2-year Post-Doctoral Position

Structure and Dynamics of Supercrystals Studied by Liquid-Phase Transmission Electron Microscopy

The MeANS group at the MPQ laboratory (CNRS / University Paris cité) is looking for an experienced and motivated post-doctoral scientist to conduct liquid-phase TEM experiments with the view to study the structure and dynamics of supercrystals made of binary assemblies of metal nanorods.

Self-assembly of nanoparticles represents a versatile and scalable route towards the creation of new functional materials with well-defined structures on the nanoscale. Depending on their shape, surface chemistry, and interactions, nanoparticles can form a variety of superstructures that exhibit polymorphism – the ability to crystallize into different structures under varying conditions. The internal structure of these supercrystals plays a key role in determining their macroscopic properties, and hence their suitability for technological application as e.g. catalysts, sensors, or photonic materials. Hence, fine control over polymorphism is a key challenge in the quest to create functional nanomaterials.

By combining the expertise of the MPQ and LPS laboratories (CNRS / Paris Saclay University) in Nanochemistry, in situ TEM and modeling, we will explore the self-assembly of binary mixtures of nanorods into superstructures driven by depletion forces in solution. Due to their elongation, these nanorods are expected to self-assemble into phases consisting of ordered layers, where the internal symmetry of each layer is determined by the cross-sections of the chosen nanorod mixture, the ionic strength, the concentration of depleting agent and the temperature. The overall aims of the project are to design systems that spontaneously self-assemble into supercrystals with a target crystalline or quasi-crystalline symmetry and to provide a deeper understanding of nanorod interactions that govern the structural properties of the assemblies.

More specifically, the future postdoc will exploit the world-leading instrumentations of the MPQ lab, combining a JEOL double-corrected TEM and state-of-the-art liquid-cell TEM holders with the view to study the structure of supercrystals in solution and also their nucleation, growth and degradation mechanisms in controlled environmental conditions. SAXS experiments will be also carried out in order to reveal possible electron beam and confinement effects. This multi-scale approach developed by our consortium is a cutting-edge strategy to understand the dynamics of nanomaterials from the beaker to the single nanoparticle levels [1-3].

This 2-year position starting in early 2026, is funded by the National Research Agency (2Rods project) and it may be extended for one additional year, depending on the performance of the candidate.
Besides high standard publications, the interdisciplinary skills in TEM, SAXS and materials sciences that will be acquired by the candidate in this collaborative project will facilitate his professional insertions.

Further information can be found on the website of the three groups involved in this project:

MeANS at MPQ : https://mpq.u-paris.fr/means/
MetaMat at LPS: https://metamat.eu/
Theory group at LPS: https://equipes.lps.u-psud.fr/theorie/members-2/

References

[1] Goldman et al Small 19, 2303380 (2023)

[2] Nag et al. Nano Lett. 24, 51, 16368 (2024)

[3] Aliyah et al. J. Phys. Chem. Lett. 11, 2830-2837 (2020)

Requirements and qualifications

- PhD in Condensed matter, Nanochemistry, Materials Science, Chemical Engineering, physics.

- Experience in transmission electron microscopy (skills in liquid-cell TEM will be a major asset) and Small Angle X-ray Scattering (SAXS) at synchrotron facilities.

- Skills in image processing and data analysis for TEM.

- Expertise in wet-chemical synthesis and self-assembling of nanomaterials.

And also (but essential): Strong motivation to perform in a multidisciplinary environment, autonomy, ability to work in a team, ability to write up experimental data to publication standard, effective verbal communication skills in English (or in French).

Application

Application (in English or in French) must be sent to *damien.alloyeau@u-paris.fr* before October 15th. They should include a Cover letter, the names and contact information of at least two references, and a CV with education history and research experiences.

Brut Salary

3081 € to 4291 € according to experience

Supervisor:

Damien Alloyeau (Laboratoire Matériaux et Phénomènes quantiques, CNRS – University Paris Cité), *damien.alloyeau@u-paris.fr*; +33 1 57 27 69 83