Hindawi Publishing Corporation
Journal of Nanomaterials
Volume 2013, Article ID 414193, 2 pages
http://dx.doi.org/10.1155/2013/414193

Editorial

Functional Nanomaterials for Optoelectric Conversion and Energy Storage

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Received 27 March 2013; Accepted 27 March 2013

The rapid increase in industrialization, urbanization, and population growth has led to a pronounced rise in the global energy demands [1–4]. With depleting fossil fuels and growing concern on environmental protection, urgent research efforts are needed to find alternative energy resources that are efficient and economically and ecologically friendly. Since energy resources such as solar power are intermittent, but the usage is increasing in numerous portable electronic devices, efficient means have to be found for energy storage and transportation. A number of electronic, photonic, and optoelectronic devices have been proposed for this purpose, such as photovoltaic solar cells, batteries, supercapacitors, field effect transistors, fuel cells, thermoelectric, thermal-photo catalysts, and luminescence display devices.

The main purpose of this special issue is to use advanced nanomaterials and nanotechnologies in designing systems for an efficient interconversion of different energy forms among thermal, photonics, and electrical energy. Graphene, carbon nanotube, and conducting polymer may represent the most studied materials where the nanoscale design permits their more efficient performance in a number of energy conversion and storage devices. All devices dealing with conversion of energy forms and storage were considered for this special issue.

The energy crisis is evident from the fact that the global energy consumption has been accelerating at an alarming rate due to the rapid economic expansion worldwide, increase in world population, and ever-increasing human reliance on energy-based appliances. By 2050, advanced technologies for both optoelectric conversion (e.g., solar cells) and energy storage (e.g., supercapacitors and batteries) are being extensively studied around the world. Functional nanomaterials have opened up new fields in materials science and engineering to meet this challenge. In particular, nanomaterials and nanotechnologies have been demonstrated to be an enabling technology for creating high-performance optoelectric conversion and energy storage devices. Like all other devices, performance of the energy-related devices depends strongly on the properties of the materials they employ. Recent development in materials science, particularly carbon nanomaterials, has facilitated the research and development of energy technologies as (shown in the works by Y. Luo et al. and L. Li et al.). Comparing to conventional energy materials, carbon nanomaterials possess some unusual size-surface-dependent (e.g., morphological, electrical, optical, and mechanical) properties useful in enhancing energy conversion and storage performance. Specifically, considerable efforts have been made to utilize the unique properties of carbon nanotubes (CNTs) and graphene as optoelectric conversion materials. Tremendous progress has been achieved in developing carbon nanomaterials for high-performance optoelectric-conversion and energy storage devices. The special issue was focused on the progress in the research and development of carbon nanomaterials during the past twenty years or so. The

advanced energy conversion (i.e., solar cells) and storage (i.e., supercapacitors and batteries) was also discussed along with some challenges and perspectives in this exciting field.

The other functional nanomaterials are also published in this special issue besides graphene, carbon nanotube, and conducting polymer. It mainly focuses on preparations, characterizations, functionalizations, and properties of nanoparticles, nanostructured coatings, films, membranes, nanoporous materials, and nanocomposites. The fundamental understanding of the mechanisms on materials and processes at nanoscale was highlighted.

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