Editorial

Heterojunction Solar Cells

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With endless energy demand and climate change issue, solar cells which convert sun light directly into electricity are becoming increasingly important in the world's renewable energy mix. The development of new solar cell technologies with lower production costs is therefore of great interest to industry. New and prospective materials are under intensive research in order to create low cost and highly efficient photovoltaic devices based on various organic, hybrid organic-inorganic, and inorganic heterojunctions. Heterojunction solar cells possess a combination of unique properties of different materials that helps to improve their operational characteristics comparing with traditional homojunction silicon solar cells.

In this special issue, we selected 6 peer-reviewed research articles which present the recent developments in various types of heterojunction solar cells, including organic bulk-heterojunction solar cells, dye/quantum dot sensitized solar cells, hybrid organic-inorganic solar cells, and inorganic heterojunction solar cells. A broad range of topics, from material synthesis and thin film deposition technique to device architecture, are discussed in this special issue. A brief overview of each paper highlighting the key result and discovery is as follows.

In the paper “*Design of a free-ruthenium In_2S_3 crystalline photosensitized solar cell*,” a new sulfide-based solid state sensitizer was assessed as a potential replacement for traditional Ru-based dyes. The morphology of In_2S_3 on TiO_2 films was investigated and the role of its concentration on the overall conversion efficiency of DSCs was discussed.

The paper “*Nanopatterned silicon substrate use in heterojunction thin film solar cells made by magnetron sputtering*” proposed a method for the fabrication of novel nanopatterned silicon heterojunction thin film solar cells ITO/p-type a-Si:H/n-type c-Si. The nanopatterned silicon wafers with a self-assembled monolayer of SiO_2 nanospheres 550 nm in diameter were used in order to achieve 31.49% higher efficiency comparing to that of heterojunction solar cells based on planar silicon substrates.

In “*Doped heterojunction used in quantum dot sensitized solar cell*,” quantum dot sensitized solar cells with indium-doped PbS/CdS QDs forming In-PbS/In-CdS heterojunction were presented by successive ionic layer adsorption and reaction method. Such an incorporation results in the light harvesting of heterojunction, leading to enhanced device performance.

In “*Excellent silicon surface passivation achieved by industrial inductively coupled plasma deposited hydrogenated intrinsic amorphous silicon suboxide*,” authors present an alternative method of depositing a high-quality passivation film for silicon solar cells. The deposition of hydrogenated intrinsic amorphous silicon suboxide was accomplished by decomposing hydrogen, silane, and carbon dioxide in an industrial remote inductively coupled plasma platform. Through the precise control of CO_2 partial pressure and process temperature, excellent surface passivation quality and optical properties were achieved.

In the paper “*Ultrathin anode buffer layer for enhancing performance of polymer solar cells*,” an enhanced polymer

solar cell was achieved by adding an ultrathin layer of lithium fluoride in between PEDOT:PSS and polymer active layer. The dominant mechanism for performance improvement was explained as the increased charge collection by anode buffer layers.

In the paper “*The promotion of the efficiency of organic photovoltaic devices by addition of anisotropic CdSe nanocrystals*,” CdSe nanocrystals with different morphologies such as tetrapod and nanorod were synthesized by seed growth method and applied as the acceptor in the active layer of the organic photovoltaic (OPV) devices. When the concentration of CdSe in P3HT: PCBM system is 50 wt% optimally, the efficiency can be promoted about 4.3%.

We do believe that the collection of papers from multidisciplinary areas will benefit the community of heterojunction solar cell research for the further development of this research area.

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