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EDITORIAL

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Editorial

Editorial for 'special issue on advanced solar cell technology'

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As part of a worldwide trend toward renewable forms of electricity, solar cells are an important class of optical device owing to their ability to convert at-times abundant incident solar power to usable electric power. And while the use of solar cells to provide electricity is still in its nascent stages, accounting for approximately 1.5% of worldwide electricity demand, the rate at which solar is being installed continues to increase each year, meaning that fraction is poised to continue to increase. Allowing for that continued fractional increase are gains in efficiency and stability that are a direct result of continued research in all aspects of the solar installation, from materials to devices to systems. In fact, no part of the solar installation is stagnating, as new milestones continue to be reached, be it a new record for crystalline silicon solar cells, to the advent of new materials for solar cells such as metal halide perovskites, or advances in manufacturing that continue to allow for reductions in cost that are so critical to driving large scale adoption of solar cell technology.

At the core of many aspects of solar cell research, from the optimization of power conversion efficiency to the study of stability issues, is gaining a better understanding of the ways in which the materials that make up solar cells or modules interact with light. And the materials-space is vast. For example, transparent conducting electrodes may be composed of highly doped transition metal oxides, thin metal films, metal nanowire networks, or carbon-based materials such as graphene. As active absorbing materials, options include bulk crystalline semiconductors such as Si or GaAs, as well as thin film semiconductors such as CdTe, copper indium gallium diselenide (CIGS), thin film Si, conjugated molecules, quantum dots, or metal halide perovskites. Finally, ancillary materials such as substrates, encapsulants, and interconnects, must also be compatible with the processing and lifetime of a solar cell.

The articles in this special issue all contribute important aspects of the field of solar cell research, and cover many of the topics mentioned above. In particular, they cover the following variety of topics:

- Light trapping and manipulation (Cho *et al* 2016, Krc *et al* 2016, Lee *et al* 2016, MacQueen *et al* 2016, Miller *et al* 2016, Barugkin *et al* 2017).
- Multijunction solar cells (Albrecht *et al* 2016, Krc *et al* 2016, Tamayo *et al* 2016).
- Luminescent solar concentrators (MacQueen *et al* 2016).
- Concepts for achieving efficiencies beyond single junction thermodynamic limits with either hot carrier (Dimmock *et al* 2016) or intermediate band (Krishna and Krich 2016) solar cells.
- CIGS solar cells (Löckinger *et al* 2016, Barugkin *et al* 2017).
- Quantum dot solar cells (Miller *et al* 2016).
- Thin film silicon solar cells (Krc *et al* 2016, Barugkin *et al* 2017).
- Metal halide perovskite solar cells (Albrecht *et al* 2016).
- Crystalline silicon solar cells (Albrecht *et al* 2016, Kowalczewski *et al* 2016, Barugkin *et al* 2017).
- Organic solar cells (Cho *et al* 2016, Linderl *et al* 2016, Barugkin *et al* 2017).

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Albrecht S, Saliba M, Correa-Baena J-P, Jager K, Korte L, Hagfeldt A, Gratzel M and Rech B 2016 Towards optical optimization of planar monolithic perovskite/silicon-heterojunction tandem solar cells *J. Opt.* **18** 64012

Barugkin C, Beck F J and Catchpole K R 2017 Diffuse reflectors for improving light management in solar cells: a review and outlook *J. Opt.* **19** 14001

Cho C, Jeong S and Lee J-Y 2016 Optical study of thin-film photovoltaic cells with apparent optical path length *J. Opt.* **18** 94001

Dimmock J A R, Kauer M, Smith K, Liu H, Stavrinou P N and Ekins-Daukes N J 2016 Optoelectronic characterization of carrier extraction in a hot carrier photovoltaic cell structure *J. Opt.* **18** 74003

Kowalczewski P, Redorici L, Bozzola A and Andreani L C 2016 Silicon solar cells reaching the efficiency limits: from simple to complex modelling *J. Opt.* **18** 54001

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Miller C W, Fu Y and Lopez R 2016 Enhancing energy absorption in quantum dot solar cells via periodic light-trapping microstructures *J. Opt.* **18** 94002

Tamayo R E E, Hoshii T, Tamaki R, Watanabe K, Sugiyama M, Okada Y and Miyano K 2016 Maskless fabrication of broadband antireflection nanostructures on glass surfaces *J. Opt.* **18** 64008