Reusable templates for the production of nanowires

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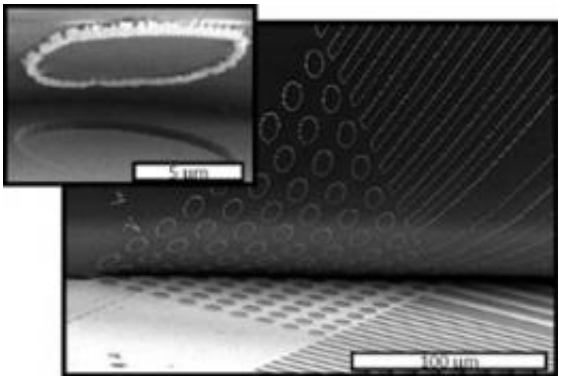

Scanning electron micrograph image showing platinum wires being lifted away from the surface of the UNCD electrode. Inset: Higher magnification image showing a single ring of platinum removed from the UNCD surface.

Scientists from Argonne National Laboratory CNM's Nanofabrication and Electronic and Magnetic Materials and Devices groups, working with users from the University of Wisconsin-Stevenson Point, discovered a fast, simple, scalable technique for solution-based, electrochemical synthesis of patterned metallic and semiconducting nanowires from a reusable, non-sacrificial, ultrananocrystalline diamond (UNCD) template.

The process involves fabrication of wafer-level electrochemical cells consisting of alternating insulating and conducting UNCD thin films.

Unique electrochemical properties of electrically conducting nitrogen incorporated UNCD not only provide a robust electrode platform for electro-deposition of micro/nanowires of various materials, but also facilitate easy peeling-off of deposited micro/nanowires for repeat use.

This bench-top technique is easy and quickly produces patterned nanowires on a large scale with diameters that are not predefined by the template, and do not require vacuum or clean-room processing. This offers a path for studying nanoscale phenomena and allows for process-scale development of a new generation of nanowire-based devices.

More information: D.B. Seley et al., "Electroplate and Lift Lithography for Patterned Micro/Nanowires Using Ultrananocrystalline Diamond (UNCD) as a Reusable Template," *ACS Appl. Mater. Interfaces,* 3(4), 925-930 (2011) DOI: 10.1021/am101226w

Abstract
A fast, simple, scalable technique is described for the controlled, solution-based, electrochemical synthesis of patterned metallic and semiconducting nanowires from reusable, nonsacrificial, ultrananocrystalline diamond (UNCD) templates. This enables the repeated fabrication of arrays of complex patterns of nanowires, potentially made of any electrochemically depositable material. Unlike all other methods of patterning nanowires, this benchtop technique quickly mass-produces patterned nanowires whose diameters are not predefined by the template, without requiring intervening vacuum or clean room processing. This technique opens a pathway for studying nanoscale phenomena with minimal equipment, allowing the process-scale development of a new generation of nanowire-based devices.

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