Extended Abstract

Asia Pacific Nano Congress 2017: Nanomaterials for third generation sensitized solar cells -Basma El Zein - University of Business and Technology

Abstract

Nano-materials are considered as building block for several optoelectronic devices. They differ from bulk counterpart within the size, characteristic and offer new opportunities to be used in various applications. Zero dimensional (0D) and one dimensional (1D) nanostructures have attracted many attentions in solar power harvesting, conversion and storage, due to their unique physical and chemical properties. Nano-materials offer many advantages in energy adjustment precisely in solar cells. These solar cells, depends on the physical interaction between nanomaterials or reaction at the surface or interface of the nanomaterials. In this presentation, we'll discuss the zero- and one-dimensional nanostructures and therefore the role they play in increasing the conversion efficiency of solar cells, taking in consideration the materials to be wont to meet the most objective of developing an eco-green photovoltaic cell with high conversion efficiency. Reducing cost and improving conversion efficiency are the foremost tasks so on form photovoltaic energy competitive and prepared to substitute traditional fossil energies. Nanotechnology seems to be the way by which photovoltaics are often developed, whether in inorganic or organic solar cells.

Wide-bandgap nanostructured materials prepared from II–VI and III–V elements are attracting an increased attention for his or her potential applications in emerging energy. They can be prepared in different geometric shapes, including nanowires (NWs), nanobelts, nano springs, nano combs, and nano pagodas. Variations within the atom arrangements so as to attenuate the electrostatic energy originated from the constant on the polar surface are liable for a good range of nanostructures. The need to supply renewable energy with low cost is indispensable in making the dream of avoiding undue reliance on non-renewable energy a reality. The emergence of a third-generation photovoltaic technology that is still in the infant stage gives hope for such a dream. Solar cells sensitized by dyes, quantum dots and perovskites are considered to be third-generation technological devices. This research focuses on the event of suitable and reliable sensitizers to widen electromagnetic (EM) wave absorption and to form sure stability of the photovoltaic system. This article discusses the basic principles and the progress in sensitized photovoltaics. Absorption of light, generation of charges carriers (electrons and holes), the separation of the electrons from holes and their transport to electrodes, are the sequence of events of solar energy conversion. Different nanostructures are employed within the structure of solar cells, to enhance its efficiency with simple manufacturing process and low cost. Zero dimensional nanostructures have gained interest because of their unique properties especially tuning their band gap supported their size and multiple exciton generation.
One dimensional nanostructure is promising for PV devices due to several advantages. They offer large area, high optical absorption across a broad spectrum,

direct path for charge transport and high charge collection efficiency. Graphene has recently emerged as an alternative to ITO substrate as an electrode in solar cells structure. With its remarkable electrical, physical and chemical properties, and high degree of flexibility and transparency; it's considered as an ideal candidate for flexible 3rd generation solar cells, the graphene solar cells an eco- green technology is going to an equivalent level of ITO based solar cells. This presentation is about presenting a versatile quantum dots sensitized solar with graphene electrode. The large scarcity of natural fuels in earth crust has triggered to search alternative energy reservoirs for the future generation of human life. Because of large abundancy, solar power is taken into account as big hope for the longer-term generation energy utilization for commercial also as home applications. The scientific revolution achieved in synthesis and processing of semiconductor nanomaterials; organic conducting polymers have led into new dimension in fabrication of future-generation solar cells. Reduction within the dimension of semiconductor nanomaterials significantly influences on their structural and optical properties which is useful for the superb photon harvesting. Also, their large area is further favourable to help with the attachment of several organic or inorganic compounds so as to functionalize them effectively.

Developments that are made in semiconducting organic polymers still encourage the fabrication of highly efficient, flexible solar cell devices on conducting substrates.Formation of nanocomposites, hybrids, alloy system, doping, etc. are successfully carried out on different kinds of inorganic semiconductor nanomaterials for the photovoltaic applications. The day-by-day improvement in terms of efficiency and new materials development predicts that the breakthrough to understand highly stable, high-efficiency solar cell is about the near future. In this aspect, it summarizes the event within the solar cells research of every category with general aspects. The important parameters and process that affects the performance of each category is outlined. To date, the development of nanotechnology has launched new ways to design efficient solar cells. Strategies have been employed to develop nano structures architecture of semiconductors, metals and polymers for solar cells. Motivated by the objective of developing an eco-green and highly efficient solar cell; Nanowire based quantum dots sensitized solar cells is presented in the book. The design of the solar cell, the nano structures and the material selections have been also illustrated. Zinc Oxide Nanowires were selected as n-type semiconductors to trap the sunshine and capture the photo-generated charges to move them quickly to the electrodes. Furthermore, Lead Sulphide quantum dots (QDs) decorating the synthesized NWs, will absorb lighter due to the tunability of the QDs size and increase the electron -hole pairs generation to achieve higher efficiency. The different ZnO NWs growth techniques by vapor deposition specifically by pulsed laser deposition are presented in this book in addition to the in-situ and ex-situ growth techniques of the PbS QDs. A demo of the Solar cell prototype, and recommendations on improving its efficiency is also revealed. Harnessing the daylight incident on earth with inexpensive and efficient solar cells is one among the foremost important challenges of the twenty-first century. Solar cells made using nanostructured materials (e.g., nanoparticles and nanowires) are being investigated round the world to deal with this challenge.

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