

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology — 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga

Frontmatter

[More information](#)

**Amorphous and Polycrystalline
Thin-Film Silicon Science
and Technology — 2009**

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology – 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga
Frontmatter

[More information](#)

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology — 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga

Frontmatter

[More information](#)

**MATERIALS RESEARCH SOCIETY
SYMPOSIUM PROCEEDINGS VOLUME 1153**

Amorphous and Polycrystalline Thin-Film Silicon Science and Technology — 2009

Symposium held April 14–17, 2009, San Francisco, California, U.S.A.

EDITORS:

Andrew Flewitt

University of Cambridge
Cambridge, United Kingdom

Jack Hou

LuxingTek Ltd.
Jhubei City, Taiwan

Arokia Nathan

University College London
London, United Kingdom

Qi Wang

National Renewable Energy Laboratory
Golden, Colorado, U.S.A.

Shuichi Uchikoga

Toshiba Corporation
Kawasaki, Japan



Materials Research Society
Warrendale, Pennsylvania

Cambridge University Press
978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and
Technology – 2009: Materials Research Society Symposium Proceedings: Volume 1153
Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga
Frontmatter
[More information](#)

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town,
Singapore, São Paulo, Delhi, Mexico City

Cambridge University Press
32 Avenue of the Americas, New York NY 10013-2473, USA

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org
Information on this title: www.cambridge.org/9781107408340

Materials Research Society
506 Keystone Drive, Warrendale, PA 15086
<http://www.mrs.org>

© Materials Research Society 2009

This publication is in copyright. Subject to statutory exception
and to the provisions of relevant collective licensing agreements,
no reproduction of any part may take place without the written
permission of Cambridge University Press.

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

First published 2009
First paperback edition 2012

Single article reprints from this publication are available through
University Microfilms Inc., 300 North Zeeb Road, Ann Arbor, MI 48106

CODEN: MRSPDH

ISBN 978-1-107-40834-0 Paperback

Cambridge University Press has no responsibility for the persistence or
accuracy of URLs for external or third-party internet websites referred to in
this publication, and does not guarantee that any content on such websites is,
or will remain, accurate or appropriate.

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology – 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga

Frontmatter

[More information](#)

CONTENTS

Prefacexv

Materials Research Society Symposium Proceedings.....xvi

CHARACTERIZATION

Photoluminescence Characterization of Hydrogenated Nanocrystalline/Amorphous Silicon3
 Jeremy D. Fields, Craig Taylor, Juliuz G. Radziszewski,
 David Baker, Baojie Yan, and Guozhen Yue

Infrared Photoconductivity in Heavily Nitrogen Doped a-Si:H9
 David Shelton, James C. Ginn, Kevin R. Coffey,
 and Glenn Boreman

Decomposition of Mixed Phase Silicon Raman Spectra15
 Martin Ledinsky, Aliaksei Vetushka, Jiri Stuchlik,
 Antonin Fejfar, and Jan Kocka

LIGHT TRAPPING IN SOLAR CELLS I

Simulation of Plasmonic Crystal Enhancement of Thin-Film Solar Cell Absorption.....23
 Rana Biswas, Dayu Zhou, and Luis Garcia

* **Light Trapping in Thin-Film $\mu\text{c-Si:H}$ Solar Cells Using Self-Ordered 2D Grating Reflector**29
 Hitoshi Sai, Yoshiaki Kanamori, and Michio Kondo

Photonic Crystal Back Reflector in Thin-Film Silicon Solar Cells.....41
 Olindo Isabella, Benjamin Lipovšek, Janez Krč, and Miro Zeman

*Invited Paper

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology – 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga
Frontmatter[More information](#)*DEFECTS AND METASTABILITY*

- Amorphous Semiconductors Studied by First-Principles Simulations: Structure and Electronic Properties**49
K. Jarolimek, Robert A. de Groot, Gilles A. de Wijs,
and Miro Zeman

POSTER SESSION: CRYSTALLIZATION

- High Temperature Post-Deposition Annealing Studies of Layer-by-Layer (LBL) Deposited Hydrogenated Amorphous Silicon Films**57
Boon Tong Goh, Saadah A. Rahman, Siti M. Gani,
and Muhamad R. Muhamad

- Modeling the Grain Size Distribution During Solid Phase Crystallization of Silicon**63
Andreas Bill, Anthony V. Teran, and Ralf B. Bergmann

- Polysilicon Films Formed on Metal Sheets by Aluminium Induced Crystallization of Amorphous Silicon: Barrier Effect**71
Prathap Pathi, Ozge Tuzun, and Abdelilah Slaoui

- Low-Temperature Fabrication of a Crystallized Si Film Deposited on a Glass Substrate Using an Ytria-Stabilized Zirconia Seed Layer**77
Sukreen Hana Herman and Susumu Horita

- Improving Silicon Crystallinity by Grain Reorientation Annealing**83
Katherine L. Saenger, Joel P. de Souza, Daniel Inns,
Keith E. Fogel, and Devendra K. Sadana

*POSTER SESSION:
NANOSTRUCTURED SILICON*

- Optimization of p-type Nanocrystalline Silicon Thin Films for Solar Cells and Photodiodes**91
Yuri Vygranenko, Ehsanollah Fathi, Andrei Sazonov,
Manuela Vieira, Gregory Heiler, Timothy Tredwell,
and Arokia Nathan

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology – 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga

Frontmatter

[More information](#)**POSTER SESSION:
SOLAR CELLS**

- High Efficiency Large Area a-Si:H and a-SiGe:H Multi-Junction Solar Cells Using MVHF at High Deposition Rate99**
Xixiang Xu, Dave Beglau, Scott Ehlert, Yang Li, Tining Su, Guozhen Yue, Baojie Yan, Ken Lord, Arindam Banerjee, Jeff Yang, Subhendu Guha, Peter Hugger, and J. David Cohen
- Improvement of Quantum Efficiency of Amorphous Silicon Thin-Film Solar Cells by Using Nanoporous PMMA Antireflection Coating105**
Liang Fang, Jong-San Im, Sang-Il Park, and Koseng Su Lim
- Hydrogenated Amorphous Silicon Based Solar Cells: Optimization Formalism and Numerical Algorithm111**
Anatoli Shkrebtii, Yuriy Kryuchenko, Anaroliy Sachenko, Igor Sokolovskiy, and Franco Gaspari
- Observation of the Evolution of Etch Features on Polycrystalline ZnO:Al Thin Films117**
Jorj I. Owen, Jürgen Hüpkes, and Eerke Bunte
- In-Situ Observation of High Deposition Rate Hydrogenated Polymorphous Silicon Cell Degradation Through Variable Intensity Method Measurements123**
Erik V. Johnson, Ka-Hyun Kim, and Pere Roca i Cabarrocas
- Junction Capacitance Study of a-SiGe:H Solar Cells Grown at Varying RF and VHF Deposition Rates129**
Peter Hugger, JinWoo Lee, J. David Cohen, Guozhen Yue, Xixiang Xu, Baojie Yan, Jeff Yang, and Subhendu Guha
- Nanosphere Lithography of Nanostructured Silver Films on Thin-Film Silicon Solar Cells for Light Trapping.....135**
Birol Ozturk, Eric A. Schiff, Hui Zhao, Subhendu Guha, Baojie Yan, and Jeff Yang

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology – 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga

Frontmatter

[More information](#)

| | |
|--|------------|
| Fabrication of Photonic Crystal Based Back-Reflectors for Light Management and Enhanced Absorption in Amorphous Silicon Solar Cells | 141 |
| Ben Curtin, Rana Biswas, and Vikram Dalal | |
| Passivation of Silicon Surfaces Using Atomic Layer Deposited Metal Oxides..... | 147 |
| Jun Wang, Mahdi Farrokh-Baroughi, Mariyappan Shanmugam, Sanjoy Paul, Roohollah Samadzadeh-Tarighat, and Siva Sivothythaman | |
| Highly Transparent and High Haze ZnO:Al Film for Front TCO of a-Si:H and μc-Si:H Solar Cells by Controlling Oxygen Flow | 153 |
| Dong-Won Kang, Seung-Hee Kuk, Kwang-Sun Ji, Seh-Won Ahn, and Min-Koo Han | |
| Optics in Thin-Film Silicon Solar Cells with Integrated Lamellar Gratings | 159 |
| Rahul Dewan, Darin Madzharov, Andrey Raykov, and Dietmar Knipp | |
| Controlling Structural Evolution by VHF Power Profiling Technique for High-Efficiency Microcrystalline Silicon Solar Cells at High Deposition Rate..... | 165 |
| Guofu Hou, Xiaoyan Han, Chang Chun Wei, Xiaodan Zhang, Guijun Li, Zhihua Dai, Xinliang Chen, Jianjun Zhang, Ying Zhao, and Xinhua Geng | |

NOVEL DEVICE APPLICATIONS

| | |
|---|------------|
| Voltage Controlled Amorphous Si/SiC Photodiodes and Phototransistors as Wavelength Selective Devices: Theoretical and Electrical Approaches..... | 173 |
| Manuel A. Vieira, Manuela Vieira, Paula Louro, Miguel Fernandes, Alessandro Fantoni, and Manuel Barata | |
| Enzymatic Biosensors with Integrated Thin-Film a-Si:H Photodiodes | 179 |
| Ana T. Pereira, Virginia Chu, Duarte M. Prazeres, and Joao Conde | |

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology – 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga

Frontmatter

[More information](#)**FILM GROWTH I**

- Low Temperature Si Homoepitaxy by a Reactive CVD with a SiH₄/F₂ Mixture.....187**
Akihisa Minowa and Michio Kondo

SOLAR CELLS

- Photoelectron Spectroscopy Measurements of Valence Band Discontinuities for a-Si:H/c-Si Heterojunction Solar Cells.....195**
Tetsuya Kaneko and Michio Kondo

- Device Physics of Heterojunction with Intrinsic Thin Layer (HIT) Solar Cells.....201**
Ana Kanevce and Wyatt K. Metzger

- High Efficiency Amorphous and Nanocrystalline Silicon Based Multi-Junction Solar Cells Deposited at High Rates on Textured Ag/ZnO Back Reflectors207**
Guozhen Yue, Laura Sivec, Baojie Yan, Jeff Yang, and Subhendu Guha

- Nanocrystalline Silicon Superlattice Solar Cells213**
Vikram Dalal, Atul Madhavan, and Nayan Chakravarty

CRYSTALLIZATION

- * High Performance n- and p-Channel Strained Single Grain Silicon TFTs Using Excimer Laser.....221**
Alessandro Baiano, Ryoichi Ishihara, and Kees Beenakker

LIGHT TRAPPING IN SOLAR CELLS II

- * Light Trapping Effects in Thin-Film Silicon Solar Cells.....235**
Franz-Josef Haug, Thomas Söderström, Didier Dominé, and Christophe Ballif

*Invited Paper

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology – 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga

Frontmatter

[More information](#)

- * **Light Trapping in Hydrogenated Amorphous and Nano-Crystalline Silicon Thin-Film Solar Cells**.....247
 Jeff Yang, Baojie Yan, Guozhen Yue, and Subhendu Guha

THIN-FILM TRANSISTORS

- Microcrystalline Silicon Thin-Film Transistors for Ambipolar and CMOS Inverters**.....261
 Kah-Yoong Chan, Aad Gordijn, Helmut Stiebig, and Dietmar Knipp

TRANSPORT

- * **Carrier Drift-Mobilities and Solar Cell Models for Amorphous and Nanocrystalline Silicon**.....269
 Eric A. Schiff

- Bulk-Heterojunction Based on Blending of Red and Blue Luminescent Silicon Nanocrystals and P3HT Polymer**281
 Vladimir Svrcek and Michio Kondo

- Imaging Electron Transport Across Grain Boundaries in an Integrated Electron and Atomic Force Microscopy Platform: Application to Polycrystalline Silicon Solar Cells**287
 Manuel J. Romero, Fude Liu, Oliver Kunz, Johnson Wong, Chun-Sheng Jiang, Mowafak Al-Jassim, and Armin G. Aberle

POSTER SESSION: CHARACTERIZATION

- Blue/White Emission from Hydrogenated Amorphous Silicon Carbide Films Prepared by PECVD**.....295
 Volodymyr Ivashchenko, Andrey Vasin, L.A. Ivashchenko, and P.L. Skrynskyy

- Defect Study of Polycrystalline-Silicon Seed Layers Made by Aluminum-Induced Crystallization**.....301
 Srisaran Venkatachalam, Dries Van Gestel, Ivan Gordon, Guy Beaucarne, and Jef Poortmans

*Invited Paper

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology – 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga

Frontmatter

[More information](#)**Infrared Ellipsometry Investigation of Hydrogenated Amorphous Silicon.....307**Franco Gaspari, Anatoli Shkrebtii, Tom E. Tiwald,
Andrea Fuchser, Shafiq M. Ahmed, Keith Leong,
Tome Koteleski, and Nazir Kherani**Raman Characterization of Protocrystalline Silicon Films.....313**A.J. Syllaios, S.K. Ajmera, C.L. Littler, G.S. Tyber,
and R.E. Hollingsworth**Characterization of Microcrystalline Silicon by High Wavenumber Raman Scattering319**Erik V. Johnson, Laurent Kroely, Mario Moreno,
and Pere Roca i Cabarrocas**Hole Drift Mobility Measurements on a-Si:H Using Surface and Uniformly Absorbed Illumination325**Steluta A. Dinca, Eric A. Schiff, Subhendu Guha,
Baojie Yan, and Jeff Yang**POSTER SESSION: FILM GROWTH****Properties of Nano-Crystalline Silicon-Carbide Films Prepared Using Modulated RF-PECVD.....333**Feng Zhu, Jian Hu, Ilvydas Matulionis,
Augusto Kunrath, and Arun Madan**Ion Assisted ETP-CVD a-Si:H at Well Defined Ion Energies.....339**Michael A. Wank, René van Swaaij, and
M. van de Sanden**Phosphorus and Boron Doping Effects on Nanocrystalline Formation in Hydrogenated Amorphous and Nanocrystalline Mixed-Phase Silicon Thin Films345**Chunsheng Jiang, Yanfa Yan, Helio Moutinho,
Mowafak Al-Jassim, Baojie Yan, Laura Sivec,
Jeff Yang, and Subhendu Guha

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology – 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga
Frontmatter[More information](#)**POSTER SESSION:
DEFECTS AND METASTABILITY**

| | |
|---|------------|
| Effects of a Bias Voltage During Hydrogenation on Passivation of the Defects in Polycrystalline Silicon for Solar Cells..... | 353 |
| Yoji Saito, Hideyuki Sano, and Hayato Kohata | |
| Structural Properties of a-Si:H Films with Improved Stability Against Light Induced Degradation | 359 |
| Gijs van Elzaker, Pavel Sutta, and Miro Zeman | |
| First-Principles Modeling of Structure, Vibrations, Electronic Properties and Bond Dynamics in Hydrogenated Amorphous Silicon: Theory versus Experiment..... | 365 |
| Anatoli Shkrebtii, Ihor Kupchak, and Franco Gaspari | |
| Defects in Hydrogenated Amorphous Silicon Carbide Alloys Using Electron Spin Resonance and Photothermal Deflection Spectroscopy | 371 |
| Brian J. Simonds, Feng Zhu, Josh Gallon, Jian Hu, Arun Madan, and Craig Taylor | |

**POSTER SESSION:
NOVEL DEVICE APPLICATIONS**

| | |
|--|------------|
| Optical Processing Devices for Optical Communications: Multilayered a-SiC:H Architectures | 379 |
| Paula Louro, Manuela Vieira, M.A. Vieira, Miguel Fernandes, Alessandro Fantoni, G. Lavareda, and C.N. Carvalho | |
| Fine Tuning of the Spectral Sensitivity in a-SiC:H Stacked p-i-i-n Graded Cells..... | 385 |
| Manuela Vieira, Alessandro Fantoni, Miguel Fernandes, Paula Louro, Guilherme Lavareda, and Carlos N. Carvalho | |
| Laser-Induced Crystallization of SiGe MEMS Structural Layers Deposited at Temperatures Below 250°C..... | 391 |
| Joumana El-Rifai, Sherif Sedky, Rami Wasfi, Chris Van Hoof, and Ann Witvrouw | |

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology – 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga

Frontmatter

[More information](#)

Evaluation of the Electrical Properties, Piezoresistivity and Noise of poly-SiGe for MEMS-Above-CMOS Applications.....397
Pilar Gonzalez, Silvia Lenci, Luc Haspeslagh,
Kristin De Meyer, and Ann Witvrouw

Noise Spectra of $\text{Si}_x\text{Ge}_y\text{B}_z\text{:H}$ Films for Micro-Bolometers403
Andrey Kosarev, Ismael Cosme, and Alfonso Torres

Electronic Detection and Quantification of Ions in Solution Using an a-Si:H Field-Effect Device409
João Costa, Miguel Fernandes, Manuela Vieira,
C.N. Carvalho, G. Lavareda, and Amin Karmali

**POSTER SESSION:
LARGE AREA AND FLEXIBLE PROCESSING**

Effects of Electro-Mechanical Stressing on the Electrical Characterization of On-Plastic a-Si:H Thin-Film Transistors417
Jian Z. Chen, Yeh Chih-Yong, I-Chung Chiu,
I-Chun Cheng, Jung-Jie Huang, and Yung-Pei Chen

Thin-Film Silicon Solar Cells on Transparent Plastic Substrates423
Ehsanollah Fathi and Andrei Sazonov

**POSTER SESSION:
THIN-FILM TRANSISTORS**

The Effect of Active-Layer Thickness on the Characteristic of Nanocrystalline Silicon Thin-Film Transistor431
Sun-Jae Kim, Sang-Myeon Han, Seung-Hee Kuk,
Jeong-Soo Lee, and Min-Koo Han

Effects of Hydrogen Plasma Treatment on Hysteresis Phenomenon and Electrical Properties for Solid Phase Crystallized Silicon Thin-Film Transistors437
Sung-Hwan Choi, Sang-Geun Park, Chang-Yeon Kim,
and Min-Koo Han

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology – 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga
Frontmatter[More information](#)*FILM GROWTH II*

| | |
|---|------------|
| * Potential of Hot Wire CVD for Active Matrix TFT Manufacturing | 445 |
| Ruud E.I. Schropp, Zomer S. Houweling, and Vasco Verlaan | |
| Comparative Study of MVHF and RF Deposited Large Area Multi-Junction Solar Cells Incorporating Hydrogenated Nano-Crystalline Silicon | 457 |
| Xixiang Xu, Yang Li, Scott Ehlert, Tining Su, Dave Beglau, David Bobela, Guozhen Yue, Baojie Yan, Jinyan Zhang, Arindam Banerjee, Jeff Yang, and Subhendu Guha | |
| Gas Phase Conditions for Obtaining Device Quality Amorphous Silicon at Low Temperature and High Deposition Rate | 463 |
| Jatindra K. Rath, Minne de Jong, Arjan Verkerk, Monica Brinza, and Ruud E.I. Schropp | |

HYDROGEN IN SILICON

| | |
|--|------------|
| ¹H NMR Study of Hydrogenated Nanocrystalline Silicon Thin Films | 471 |
| Kristin Kiriluk, David Bobela, Tining Su, Baojie Yan, Subhendu Guha, Jeff Yang, Arneyl Reyes, Philip Kuhns, and Craig Taylor | |
| Author Index | 477 |
| Subject Index..... | 481 |

*Invited Paper

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology — 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga

Frontmatter

[More information](#)

PREFACE

Thin-film silicon materials and their alloys underpin a diverse range of electronic systems from active matrix flat-panel displays, through solar panels for “green-power” generation, to surface micromachined MEMS devices. Furthermore, new application areas are emerging, including RFID tagging and biosensors. As a consequence, large-area electronics is currently one of the fastest growing semiconductor technologies. Thin-film silicon can possess a diverse range of structures, from being fully amorphous to fully polycrystalline, as well as allowing mixed-phase states, such as micro- and nanocrystalline silicon. Such diversity has enabled this growth of large-area electronics, but it has also introduced complexity.

Symposium A, “Amorphous and Polycrystalline Thin-Film Silicon Science and Technology — 2009,” held April 14–17 at the 2009 MRS Spring Meeting in San Francisco, California, has been running annually at the MRS Spring Meeting for over 25 years. This symposium provides a unique annual forum for scientists and engineers dealing with thin-film silicon materials, and their alloys with Ge, C, N, and other elements, to discuss issues related to both fundamental materials science and applied technology. The symposium opened with a full day tutorial looking at the deposition, characterization and physics of thin-film silicon materials in the morning session, followed by an afternoon devoted to studying the devices that use thin-film silicon. This was followed over the course of the next three and a half days by 15 invited talks, 52 contributed oral presentations and 71 poster presentations. This volume therefore acts as a good overview of the fields discussed, which ranged from studies of film growth and crystallization, through investigations on materials characterization, defects, metastability and carrier transport, to reports on devices such as solar cells and thin-film transistors. The importance of developing efficient solar cells was reflected in the significant number of papers that looked at aspects of improving lifetime and efficiency, and two focus sessions were devoted to light trapping in solar cells. The drive towards ever larger and more flexible substrates was also evident.

The organizers would like to thank all those who attended the symposium and contributed such excellent presentations. Particular thanks are due to the contributors and reviewers of this proceedings volume, and to the members of the Symposium A Advisory Group for their help and support. We would like to extend special thanks to Craig Taylor for his active role in organizing and providing administrative support for these symposia for over 15 years. We are also indebted to Mary Ann Woolf for all her help, advice and support in managing the construction of the symposium and the process of producing this proceedings volume. Finally, we would like to thank the Industrial Technology Research Institute, Taiwan for their generous financial support by sponsoring this symposium.

Andrew Flewitt
Jack Hou
Arokia Nathan
Qi Wang
Shuichi Uchikoga

August 2009

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology — 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga
Frontmatter[More information](#)**MATERIALS RESEARCH SOCIETY SYMPOSIUM PROCEEDINGS**

- Volume 1153 — Amorphous and Polycrystalline Thin-Film Silicon Science and Technology — 2009, A. Flewitt, Q. Wang, J. Hou, S. Uchikoga, A. Nathan, 2009, ISBN 978-1-60511-126-1
- Volume 1154 — Concepts in Molecular and Organic Electronics, N. Koch, E. Zojer, S.-W. Hla, X. Zhu, 2009, ISBN 978-1-60511-127-8
- Volume 1155 — CMOS Gate-Stack Scaling — Materials, Interfaces and Reliability Implications, J. Butterbaugh, A. Demkov, R. Harris, W. Rachmady, B. Taylor, 2009, ISBN 978-1-60511-128-5
- Volume 1156 — Materials, Processes and Reliability for Advanced Interconnects for Micro- and Nanoelectronics — 2009, M. Gall, A. Grill, F. Iacopi, J. Koike, T. Usui, 2009, ISBN 978-1-60511-129-2
- Volume 1157 — Science and Technology of Chemical Mechanical Planarization (CMP), A. Kumar, C.F. Higgs III, C.S. Korach, S. Balakumar, 2009, ISBN 978-1-60511-130-8
- Volume 1158E — Packaging, Chip-Package Interactions and Solder Materials Challenges, P.A. Kohl, P.S. Ho, P. Thompson, R. Aschenbrenner, 2009, ISBN 978-1-60511-131-5
- Volume 1159E — High-Throughput Synthesis and Measurement Methods for Rapid Optimization and Discovery of Advanced Materials, M.L. Green, I. Takeuchi, T. Chiang, J. Paul, 2009, ISBN 978-1-60511-132-2
- Volume 1160 — Materials and Physics for Nonvolatile Memories, Y. Fujisaki, R. Waser, T. Li, C. Bonafos, 2009, ISBN 978-1-60511-133-9
- Volume 1161E — Engineered Multiferroics — Magnetoelectric Interactions, Sensors and Devices, G. Srinivasan, M.I. Bichurin, S. Priya, N.X. Sun, 2009, ISBN 978-1-60511-134-6
- Volume 1162E — High-Temperature Photonic Structures, V. Shklover, S.-Y. Lin, R. Biswas, E. Johnson, 2009, ISBN 978-1-60511-135-3
- Volume 1163E — Materials Research for Terahertz Technology Development, C.E. Stutz, D. Ritchie, P. Schunemann, J. Deibel, 2009, ISBN 978-1-60511-136-0
- Volume 1164 — Nuclear Radiation Detection Materials — 2009, D.L. Perry, A. Burger, L. Franks, K. Yasuda, M. Fiederle, 2009, ISBN 978-1-60511-137-7
- Volume 1165 — Thin-Film Compound Semiconductor Photovoltaics — 2009, A. Yamada, C. Heske, M. Contreras, M. Igalson, S.J.C. Irvine, 2009, ISBN 978-1-60511-138-4
- Volume 1166 — Materials and Devices for Thermal-to-Electric Energy Conversion, J. Yang, G.S. Nolas, K. Koumoto, Y. Grin, 2009, ISBN 978-1-60511-139-1
- Volume 1167 — Compound Semiconductors for Energy Applications and Environmental Sustainability, F. Shahedipour-Sandvik, E.F. Schubert, L.D. Bell, V. Tilak, A.W. Bett, 2009, ISBN 978-1-60511-140-7
- Volume 1168E — Three-Dimensional Architectures for Energy Generation and Storage, B. Dunn, G. Li, J.W. Long, E. Yablonovitch, 2009, ISBN 978-1-60511-141-4
- Volume 1169E — Materials Science of Water Purification, Y. Cohen, 2009, ISBN 978-1-60511-142-1
- Volume 1170E — Materials for Renewable Energy at the Society and Technology Nexus, R.T. Collins, 2009, ISBN 978-1-60511-143-8
- Volume 1171E — Materials in Photocatalysis and Photoelectrochemistry for Environmental Applications and H₂ Generation, A. Braun, P.A. Alivisatos, E. Figgemeier, J.A. Turner, J. Ye, E.A. Chandler, 2009, ISBN 978-1-60511-144-5
- Volume 1172E — Nanoscale Heat Transport — From Fundamentals to Devices, R. Venkatasubramanian, 2009, ISBN 978-1-60511-145-2
- Volume 1173E — Electrofluidic Materials and Applications — Micro/Biofluidics, Electowetting and Electrospinning, A. Steckl, Y. Nemirovsky, A. Singh, W.-C. Tian, 2009, ISBN 978-1-60511-146-9
- Volume 1174 — Functional Metal-Oxide Nanostructures, J. Wu, W. Han, A. Janotti, H.-C. Kim, 2009, ISBN 978-1-60511-147-6

Cambridge University Press

978-1-107-40834-0 - Amorphous and Polycrystalline Thin-Film Silicon Science and Technology — 2009: Materials Research Society Symposium Proceedings: Volume 1153

Editors: Andrew Flewitt, Jack Hou, Arokia Nathan, Qi Wang and Shuichi Uchikoga
Frontmatter[More information](#)**MATERIALS RESEARCH SOCIETY SYMPOSIUM PROCEEDINGS**

- Volume 1175E — Novel Functional Properties at Oxide-Oxide Interfaces, G. Rijnders, R. Pentcheva, J. Chakhalian, I. Bozovic, 2009, ISBN 978-1-60511-148-3
- Volume 1176E — Nanocrystalline Materials as Precursors for Complex Multifunctional Structures through Chemical Transformations and Self Assembly, Y. Yin, Y. Sun, D. Talapin, H. Yang, 2009, ISBN 978-1-60511-149-0
- Volume 1177E — Computational Nanoscience — How to Exploit Synergy between Predictive Simulations and Experiment, G. Galli, D. Johnson, M. Hybertsen, S. Shankar, 2009, ISBN 978-1-60511-150-6
- Volume 1178E — Semiconductor Nanowires — Growth, Size-Dependent Properties and Applications, A. Javey, 2009, ISBN 978-1-60511-151-3
- Volume 1179E — Material Systems and Processes for Three-Dimensional Micro- and Nanoscale Fabrication and Lithography, S.M. Kuebler, V.T. Milam, 2009, ISBN 978-1-60511-152-0
- Volume 1180E — Nanoscale Functionalization and New Discoveries in Modern Superconductivity, R. Feenstra, D.C. Larbalestier, B. Maierov, M. Putti, Y.-Y. Xie, 2009, ISBN 978-1-60511-153-7
- Volume 1181 — Ion Beams and Nano-Engineering, D. Ila, P.K. Chu, N. Kishimoto, J.K.N. Lindner, J. Baglin, 2009, ISBN 978-1-60511-154-4
- Volume 1182 — Materials for Nanophotonics — Plasmonics, Metamaterials and Light Localization, M. Brongersma, L. Dal Negro, J.M. Fukumoto, L. Novotny, 2009, ISBN 978-1-60511-155-1
- Volume 1183 — Novel Materials and Devices for Spintronics, O.G. Heinonen, S. Sanvito, V.A. Dediu, N. Rizzo, 2009, ISBN 978-1-60511-156-8
- Volume 1184 — Electron Crystallography for Materials Research and Quantitative Characterization of Nanostructured Materials, P. Moeck, S. Hovmöller, S. Nicolopoulos, S. Rouvimov, V. Petkov, M. Gateshki, P. Fraundorf, 2009, ISBN 978-1-60511-157-5
- Volume 1185 — Probing Mechanics at Nanoscale Dimensions, N. Tamura, A. Minor, C. Murray, L. Friedman, 2009, ISBN 978-1-60511-158-2
- Volume 1186E — Nanoscale Electromechanics and Piezoresponse Force Microcopy of Inorganic, Macromolecular and Biological Systems, S.V. Kalinin, A.N. Morozovska, N. Valanoor, W. Brownell, 2009, ISBN 978-1-60511-159-9
- Volume 1187 — Structure-Property Relationships in Biomineralized and Biomimetic Composites, D. Kisailus, L. Estroff, W. Landis, P. Zavattieri, H.S. Gupta, 2009, ISBN 978-1-60511-160-5
- Volume 1188 — Architected Multifunctional Materials, Y. Brechet, J.D. Embury, P.R. Onck, 2009, ISBN 978-1-60511-161-2
- Volume 1189E — Synthesis of Bioinspired Hierarchical Soft and Hybrid Materials, S. Yang, F. Meldrum, N. Kotov, C. Li, 2009, ISBN 978-1-60511-162-9
- Volume 1190 — Active Polymers, K. Gall, T. Ikeda, P. Shastri, A. Lendlein, 2009, ISBN 978-1-60511-163-6
- Volume 1191 — Materials and Strategies for Lab-on-a-Chip — Biological Analysis, Cell-Material Interfaces and Fluidic Assembly of Nanostructures, S. Murthy, H. Zeringue, S. Khan, V. Ugaz, 2009, ISBN 978-1-60511-164-3
- Volume 1192E — Materials and Devices for Flexible and Stretchable Electronics, S. Bauer, S.P. Lacour, T. Li, T. Someya, 2009, ISBN 978-1-60511-165-0
- Volume 1193 — Scientific Basis for Nuclear Waste Management XXXIII, B.E. Burakov, A.S. Aloy, 2009, ISBN 978-1-60511-166-7

Prior Materials Research Society Symposium Proceedings available by contacting Materials Research Society