

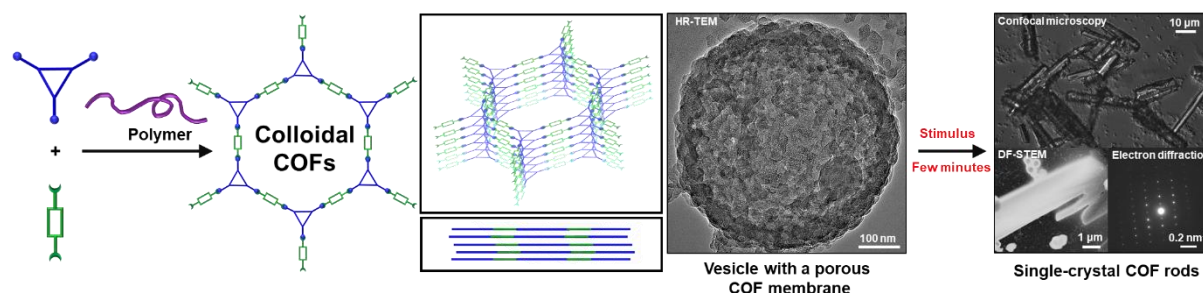
**Postdoctoral position starting from March-April 2026 (18 months)**

**Fast Assembly of Supramolecular-Triggered COF-vesicles into micro-sized single-crystals**

COFs were first developed in 2005,<sup>1</sup> they are organic materials, made up of dynamic covalent bonds that give them a good self-correcting capacity during their formation, leading to highly crystalline structures.<sup>2</sup> The geometry of the building blocks and the orientation of their reactive groups determine the dimensions, the topology of the network and defines the pore size. For example, a trifunctional planar building block with reactive groups at each vertex bonds can react with a bifunctional linear building block to form a 2D hexagonal lattice (**Figure, left**). No other multi-dimensional polymerization strategy allows for today to predict and adjust the structure of the network to such a level. Thanks to their properties (tunable porosity, high specific surface area and lightness), COFs are envisaged for numerous applications in storage, molecular separation, catalysis, sensing, optoelectronics, encapsulation and delivery of bioactive molecules.<sup>3</sup>

However, there are still bottlenecks limiting further development. Most COFs are isolated as insoluble powders with small crystalline domains, typically on the order of 50 nm. A few studies report the production of large single-crystals of COF (> 15 microns), essentially restricted to imine-linked COF. Nevertheless, they all rely on the chemistry optimization conditions (by changing the catalyst nature for example) and consequently lead to incompressible time-scale reactions despite some incremental improvements (from months to days).<sup>2,4,5</sup>

Very recently, we have developed a new class of hybrid materials by combining COFs with macromolecular chemistry. The polymer was used, in the presence of COF building blocks, to assist in the formation of COF-polymer hybrid particles. The polymer has succeeded to manipulate the organization of crystallites, leading to raspberry-like particles<sup>6</sup> or meso-sized hollow spheres (**Figure, middle**), named “COFosomes”. Then, we discovered that the addition of small molecule bearing amide groups, can induced a very fast and drastic change in the morphology. Indeed, in a few minutes, the hollow spheres merge together and reorganize into micro-size single-crystal rods (**Figure, right**).



**Figure.** Previous results obtained, highlighting the “template effect” afford by a polymer in the COF-polymer particle organization and the non-understood mechanism allowing the formation of micro-sized single-crystal rods.

For the moment, the underlying mechanism is not fully understood. We hypothesize an osmotic shock but assisted by the interactions of the amide groups with the COF membrane. An in-depth study on the phenomenon, implying triggering molecule size-change in relation with the pore size of the membrane and the number of amide groups will help to manipulate the phenomenon. This fast formation of large single-crystal COF *via* a supramolecular approach, will represent a definite step forward in the field to gain control over the time-scale and the structural features of the fully organic matter.

## References

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**Candidate profile:**

Priority will be given to candidates holding a PhD degree in soft matter/polymer science. A strong interest in material science, material characterization (scattering techniques, X-Ray diffraction, electron microscopies, confocal microscopy), as well as organic and polymer synthesis skills are desired.

**Duration:** 18 months

**Location:**

The academic work will be carried out at the Unité Matériaux et Transformations (UMET, UMR CNRS 8207) in Villeneuve d'Ascq.

<https://umet.univ-lille.fr/>

<https://chevreul.univ-lille.fr/>

**Contacts:** please email a CV, a cover letter and two contacts for the recommendations.

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