Getting to the bottom: Molecular Self-Assemblies at Surfaces

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Owing to their structural and chemical versatility, functionalised aromatic molecules are widely employed for spontaneous assembly on surfaces with options comprising the formation of extended networks of flat lying molecules linked by supramolecular or covalent bonding, and densely packed layers of upright orientated molecules, commonly referred to as self-assembled monolayers (SAMs).

Networks and SAMs are complementary in various ways as regards the control of structures and chemical processes on the nanoscale. As part of a bottom-up approach, the former consist of atomically precise building blocks, thus enabling ultraprecise templating. However, restrictions apply such as the limitation to regular structures and the limited scope for functionalisation. In contrast, SAMs allow for a flexible functionalisation of surfaces, which makes them of interest for area selective deposition. Since the bottom-up generation of SAMs featuring ultrasmall patterns is challenging and has only been demonstrated for a few specific cases, the top-down lithographic approach is usually employed, yielding SAMs with freely defined chemical patterns. How far this can be extended towards the bottom end of the nanoscale is not only dependent on the lithographic technique but is also crucially dependent how well elementary steps in the deposition process such as diffusion and nucleation can be controlled.

Focusing on processes at the solid/liquid interface including the electrochemical one, the talk will discuss opportunities and challenges of molecule based bottom-up and top-down strategies for the generation of ultrasmall structures.