Taming complexity in dynamic multicomponent supramolecular materials: tailoring low dimensional multifunctional nanostructures

Thursday, June 18
13:00 – 14:00

Seminar Room 115, Hallwachsstr. 3 (HAL)

Stimuli-responsive supramolecularly engineered hybrid materials either based on graphene or on organic semiconductors are key multifunctional systems for applications in (opto)electronics and energy. However, their practical use requires the optimization of the self-assembly of multimodular architectures at surfaces using non-conventional methods, their controlled manipulation and responsiveness to external stimuli, and the quantitative study of various physico-chemical properties at distinct length- and time-scales. My lecture will review our recent findings on:

(i) The harnessing of the yield of exfoliation of graphene in liquid media by mastering the supramolecular approach via the combination with ad-hoc functional molecules possessing high affinity for the graphene surface, leading ultimately to the bottom-up formation of optically responsive graphene based nanocomposites for electronics.

(ii) The bottom-up formation of graphene based 3D covalent frameworks with tunable intersheet distance, exhibiting large specific surface areas which determine an ability to adsorb CO₂ which is the highest reported among carbon-based materials and extremely high performance in supercapacitors.

(iii) The formation of electroactive π-π stacked fibrillar structures from an amphiphilic monomolecular dyad. These fibers show unique characteristics as resistive humidity sensors combining a response rate as fast as 26 ms with an exponential growth of the current from 0 to, at least, 75% of relative humidity (RH). In this RH range the current changes up to 7 orders of magnitude, i.e. from a few pA to tens mA, demonstrating an extremely high sensitivity to humidity variations.

(iv) The tailoring multicomponent films comprising photochromic systems and semiconducting molecules, and their exploitation to realise multifunctional devices such as optically switchable field-effect transistors.
Paolo Samorì (Imola, Italy, 1971) is Distinguished Professor (PRCE) and director of the Institut de Science et d'Ingénierie Supramoléculaires (ISIS) of the Université de Strasbourg (UdS) where he is also head of the Nanochemistry Laboratory. He is also Fellow of the Royal Society of Chemistry (FRSC), fellow of the European Academy of Sciences (EURASC), member of the Academia Europaea (MAE) and junior member of the Institut Universitaire de France (IUF). He obtained a Laurea (master’s degree) in Industrial Chemistry at University of Bologna in 1995. In 2000 he received his PhD in Chemistry from the Humboldt University of Berlin (Prof. J. P. Rabe). He was permanent research scientist at Istituto per la Sintesi Organica e la Fotoreattività of the Consiglio Nazionale delle Ricerche of Bologna from 2001 til 2008, and Visiting Professor at ISIS from 2003 til 2008. He has published >190 papers on applications of scanning probe microscopies beyond imaging, hierarchical self-assembly of hybrid architectures at surfaces, supramolecular electronics, and the fabrication of organic-based nanodevices. His work has been awarded various prizes, including the Young Scientist Awards at E-MRS (1998) and MRS (2000) as well as the IUPAC Prize for Young Chemists (2001), the "Vincenzo Caglioti" Award (2006) granted by the Accademia Nazionale dei Lincei (Italy), the "Nicolò Copernico" Award (2009) for his discoveries in the field of nanoscience and nanotechnology, the "Guy Ourisson" Prize (2010) of the Cercle Gutenberg (France), the ERC Starting Grant (2010) and the CNRS Silver Medal (2012). He is member of the advisory boards of Advanced Materials, Small, ChemPhysChem and ChemPlusChem (Wiley-VCH), Chemical Society Reviews, Chemical Communications, Journal of Materials Chemistry and Nanoscale (RSC).