# PROCEEDINGS OF SPIE

# Physics, Simulation, and Photonic Engineering of Photovoltaic Devices XIII

Alexandre Freundlich Stéphane Collin Karin Hinzer Ian R. Sellers Editors

29–30 January 2024 San Francisco, California, United States

Sponsored and Published by SPIE

Volume 12881

Proceedings of SPIE 0277-786X, V. 12881

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Physics, Simulation, and Photonic Engineering of Photovoltaic Devices XIII, edited by Alexandre Freundlich, Stéphane Collin, Karin Hinzer, Ian R. Sellers, Proc. of SPIE Vol. 12881, 1288101 · © 2024 SPIE · 0277-786X · doi: 10.1117/12.3029928

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings: Author(s), "Title of Paper," in *Physics, Simulation, and Photonic Engineering of Photovoltaic Devices XIII*, edited by Alexandre Freundlich, Stéphane Collin, Karin Hinzer, Ian R. Sellers, Proc. of SPIE 12881, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510670228

ISBN: 9781510670235 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2024 Society of Photo-Optical Instrumentation Engineers (SPIE).

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.



**Paper Numbering:** A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

## **Contents**

v Conference Committee

	NEW CONCEPTS AND APPROACHES IN PHOTOVOLTAICS I
12881 02	Toward high-throughput deposition of III-V materials and devices using halide vapor phase epitaxy (Invited Paper) [12881-1]
	MULTI-JUNCTION DEVICES AND LIGHT MANAGEMENT
12881 03	Advancing solar energy conversion efficiency to 47.6% and exploring the spectral versatility of III-V photonic power converters (Invited Paper) [12881-36]
	ADVANCED CHARACTERIZATION
12881 04	Antimony selenide solar cells: non-ideal deep level response and study of trap-filling transients [12881-13]
	NEW CONCEPTS AND APPROACHES IN PHOTOVOLTAICS II
12881 05	Simulating quantum dot intermediate band solar cells by enhanced semiclassical model (Invited Paper) [12881-15]
12881 06	Drift-diffusion-reaction and machine learning modeling of Cu diffusion in CdTe solar cells (Invited Paper) [12881-16]
	PHYSICS AND APPLICATIONS OF PEROVSKITES SOLAR CELLS
12881 07	Semitransparent perovskite solar cells for Si tandem and agrivoltaic integration [12881-25]
	PHOTOVOLTAIC POWER CONVERTERS
12881 08	Design and characterization of multijunction photovoltaic devices for optical wireless power transmission [12881-28]

12881 09 Optical wireless power transmission using CIGS solar cells [12881-29]

#### **POSTER SESSION**

Solar cell position, attitude determination by differential absorption imaging in optical wireless power transmission [12881-33]

### **Conference Committee**

#### Symposium Chairs

**Ulrich T. Schwarz**, Technische Universität Chemnitz (Germany) **Karin Hinzer**, University of Ottawa (Canada)

#### Symposium Co-chairs

Sonia M. García-Blanco, Universiteit Twente (Netherlands)
Bernd Witzigmann, Friedrich-Alexander-Universität Erlangen-Nürnberg (Germany)

#### **Program Track Chairs**

**James G. Grote**, Photonics Engineering Consultant (United States) **Shibin Jiang**, AdValue Photonics, Inc. (United States)

#### Conference Chairs

Alexandre Freundlich, University of Houston (United States)
Stéphane Collin, Centre de Nanosciences et de Nanotechnologies
(France)

Karin Hinzer, University of Ottawa (Canada)

#### Conference Co-chair

lan R. Sellers, University at Buffalo (United States)

#### Conference Program Committee

Urs Aeberhard, ETH Zurich (Switzerland) and FLUXiM AG (Switzerland)
Mariana Bertoni, Arizona State University (United States)
Abderraouf Boucherif, Université de Sherbrooke (Canada)
Gavin C. Conibeer, The University of New South Wales (Australia)
Olivier Durand, Fonctions Optiques pour les Technologies de l'information (France)

**Jean-François Guillemoles**, Institut Photovoltaïque d'Ile-de-France (France) and NextPV LIA (Japan)

**Oliver Höhn**, Fraunhofer-Institut für Solare Energiesysteme ISE (Germany)

Seth M. Hubbard, Rochester Institute of Technology (United States)
 Marina S. Leite, University of California, Davis (United States)
 Laurent Lombez, Laboratoire de Physique et Chimie des Nano-objets (France)

Masakazu Sugiyama, The University of Tokyo (Japan) Samuel D. Stranks, University of Cambridge (United Kingdom)