International Journal of Photoenergy

Hindawi

Special Issue on

Chalcogenide Semiconductors Based Thin-Film Solar Cell

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Photovoltaic (PV) electricity generation presents the most promising renewable energy solution in order to resolve the energy crisis. The solar cells can meet the rising energy demand by harvesting electrical energy from an unlimited source, solar energy. However, the high production cost of Si-based PV technology has imposed a barrier for the replacement of petroleum-based technology. Therefore, it is urgent to develop low-cost PV technology to ensure that these solar technologies are cost-competitive.

Thin-film based PV is a cost-effective fabrication technology. Thin-film PV devices based on chalcogenide semiconductors, such as Cu(In,Ga)(S,Se)2, (CIGSSe), Cu2ZnSn(S,Se)4, and (CZTSSe), have attracted much attention due to their promising optoelectronic properties and their economic fabrication approach. These materials have demonstrated promising device efficiency by passivating the defect in the absorber layer, bandgap engineering, and tailoring the interfacial carrier transport layers. Moreover, ternary and binary compound semiconductors such as Cu2SnS3 (CTS), SnS, FeS2, CuS, Sb2S3, and so on are also being explored as an absorber layer for applications in thin-film solar cells. Similarly, solar cell materials containing nontoxic constituents are also equally important in order to ensure that they do not carry any negative effects to health. We have to consider a cost-effective fabrication approach, as well as the abundance and toxicity of the constituents in solar cell materials.

In addition, it is imperative to understand the material growth, film quality, and photophysical properties such as absorption spectra, photoluminescence, electroluminescence, and carrier life time of these solar cell materials in order to optimize the material properties. Further investigations on the device characteristics and optoelectronic properties such as the evaluation of defect states, trap centers, carrier profiles, and recombination barrier of the device pave the way for improvements in the device performance. Moreover, the carrier transport layers such as buffer layer, window layer, and transparent conductive oxide (TCO) layers are also important for optimal band alignment and efficient carrier transport.

This special issue aims to collate original research and review articles focused on topics within the scope of the chalcogenide semiconductor-based PV devices such as fabrication approaches, fundamental properties, device characterization, and novel device structure.

Potential topics include but are not limited to the following:

- Growth of chalcogenide semiconductors (CIGSSe, CZTSSe, CZGSSe, SnS, FeS2, CuS, etc.)
- Fundamental properties of chalcogenide semiconductors
- Thin-film PV device fabrication and optoelectronic characterization
- Thin-film PV devices with various buffer, window, and transparent conductive oxides layers

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Papers are published upon acceptance, regardless of the Special Issue publication date.

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Submission Deadline
Friday, 14 February 2020

Publication Date
July 2020