

Self-assembly of supramolecular architectures on surfaces

Fawad S. Khokhar, Raoul van Gastel and Bene Poelsema

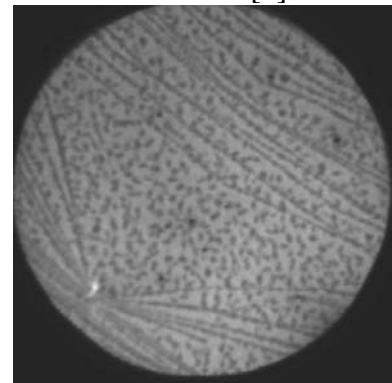
*MESA+ Institute for Nanotechnology, Solid State Physics,
University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands*

The natural alternative to the conventional top down construction is the bottom-up approach, in which nanoscale structures are obtained from their atomic and molecular constituents by self-organised growth [1].

In fabrication of molecular nanoscale structures and patterns, building blocks are linked through different types of relatively weak, non-covalent, interactions (predominantly hydrogen bonds and metal–ligand interactions) to yield organized supramolecular architectures with tailor-made properties [2].

Trimesic acid (TMA) – 1,3,5-benzenetricarboxylic acid – represents a prototype material for supramolecular self-assembly of nanostructures at surfaces. It is a polyfunctional carboxylic acid with three-fold symmetry comprising a phenyl ring and three identical carboxyl end groups in the same plane [3]. A fine balance between surface-molecule interaction and molecule-molecule interaction controls final morphology of TMA based surface nanostructures. TMA molecules are deposited at ambient temperature on the Cu (001) surface. The presence of Cu adatoms on the surface and deprotonation of the carboxyl moieties result in formation of cloverleaf-shaped Cu–TMA coordination structures [3].

Low energy electron microscopy (LEEM) is a unique tool to gain insights into a variety of dynamical processes on surfaces [4]. We used LEEM to study the growth of islands containing nanosize metal–ligand architectures. Inspection and analysis of LEEM real time images/movie reveal the information about dependence of island density on availability of Cu adatoms, island stability, mobility of islands, and existence of mutual interaction at room temperature.



LEEM Image: FOV 2 micron

Getting control over the size of self-assembled nanostructures is a huge challenge for experimentalists.

[1] S. Stepanow, M. Lingenfelder¹, A. Dmitriev, N. Lin, Th. Strunskus, Ch. Wöll, J.V. Barth, K. Kern, Bessy – Highlights (2003).

[2] Johannes V. Barth, Giovanni Costantini and Klaus Kern, Nature, vol 437, 2005.

[3] J.V. Barth, J. Weckesser, N. Lin, A. Dmitriev and K. Kern, Appl. Phys. A 76, 645–652 (2003).

[4] Raymond J. Phaneuf and Andreas K. Schmid, Physics Today, vol 56(2003).