

MRSEC SEMINAR SERIES

“Perfectly Ordered Si-based Hybrid Nanostructured Arrays”



Hybrid nanostructures consist of two or more nanostructures that allow the significant property enhancement for individual nano-components. Recently, the ability to produce hybrid nanostructures has been of growing interest worldwide. Due to the difficulty of control during their fabrication, most available hybrid nanostructures, at present, are generally arranged in a random order leading to significant degeneration of performance in comparison with perfectly-ordered hybrid nanostructures. Thus, it is reasonable that there have been very few reports of methods on the fabrication of ordered hybrid nanostructures. Notwithstanding, these methods require mask/template and involve a fairly complex procedure during the fabrication although the production of the ordered non-hybrid nanostructures has been well established.

In this talk, I will present two special Si-based ordered hybrid nanostructured arrays in terms of their fabrication and properties including gas sensing and photocurrent response. One is a unique hybrid nanonipple structure, consisting of a nanoneedle with a small nanodot sitting on the top. The sharp tip of the nanonipples with a small radius, for instance, is an ideal design of field ionizer for gas sensing. The measurements show that the nanonipple gas sensor not only is capable of differentiating the type of gas but also has a high sensitivity of resolving the gas quantity with a small breakdown applied voltage. Ordered ZnO/Si nano-heterojunction is the other hybrid nanostructured array, where ZnO nanorods are grown on top of ordered Si (p-type) nano-needles. Each nano-heterojunction is examined to be a p-n junction and shows better diode characteristic after heat treatment. A number of such individual nano-heterojunctions that are perfectly arranged across the Si substrate surfaces can provide a building block to fabricate various types of optoelectronic nanodevices, such as photovoltaic solar cells and light emitting diodes with significantly enhanced properties.

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