

## One-Dimensional Nanostructures for Energy and Electronics Applications

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One-dimensional nanostructures such as nanowires and nanotubes are expected to have tremendous potential applications in next-generation energy and electronic devices. Our laboratory has carried out extensive work on synthesis and characterization of one-dimensional nanostructures of the type GaN nanowires and titania nanotube arrays.

In the case of GaN nanowires, we have used a simple, scalable chemical vapor deposition process to demonstrate GaN nanowires in unique morphologies such as epitaxial nanowires in the cubic zinc blende structure with superior optical properties and serrated nanowires in wurtzite structure with enhanced effective surface area. While the epitaxial nanowires have direct application in nanoelectronic and optical devices, the serrated nanowires with their unique morphology and large effective surface area will have tremendous applications in sensors and lighting devices and p-n junction solar cells.

Extensive research has also been carried out in our lab on the inexpensive and large-scale electrochemical synthesis of titania nanotube arrays. The nanotubes may be produced in the form of arrays (either free-standing or attached to Ti) or bundles or even single nanotubes. Due to remarkable properties such as high effective surface area and desirable current carrying capacity, the nanotubes have numerous applications in energy such as in photoanodes for cost-effective, third generation photovoltaic systems such as sensitized solar cells, portable photovoltaic devices, automobile/building integrated photovoltaics; photocatalytic applications such as in the production of hydrogen; and as robust supports for catalysts for chemical conversion applications such as CO to CO<sub>2</sub>. More recently, our laboratory has been exploring commercialization venues for the titania nanotubes in high-performance filtration applications of relevance to the energy industry such as in oil-water separation, processed water treatment, etc.