One-Dimensional Heterostructures Based Nanodevices

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Nanotechnology has been rapidly evolved from passive nanostructures where nanostructures with steady structures and functions often used as parts of a product to active nanostructures which change their properties during use. Starting around 2010, it is anticipated that researchers will cultivate expertise with systems of nanostructures, directing large numbers of intricate components to specified needs.

One dimensional (1-D) nanostructures such as nanowires and nanotubes are extremely attractive building blocks for next generation devices because of their high surface to volume ratio and unique size dependent properties. In addition, their extremely high aspect ratio offers researchers the potentials to build axial or radial heterostructures to integrate multiple functionality from intrinsic properties of the material or through interfacial phenomena. Spatial manipulation and the ability to assemble and position nanostructures in a controlled manner so they are registered to define spaces is also a critical step toward scalable integration in high density nanodevices. In this presentation, a generalized template directed electrodeposition with ancillary assembly, contact will be presented to synthesize axial and radial heterostructures in cost-effective matter and these individual nanostructures will be applied to spintronics, gas and biological sensors and thermoelectrics.

Keywords: Nanowire, Nanotube, Nanodevice

Microfluidic Devices for Cell Analysis

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Microfluidics and BioMEMS technology has increasingly been used as a tool for studying small volumes of tissue and even individual cells. One of the most important benefits of microfluidic technology is the potential to build devices that analyze and sort mammalian cells. The "sorting problem" typically requires that a few cells be selected and isolated from a larger population of hundreds, thousands or even millions of other cells. For example, cancer tumor cells may reside among a large population of healthy cells, but it would be of great interest to identify, isolate and study only the cancer cells. In another application, one may want to determine the number of white blood cells within a sample of blood. We have developed microfluidic devices that enable researchers to select cells from a population by a variety of methods, including antibody staining, dielectrophoretic selection, and physical size selection. These devices have applications in cancer research where cancer cells must be identified from normal tissue, but where only small samples of tissue are available. In this talk, we will present some of our microfluidic cell sorting devices, discuss their physical principles, and their use in biological applications.

Keywords: bio-MEMS, microfluidic devices, sorting cell, biological application