

Séminaire SOLEIL

Molecular Nanoscience at Surfaces : From Single Molecules to the Emergence of Complexity

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Invitée par Paul DUMAS

**Lundi 5 mars à 14h00
Grand Amphi SOLEIL**

Séminaires

Molecules represent the most versatile, functional entities available in Nature and are the central components in the machinery of life. Molecular ensembles confined at solid surfaces promise exciting applications in catalysis, sensing, energy-harvesting, data storage and molecular electronics. The nanoscale details of how molecular organisations are nucleated, controlled and propagated at surfaces have begun to emerge from scanning probe microscopy, a powerful range of surface science techniques and periodic density functional theory.

This talk will outline the mechanisms that underpin self-organisation and 2D crystallisation of chiral molecules at surfaces, leading to important outcomes such as chiral separation, chiral recognition and chiral amplification [1,2]. In many cases, the chiral response of an entire molecular surface assembly can be traced back to nanoscopic single-molecule events [2-5]. Complex organisational behaviour will also be shown to emerge from simple initiators such as the presence of the surface [4,5] or from fluctuating populations of mirror molecules [6].

Finally, on-surface synthesis of robust, covalent chiral superstructures will be demonstrated using clean, connection strategies, with the direct emergence of structural complexity [7,8].

- [1] M.Ortega-Lorenzo, C.J.Baddeley, C.Muryn and R.Raval, 'Extended Surface Chirality from Supramolecular Assemblies of Adsorbed Chiral Molecules', *Nature*, 404 (2000) 376.
- [2] N. Liu, S. Haq, G. R. Darling and R. Raval, 'Direct Visualisation of Enantiospecific Substitution of Chiral Guest Molecules into Heterochiral Molecular Assemblies at Surfaces' *Angewandte Chemie Int.Ed.*, 46 (2007) 7613.
- [3] P. Donovan, A. Robin, M. S. Dyer, M. Persson, R. Raval, 'Unexpected Deformations Induced by Surface Interaction and Chiral Self-Assembly of Co(II)-Tetraphenylporphyrin adsorbed on Cu(110): A combined STM and Periodic DFT study'. *Chemistry, A European Journal*, 16 (2010) 11641.
- [4] M. Forster, M. Dyer, M. Persson and R.Raval, 'Probing Conformers and Adsorption Footprints at the Single-Molecule Level in a Highly Organized Amino Acid Assembly of (S)-Proline on Cu(110)'. *J. Am. Chem. Soc.*, 131 (2009) 10173-10181.
- [5] M. Forster, M. Dyer, M. Persson and R.Raval, '2-D Random Organization of Racemic Amino-Acid Monolayers Driven by Nanoscale Adsorption Footprints: Proline on Cu(110)', *Angewandte Chemie Int. Ed.*, 2010 (49), 2344-47.
- [6] S.Haq, N. Liu, V.Humblot, A.P.J.Jansen, R.Raval, 'Drastic Symmetry Breaking in Supramolecular Organization of Enantiomerically Unbalanced Monolayers at Surfaces'. *Nature Chemistry*, 1 (2009) 409-414.
- [7] S. Haq, F. Hank, M. S Dyer, M. Persson P. Iavicoli, D. B. Amabilino and R. Raval, 'Clean Coupling of Unfunctionalized Porphyrins at Surfaces To Give Highly Oriented Organometallic Oligomers', *J. Am. Chem. Soc.* 133 (2011) 12031

**Ce séminaire sera suivi d'une pause-café**

Formalités d'entrée : accès libre dans l'amphi du Pavillon d'Accueil. Si la manifestation a lieu dans le Grand Amphi SOLEIL du Bâtiment Central, merci de vous munir d'une pièce d'identité (à échanger à l'accueil contre un badge d'accès).

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