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Introduction

The third Thin Film Solar Technology conference was held this year at the SPIE Solar Energy + Technology symposium, and the strong program with stimulating talks from various areas in the field ensured a well-attended and successful event. The conference included speakers from leading academic institutions, government laboratories, and the industry.

This volume features contributions from scientists and engineers in the general area of Thin Film Solar Technology, with special emphasis on Thin Film Photovoltaics (TF PV). Thin film solar technologies are a compelling alternative to conventional crystalline silicon solar technologies because they offer a cost reduction potential, driven mainly by the need for a lower amount of material, as well as the possibility of monolithic integration. It is important to note however that silicon pricing has continued to drop dramatically this year, challenging TF PV manufacturers to further improve the efficiency and reduce the cost of their modules. As a result, this year has seen a shake-out in the TF PV space, resulting in the last few companies in each technology area standing, as well as significant consolidation activity through mergers and acquisitions. The PV industry came out of this period of change stronger.

To illustrate the breadth of topics covered in this conference, we mention just a few of the papers presented in each session. The first session dealt with epitaxial film crystal silicon. Chaz Teplin from the National Renewable Energy Laboratory (NREL) presented a talk on the progress and challenges in low-temperature, high-rate epitaxy for film silicon photovoltaics, which offer low cost potential at high efficiency, as they eliminate the wafer that accounts for a substantial part of the cost of a conventional crystalline Si module, and they can deliver high efficiency to maintain low area-related (BOS, installation) system costs. The second session focused on copper zinc tin sulfide (CZTS). Dongho Lee et al. from the University of Buffalo described the fabrication of CZTS solar cells using spray chemical vapor deposition, and Mowafak Al-Jassim et al. from NREL presented a talk on probing the defect physics of CZTS by luminescence spectrum imaging.

The third session dealt with CIGS photovoltaic devices and modules. Rommel Noufi of NREL gave an overview of the potential, challenges, and opportunities of thin film CIGS solar cells, and Peter Hersh et al. from HelioVolt Corporation and NREL described the use of solution-based precursors in conjunction with rapid thermal processing for the production of high-quality hybrid CIGS. The fourth session covered the emerging field of photonic and plasmonic light management in photovoltaics. Prof. Shanhui Fan et al. from Stanford University gave an overview talk on the field of nanophotonic light management in solar cells, and Prof. Eric Schiff et al. from Syracuse University and United Solar Ovonic

(UniSolar) presented a talk on plasmonic effects and light-trapping in thin-film photovoltaics.

The fifth session focused on the characterization and measurement of solar cells and modules. Prof. Jim Sites from Colorado State University presented an overview talk on the measurement and analysis of non-uniformities in CdTe solar cells, and Karl-Anders Weiss et al. from the Fraunhofer-Institut für Solare Energiesysteme, Germany, described correction methods and stabilization of outdoor measurements of thin film modules. The sixth session dealt with amorphous, nanostructured, and textured photovoltaics. Thomas Gennett et al. from NREL gave a talk on the use of ALD versus sputtering for the deposition of conductive conformal thin film coatings for textured PV. The seventh session covered novel thin film photovoltaic devices. Susanna Thon from Prof. Ted Sargent's group at the University of Toronto presented a talk on recent breakthroughs in the field of colloidal quantum dot photovoltaics, where low-temperature solution-processed quantum dots of the same material but different sizes are used to achieve tunability for efficient photon harvesting over a wide band of the solar spectrum, providing a simple and low-cost path to high-efficiency tandem and triple-junction cells.

The eighth session dealt with thin film PV cost and the progress toward grid parity. Louay Eldada of SunEdison gave an overview of the factors impacting the LCOE (levelized cost of electricity) related to the leading thin film PV technologies (CdTe, CIGS, a-Si) and compared the costs of electricity from these technologies to those of electricity from incumbent PV technologies (multicrystalline and monocrystalline silicon), and Bulent Basol of EncoreSolar described the application of electrochemical deposition techniques to thin film solar cell processing. Finally, the last session of the conference, the ninth session, focused on PV module patterning and packaging. Stefano Buratin et al. from Università degli Studi di Padova, Italy, discussed laser-induced localized strain and ultrafast absorption in the ablation of thin film solar cells, and Harmen Rooms from TNO Science and Industry, the Netherlands, described a technology for a PV module multilayer front-sheet with tuned color appearance.

Although this volume cannot include all the recent important work in the vast field of thin film solar technologies, it does cover a significant cross section of the advances happening globally, and it provides a roadmap for this fast-growing and exciting field by presenting the cutting-edge work and the visions of leading experts who are actively inventing the future.

Louay Eldada