrate that different π-conjugated nanostructures can be easily obtained in a controlled manner through direct dissolution in water. The controlled formation of well-defined nanoribbons and nanofibers with π-conjugated cores could significantly improve charge transport in organic semiconductors. Moreover, the water-soluble nature of these polymeric nanostructures presents a significant advantage for device fabrication.



References: [1] Q. Fernez, S. Moradmand, M. Mattera, W. Djampa-Tapi, C. Fiorini- Debuisschert, F. Charra, D. Kreher, F. Mathevet, I. Arfaoui, L. Sosa Vargas*, J. Mat. Chem. C.* **2022**,*10*, 13981-1398. [2] S. Berruée, J.-M. Guigner, T. Bizien, L. Bouteiller, L. Sosa Vargas, J. Rieger, *Angew. Chem. Int. Ed.* **2025**, 64, e202413627.