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Pattern control in molecular self-assembly

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The investigation of self-assembled adsorbate structures on crystalline substrate surfaces is a classical topic of surface physics which has been dominated for a long time by diffraction techniques. The appearance of scanning probe microscopies – especially scanning tunneling microscopy (STM) – has opened the fascinating opportunity of direct real-space imaging with atomic or sub-molecular resolution. At the interface between a solution and a crystalline solid, solute (and sometimes also solvent) molecules may deposit in an ordered manner at the solid substrate surface. In-situ studies of the adsorption pattern created this way are possible by ambient STM with the tip immersed in a deposited solution droplet. As an example, trimesic acid (TMA) molecules solvated in alkanolic acids may arrange in open adsorption patterns (chicken wire and flower structures) due to H bonding via carboxylic functional groups. At the liquid-solid interface, such type polymorphism may be controlled by the nature of the solvent as well as the concentration of the solutions which opens access to further novel structures. By a controlled increase of molecular packing density of solutions of TMA in alcohols, a surface-reaction of TMA with co-adsorbed solvent molecules (monoester formation with undecanol) has been observed. Recent investigations concerning substrate temperature during deposition and replacement of trimesic acid by the non-planar benzene-triphosphonic acid will be discussed also. Such kind of investigations may open a way to better understanding the conditions of structure formation and control which is permanently encountered in the biotic world and which might become extremely fruitful for future engineering.

Biography

Michael Hietschold studied physics and completed PhD 1976 at Technical University Dresden, Germany. He was a Postdoc at Moscow State Lomonosov University, Soviet Union. Since 1993, he is a Professor at Technische Universität Chemnitz, Germany. His research interests are surface physics, nanophysics and ultramicroscopy. He was Guest Professor at the National University Ho Chi Minh City, Vietnam, and also lecturing at Portland State University, Oregon, USA. Since 2008 he is Advisor for the National Metals and Materials Technology Center (MTEC), Pathumthani, Thailand. He is a referee for many international scientific journals and funding organizations and has published more than 200 scientific papers.

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