Ecole Doctorale Physique et Chimie des Matériaux (ED 397), Sorbonne Université

Title: Assemblies of DNA-decorated functional nano-objects by supramolecular recognition

Funding: Sorbonne Université

Location: Sorbonne Université (+ stays at Yonsei University, South Korea)

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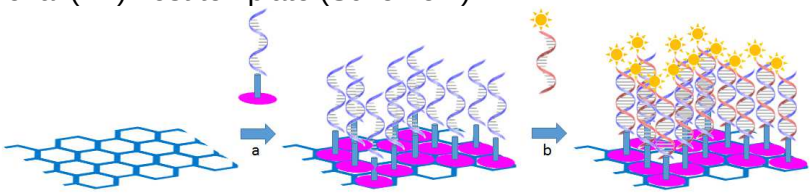
Summary

Developing new nanostructured materials or devices based on the properties of nano-objects requires the ability to specifically locate them into hierarchical materials on a large scale whatever the size, shape or nature of the nano-object.

The multidisciplinary thesis aims to provide a new multi-functional platform based on well-defined supramolecular organic networks hosting guest functional nano-objects organized through biomolecules. The guests will range from nanoparticles to electro-, and photo-active molecules for new generation of devices in data storage, organic electronics and sensors. To achieve this objective, a new approach will be developed, combining (i) organic supramolecular chemistry at surfaces, (ii) inorganic and physical chemistry, and (iii) biomolecules (DNA, peptide) chemistry.

We propose a bottom-up approach based on supramolecular chemistry where the patterning is based on a molecular unit, which forms nanoporous networks on highly oriented pyrolytic graphite or graphene. We propose to combine the cavity surface-confined host-guest recognition and the metallo phthalocyanine axial ligation approaches to immobilize standing-up three dimensional (3D) functional guest structures into the pores of a two-dimensional (2D) host template (Scheme 1)



Scheme 1. Sketch of the fabrication of the platform from a supramolecular self-assembly on a graphitic substrate (graphite or graphene): a) trapping of a guest functionalized with an oligonucleotide; b) recognition of a nano-object equipped with the complementary oligonucleotide.

Recently we have demonstrated the validity of the surface-confined 'host-guest' chemistry by trapping 3D Zn-Phthalocyanine complexes into two-dimensional nanoporous self-assembled organic networks[1-2].

To go further, the candidate will extend this new concept to design a platform for the formation of three-dimensional architectures where the precise arrangement of functional nano-objects, differing by their size or their composition can be tailored, leading to new multi-functional materials. For that, he/she will combine the supramolecular approach of patterning and the ability of oligonucleotides to arrange efficiently nano-objects on a surface. Functional nano-objects grafted with the complementary oligonucleotide will be either metallic nanoparticles or organic conjugated fluorophores.

Applicant

Highly motivated candidate with a background in organic and/or inorganic chemistry (**Ingénieur Chimiste/ Master Chimie des Matériaux**). A former experience in the field of scanning probe microscopies and/or bioorganic chemistry/biochemistry will be an advantage. Real interest for physical-chemistry and nanoscience is also important.

Deadline for applying: **30th September, 2020**.

Contact: christophe.petit@sorbonne-universite.fr (01 44 27 29 06). Applications should include a detailed CV, transcript of records (M1-M2, Ingénieur 2e-3e années), a motivation letter, and a recommendation letter.

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[1] R. Brisse, I. Arfaoui, S. Sagan, C. Petit, A. J. Attias et al., *Chem Commun.*, 2018, 54, 10068.

[2] B. Kim, I. Arfaoui, C. Petit, A. J. Attias et al., *Materials Horizons*, 2020, DOI: 10.1039/D0MH00950D