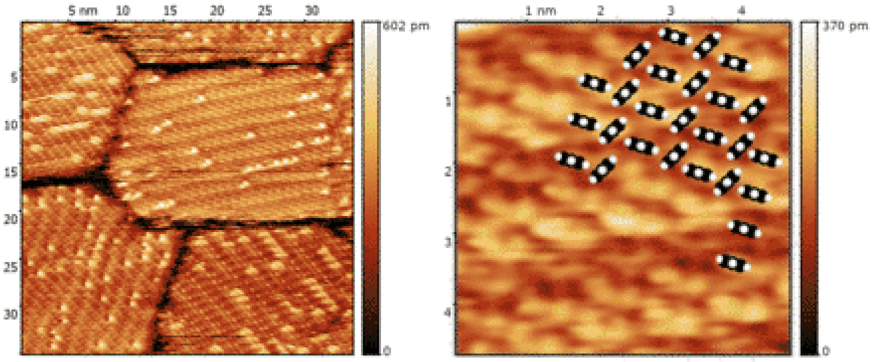
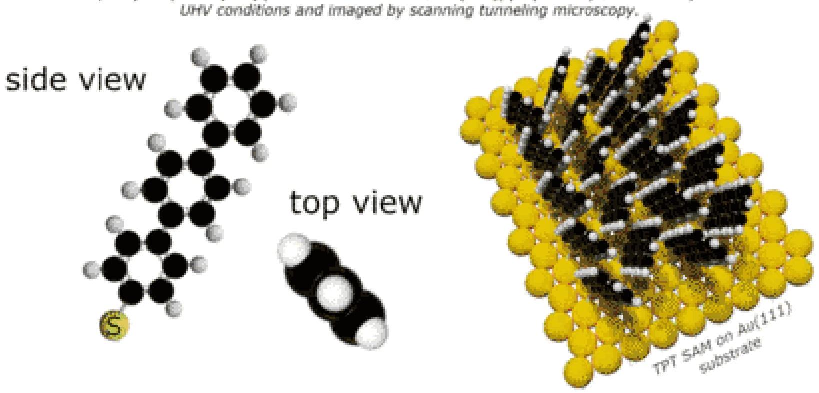
Surface Studies and Self-Assembled Monolayeres



SAM from p-terphenylthiol (TPT) precursor molecules on Au(111), prepared by thermal evaporation under UHV conditions and imaged by scanning tunneling microscopy.



Specific functionalization of surfaces is of crucial importance in the material sciences. In particular in nanotechnology, complex functionalizations are desired for an increasing number of applications, which will require the development of novel interface modification strategies. Examples are the functionalization of electrodes for organic electronics, the remote control of surface properties by optical switching, the setup of biomimetic or biologically relevant interfaces (cell recognition, differentiation of stem cells, and the colonization of technical surfaces by microorganisms) as well as coatings of implants.

The most promising strategies of such surface functionalization are based on self-assembled monolayers (SAMs). SAMs have not only turned out to be the model system for organic surfaces, but are of high relevance to both fundamental and applied research. Above all, they serve as a technology platform for the further development of nanotechnology.

SAMs have produced a number of innovative stimuli in materials sciences and are increasingly applied as a technology platform for the (further) development of nanotechnology. Examples are:

- Functional coatings in organic electronics.
- Carbon nanomembranes (CNMs) for sensors and bioengineering.
- Control of protein affinity on surfaces for medical engineering.
- Platform for highest-resolution (sub-10 nm) lithography.
- Tribological coatings of nanomechanical components.

Owing to the unique combination of simple production and excellent structural properties, SAMs are particularly well suited as model systems for studying basic interface phenomena at both solid-gaseous and solid/liquid phase boundaries. SAMs have a small thickness which makes them accessible by classical electron spectroscopy methods. Practically all standard methods of surface analysis can be applied directly to these organic thin layers. Hence, the complete knowledge base established for metal and inorganic substrates in "Interface Sciences" can be applied, including diffraction methods. As a result SAMs are ideal to validate different types of theoretical approaches. Whereas thin polymer films, for example, also offer a large variety of options with regard to obtaining highly functional interfaces, they typically lack the high degree of perfections obtainable with SAMs. As a consequence, the application of diffraction methods is difficult and a reliable, direct validation of theoretical calculations is hampered for such systems.