Lithographically Patterned Nanowire Electrodeposition

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CONTACT

Ben Chu
ben.chu@uci.edu
tel: .



INVENTORS

- Menke, Erik
- Penner, Reginald M.
- Thompson, Michael A.
- Xiang, Chengxiang

OTHER INFORMATION

CATEGORIZED AS

- **Nanotechnology**
  - Materials

RELATED CASES

2007-062-0

BACKGROUND

Electron beam lithography (EBL), invented in the early 70's, provides a means for patterning polycrystalline metal nanowires as small as 20 nm in diameter onto surfaces. The applicability of EBL, however, has been limited to research and development applications because it is a serial patterning technology. In 1990, a parallel version of EBL was developed, but space charge "blurring" has prevented this technique from approaching the resolution of direct-write EBL. By using, as a template, semiconductor surfaces with atomically-defined grooves and troughs, past researchers had prepared sub-10 nm metal nanowires using vapor deposition. Others used a variant of this approach to create high density arrays of linear, 10 nm diameter Pt nanowires. UC Irvine researchers have demonstrated that ensembles of 30 nm antimony nanowires can be prepared by electrochemical step edge decoration on graphite surfaces coupled with etching, but no control of nanowire position on the surface or inter-wire pitch has been possible using this method.

TECHNOLOGY DESCRIPTION

University researchers have developed a technique called Lithographically Patterned Nanowire Electrodeposition (LPNE) as a new method for synthesizing noble metal nanowires on glass or oxidized silicon surfaces.

Nanowire fabrication methods can be classified either as "top down", involving photo- or electron beam lithography, or "bottom-up", involving the synthesis of nanowires from molecular precursors. LPNE combines attributes of photolithography with the versatility of bottom-up electrochemical synthesis. Photolithography is employed to define the position of a sacrificial nickel nanoband electrode that is recessed into a horizontal trench defined by the substrate surface and photoresist. This trench acts as a "nanoform" to define the height of an incipient nanowire during its electrodeposition. The width of the nanowire is determined by the electrodeposition duration. Removal of the photoresist and nickel reveals a nanowire - composed of gold, platinum or palladium - with a rectangular cross section and a height and width that can be independently controlled, down to 20 nm. The polycrystalline nanowires synthesized by LPNE can be continuous for more than 2 cm. These nanowires show a metal-like temperature dependence of their resistance.

APPLICATIONS

This invention can be used for the synthesis of ultra-small nanowires.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,142,984	03/27/2012	2007-062

LEAD INVENTOR

Reginald M. Penner
Professor & Chair, Department of Chemistry
School of Physical Sciences
University of California, Irvine

http://www.faculty.uci.edu/profile.cfm?faculty_id=2040

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Enhanced Cycle Lifetime With Gel Electrolyte For Mn02 Nanowire Capacitors

5270 California Avenue / Irvine,CA
92697-7700 / Tel: 949.824.2683

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