INTEGRATED NOVEL NANOSTRUCTURES AND MATERIALS FOR FLEXIBLE AND HIGH-PERFORMANCE DEVICES

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Abstract

Materials made of nano/micro-structures have unique physical properties, such as fast carrier transport, high surface-to-volume ratio, mechanical flexibility, sub-wavelength optical waveguiding, *etc*. These intriguing properties can be harnessed for a variety of applications in electronics and photonics. In the past, we have fabricated an assortment of arrayed nanostructures consist of nanowires, nanopillars, nanocones, etc., using a variety of materials from inorganic semiconductors to organometal perovskite materials. These nanomaterials can be fabricated with chemical vapor deposition method and/or printable method with scalability. The optical properties of these nanostructures have been systematically investigated and the mechanism of light trapping was revealed. Meanwhile, the materials have been fabricated into various electronic devices, including sensors, light emitting diode and solar cells. The study has shown that three-dimensionally (3-D) arrayed nanostructures can help to improve device performance as well as the flexibility. However, proper structural optimization is not trivial. Particularly, using printable method and template guided growth method, semiconductor nanowires have been fabricated into planar arrays and 3-D arrays for photodetectors. Overall, the nanostructure integration methodology that we developed may enable many applications on electronics and optoelectronics in the future.

Brief Biography

Dr. Zhiyong Fan received his B. S. and M. S. degrees in Materials Science from Fudan University, Shanghai, China, in 1998 and 2001. He received Ph.D. degree from University of California, Irvine in 2006 in Materials