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Editorial

Inorganic Nanocrystal Solar Cells

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1. Introduction

In recent decades, global electricity consumption has rapidly increased, and worldwide electricity demand is expected to follow the same trend. However, currently, electricity is largely produced from fossil fuels, including coal, natural gas, and petroleum, which are considered the cause of carbon emissions and climate changes. Thus, renewable energy technology is the best method to mitigate climate change, as energy can be generated without causing carbon dioxide emissions.

Solar cells (or photovoltaics) are considered one of the most promising renewable energy technologies in the face of the rising electricity demand and climate changes. So far, the current solar cell technology is striving to reach the theoretical limit efficiency through the development of various light-absorbing materials, high-efficiency technologies with a large area, and a high stability with the consideration of commercialization. Therefore, this Special Issue covers the latest advances in the research field of inorganic nanocrystal solar cells, focusing on a broad range of topics from thin film solar cells to building-integrated PV technologies.

2. A Short Review of the Contributions in This Issue

Solhee Lee et al. [1] obtained successful results from an analysis of a potential-induced degradation phenomenon in CIGS thin-film solar cells, using a variety of characterization techniques such as light current–voltage, dark current–voltage, external quantum efficiency, and capacitance–voltage measurement systems. Based on these approaches, these authors suggested that the main cause of PID in CIGS is the variation in bulk doping concentration, and the built-in potential formed at the junction of CIGS solar cells. Thus, it is promising that this analysis of PID in CIGS solar cells will be helpful in facilitating the commercialization of CIGS thin-film solar cells.

Seung Hoon Lee et al. [2] demonstrated detailed methods and results from an analysis of CIS solar cells, which are prepared by unique and advanced technology, the metal-organic chemical vapor deposition (MOCVD) method. Additionally, these authors demonstrated the use of highly efficient CIS solar cells without applying a buffer layer, achieving a 7.39% power conversion efficiency. The approaches used to analyze then MOCVD-prepared buffer-less CIS solar cells include XRD, SEM, EDS, SIMS, EBIC, and illuminated current-voltage measurements. Furthermore, the authors exhibited the successful fabrication of sub-modules, which showed a high potential for applications in the commercial mass production of the suggested solar cells.

Additionally, although not focusing on solar cells, one study on bifunctional electrocatalysts was conducted by Seung-hoon Kim et al. [3] Electrocatalysts are as important as oxygen electrodes, constituting one of the core elements of hydrogen fuel cells and metal-air batteries. Moreover, this research is important as these types of renewable energy technologies can potentially be integrated with other sustainable technologies, such as solar cells, enabling fully sustainable and renewable energy production cycles without any

Citation: Park, H. Inorganic Nanocrystal Solar Cells. *Energies* **2022**, *15*, 5450. https://doi.org/10.3390/en15155450

Received: 19 July 2022
Accepted: 27 July 2022
Published: 27 July 2022

carbon emissions. This study conducted by Seung-hoon Kim et al. focused on electrochemical reactions, such as an oxygen evolution reaction (OER) and oxygen reduction reaction (ORR). Based on theoretical calculations, the authors confirmed that the key factors for improving the catalytic performance of OER/ORR bifunctional catalysts are compressive strain and ligand effects.

Young-Su Kim et al. [4] present a detailed study on the manufacturing of power-efficient building-integrated photovoltaic (BIPV) modules to achieve zero-energy buildings. In this research article, the authors not only conducted simulations to optimize the design of color PV modules but also fabricated these PV modules based on their optimized design through the simulation. The experimental results show that module output power increases via an increase in pattern angle and lens space, while the aesthetic functionality decreases. This study shows the promises of color BIPV technologies by providing methods to optimize the module output power and analyze the behavior of the realized module according to such variables.

3. Conclusions

In conclusion, the articles in this Special Issue show the latest progress achieved in renewable energy technologies, especially regarding solar cells. There is no doubt that these articles [1–4] present exciting and significant research results, as well as make contributions to renewable energy research fields, allowing us to take another step toward achieving a zero-carbon society.

Funding: This work was conducted under the framework of the Research and Development Program of the Korea Institute of Energy Research (KIER) (C0-2401-01). This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT). (NRF-2020R1A2C1011815). This work was supported by "Human Resources Program in Energy Technology" of the Korea Institute of Energy Technology Evaluation and Planning (KETEP), granted financial resource from the Ministry of Trade, Industry & Energy, Republic of Korea. (No. 20204010600470). This work was also supported by the KU-KIST Graduate School Project.

Conflicts of Interest: The author declares no conflict of interest.

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