Front. Optoelectron. 2018, 11(4): 315–316
https://doi.org/10.1007/s12200-018-0856-3

EDITORIAL

A special issue on *Optoelectronics for Energy*

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Optoelectronics is based on the quantum mechanical effects of light on electronic materials, especially semiconductors, sometimes in the presence of electric field. Solar cell, light emitting diodes, photodetectors and fiber lasers all belong to optoelectronics devices. For these devices, the semiconductor electrode interface and materials play a vital role in improving charge carrier separation, transport and recombination pathways. Solar energy is an important clean, renewable and abundant source to meet the sustainable development of human society. In comparison to the conventional fluorescent devices, the discovery of phosphorescent organic light-emitting diodes (OLEDs) is a major breakthrough. Nowadays, OLED and LED could complement each other with their own advantages and meet different commercial requirements. It is our intention to bring the research community's attention to these above mentioned hot topics. In this Special Issue on "*Optoelectronics for Energy*", 2 review articles and 7 research articles focusing on relevant subjects are specially presented.

In the review articles, Prof. Ming-Qiang Zhu from Wuhan National Laboratory for Optoelectronics (WNLO) reviewed the current research progress on the structure, properties and applications of the diarylethene based photochromicaggregation induced emission (AIE) materials and points out some existing problems so as to promote subsequent development of this field in the future. Dr. Xiaofan Zhang talked about the basic principles and the development of scanning electrochemical microscopy (SECM), and chiefly introduced the recent advances in photoelectrochemical (PEC) cells including solar cells and PEC water splitting studied by SECM. These advances include rapid screening of photocatalysts, interfacial reaction kinetics and quantitation of reaction intermediates, which is significant for evaluating the performance, choosing catalysts and developing novel composite photoelectrodes and high efficiency devices. Finally, they briefly described the development trends of SECM in energy research.

In the research field related to solar cells, two research paper are presented. Prof. Guoli Tu designed and synthesized an ether chain functionalized fullerene derivatives [6,6]-phenyl-C_{61}-butyricacid-(3,5-bis(2-(2-ethoxyethoxy) ethoxy)phenyl)-methyl ester (C_{60}-2EPM) to modify zinc oxide (ZnO) in inverted structure organic solar cells (OSCs). By introducing the C_{60}-2EPM layer, the composited fullerene derivatives tune energy alignment and accelerated the electronic transfer, leading to increased photocurrent and power conversion efficiency (PCE) in the inverted OSCs. An research paper employing an antibiotic and antimicrobial compound of 1-(o-Tolyl) biguanide (oTb) to dope the electron transport material of phenyl-C_{61}-butyric acid methyl ester (PCBM) is also presented by Prof. Yinhua Zhou from WNLO, reporting that the oTb doping can significantly enhance the fill factor of the perovskite solar cells with the structure of glass/ITO/NiO_x/$MAPbI_3$/(oTb)PCBM/(PEIE)/Ag. In addition, Prof. Yan Shen from WNLO reported on a novel BiOI/WO_3 composite photoanode and the enhanced photoelectrochemical acticity of BiOI/WO_3 for water splitting could be attributed to the expansion of light absorption range as well as the facilitated separation of photo-generated carriers.

There are another two research work, one focusing on OLED, the other is focusing on luminescence. OLED consume less power and have larger fields of view than conventional LCDs and have shown many competitive applications in the market. In the paper indicated by Prof. Lei Wang from WNLO, a series of 1,2,4-thiadiazole core-based bipolar materials were developed as the host matrixes for the deep red phosphorescent emitters. And they

Received September 28, 2018

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found that a symmetrical charge-trapping effect contributed to realizing a stable charge-balance. Related to luminescence, Prof. Haifeng Bao from Wuhan Textile University reported that a disorderly nanostructured CdSe nano-agglomerates (NAs) with tunable emission are synthesized and the collective energy state based on Anderson localization was studied.

For fibers, Yb-doped fiber lasers and amplifiers have been rapidly developed and widely applied in many fields. In this issue, Dr. Haiqing Li from WNLO explored the influence of Ce ions on photo-darkening behavior in Yb-Al co-doped silica fibers at room and elevated temperatures and found that Ce co-doping in Yb/Al fiber also decreased the heat-induced loss. For photodiodes, InP/InGaAs separate absorption grading charge multiplication avalanche photodiodes (SAGCM APDs) have been widely applied in optical communication systems. Prof. Yanli Zhao from WNLO investigated the breakdown voltage and bandwidth of InP/InGaAs APD in the range between −50°C and 100°C and found that the temperature dependent dead space theory proposed by them was more consistent with the measurements, compared to the previous empirical formula.

I would like to thank all the authors for their excellent contribution to this special issue. We hope the readers will find them interesting and inspiring.

Yan Shen received her Ph.D. degree from the Changchun Institute of Applied Chemistry, Chinese Academy of Sciences in 2003. From 2004 to 2006, she was an Alexander von Humboldt Fellow and Hanse-Wissenschaftskolleg (HWK) fellow successively in the group of Prof. Gunther Wittstock at the University of Oldenburg. She became a professor at Harbin Institute of Technology in 2009. Currently, she works as a professor at Wuhan National Laboratory for Optoelectronics. Her research interests include electrochemistry related to energy conversion and storage, photoelectrochemical water splitting, and investigation of local reactions at solid-liquid interfaces.