14:45 – 15:10

Self-assembly of TMA on Ag (111); the role of coverage and surface temperature

Mahdi S. Baviloliaei*, Michele Gastaldo, Steffen Kiel and Lars Diekhöner

Department of Physics & Nanotechnology, Aalborg University, Aalborg, Denmark
**)E-Mail: ms@nano.aau.dk*

Molecular self-assembly has been developed as a bottom-up nanofabrication method, using organic molecules and atoms as building blocks to fabricate structures with great precision [1]. Recently, interaction mechanisms such as hydrogen bonding and metal-organic interactions have proven to have the advantages of stability, directionality and also the formed structures are transformable to novel patterns at certain conditions [2]. Trimesic acid (TMA) has previously been studied on different noble metal surfaces [3–5]. On Ag (111) it was found that TMA deposited at room temperature form an open honey-comb network, whereas annealing to 420 K leads to a dense close-packed phase [4].

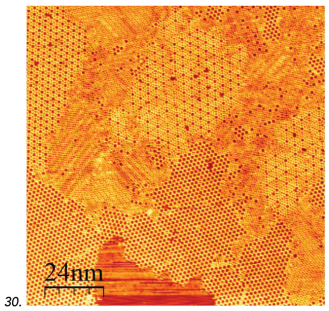

Figure 1 STM images of TMA deposited at room temperature on a Ag (111) single crystal surface. The image size is 120 nm × 120 nm. Several domains of well-ordered structures formed by self-assembly are observed.

We have used a Scanning Tunneling Microscope under ultra-high vacuum conditions to study the self-assembly of TMA on Ag(111) as a function of coverage and surface temperature.

The coverage effect is illustrated in Figure 1. In the lower part of the image the honey-comb phase is seen, whereas other parts of the surface contain domains of denser phases of well-ordered TMA molecules. It is observed that the denser phases are created by successive filling of the open pores in the honey-comb structure. The final saturation structure is completely filling the surface.

We also investigated the effect of surface temperature by annealing the surface from room temperature to 430 K in successive small steps of 25 K. We find a rich variety of structures. The self-assembly of TMA on Ag(111) thus forms long-range ordered networks, where the shape and most likely also the properties depend strongly on both coverage and temperature.

References

[1] Kühnle, A., Current Opinion in Colloid & Interface Science, 2009. 14(2): p. 157–168.
[2] Barth, J.V., G. Costantini, and K. Kern, Nature, 2005. 437(7059): p. 671–679.
[3] Ye, Y., *et al.*, The Journal of Physical Chemistry C, 2007. 111(28): p. 10138–10141.
[4] Payer, D., *et al.*, Chemistry – A European Journal, 2007. 13(14): p. 3900–3906.
[5] Baviloliaei, M.S. and L. Diekhöner, Physical Chemistry Chemical Physics, 2014. 16(23): p. 11265–11269.