
Photovoltaics for the 21st Century 6

Editors:

M. Tao

The University of Texas
Arlington, Texas, USA

C. Claeys

imec
Leuven, Belgium

J. Fenton

Florida Solar Energy Center
Cocoa, Florida, USA

K. Rajeshwar

The University of Texas
Arlington, Texas, USA

P. Chang

Northrop Grumman
Los Angeles, California, USA

L. Deligianni

IBM T.J. Watson Research Center
Yorktown Heights, New York, USA

K. Kakimoto

Kyushu University
Fukuoka, Japan

M. Sunkara

University of Louisville
Louisville, Kentucky, USA

Sponsoring Divisions:

**Energy Technology****Industrial Electrochemistry and Electrochemical Engineering****Electrodeposition****Dielectric Science & Technology**

Published by

The Electrochemical Society65 South Main Street, Building D
Pennington, NJ 08534-2839, USA

tel 609 737 1902

fax 609 737 2743

www.electrochem.org

ecs transactions™**Vol. 33, No. 17**

Copyright 2011 by The Electrochemical Society.
All rights reserved.

This book has been registered with Copyright Clearance Center.
For further information, please contact the Copyright Clearance Center,
Salem, Massachusetts.

Published by:

The Electrochemical Society
65 South Main Street
Pennington, New Jersey 08534-2839, USA

Telephone 609.737.1902
Fax 609.737.2743
e-mail: ecs@electrochem.org
Web: www.electrochem.org

ISSN 1938-6737 (online)
ISSN 1938-5862 (print)
ISSN 2151-2051 (cd-rom)

ISBN 978-1-56677-873-2 (PDF)
ISBN 978-1-60768-223-3 (Softcover)

Printed in the United States of America.

Table of Contents

Preface

iii

**Chapter 1
Cross-Cutting Issues**

Natural Resource Limitations to Terawatt Solar Cell Deployment <i>C. Tao, J. Jiang, and M. Tao</i>	3
Yttrium-Doped Zinc Oxide as a Terawatt-Scale Transparent Conducting Oxide <i>M. Tao and X. Han</i>	13

**Chapter 2
Si Cells**

Crack Propagation in Large Diameter PV Silicon <i>P. K. Kulshreshtha, I. T. Witting, K. Youssef, E. Good, and G. Rozgonyi</i>	25
Mono-Crystalline Silicon Solar Cell Optimization and Modeling <i>J. Huang and V. Moroz</i>	33
Electrochemical Etching of Zinc Oxide for Silicon Thin Film Solar Cell Applications <i>S. E. Pust, J. Worbs, J. Hülpkes, S. O. Klemm, and K. J. Mayrhofer</i>	41
Recovery of Light Induced Degradation of Micromorph Solar Cells by Reverse Bias <i>H. Sun, W. Chen, T. Cheng, Y. Yang, C. Liu, and H. Shih</i>	57
Effects of Microwave Power on Thermal Annealing Behaviors of Hydrogenated Amorphous Silicon <i>P. Wu, I. Chen, C. Lee, J. Chang, T. Li, and C. Su</i>	65
On the Electrical Characterization of Grain Boundaries in Multicrystalline Silicon <i>J. Chen, E. Cornagliotti, E. Hieckmann, S. Behrendt, J. Weber, E. Simoen, and J. Poortmans</i>	71

Plasmon Effect in Si Solar Cells Coated with a Thin Polymer Film Containing Silver or Gold Nanoparticles <i>Y. Tanaka, H. Hachimura, T. Mishima, and M. Ihara</i>	81
--	----

Chapter 3 Non-Si Cells

Porous Germanium Layers by Electrochemical Etching for Layer Transfer Processes of High-Efficiency Multi-Junction Solar Cells <i>E. Garralaga Rojas, J. Hensen, J. Carstensen, H. Föll, and R. Brendel</i>	95
The Circle-Grid Electrode on Concentrated GaAs Solar Cells Efficiency <i>C. Chung, H. Yu, L. Hsu, C. Kuo, N. Quan, Y. Chiu, and E. Chang</i>	103
Syntheses of Fluorene/Carbazole-Thienothiadiazole Copolymers for Organic Photovoltaics <i>D. Výprachtický, I. Kmínek, P. Pavlačková, and V. Cimrová</i>	111
Low-Band Gap Donor-Acceptor Copolymers Containing Thienothiadiazole Units for Photovoltaics <i>V. Cimrová, I. Kmínek, P. Pavlačková, and D. Výprachtický</i>	119
Corrosion Resistance of Metallic Substrates for the Fabrication Dye-Sensitized Solar Cells <i>G. J. Reynolds, T. M. Watson, G. Williams, and D. Worsley</i>	129
Peptide Nucleic Acids in Dye-Sensitized Solar Cells - Functional Component, and Structural Component to Immobilize Silver Nanoparticles <i>N. Loew, S. Ikenouchi, and M. Ihara</i>	139
Ultrafast TiO ₂ Sintering of Metal Mounted Dye-Sensitized Solar Cells <i>T. M. Watson, I. Mabbett, and D. Worsley</i>	151
Electrochemical Characterization of the Dye-Sensitized Solar Cells <i>S. Ha, M. Ramanathan, V. Ramani, and J. Prakash</i>	159
STEP (Solar Thermal Electrochemical Production) of Energetic Molecules: A Synergy of Photovoltaics and Solar Thermal to Form a New, Higher Efficiency Solar Energy Process <i>S. Licht</i>	169
ZnO Buffer Layers and Nanowires Electrodeposition for Extremely Thin Absorber Solar Cells <i>S. Sanchez, R. Salazar, C. Lévy-Clément, and V. Ivanova</i>	183

Photoluminescence Characterization and Passivation of CIGS Absorber <i>T. Cheng, W. Hsu, C. Huang, J. Lu, J. Chen, and C. Liu</i>	191
Estimation of Organic Tandem Solar Cell Power Conversion Efficiency via Optical Simulation Methods <i>P. M. Boland, K. Foe, D. Gu, H. Baumgart, K. Lee, and G. Namkoong</i>	199
Author Index	207