

TABLE OF CONTENTS

Preface	iii
<u>PHOTOVOLTAICS FOR THE 21ST CENTURY</u>	1
Baseline Evaluation of Thin-Film Amorphous Silicon, Copper Indium Diselenide, and Cadmium Telluride for the 21st Century	
K. Zweibel.....	3
A Forecast - Photovoltaics in the Year 2030	
D.E. Carlson.....	16
Harnessing the Sun with Thin-Film Photovoltaics	
R.W. Birkmire and L.L. Kazmerski	24
Rapid Thermal Processing as a Photovoltaic Manufacturing Technology for the 21st Century	
R. Singh, A. Rohatgi, K. Rajan, S. Venkataraman, and K.F. Poole	33
Crystalline-Silicon Solar Cells for the 21st Century	
Y.S. Tsuo, T.H. Wang, and T.F. Ciszek	49
Accelerated Life Testing and Service Lifetime Prediction for PV Technologies in the Twenty-First Century	
A.W. Czanderna and G.J. Jorgensen	57
Novel Compound and Solid-Solution Transparent Conducting Oxides for Photovoltaics	
D.R. Kammler, D.D. Edwards, B.J. Ingram, T.O. Mason, G.B. Palmer, A. Ambrosini, and K.R. Poeppelmeier	68
Non-Vacuum Thin-Film Process for CuInSe₂ Solar Cells	
V.K. Kapur, B.M. Basol, C.R. Leidholm, G. Norsworthy, A. Halani, and R. Roe	78
CdSe Nanocrystal Rods/Poly(3-Hexylthiophene) Composite Photovoltaic Devices	
W.U. Huynh, X. Peng, and P. Alivisatos.....	86
Analysis of the Nanocrystal Interface in Composite Photovoltaic Device Structures with an Active Layer Based on Semiconducting Nanocrystals	
A.V. Kadavanich, J. Taylor, D.F. Underwood, T. Kippenny, M.M. Erwin, S.J. Pennycook, and S.J. Rosenthal	91
Low-Cost High-Efficiency Multijunction Photovoltaic Cells Based on Semiconductor Nanostructures	
B. Das, S.P. McGinnis, and P. Sines	97

Nanoparticle-Derived Contacts for Photovoltaic Cells	103
D.S. Ginley.....	
Maneuvering Surface Defects in CuInSe₂ and Its Alloys	110
S. Menezes, B. Canava, J.-F. Guillemoles, and D. Lincot.....	
Attempt of Spray Pyrolysis Deposition of Various Semiconducting Thin Films for Solar Cells	118
S. Kaneko, T. Kosugi, T. Fujiwara, and M. Okuya.....	
Dye-Sensitized PV Cell Concepts	128
K. Brooks, A.J. McEvoy, U. Bach, and M. Grätzel	
PV Optics: An Optical Modeling Tool for Solar Cell and Module Design	138
B. Sopori, J. Madjdpor, Y. Zhang, and W. Chen	
A Thin Silicon Solar Cell on Glass: Cell Design and Process Physics	145
W. Chen and B. Sopori	
Characterization of Microstructures and Interfaces in Thin-Film Photovoltaic Materials Using Synchrotron Radiation: A Review	153
Y.H. Kao.....	
Minority-Carrier Lifetimes, Defects, and Solar Cells of InGaAsN, Lattice-Matched to GaAs	163
S.R. Kurtz, A.A. Allerman, E.D. Jones, J.F. Klem, and C.H. Seager	
Photoluminescence Investigations of InGaAsN Alloys Lattice-Matched to GaAs	170
E.D. Jones, N.A. Modine, A.A. Allerman, I.J. Fritz, S.R. Kurtz, A.F. Wright S.T. Tozer, and X. Wei	
The Growth of InGaAsN for High-Efficiency Solar Cells by Metalorganic Chemical Vapor Deposition	178
A.A. Allerman, S.R. Kurtz, E.D. Jones, J.M. Gee, J.C. Banks, and A. Climent-Font	
Hydrazine N Source for Growth of GaInNAs for Solar Cells	185
D.J. Friedman, J.F. Geisz, S.R. Kurtz, A.G. Norman, and Y.C.M. Yeh	
Nitrogen-Induced Modification of the Electronic Band Structures in Group III-N-V Alloys	190
W. Walukiewicz, W. Shan, J.W. Ager III, D.R. Chamberlin, E.E. Haller, J.F. Geisz, D.J. Friedman, J.M. Olson, and S.R. Kurtz	
<u>BASIC RESEARCH OPPORTUNITIES IN PHOTOVOLTAICS</u>	201
Basic Research Opportunities in Photovoltaics Workshop	203
J. Benner, S. Deb, and R.D. McConnell	

Research Opportunities in Crystalline Silicon Photovoltaics for the 21st Century	
H.A. Atwater, B. Sopori, T. Ciszek, L.C. Feldman, J. Gee, and A. Rohatgi	206
Amorphous and Microcrystalline Silicon Solar Cells	
S. Wagner, D.E. Carlson, and H.M. Branz	219
Basic Research Opportunities in Cu-Chalcopyrite Photovoltaics	
A. Rockett, R.N. Bhattacharya, C. Eberspacher, V. Kapur, and S.-H Wei.....	232
Critical Issues and Research Needs for CdTe-Based Solar Cells	
A.D. Compaan, J.R. Sites, R.W. Birkmire, C.S. Ferekides, and A.L. Fahrenbruch	241
Next-Generation Thin Films for Photovoltaics: InGaAsN	
E.D. Jones, A.A. Allerman, D.J. Friedman, J.F. Geisz, J.F. Klem, S.R. Kurtz, N.R. Modine, W. Shan, C. Tu, and W. Walukiewicz.....	252
Novel Materials for Photovoltaic Technologies	
P. Alivisatos, S. Carter, D. Ginley, G. Meyer, A. Nozik, and S. Rosenthal	268
Transparent Conducting Oxides: Status and Opportunities in Basic Research	
T.J. Coutts, T.O. Mason, J.D. Perkins, and D.S. Ginley.....	274
Photovoltaics Characterization: An Overview	
Y.H. Kao, L. Kazmerski, K.G. Lynn, and A. Mascarenhas.....	289
Author Index	301
Subject Index	302