Proposal for diploma subject (2010)

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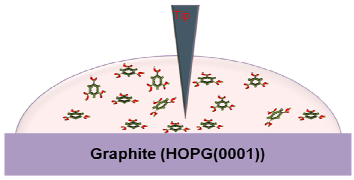
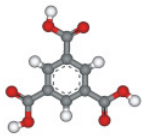
SCANNING TUNNELING MICROSCOPY (STM) STUDY OF SELF-ASSEMBLY AT THE SOLID-LIQUID INTERFACE

Saturated solutions of organic molecules dissolved in proper solvents are used to study self-assembled structures which are governed by intermolecular hydrogen bonding. Depending on the concentration of the molecules in the solvent, there appear different highly ordered structures.The molecular concentration depends on many factors: the physico-chemical properties of the solutes and solvents - reactive groups, chain lengths,…), the sonication time (we use super-saturated solutions prepared by sonication); furthermore it changes due to temporal instability of the solutions (concentration is checked by UV-Vis absorption).

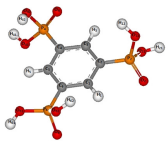
The student will become involved in these interesting experiments. He/she should especially prepare solutios of different molecular solutes and solvents and study them with respect of concentrations achieved and temporal stability. These investigations are a prerequisite for more profound studies of self-assembling. In the second period, STM studies of monolayer self-assembling out of the prepared solutions on crystalline graphite surfaces will be performed.



STM at liquid-solid interface

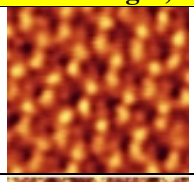
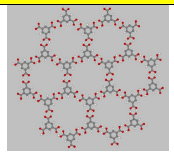
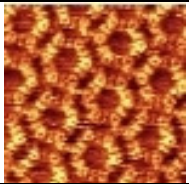
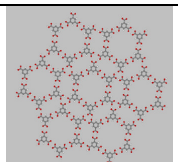


Two dimensional molecule: Trimesis acid_ TMA



Three dimensional molecule: Benzene triphosphonic acid_BTP

A few experimental results from trimesic acid (TMA) molecules demonstrate the variety and beauty of patterns:

Sonication time	Structure	$d_{c\text{-}c}$ (distance center-center)	STM (current images at constant height)	Models
0h – 2h	Chicken wire	1.7 nm		
~ 3h	Flower	2.5 nm		
6 – 10 h	Still un-named	3.0 nm