

Some Applications of Nanowires

Nanowires are nanostructures that can be fabricated in many ways; eg, vapor-liquid-solid deposition, electrochemical deposition¹, step-edge growth² and lithographic techniques with many metals, semiconductors and insulators. Their dimensions, electronic properties and chemical composition depend on the method and materials used to fabricate it. Nanowires can be used as a gas sensor when they adsorb analyte gas molecules that supply or demand electrons from the surface changing the resistance of the wire.^{3 4} Owing to the high surface to volume ratio of these structures, nanowires like GaN can be used as photo catalysts where they yield high photocatalytic activity and reusability compared to thin films or micron dot arrays⁵. Use of nanowires in nano-electronics is an emerging field where field effect transistors⁶ and logic gates⁷ are created that would ultimately lead to sub-micron level circuits. By thermal annealing and passivation, performance of silicon nanowire field effect transistors can be enhanced⁸. Furthermore, nanowires have been used in lithium ion batteries anodes⁹ due to their special properties; eg, parallel transport of electrons and immunity to degradation of structure due to volume expansion¹⁰, thus giving high efficiency compared to traditional materials in energy storage devices. In order to increase the efficiency even more, bulk synthesis methods of nanowires have also been investigated¹¹.

Bibliography e

- (1) Maria, B.; Toimil, E.; Buschmann, V.; Dobrev, D.; Neumann, R.; Scholz, R.; Schuchert, I. U.; Vetter, J. Single-Crystalline Copper Nanowires Produced by Electrochemical Deposition in Polymeric Ion Track Membranes. *Adv Mater* **2001**, 62-65.
- (2) Sun, Y.; Cui, H.; Wang, C. X. Step-Edge Induced Ordered Growth: Targeting to Assemble Super Long Horizontal Nanowire Alignment in Large-Scale. *Phys. Chem. Chem. Phys.* **2013**, 15, 11808–11813.
- (3) Wang, G.; Gou, X.; Horvat, J.; Park, J. Facile Synthesis and Characterization of Iron Oxide Semiconductor Nanowires for Gas Sensing Application. *J. Phys.Chem.C.* **2008**, 112, 15220–15225.
- (4) Park, S.; An, S.; Ko, H.; Jin, C.; Lee, C. Synthesis of Nanograined ZnO Nanowires and Their Enhanced Gas Sensing Properties. *ACS Appl. Mater. Interfaces* **2012**, 4, 3650–3656.
- (5) Nanowires, G.; Jung, H. S.; Hong, Y. J.; Li, Y.; Cho, J.; Kim, Y.; Yi, G. Photocatalysis Using GaN Nanowires. *ACS Nano* **2008**, 2, 637–642.
- (6) Field, N.; Sensors, E.; Patolsky, F.; Brian, P. Nanowire - Based Devices in the Life Sciences. *MRS Bulletin* **2007**, 32, 142-149
- (7) Huang, Y.; Duan, X.; Cui, Y.; Lauhon, L. J.; Kim, K. H.; Lieber, C. M. Logic Gates and Computation from Assembled Nanowire Building Blocks. *Science* **2001**, 294, 1313–1317.
- (8) Cui, Y.; Zhong, Z.; Wang, D.; Wang, W. U.; Lieber, C. M. High Performance Silicon Nanowire Field Effect Transistors. *Nano Lett.* **2003**, 3, 149–152.
- (9) Bandaru, P. R.; Pichanusakorn, P. An Outline of the Synthesis and Properties of Silicon Nanowires. *Semicond. Sci. Technol.* **2010**, 25, 024003.
- (10) Chan, C. K.; Peng, H.; Liu, G.; McIlwrath, K.; Zhang, X. F.; Huggins, R. a; Cui, Y. High-Performance Lithium Battery Anodes Using Silicon Nanowires. *Nat. Nanotechnol.* **2008**, 3, 31–35.
- (11) Chen, H.; Xu, J.; Chen, P.-C.; Fang, X.; Qiu, J.; Fu, Y.; Zhou, C. Bulk Synthesis of Crystalline and Crystalline Core/amorphous Shell Silicon Nanowires and Their Application for Energy Storage. *ACS Nano* **2011**, 5, 8383–8390.