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Lithographically defined Nanochannels aligned In-Plane for Electrochemical Synthesis of Nanowires

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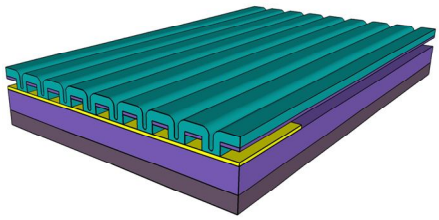
The electrical characterization of single nanowires, synthesized electrochemically by template systems, requires in general a transfer process and implementation in microstructured electrode on planar substrates. After release from the template matrix, nanomanipulation and lithographic processing must be carried out for system-on-chip integration. Creating a local electrical contact to single nanowire or a limited number of nanowires on a micrometer scale is challenging. In this paper a more sophisticated system for the electrochemical synthesis and electrical integration has been developed, where the nanowires are grown using an in-plane nanochannel array in the desired layout. Previously, A.R. Halpern et al. [1] have successfully demonstrated the integration of such a system for nanofluidic devices.

The template structure (schematized below) already incorporates the electrode required for the electrodeposition process of nanowires (yellow layer), whereas additional electrodes can also be added at will for the later characterization. The periodic arrays of rectangular-shaped nanochannels are produced by a combination of Laser Interference Lithography and Atomic Layer Deposition techniques. Highly accurate control of the whole geometry of the nanochannel (spatial distribution, height and width) is achieved by this approach. The template, similar to the porous anodic alumina template, forces unidirectional electrochemical growth, incorporating the advantages of this type of nanowire synthesis processes.



References:

[1] A.R. Halpern, K.C. Donavan, R.M. Penner and R.M. Corn, "Wafer-Scale Fabrication of Nanofluidic Arrays and Networks Using Nanoimprint Lithography and LPNE Gold Nanowire Masters," Analytical Chemistry **84** (11), 5053-5058 (2012);