O 25: [DS] Progress in Micro- and Nanopatterning: Techniques and Applications I (Focused Session, jointly with O - Organisers: Graaf, Hartmann)

Time: Tuesday 11:00–13:00 Location: GER 37

Topical Talk O 25.1 Tue 11:00 GER 37

Microcontact chemistry: surface reactions in nanoscale confinement — •Bart Jan Ravoo — Organic Chemistry Institute, Westfälische Wilhelms-Universität Münster, Corrensstraße 40, 48149 Münster, Germany

Microcontact printing is an established method for the preparation of physical, chemical and biological patterns on solid surfaces. Typically, microcontact printing involves a microstructured elastomer stamp that delivers a molecular ink in the contact area between stamp and substrate. Recently, it has been shown that microcontact printing can also induce chemical reactions when an ink is printed on a substrate, even when the reaction partners are normally unreactive. Rapid and spatially controlled surface reactions induced by microcontact printing enable the molecular modification and patterning of a wide range of inorganic and organic substrates. This lecture will highlight our newest findings concerning the scope and kinetics of surface chemistry by microcontact printing as well as its application in bionanotechnology.

Literature: Ravoo, B.J. J. Mater. Chem. 2009, 18, 8902-8906. Wendeln, C. et al. Langmuir 2010, 26, 15966-15971 Kaufmann, T. et al. Adv. Mater. 2010, DOI: 10.1002/adma.201003564

Topical Talk O 25.2 Tue 11:30 GER 37

Electrochemical Microstructuring — Xinzhou Ma[1,2], Vadym Halka[1,2], and •Rolf Schuster[1,2] — [1]Physical Chemistry, Karlsruhe Institute of Technology, Karlsruhe, Germany — [2]Center for Functional Nanostructures, Karlsruhe, Germany

Small metallic structures of nanometer dimensions are mostly fabricated by lithographic methods, eventually followed by metal deposition under UHV conditions. Recently also electrochemical methods became very promising for microfabrication, because the number of steps involved in the fabrication process may be significantly reduced. However, often the application of conventional electrochemical methods is hampered by long range charging of the double layer and the weak spatial confinement of electrochemical reactions.

In this contribution we review recent methods by which the constraints of conventional electrochemical methods can be circumvented and which allow to structure surfaces on the micrometer to nanometer scale. These approaches are for example based on putting geometrical constraints, using small tools in combination with controlled nucleation or mechanical detachment of metal clusters from the tool or by locally charging the electrochemical double layer upon application of short potential pulses. Also first results on electron beam induced metal deposition from a thin electrolyte film will be presented.

Topical Talk O 25.3 Tue 12:00 GER 37

Electrochemical Oxidation and Anodization Lithography on Self-Assembled Monolayers — •Stephanie Hoeppener — Laboratory of Organic and Macromolecular Chemistry, Friedrich-Schiller-University Jena, Germany

The use of Scanning Probe Based lithography techniques dates back shortly after the introduction of SXM techniques. In particular bias mediated chemical oxidation processes can be used to induce changes in the substrate's properties, i.e., the conductivity, topography, etc.

Implementing the bias mediated electrochemical oxidation onto self-assembled monolayers was introduced as an alternative that permits the fabrication of surfaces bearing addressable chemically active functional groups. The research activities in this field will be highlighted.

In particular the fabrication of chemically heterogeneous nanostructures introduces the possibility for a site-selective fictionalization of nanostructures – a challenge which is difficult to establish by common photo- and electron lithographic structuring approaches. Besides of fundamental investigations of the electrochemical oxidation process, illustrative examples of the oxidation pattern modification will be presented with respect to nanofabrication approaches.

Topical Talk O 25.4 Tue 12:30 GER 37

Surface Structuring by Single Pulse Laser Interference: Principles and Applications — •Johannes Boneberg — University of Konstanz

A nanosecond laser pulse is split into several beams. These beams are then overlapped on the sample surface. The resulting interference pattern induces surface modifications. The physical mechanism which lead to surface modification are discussed for thin films and bulk materials. Periods achieved are below 200nm, while the structure sizes could be much smaller. Besides the direct application for the generation of nanostructures, the method can be used as well to generate laterally modified chemical surface structures. These can be utilized in different applications, like the lateral patterning by a sol-gel process.