Dr.ir. Niels Tas

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Biography

Niels Tas received his Ph.D. degree from the University of Twente (UT) in April 2000. His Thesis dealt with the design and realization of MEMS linear electrostatic motors, employing walking motion and mechanical leverage. The main results of the thesis work include the invention of the electrostatic “shuffle motor” and modelling and characterization of sliding friction in adhesive rough contacts. From 2000 – 2004 he was a post-doctoral fellow in the BIOS lab-on-a-chip group, UT, working on surface tension effects in nanochannels, like capillary negative pressure and directional bubble injection (“bubble pump”). Also he contributed to the invention of the UT nano-fountain pen. In 2004 he was appointed as assistant professor at the Transducers Science and Technology group. In 2008 Niels Tas was awarded a Vidi-grant which he used to further develop new 3D-nanofabrication techniques with focus on application in advanced scanning probe microscopy. In this application area there is a fruitful collaboration with dr. Edin Sarajlic from SmartTip BV. In 2010 he was appointed associate professor. Since 2014, he is working in the Mesoscale Chemical Systems group at the University of Twente, headed by Prof. dr. Han Gardeniers. In close collaboration with Erwin Berenschot B.Sc., he is focusing on a broad range of applications of innovative 3D-nanofabrication techniques in the fields of nanofluidics, NEMS, nanoelectronics and nanophotonics.

Abstract - Silicon wedge machining for wafer-scale fabrication of functional 3D-nanostructures

Corner lithography is an emerging self-aligned technique for wafer-scale nano-patterning based on simple thin film processing in or on a mold containing sharp corners [1 - 3]. Based on this technique, nano-substructures can be formed on each sharp corner in parallel, and independent on orientation in space. It is therefore a relatively cheap and versatile patterning technique for 3D-nanomachining, in the same “family” of techniques as edge lithography [4].

When thermal oxidation is performed at relative low temperature (typically < 900 °C), a locally thinner layer forms near and around sharp convex corners. Through isotropic HF etching it is thus possible to selectively expose the silicon for example at the apices of {111}-plane defined wedges. This procedure (“convex corner lithography”) has been followed to produce nano-cavities, and high density arrays of sub-20 nm nanogaps [5] at the apices of such wedges. By means of this technique more complicated functional nanostructures can be produced at these apices, in high density arrays and over large substrate areas. Typical application fields include nanofluidics, nanoelectronics, nanophotonics, and NEMS. Some examples will be presented and discussed.