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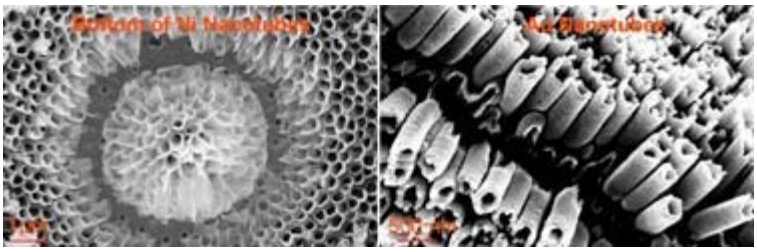
LAB TALK

Nov 19, 2009

Short metallic nanotubes made simple

There appears to be no shortage of potential applications for high aspect ratio metallic nanostructures such as nanowires, nanorods and nanotubes. Examples include chemical sensing, bioseparation, magnetic data storage, battery electrodes and drug delivery.



Short metallic nanotubes

Template-based electrochemical synthesis has been widely used to produce these metallic nanostructures. Commercially available filtration membranes such as anodic aluminum oxide (AAO) and polycarbonate track etch membranes have commonly been used as hard templates for this purpose.

The process usually involves sputtering or vacuum evaporating a thick metal film onto one side of the membrane to block the pores and serve as the working electrode for the subsequent electrodeposition. Nanowires or nanorods form as the pores in the membranes become filled with the deposited material.

Template-based synthesis revisited

Researchers at the University of Texas at Arlington, US, have revisited the template-based electrochemical synthesis route by closely examining early stage electrodeposition inside the pores. They found that a well defined short tubular structure was formed at this point in the process.

The scientists showed that during the deposition of the metal electrode for AAO membranes, the electrode metal diffused into the pores and was deposited on the pore walls, which leads to preferential electrodeposition of metal on the walls and therefore forms metal tubes. They used this phenomenon to fabricate short nanotubes by carefully controlling electrodeposition conditions.

Testing the process on different metals

According to the team, this straightforward synthesis approach could be used for any electroplatable materials to form nanoscale tubular structures. Using this simple method, a much wider range of metal nanotubes can be obtained in a large quantity. The group has produced short tubular structures from a variety of metals including Au, Co, Fe, Ni, and Zn.

Short metallic tubes are desirable for many applications. For example, by using nanotubes instead of nanorods for magnetic data storage, developers can achieve much smaller magnetostatic interactions between each data bits. The researchers compared the magnetostatic interactions between short Ni nanorods and nanotubes. A simple magnetic hysteresis measurement revealed a large reduction in the interaction for nanotubes, and this property alone could be used to distinguish nanotubes from nanorods.

The researchers presented their work in the journal *Nanotechnology*.

About the author

The work was performed at the University of Texas at Arlington (UTA) and supported by the Research Enhancement Program at UTA. Chienwen Huang is a PhD student studying Materials Science at UTA. Prof. Hao is an assistant professor in the Department of Materials Science and Engineering at UTA.