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

**Neelkanth G. Dhere
John H. Wohlgemuth
Kevin Lynn**
Editors

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Contents

vii	Conference Committee
ix	Introduction

SESSION 1 RELIABILITY OF ORGANIC SOLAR CELLS: JOINT SESSION WITH CONFERENCE 7777

- 7773 02 **Considerations for low cost, reliable, and durable packaging for flexible PV modules** [7773-01]
N. G. Dhere, Univ. of Central Florida (United States)

SESSION 2 RELIABILITY OF CPV: JOINT SESSION WITH CONFERENCE 7769

- 7773 03 **Durability of poly(methyl methacrylate) lenses used in concentrating photovoltaic modules** [7773-02]
D. C. Miller, L. M. Gedvilas, B. To, C. E. Kennedy, S. R. Kurtz, National Renewable Energy Lab. (United States)
- 7773 04 **Optical design for reliability and efficiency in concentrating photovoltaics** [7773-03]
R. Leutz, H. P. Annen, L. Fu, Concentrator Optics GmbH (Germany)

SESSION 3 PV MODULE RELIABILITY

- 7773 05 **Temperatures of building applied photovoltaic (BAPV) modules: air gap effects** [7773-04]
J. Oh, G. Tamizhmani, Arizona State Univ. (United States); E. Palomino, Salt River Project (United States)
- 7773 06 **Photovoltaic system lifetime prediction using Petri networks method** [7773-05]
R. Laronde, A. Charki, D. Bigaud, LASQUO Lab. (France); P. Excoffier, GINGER CEBTP (France)
- 7773 07 **Measuring and simulation of water vapour permeation into PV modules under different climatic conditions** [7773-06]
P. Hülsmann, M. Jäger, K.-A. Weiss, M. Köhl, Fraunhofer Institute for Solar Energy Systems (Germany)
- 7773 08 **Characterization of PV modules by combining results of mechanical and electrical analysis methods** [7773-07]
M. Sander, Fraunhofer Ctr. for Silicon Photovoltaics (Germany) and Fraunhofer Institute for Mechanics of Materials (Germany); B. Henke, Fraunhofer Ctr. for Silicon Photovoltaics (Germany) and Martin-Luther-Univ. Halle-Wittenberg (Germany); H. Schwarz, S. Dietrich, Fraunhofer Ctr. for Silicon Photovoltaics (Germany); S. Schweizer, Fraunhofer Ctr. for Silicon Photovoltaics (Germany) and Martin-Luther-Univ. Halle-Wittenberg (Germany); M. Ebert, J. Bagdahn, Fraunhofer Ctr. for Silicon Photovoltaics (Germany)
- 7773 09 **Solar panel installation configurations for optimum system performance** [7773-08]
A. R. Jha, JHA Technical Consulting Services (United States)

- 7773 0A **Thermoreflectance and multimode imaging for defect location in silicon solar cells** [7773-09]
L. Domash, Alenas Imaging Inc. (United States); K. McCarthy, Alenas Imaging Inc. (United States) and Mount Holyoke College (United States); Q. Zhou, Alenas Imaging Inc. (United States) and Univ. of California, Santa Cruz (United States); K. Al-Hemyari, X. Hu, Mount Holyoke College (United States); J. Hudgings, Alenas Imaging Inc. (United States) and Mount Holyoke College (United States)

SESSION 4 ENCAPSULANT/BACKSHEETS/GLASS

- 7773 0B **Analysis of the glass-clear PVB lamination foil interface of thin film laminates** [7773-10]
J. Günster, S. Krull, F. Rakusa, F. Roth, I. Sinicco, Oerlikon Solar Ltd. (Switzerland)
- 7773 0D **Accelerated indoor durability testing of polymeric photovoltaic encapsulation materials** [7773-12]
G. Oreski, Polymer Competence Ctr. Leoben GmbH (Austria)
- 7773 0E **Lateral distribution of the degradation of encapsulants after different damp-heat exposure times investigated by Raman spectroscopy** [7773-13]
C. Peike, T. Kaltenbach, M. Köhl, K.-A. Weiß, Fraunhofer Institute for Solar Energy Systems (Germany)
- 7773 0F **Mechanical and thermomechanical assessment of encapsulated solar cells by finite-element-simulation** [7773-14]
S. Dietrich, M. Pander, M. Sander, S. H. Schulze, M. Ebert, Fraunhofer Ctr. for Silicon Photovoltaics (Germany)

SESSION 5 MEASUREMENTS FOR CPV: JOINT SESSION WITH CONFERENCE 7769

- 7773 0G **Comparison of direct normal irradiance derived from silicon and thermopile global hemispherical radiation detectors (Invited Paper)** [7773-15]
D. R. Myers, National Renewable Energy Lab. (United States)
- 7773 0H **Evaluating calibrations of normal incident pyrheliometers** [7773-16]
F. Vignola, F. Lin, Univ. of Oregon (United States)

SESSION 6 LONG TERM/OUTDOOR TESTING OF PV MODULES

- 7773 0I **PV module degradation caused by thermomechanical stress: real impacts of outdoor weathering versus accelerated testing in the laboratory (Invited Paper)** [7773-17]
W. Herrmann, N. Bogdanski, F. Reil, TÜV Rheinland Group (Germany); M. Köhl, K.-A. Weiss, M. Assmus, M. Heck, Fraunhofer Institute for Solar Energy Systems (Germany)
- 7773 0J **Degradation of photovoltaic modules under high voltage stress in the field** [7773-18]
J. A. del Cueto, S. R. Rummel, National Renewable Energy Lab. (United States)

- 7773 OL **Results of 3 years' PV module weathering in various open-air climates** [7773-20]
N. Bogdanski, W. Herrmann, F. Reil, TÜV Rheinland Group (Germany); M. Köhl, K.-A. Weiss, M. Heck, Fraunhofer Institute for Solar Energy Systems (Germany)

SESSION 7 RELIABILITY OF THIN FILM PV MODULES I

- 7773 ON **Effect of hysteresis on measurements of thin-film cell performance** [7773-23]
D. S. Albin, J. A. del Cueto, National Renewable Energy Lab. (United States)
- 7773 OO **Leakage current and performance loss of thin film solar modules** [7773-24]
M. Gossia, T. Hölker, S. Krull, F. Rakusa, F. Roth, I. Sinicco, Oerlikon Solar Ltd. (Switzerland)

SESSION 8 RELIABILITY OF THIN FILM PV MODULES II

- 7773 OQ **Preliminary damp-heat stability studies of encapsulated CIGS solar cells** [7773-26]
R. Sundaramoorthy, F. J. Pern, T. Gessert, National Renewable Energy Lab. (United States)
- 7773 OR **Variations in damp heat-induced degradation behavior of sputtered ZnO window layer for CIGS solar cells** [7773-27]
F. J. Pern, B. To, S. H. Glick, R. Sundaramoorthy, C. DeHart, S. Glynn, C. Perkins, L. Mansfield, T. Gessert, National Renewable Energy Lab. (United States)
- 7773 OS **Approaches to improving energy yield from PV modules** [7773-28]
J. Jaus, M. Duell, J. Eckert, F. O. Adurodija, B. Li, R. A. Mickiewicz, D. M. Doble, Fraunhofer Ctr. for Sustainable Energy Systems (United States)

SESSION 9 MEASUREMENTS/MODELING

- 7773 OT **Validating an operational physical method to compute surface radiation from geostationary satellites** [7773-29]
M. Sengupta, National Renewable Energy Lab. (United States); A. Heidinger, National Oceanic and Atmospheric Administration (United States); S. Miller, Colorado State Univ. (United States)
- 7773 OU **CCD fiber optic spectrometer for the measurement of spectral irradiance** [7773-30]
J. U. Morley, L. J. B. McArthur, D. Halliwell, Environment Canada (Canada); Y. Poissant, S. Pelland, Natural Resources Canada (Canada)
- 7773 OV **Correlations for a Mediterranean cloud cover model** [7773-31]
A. Spena, G. D'Angiolini, C. Strati, Univ. degli Studi di Roma Tor Vergata (Italy)
- 7773 OW **A data processing algorithm for the perforated shadow band incorporating a ray trace model of pyranometer exposure** [7773-32]
M. J. Brooks, L. W. Roberts, Univ. of KwaZulu-Natal (South Africa)

POSTER SESSION

- 7773 0X **Performance of a new type of module based on back-contact solar cells** [7773-33]
J. Govaerts, J. Robbelein, C. Gong, B. J. Pawlak, M. Gonzalez, IMEC (Belgium); I. De Wolf, IMEC (Belgium) and Katholieke Univ. Leuven (Belgium); F. Bossuyt, S. Van Put, Univ. Gent (Belgium); I. Gordon, K. Baert, IMEC (Belgium); J. Vanfleteren, Univ. Gent (Belgium)
- 7773 10 **Characteristics of power-enhancement coating for photovoltaic modules** [7773-36]
J. Hirose, H. Takanohashi, S. Ogawa, ASAHI Kasei E-Materials Corp. (Japan)
- 7773 11 **Glass-encapsulant interface characterization following temperature and humidity exposure** [7773-37]
K. Stika, R. Smith, D. Swartzfager, D. Huang, D. Davidson, J. Marsh, R. Agostinelli, J. Wyre, D. Brill, R. Senigo, E.I. DuPont de Nemours & Co., Inc. (United States)
- 7773 12 **Thermal cycling induced load on copper-ribbons in crystalline photovoltaic modules** [7773-38]
R. Meier, F. Kraemer, S. Wiese, Fraunhofer Ctr. for Silicon Photovoltaics (Germany); K.-J. Wolter, Technische Univ. Dresden (Germany); J. Bagdahn, Fraunhofer Ctr. for Silicon Photovoltaics (Germany)
- 7773 13 **Influence of TiO₂ particles on PVB foils used in silicon based thin film photovoltaic modules** [7773-40]
I. Sinicco, M. Gossia, S. Krull, F. Rakusa, F. Roth, Oerlikon Solar Ltd. (Switzerland)
- 7773 14 **Accuracy of silicon versus thermopile radiometers for daily and monthly integrated total hemispherical solar radiation** [7773-41]
T. L. Stoffel, D. R. Myers, National Renewable Energy Lab. (United States)
- 7773 15 **Benchmarking concentrating photovoltaic systems** [7773-42]
F. Duerr, B. Muthirayan, Y. Meuret, H. Thienpont, Vrije Univ. Brussel (Belgium)

Author Index

Conference Committee

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Session Chairs

- 1 Reliability of Organic Solar Cells: Joint Session with Conference 7777
Samuel Graham, Georgia Institute of Technology (United States)

- 2 Reliability of CPV: Joint Session with Conference 7769
Raed A. Sherif, eSolar Inc. (United States)
- 3 PV Module Reliability
F. John Pern, National Renewable Energy Laboratory (United States)
- 4 Encapsulant/Backsheets/Glass
Glenn B. Alers, University of California, Santa Cruz (United States)
- 5 Measurements for CPV: Joint Session with Conference 7769
Takuya Doi, National Institute of Advanced Industrial Science and Technology (Japan)
- 6 Long Term/Outdoor Testing of PV Modules
Jennifer E. Granata, Sandia National Laboratories (United States)
- 7 Reliability of Thin Film PV Modules I
David S. Albin, National Renewable Energy Laboratory (United States)
- 8 Reliability of Thin Film PV Modules II
Jennifer E. Granata, Sandia National Laboratories (United States)
- 9 Measurements/Modeling
Ivan Sinicco, Oerlikon Solar Ltd. (Switzerland)

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 a useful lifetime of 25–30 years so as to achieve economic viability.

Reliability of Photovoltaic Cells, Modules, Components, and Systems III conference as part of the SPIE Solar Energy + Technology symposium followed on the successful organization of the Reliability of PV Modules conferences during the SPIE 2008 and SPIE 2009 Optics + 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-nine papers were presented and thirty-four papers were published for this conference. The conference was divided into one plenary session, nine oral sessions, and one poster session extending over a four-day period from 2–5 August 2010.

Session one on Reliability of Organic Solar Cells was a joint session with conference 7777. It had interesting presentations on lifetime and stability of organic solar cells and considerations for low cost, reliable, and durable packaging. The session included a panel discussion on low cost packaging for flexible cells.

One of the talks during the plenary session by Kent Whitfield titled “Thin-Film Photovoltaic Module Reliability and Durability Issues” discussed the current status of thin-film PV reliability and ways to improve it further.

Session two on Reliability of Concentrated Photovoltaics was a joint session with conference 7769. It discussed optical design for reliability and efficiency in concentrating PV, thermal management materials, and lens durability.

The all important issue of Reliability of PV Modules was discussed in session three. It included interesting presentations on characterization by mechanical, electrical, thermoreflectance and multimodal imaging techniques and water vapor permeation measurements, temperature of building integrated PV modules, and system lifetime prediction.

Session four, titled Encapsulant/Backsheets/Glass included presentations on study of glass-lamination foil interface, influence of back sheet materials, accelerated testing by using mechanical and thermomechanical assessment, and Raman spectroscopy.

Session five on Measurements for CPV was another joint session with conference 7769. It included presentations on comparison and calibration of direct normal irradiance by different detectors.

Long Term/Outdoor Testing of PV Modules was discussed in session six. It had interesting presentations on degradation caused by thermomechanical stress, high voltage bias, and weathering in various climates as well as investigation of the degradation by luminescence, electroluminescence, and differential I-V analysis.

Sessions seven and eight on Reliability of Thin Film PV Modules had very interesting presentations on leakage current effects, damp heat-induced degradation, ultra acceleration factors, chemical stabilization, and improving energy yield.

Session nine discussed Measurements and Modeling. It had interesting presentations on computation of surface radiation using geostationary satellites, cloud cover model, and data filtering algorithm for ray trace model of pyranometer.

As part of this conference a short course on design and reliability of photovoltaic modules was offered. The course was well attended and appreciated by the attendees. 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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