

NANO HIGHLIGHT

Nanoreactor Processes for Manufacturing Oriented Materials

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The use of templates for nano-wire and nano-filament creation has received a great deal of attention. The common approach based on nano-templates is to use the templates strictly for growth and then etch or dissolve them to release the produced nano-wires. These nano-wires must then be “caught” and directed to their point of use. In this process, the big challenge that must be overcome for mass production of nanowire-based electronics and sensors is that one must be able to align and assemble these nanowires *by design*, not by statistics. Once nano-wires are released from the template, it is very difficult to obtain spatial and orientational control in nanowire assembly as well as electrical contacts at a specific location. In the processes developed here, we do not destroy nanochannel templates after nano-wire synthesis. Instead, we will use the nanochannel template as an assembling unit. One approach is to use it as a

continuous nanowire extruder that produces and lays down nanowires on a substrate in a controlled way (Figure 1a,b).[1] Another approach is to build electrodes into the nanochannel templates so that the electrical devices can be produced without releasing and reassembling nanowires. In other words, when the nanowires are synthesized in the templates the final electrical arrays are completed with electrical contacts and interconnects being already in places. We have developed the full process flow for producing these nanochannel templates with built-in electrical contacts (Figure 1c,d), which is fully convertible to more high-throughput type processing approach such as the step and flash lithography.

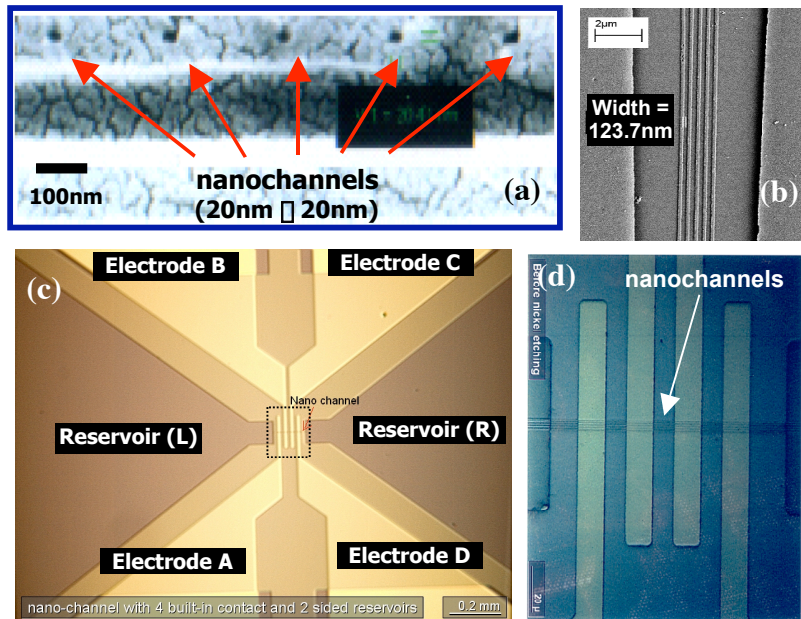


Figure 1. (a) FE-SEM cross-sectional view of the nanochannel reactor array. (b) five parallel PMMA filaments (124nm wide, 20nm thick) produced by polymerization inside nanofabricated channels. (c) Optical micrograph of nano-channels and electrode contact pads. (d) high-magnification view of nanochannels and built-in electrodes.

References:

- [1] C.-Y. Peng, W. J. Nam, S. J. Fonash, B. Gu, A. Sen, K. Strawhecker, S. Natarajan, H. C. Foley, and S. H. Kim.
“Formation of Nanostructured Polymer Filaments In Nano-Channel Reactors” *J. Am. Chem. Soc.* **125**, 9298-9299
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