Nano-patterning of biological molecules using electron-beam-based lithographic approaches

T. Djenizian, E. Balaur and P. Schmuki

Dept. of Material Science, LKO,
University of Erlangen-Nuremberg,
Martensstr. 7, D-91058 Erlangen, Germany.

Due to the high resolution and the ability to be combined with other microfabrication techniques, electron-beam (e-beam) lithography is one of the most powerful technique employed to pattern surfaces at the nanometer scale. During this work, the feasibility to immobilize DNA in the sub-100 nm range is achieved by e-beam patterning of surfaces. Immobilization of biological molecules on solid surfaces with spatially controlled features at the nanometer scale has deep scientific impacts ranging from nanotechnology to medicine.

Nano-patterning of DNA has been investigated via two e-beam-based lithographic approaches.

The first method is based on the e-beam patterning of chemically modified silicon surfaces [1]. For this, self-assembled monolayers used as subsequent bio-linkers are covalently attached at Si(111) surfaces and then selectively irradiated by a beam of electrons. Thus, the contrast in reactivity of patterned areas can be exploited to chemically attach desired biomolecules at untreated e-beam locations.

The second approach developed in this work is based on the direct functionalization of e-beam-grown carbon-dots. The feasibility to anchor directly and covalently DNA in the sub-100 nm range at patterns written by electron-beam-induced C-deposition technique is demonstrated on a non-derivatized glass microscope.

The selectivity, the lateral resolution as well as the mechanisms of DNA attachment using both approaches will be discussed.

References:

[1] M. J. Lercel, H. G. Craighead, A. N. Parikh, K. Seshadri, and D. L. Allara, *Appl. Phys. Lett.*, **68**, 1504 (1996).