

Tuning the 2D supramolecular self-assembly of binary organic layers

E. Barrena,^{1,2,3} Dimas G. de Oteyza,^{1,3,4} J. Enrique Ortega,^{4,5} Helmut Dosch,^{1,2} Yutaka Wakayama³

¹ *Max-Planck-Institut für Metallforschung, Heisenbergstr. 3, Stuttgart, Germany*

² *Institut für Theoretische und Angewandte Physik, Universität Stuttgart, Stuttgart, Germany*

³ *National Institute for Materials Science, 1-1 Namiki, Tsukuba, Japan*

⁴ *Donostia International Physics Center, Paseo Manuel Lardizabal 4, San Sebastián, Spain*

⁵ *Departamento de Física Aplicada UPV/EHU, Plaza de Oñate 2, San Sebastián, Spain*

barrena@mf.mpg.de

Resumen

Non-covalent interactions (van der Waals, electrostatic, hydrogen and coordination bonds) are responsible for hierarchical self-assembly of organic and biological architectures. This concept has sparked enormous research in nanotechnology, materials science and supramolecular chemistry, in the challenge of bottom-up design of molecular nanostructures. In particular 2D binary molecular monolayers, the self-assembly of 2D supramolecular structures by mixing of molecular species with complementary properties, is a potential strategy for the development of complex chemical systems. This opens the door to create organic functional surfaces and thin films with novel properties or nanostructured templates for building further hierarchical structures.

Due to their interesting and versatile electronic properties, small organic molecules with π -conjugated orbitals are particularly attractive as building blocks. In this work we show that the growth of ordered binary monolayers can be tailored via variation of the relative co-deposition ratio. The formation of C-F...H-C interactions are the driving force for the supramolecular self-assembly. We have been able to provide the first pieces of a catalogue of the structures found as a function of the molecular species, relative concentration and the substrate. The growth of mixed binary layers results in films with strongly enhanced intermolecular interactions and reduced molecule-substrate interactions. These studies offer new insight into the interplay among non-covalent interactions in the self-assembly of functional organic nanostructures on surfaces.

Figuras: Scanning Tunneling microscopy study on supramolecular self-assembly of binary monolayers



