

HYDROGEN-BONDED SUPRAMOLECULAR NANOSTRUCTURES ON SURFACES

Socorro Vázquez-Campos, Mária Péter, Mercedes Crego-Cálama, David N. Reinhoudt
University of Twente Laboratory of Supramolecular Chemistry & Technology, MESA⁺ Institute of
Nanotechnology, P.O. box 217, 7500 AE Enschede, The Netherlands
m.s.vazquezcampos@utwente.nl

One promising approach for the construction of nanometric objects comes from supramolecular chemistry. It has been demonstrated in the last few years that information stored in molecular components can be read out by noncovalent interactions (self-assembly), for example, hydrogen-bonding or metal-ligand interactions, to assemble the final ordered architectures. Moreover, the arrangement of special functional units with nanometer dimensions into defined molecular architectures on surfaces is one of the major goals in supramolecular, polymer and material science due to the potential application of these systems in nanotechnology leading to molecular information storage devices or functional surfaces.

The multicomponent nature of hydrogen-bonded structures based on rosette motif as well as the multiple sites available for further chemical modifications at building blocks make these structures very interesting candidates for the precise spatial diversity onto solid supports[1]. Our group has studied the self-organization of double (36 hydrogen bonds) and tetra-rosettes assemblies (72 hydrogen bonds) into ordered nanostructures on graphite surfaces by atomic force microscopy (AFM). Highly ordered nanorod domains have been observed (Fig. 1).

Furthermore, It has been shown, by means of AFM, that a racemic mixture of tetra-rosettes has been spontaneously resolved into enantiopure domains in 2D supramolecular assemblies on highly oriented pyrolytic graphite (HOPG) [2]. These results imply that the spontaneous resolution of racemic mixtures of P and M rosettes may occur in general upon formation of highly ordered nanostructures on graphite surfaces. Consequently our studies are focused on the generation of diastereopure and enantiopure chiral rosettes and expecting that these assemblies exclusively form one orientation of the nanorod domains with respect to the underlying HOPG. Furthermore, we are studying the incorporation of metal atoms (in particular gold atoms), employing rosettes as templates to direct the formation of metallic nanostructures [3]. This approach could lead in the future to versatile routes to fabricate electrically conducting nanowires (Fig. 2)

References:

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 [2] H. Schönherr, M. Crego-Calama, G. J. Vansco, D. N. Reinhoudt, *Adv. Mater.*, **16**, (2004), 1416.
 [3] H-J. van Manen, V. Paraschiv, J. J. García-López, H. Schönherr, S. Zapotoczny, G. J. Vansco, M. Crego-Calama, D. N. Reinhoudt, *Nano Letters*, **4**, (2004), 441.

Figures:

Figure 1: Tetra-rosette structure (left, top). Schematic structure (top, right). Gas phase minimized structure in side view (bottom, right). (A) Unfiltered high resolution tapping mode AFM phase image of tetra-rosette nanorod domain structure; (inset) two-dimensional fast Fourier transform. (B) Fourier filtered section of raw data shown in A and unit cell of the lattice structure.

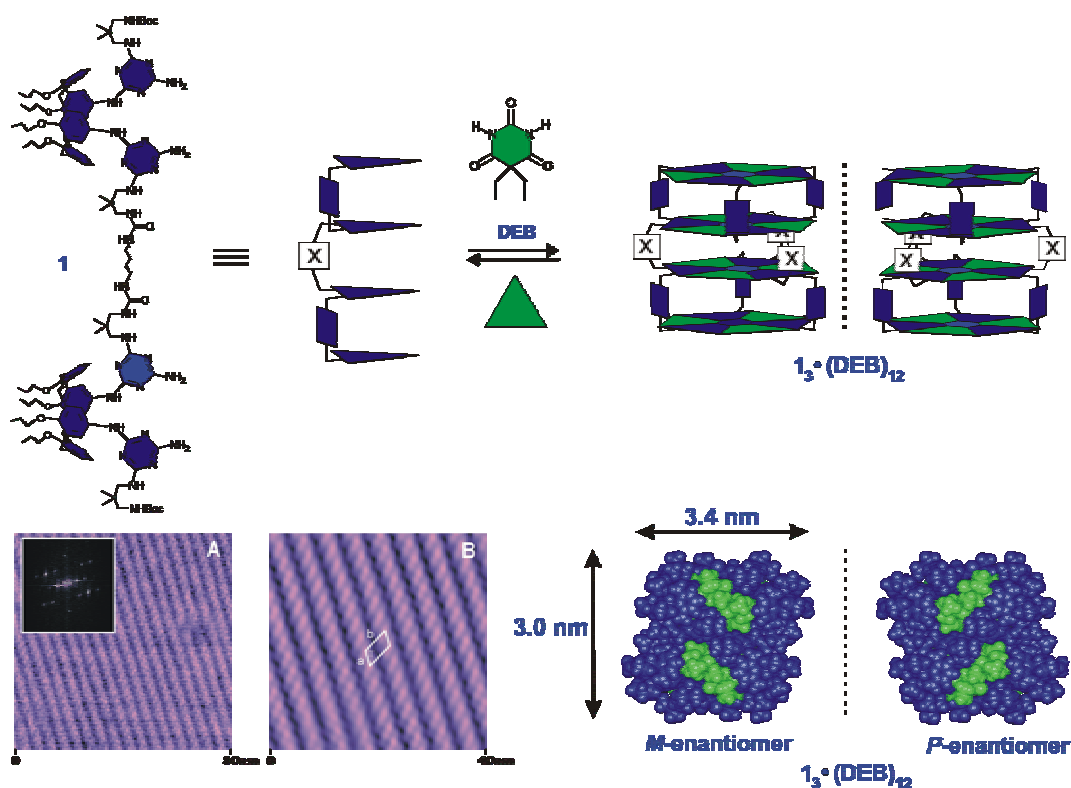


Figure 2: Formation of Rod-like structures with the gold-functionalized assemblies and metal reduction.

