

Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials  
Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello

Frontmatter

[More information](#)

---

**Materials Science  
and Technology for  
Nonvolatile Memories**

Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials  
Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello

Frontmatter

[More information](#)

---

Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello  
Frontmatter

[More information](#)

**MATERIALS RESEARCH SOCIETY  
SYMPOSIUM PROCEEDINGS VOLUME 1071**

# **Materials Science and Technology for Nonvolatile Memories**

Symposium held March 24–27, 2008, San Francisco, California, U.S.A.

**EDITORS:**

**Dirk J. Wouters**

IMEC  
Leuven, Belgium

**Seungbum Hong**

Argonne National Laboratory  
Materials Science Division  
Argonne, Illinois, U.S.A.

**Steven Soss**

Numonyx Corporation  
California Technology Center  
Santa Clara, California, U.S.A.

**Orlando Auciello**

Argonne National Laboratory  
Materials Science Division and  
Center for Nanoscale Materials  
Argonne, Illinois, U.S.A.



Materials Research Society  
Warrendale, Pennsylvania

Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello  
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](http://www.cambridge.org)

Information on this title: [www.cambridge.org/9781107408531](http://www.cambridge.org/9781107408531)

Materials Research Society

506 Keystone Drive, Warrendale, PA 15086

<http://www.mrs.org>

© Materials Research Society 2008

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 2008

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 978-1-107-40853-1 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

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello

Frontmatter

[More information](#)

## CONTENTS

<b>Preface</b> .....	<b>xi</b>
<b>Acknowledgments</b> .....	<b>xiii</b>
<b>Materials Research Society Symposium Proceedings</b> .....	<b>xiv</b>

*ADVANCED FLASH MEMORY*

<b>* Flash Memory Scaling: From Material Selection to Performance Improvement</b> .....	<b>3</b>
Tuo-Hung Hou, Jaegoo Lee, Jonathan T. Shaw, and Edwin C. Kan	
<b>Realization of Hybrid Silicon Core/Silicon Nitride Shell Nanodots by LPCVD for NVM Application</b> .....	<b>17</b>
Jean Colonna, Gabriel Molas, Marc W. Gely, Marc Bocquet, Eric Jalaguier, Barbara De Slavo, Helen Grampeix, Pierre Brianceau, Karim Yckache, Anne-Marie Papon, Geoffroy Auvert, Corrado Bongiorno, and Salvatore Lombardo	
<b>Impact of the High-Temperature Process Steps on the HfAlO Interpoly Dielectric Stacks for Nonvolatile Memory Applications</b> .....	<b>23</b>
Daniel Ruiz Aguado, Bogdan Govoreanu, Paola Favia, Kristin De Meyer, and Jan Van Houdt	
<b>Effect of Top Dielectric Morphology and Gate Material on the Performance of Nitride-based FLASH Memory Cells</b> .....	<b>29</b>
Antonio Cacciato, Laurent Breuil, Geert Van den Bosch, Olivier Richard, Aude Rothschild, Arnaud Furnémont, Hugo Bender, Jorge A. Kittl, and Jan Van Houdt	
<b>Relaxation Behavior and Breakdown Mechanisms of Nanocrystals Embedded Zr-doped HfO<sub>2</sub> High-k Thin Films for Nonvolatile Memories</b> .....	<b>35</b>
Chia-Han Yang, Yue Kuo, Chen-Han Lin, Rui Wan, and Way Kuo	

\*Invited Paper

Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello

Frontmatter

[More information](#)

<b>Simulation of Capacitance-Voltage Characteristics of Ultra-Thin Metal-Oxide-Semiconductor Structures with Embedded Nanocrystals.....</b>	<b>43</b>
Mosur Rahman, Bo Lojek, and Thottam Kalkur	
<b>Synthesis of Nickel Disilicide Nanocrystal Monolayers for Nonvolatile Memory Applications.....</b>	<b>49</b>
Jong-Hwan Yoon and Robert G. Elliman	
<b>Using Thermal Oxidation and Rapid Thermal Annealing on Polycrystalline-SiGe for Ge Nanocrystals .....</b>	<b>55</b>
Chyuan-Haur Kao, C.S. Lai, M.C. Tsai, C.H. Lee, C.S. Huang, and C.R. Chen	

***OXIDE RESISTIVE SWITCHING  
MEMORY***

<b>Nonvolatile Resistive Switching Characteristics of HfO<sub>2</sub> with Cu Doping .....</b>	<b>63</b>
Weihua Guan, Shibing Long, Ming Liu, and Wei Wang	
<b>Temperature Dependence of Electrical Properties of NiO Thin Films for Resistive Random Access Memory .....</b>	<b>69</b>
Ryota Suzuki, Jun Suda, and Tsunenobu Kimoto	
<b>Substantial Reduction of Reset Current in CoO RRAM with Ta Bottom Electrode .....</b>	<b>75</b>
Hisashi Shima, Fumiyoshi Takano, Yukio Tamai, Hidenobu Muramatsu, Hiroyuki Akinaga, Isao H. Inoue, and Hidenori Takagi	
<b>The Interfacial States Between Metal/Oxide and the RRAM - Part II.....</b>	<b>81</b>
Wei Pan and David Russell Evans	
<b>Reproducible Electro-resistance Memory Effect in Ag/La<sub>0.67</sub>Sr<sub>0.33</sub>MnO<sub>3</sub> Thin Films.....</b>	<b>89</b>
Lina Huang, Bingjun Qu, and Litian Liu	

Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello  
Frontmatter[More information](#)**ORGANIC RESISTIVE SWITCHING MEMORY**

- \* Resistive Electrical Switching of Cu<sup>+</sup> and Ag<sup>+</sup> Based Metal-Organic Charge Transfer Complexes** ..... 97  
Robert Mueller, Joris Billen, Aaron Katzenmeyer,  
Ludovic Goux, Dirk J. Wouters, Jan Genoe, and  
Paul Heremans
- Molecular Conformation-Dependent Memory Effects in Non-Conjugated Polymers with Pendant Carbazole Moieties** ..... 109  
Siew Lay Lim, Qidan Ling, Eric Yeow Hwee Teo,  
Chun Xiang Zhu, Daniel Siu Hung Chan, En Tang Kang,  
and Koon Gee Neoh
- Dependence on Organic Thickness of Electrical Characteristics Behavior in Low Molecular Organic Nonvolatile Memory** ..... 115  
Yool Guk Kim, Sung Ho Seo, Gon Sub Lee,  
Jea Gun Park, and Jin Kyu Kim
- Current Conduction Mechanism for Low-Molecular Organic Nonvolatile Memory** ..... 121  
Sung-ho Seo, Woo-sik Nam, Gon-sub Lee, and  
Jea-gun Park

**NANOPARTICLE-BASED ORGANIC MEMORY**

- Imaging and Elemental Analysis of Polymer/Fullerene Nanocomposite Memory Devices** ..... 129  
Ari Laiho, Jayanta K. Baral, Himadri S. Majumdar,  
Daniel Tobjörk, Janne Ruokolainen, Ronald Österbacka,  
and Olli Ikkala
- Small Molecular Organic Nonvolatile Memory Fabricated with Ni Nanocrystals Embedded in Alq<sub>3</sub>** ..... 135  
YoungHwan Oh, WooSik Nam, GonSub Lee,  
JeaGun Park, and YongBok Lee
- Effect of Au Nanocrystals Embedded in Conductive Polymer on Nonvolatile Memory Window** ..... 141  
Hyun Min Seung, Jong Dae Lee, Byeong-Il Han,  
Gon-Sub Lee, and Jea-Gun Park

\*Invited Paper

Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello  
Frontmatter[More information](#)

**Process Optimization of Ni Nanocrystals Formation  
Using O<sub>2</sub> Plasma Oxidation to Fabricate Low-Molecular  
Organic Nonvolatile Memory ..... 147**  
Woo Sik Nam, Gon-Sub Lee, Sung Ho Seo, and  
Jea Gun Park

**Current Conduction Mechanism for Nonvolatile Memory  
Fabricated with Conductive Polymer Embedded Au  
Nanocrystals ..... 153**  
Jong Dae Lee, Hyun Min Seung, Byeong Il Han,  
Gon-Sub Lee, and Jea-Gun Park

### *ORGANIC FERROELECTRIC MEMORY*

**Organic Field Effect Transistor Using BaTiO<sub>3</sub>-Mn Doped  
and P(VDF-TrFE) for Nonvolatile Memory Application ..... 161**  
Sambit Pattnaik, Ashish Garg, and Monica Katiyar

**Fabrication and Characterization of Ferroelectric  
Polymer/TiO<sub>2</sub>/Al-doped ZnO Structures ..... 167**  
Koji Aizawa

**Fabrication and Electrical Studies of P(VDF/TrFE)(72/28)  
Copolymer Based Nonvolatile Memory Devices as a Function  
of Varying Device Structures ..... 173**  
Kap Jin Kim, Chang Woo Choi, Arun Anand Prabu, and  
Sun Yoon

### *NEW PHASE CHANGE MEMORY AND DEPOSITION METHODS*

**Reversible Electrical Resistance Switching in GeSbTe  
Thin Films: An Electrolytic Approach without  
Amorphous-Crystalline Phase-Change ..... 181**  
Ramanathaswamy Pandian, Bart J. Kooi,  
George Palasantzas, and Jeff Th. M. De Hosson

**CVD of Amorphous GeTe Thin Films ..... 187**  
Philip S. Chen, William J. Hunks, Matthias Stender,  
Tianniu Chen, Gregory T. Stauff, Chongying Xu, and  
Jeffrey F. Roeder



Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello

Frontmatter

[More information](#)

<b>Germanium ALD/CVD Precursors for Deposition of Ge/GeTe Films .....</b>	<b>193</b>
William Hunks, Philip S. Chen, Tianniu Chen, Matthias Stender, Gregory T. Stauf, Leah Maylott, Chongying Xu, and Jeffrey F. Roeder	

***FUTURE EXPLORATIVE MEMORY  
CONCEPTS***

<b>Concentric Metallic-Piezoelectric Microtube Arrays .....</b>	<b>201</b>
H.J. Fan, S. Kawasaki, J.M. Gregg, A. Langner, T. Leedham, and J.F. Scott	
<b>Ferroelectric and Electrical Properties of BaZrO<sub>3</sub> Doped Sr<sub>0.8</sub>Bi<sub>2.2</sub>Ta<sub>2</sub>O<sub>9</sub> Thin Films .....</b>	<b>207</b>
Mehmet S. Bozgeyik, J.S. Cross, H. Ishiwara, and K. Shinozaki	
<b>Stability of Larger Ferromagnetic Chain-of-Sphere Nanostructure Comprising Magnetic Vortices .....</b>	<b>213</b>
Prabeer Barpanda	
<b>Author Index .....</b>	<b>219</b>
<b>Subject Index.....</b>	<b>221</b>

Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials  
Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello  
Frontmatter

[More information](#)

---

Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello  
Frontmatter

[More information](#)

## PREFACE

The symposium "Materials Science and Technology for Nonvolatile Memories," held March 24–27 at the 2008 MRS Spring Meeting in San Francisco, California, was a follow-up of the 2006 Spring Meeting symposium on "Science and Technology of Nonvolatile Memories" (*Mat. Res. Soc. Symp. Proc. Vol. 933E*) and also the 2004 Fall Meeting symposium "Materials and Processes for Nonvolatile Memories" (*Mat. Res. Soc. Symp. Proc. Vol. 830*), and the 2007 Spring Meeting symposium "Materials and Processes for Nonvolatile Memories II" (*Mat. Res. Soc. Symp. Proc. Vol. 997*), and was the fourth symposium in a series of MRS Meeting symposia on nonvolatile memories.

The strong attendance and large paper submission (in total 51 oral and 60 poster contributions were presented in 9 sessions, together with 10 invited talks), indicate the continuing strong international interest and research effort in the field of emerging new nonvolatile memory materials. Main areas of research are advanced Flash and resistive switching RAM including cross-point and organic memories, while ferroelectric-ferromagnetic and ferroic materials also remain of interest (it must be noted that phase change material was mostly covered in a separate symposium at the same conference).

The selected papers in this proceedings volume have been categorized into seven chapters. The first chapter *Advanced Flash Memory* deals with solutions for scaled Flash memory, including the use of new high-k layers and nanocrystals. Resistive switching concepts are discussed in the *Oxide Resistive Switching Memory* as well as in the *Organic Resistive Switching Memory* chapters. More research on polymer memories can be found in the chapters on *Nanoparticle-based Organic Memory* and *Organic Ferroelectric Memory*. The final two chapters deal with *New Phase Change Memory and Deposition Methods*, and *Future Explorative Memory Concepts*, the latter including piezoelectric, ferroelectric and ferromagnetic concepts.

A highly successful one-day tutorial was conducted, including tutorials on oxide resistive random access memories (OXRRAM), magnetic random access memories (MRAM), probe storage and phase change memories (PCM). The tutorials were very well attended (60–100 people) by scientists, postdoctorals and students, providing an opportunity for detailed discussion on the addressed topics.

With contributions from university, research centers and industry, the papers from this symposium proceedings reflect the recent evolutions in material technology and the understanding in these different fields.

Dirk J. Wouters  
Seungbum Hong  
Steven Soss  
Orlando Auciello

June 2008

Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials  
Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello  
Frontmatter

[More information](#)

---

Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello  
Frontmatter

[More information](#)

## ACKNOWLEDGMENTS

The Symposium Organizers would like to thank the tutorial speakers as well as the invited speakers who contributed to the success of this symposium:

### **Tutorial Speakers:**

Greg Atwood (Intel Corp., Santa Clara, CA), Claude Chappert (CNRS, France), Yasuo Cho (Tohoku Univ., Japan), and Rainer Waser (RWTH Aachen, Germany)

### **Invited Speakers:**

R. Ramesh (Univ. of California-Berkeley, CA), Jun Hayakawa (Hitachi Advanced Research Laboratory, Tokyo, Japan), Edwin C. Kan (Cornell University, Ithaca, NY), Jan Van Houdt (IMEC, Leuven, Belgium), Armin Knoll (IBM Research GmbH, Ruschlikon, Switzerland), Hyoungsoo Ko (Samsung Advanced Institute of Technology, Gyeonggi-do, South Korea), Myoungjae Lee (Samsung Advanced Institute of Technology, Gyeonggi-do, South Korea), Robert Mueller (IMEC, Leuven, Belgium), Yan Yang (UCLA, Los Angeles, CA), and Carlos A. Paz de Aroujo, (Symetrix Corp., Colorado Springs, CO).

We also wish to thank the following organizations for their financial support of this symposium:

Applied Materials Inc.  
Intel Corporation  
Seagate Technology  
Symetrix Corp., Colorado Springs

Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello  
Frontmatter[More information](#)**MATERIALS RESEARCH SOCIETY SYMPOSIUM PROCEEDINGS**

- Volume 1066 — Amorphous and Polycrystalline Thin-Film Silicon Science and Technology—2008, A. Nathan, J. Yang, S. Miyazaki, H. Hou, A. Flewitt, 2008, ISBN 978-1-60511-036-3
- Volume 1067E —Materials and Devices for “Beyond CMOS” Scaling, S. Ramanathan, 2008, ISBN 978-1-60511-037-0
- Volume 1068 — Advances in GaN, GaAs, SiC and Related Alloys on Silicon Substrates, T. Li, J. Redwing, M. Mastro, E.L. Piner, A. Dadgar, 2008, ISBN 978-1-60511-038-7
- Volume 1069 — Silicon Carbide 2008—Materials, Processing and Devices, A. Powell, M. Dudley, C.M. Johnson, S-H. Ryu, 2008, ISBN 978-1-60511-039-4
- Volume 1070 — Doping Engineering for Front-End Processing, B.J. Pawlak, M. Law, K. Suguro, M.L. Pelaz, 2008, ISBN 978-1-60511-040-0
- Volume 1071 — Materials Science and Technology for Nonvolatile Memories, O. Auciello, D. Wouters, S. Soss, S. Hong, 2008, ISBN 978-1-60511-041-7
- Volume 1072E —Phase-Change Materials for Reconfigurable Electronics and Memory Applications, S. Raoux, A.H. Edwards, M. Wuttig, P.J. Fons, P.C. Taylor, 2008, ISBN 978-1-60511-042-4
- Volume 1073E —Materials Science of High-k Dielectric Stacks—From Fundamentals to Technology, L. Pantisano, E. Gusev, M. Green, M. Niwa, 2008, ISBN 978-1-60511-043-1
- Volume 1074E —Synthesis and Metrology of Nanoscale Oxides and Thin Films, V. Craciun, D. Kumar, S.J. Pennycook, K.K. Singh, 2008, ISBN 978-1-60511-044-8
- Volume 1075E —Passive and Electromechanical Materials and Integration, Y.S. Cho, H.A.C. Tilmans, T. Tsurumi, G.K. Fedder, 2008, ISBN 978-1-60511-045-5
- Volume 1076 — Materials and Devices for Laser Remote Sensing and Optical Communication, A. Aksnes, F. Amzajerdian, N. Peyghambarian, 2008, ISBN 978-1-60511-046-2
- Volume 1077E —Functional Plasmonics and Nanophotonics, S. Maier, 2008, ISBN 978-1-60511-047-9
- Volume 1078E —Materials and Technology for Flexible, Conformable and Stretchable Sensors and Transistors, 2008, ISBN 978-1-60511-048-6
- Volume 1079E —Materials and Processes for Advanced Interconnects for Microelectronics, J. Gambino, S. Ogawa, C.L. Gan, Z. Tokei, 2008, ISBN 978-1-60511-049-3
- Volume 1080E —Semiconductor Nanowires—Growth, Physics, Devices and Applications, H. Riel, T. Kamins, H. Fan, S. Fischer, C. Thelander, 2008, ISBN 978-1-60511-050-9
- Volume 1081E —Carbon Nanotubes and Related Low-Dimensional Materials, L-C. Chen, J. Robertson, Z.L. Wang, D.B. Geohegan, 2008, ISBN 978-1-60511-051-6
- Volume 1082E —Ionic Liquids in Materials Synthesis and Application, H. Yang, G.A. Baker, J.S. Wilkes, 2008, ISBN 978-1-60511-052-3
- Volume 1083E —Coupled Mechanical, Electrical and Thermal Behaviors of Nanomaterials, L. Shi, M. Zhou, M-F. Yu, V. Tomar, 2008, ISBN 978-1-60511-053-0
- Volume 1084E —Weak Interaction Phenomena—Modeling and Simulation from First Principles, E. Schwegler, 2008, ISBN 978-1-60511-054-7
- Volume 1085E —Nanoscale Tribology—Impact for Materials and Devices, Y. Ando, R.W. Carpick, R. Bennewitz, W.G. Sawyer, 2008, ISBN 978-1-60511-055-4
- Volume 1086E —Mechanics of Nanoscale Materials, C. Friesen, R.C. Cammarata, A. Hodge, O.L. Warren, 2008, ISBN 978-1-60511-056-1

Cambridge University Press

978-1-107-40853-1 - Materials Science and Technology for Nonvolatile Memories: Materials Research Society Symposium Proceedings: Volume 1071

Editors: Dirk J. Wouters, Seungbum Hong, Steven Soss and Orlando Auciello  
Frontmatter[More information](#)**MATERIALS RESEARCH SOCIETY SYMPOSIUM PROCEEDINGS**

- Volume 1087E —Crystal-Shape Control and Shape-Dependent Properties—Methods, Mechanism, Theory and Simulation, K-S. Choi, A.S. Barnard, D.J. Srolovitz, H. Xu, 2008, ISBN 978-1-60511-057-8
- Volume 1088E —Advances and Applications of Surface Electron Microscopy, D.L. Adler, E. Bauer, G.L. Kellogg, A. Scholl, 2008, ISBN 978-1-60511-058-5
- Volume 1089E —Focused Ion Beams for Materials Characterization and Micromachining, L. Holzer, M.D. Uchic, C. Volkert, A. Minor, 2008, ISBN 978-1-60511-059-2
- Volume 1090E —Materials Structures—The Nabarro Legacy, P. Müllner, S. Sant, 2008, ISBN 978-1-60511-060-8
- Volume 1091E —Conjugated Organic Materials—Synthesis, Structure, Device and Applications, Z. Bao, J. Locklin, W. You, J. Li, 2008, ISBN 978-1-60511-061-5
- Volume 1092E —Signal Transduction Across the Biology-Technology Interface, K. Plaxco, T. Tarasow, M. Berggren, A. Dodabalapur, 2008, ISBN 978-1-60511-062-2
- Volume 1093E —Designer Biointerfaces, E. Chaikof, A. Chilkoti, J. Elisseeff, J. Lahann, 2008, ISBN 978-1-60511-063-9
- Volume 1094E —From Biological Materials to Biomimetic Material Synthesis, N. Kröger, R. Qiu, R. Naik, D. Kaplan, 2008, ISBN 978-1-60511-064-6
- Volume 1095E —Responsive Biomaterials for Biomedical Applications, J. Cheng, A. Khademhosseini, H-Q. Mao, M. Stevens, C. Wang, 2008, ISBN 978-1-60511-065-3
- Volume 1096E —Molecular Motors, Nanomachines and Active Nanostructures, H. Hess, A. Flood, H. Linke, A.J. Turberfield, 2008, ISBN 978-1-60511-066-0
- Volume 1097E —Mechanical Behavior of Biological Materials and Biomaterials, J. Zhou, A.G. Checa, O.O. Popoola, E.D. Rekow, 2008, ISBN 978-1-60511-067-7
- Volume 1098E —The Hydrogen Economy, A. Dillon, C. Moen, B. Choudhury, J. Keller, 2008, ISBN 978-1-60511-068-4
- Volume 1099E —Heterostructures, Functionalization and Nanoscale Optimization in Superconductivity, T. Aytug, V. Maroni, B. Holzapfel, T. Kiss, X. Li, 2008, ISBN 978-1-60511-069-1
- Volume 1100E —Materials Research for Electrical Energy Storage, J.B. Goodenough, H.D. Abruña, M.V. Buchanan, 2008, ISBN 978-1-60511-070-7
- Volume 1101E —Light Management in Photovoltaic Devices—Theory and Practice, C. Ballif, R. Ellingson, M. Topic, M. Zeman, 2008, ISBN 978-1-60511-071-4
- Volume 1102E —Energy Harvesting—From Fundamentals to Devices, H. Radosky, J. Holbery, B. O'Handley, N. Kioussis, 2008, ISBN 978-1-60511-072-1
- Volume 1103E —Health and Environmental Impacts of Nanoscale Materials—Safety by Design, S. Tinkle, 2008, ISBN 978-1-60511-073-8
- Volume 1104 — Actinides 2008—Basic Science, Applications and Technology, B. Chung, J. Thompson, D. Shuh, T. Albrecht-Schmitt, T. Gouder, 2008, ISBN 978-1-60511-074-5
- Volume 1105E —The Role of Lifelong Education in Nanoscience and Engineering, D. Palma, L. Bell, R. Chang, R. Tomellini, 2008, ISBN 978-1-60511-075-2
- Volume 1106E —The Business of Nanotechnology, L. Merhari, A. Gandhi, S. Giordani, L. Tsakalacos, C. Tsamis, 2008, ISBN 978-1-60511-076-9
- Volume 1107 — Scientific Basis for Nuclear Waste Management XXXI, W.E. Lee, J.W. Roberts, N.C. Hyatt, R.W. Grimes, 2008, ISBN 978-1-60511-079-0

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