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Reliability of Photovoltaic Cells, Modules, Components, and Systems IV

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Editors

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Introduction

The efficiencies and production volumes of photovoltaic (PV) modules are increasing and their cost is reducing making them increasingly more attractive for residential, commercial and utility scale operations. However, their reliability and durability must be ensured over useful lifetime of 25-30 years so as to achieve grid parity without subsidy.

Reliability of Photovoltaic Cells, Modules, Components, and Systems IV Conference as part of the SPIE Solar Energy + Technology Meeting followed on the successful organization of The Reliability of PV Modules Conferences during the SPIE 2008-2010 Optics and Photonics events. This Conference provided a useful platform to PV scientists and engineers from various companies, national laboratories, and universities to discuss their research.

Thirty-eight abstracts were received and were included in the Program. Thirty two presentations were made and manuscripts were received. All were reviewed by at least two reviewers. A total of 29 manuscripts are being published in the printed Proceedings. Two other manuscripts could not be revised in time for the Proceeding in Print.

The conference was divided into one plenary session, eight oral sessions, and one poster session extending over a four-day period from 22–25 August 2011. The Plenary Session included a very interesting presentation on Solar energy grid integration systems. Session one, titled CPV-PV Reliability was a Joint Session with Conference 8108 included interesting presentation on Field performance of concentrix CPV systems; glass strength measurements for concentrator photovoltaic (CPV) mirrors; durability of PV materials; and comparison of PMMA and silicone-on-glass, etc. Session two on Reliability and Stability of Organic Photovoltaics was a Joint Session with Conference 8116. It had interesting presentations on bulk-heterojunction solar cells with stable morphology; degradation in unencapsulated organic photovoltaics; using photothermal deflection spectroscopy; Efficient polymer-based OPV with 7-year lifetime; Luminescence imaging and defect investigations.

The all important issue PV Module Reliability in session three included a bold assessment on factors needed to be improved for array models to correctly predict "real-world" performance; and presentations on Accelerated aging tests of PV grounding connections; Correlation between mechanical properties and microstructure of copper-ribbons; heavy soiling and power output; Antistatic coating for avoiding soiling; and crack development and growth.

Sessions four and five, titled Encapsulant/Backsheets/Glass I and II included an invited talk on standards for PV packaging materials and presentations on

Polymeric component qualification; Effect of stabilization compounds; optimizing energy balance; edge sealing with getter; and ionomer encapsulants.

Session six entitled Measurements and Modeling included an invited presentation on Interlaboratory comparison of UV-light sources; Reliability evaluation using accelerated degradation models; UV-accelerated test; and Optical and opto-electronic equipment.

Long Term/Outdoor Testing of PV Modules was discussed in Session seven. It had an interesting invited presentation on volunteer effort to provide assistance to analyze PVRessQ!": a research activity on testing reliability of PV systems installed by small-scale consumers in Japan; and presentations on Failure modes effects and criticality analysis; lessons learned from a 400 in India; Normalization technique; grid-tied photovoltaic modules; and Fire hazard of PV systems.

Sessions eight on Reliability of Thin Film PV Modules had very interesting presentations on Long-term performance analysis of CIGS thin film PV modules; Metastable behavior of the electrical characteristics of CIGS photovoltaic modules; Automated shading for cell-level failure detection; detection of damp heat susceptibility of $CuInGaSe_2$ solar cell components; and the effect of growth temperature on CdTe solar cell reliability.

As part of this conference a short course on design and reliability of photovoltaic modules was offered. As usual the course attendance was amongst the top 10%. The focus of the tutorial was on various packaging configurations, application of concepts of physics of failure to PV systems with several examples, development of accelerated tests for various technologies, and the application of this knowledge in development of new products and technologies.

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