
Nanoscale Luminescent Materials 3

Editors:

P. Mascher

McMaster University
Hamilton, Ontario, Canada

D. J. Lockwood

National Research Council - Canada
Ottawa, Ontario, Canada

Sponsoring Divisions:



Dielectric Science & Technology



Luminescence and Display Materials



Published by

The Electrochemical Society

65 South Main Street, Building D
Pennington, NJ 08534-2839, USA

tel 609 737 1902

fax 609 737 2743

www.electrochem.org

ecstransactions™

Vol. 61, No. 5

Copyright 2014 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 978-1-62332-164-2 (Hard Cover)
ISBN 978-1-60768-520-3 (PDF)

Printed in the United States of America.

Table of Contents

Preface *iii*

Chapter 1 **Semiconductor Nanowires**

(Invited) Novel Luminescent Materials Based on Semiconductor Nanowires 3
R. R. LaPierre, A. Gustafsson, P. Kuyanov, C. Haapamaki

(Invited) High Power Phosphor-Free InGaN/GaN/AlGaIn Core-Shell Nanowire White
Light Emitting Diodes on Si Substrates 9
*Z. Mi, H. Nguyen, M. Djavid, S. Zhang, A. Connie, S. Sadaf, Q. Wang, S. Zhao,
I. Shih*

Chapter 2 **Compound Semiconductor Systems**

(Invited) Point Defect Characterization of Group-III Nitrides by Using Monoenergetic
Positron Beams 19
A. Uedono, S. Ishibashi, N. Oshima, R. Suzuki, M. Sumiya

Optically Allowed Photoluminescence from a Direct-Gap Si-Ge Superstructure on
Si_{0.4}Ge_{0.6} 31
D. J. Lockwood, N. L. Rowell, A. Gouyé, L. Favre, A. Ronda, I. Berbezier

Chapter 3 **Quantum Dots - Electronic and Photonic Properties**

(Invited) The Interplay of Particle Size and Doping Concentration on the Electronic
Structure of Doped Quantum Dots 39
J. Wright, S. Lawson, R. W. Meulenberg

(Invited) Ballistic Hot Electron Effects in Nanosilicon Dots and Their Photonic Applications <i>N. Koshida, N. Ikegami, A. Kojima, R. Mentek, R. Suda, M. Yagi, J. Shirakashi, B. Gelloz, N. Mori</i>	47
--	----

White-Light Emission from Amorphous ZrHfO Thin Film Dielectrics with and without Embedded Nanocrystalline CdSe Dots <i>C. C. Lin, Y. Kuo</i>	55
---	----

Chapter 4 **Quantum Dot LEDs**

(Invited) Narrow Linewidth, Highly Efficient, and Integrated Light Emitting Diodes Based on Ge Quantum Dots in Optical Microcavities <i>X. Xu, T. Maruizumi, Y. Shiraki</i>	63
--	----

(Invited) Improving the Performance of Quantum Dot Light-Emitting Diodes through Nanoscale Engineering <i>J. M. Pietryga, W. K. Bae, Y. S. Park, I. Robel, V. I. Klimov</i>	75
--	----

Chapter 5 **Carbon-based Systems**

(Invited) Carbon Nanotube Based Photonics <i>A. Noury, X. Le Roux, E. Gauffrès, L. Vivien, N. Izard</i>	89
--	----

Structural and Optical Properties of Luminescent Silicon Carbonitride Thin Films <i>Z. Khatami, P. R. J. Wilson, O. Taggart, D. R. Frisina, J. Wojcik, P. Mascher</i>	97
--	----

Chapter 6 **Rare-Earth Doped Si Systems**

(Invited) Rare Earth Luminescence in Nanostructured Amorphous Silicon Alloys <i>L. R. Tessler</i>	107
--	-----

(Invited) Lanthanides Fluorides Doped Nanocrystals for Biomedical Applications 115
*A. Podhorodecki, A. Noculak, M. Banski, B. Sojka, A. Zelazo, J. Misiewicz,
J. Cichos, M. Karbowski, B. Zasonska, D. Horak, B. Sikora, D. Elbaum, T. Dumych,
R. Bilyy, M. Szewczyk*

(Invited) Photon Management Using Si Nanocrystals and Er³⁺ Ions: Generation of Hot Carriers upon Absorption of Low-Energy Photons 127
E. M. L. D. de Jong, S. Saeed, T. Gregorkiewicz

(Invited) Transport and Electroluminescence Properties of Size-Controlled Silicon Nanocrystals Embedded in SiO₂ Matrix Following the Superlattice Approach 133
*J. López-Vidrier, Y. Berencén, L. López-Conesa, O. Blázquez, J. M. Ramírez,
S. Estradé, F. Peiró, S. Hernández, B. Garrido*

Tb³⁺ Luminescence in a-SiN_x:H 141
G. F. Bosco, L. R. Tessler

Chapter 7 **Silicon Nanophotonics**

(Invited) Advances in Silicon Nanophotonics 149
G. Franzó, A. Irrera, M. Miritello, S. Boninelli, F. Iacona, F. Priolo

(Invited) Inhomogeneous Strain in Silicon Photonics 161
R. Wehrspohn, C. Schriever, J. Schilling

(Invited) Rare Earth Doped Metal-Oxide-Semiconductor Structures: A Promising Material System or a Dead End of Optoelectronic Evolution? 175
*L. Rebohle, Y. Berencén, M. Braun, B. Garrido, D. Hiller, B. Liu, J. M. Ramírez,
J. Sun, R. Wutzler, M. Helm, W. Skorupa*

Chapter 8 **The Materials Science of Nanoluminescence**

(Invited) Photoluminescence Enhancement of a Silicon Nanocrystal Plane Positioned in the Near-Field of a Silicon Nanowire 189
*H. Kallel, P. Wiecha, Y. Zhao, A. Arbouet, M. Carrada, G. Ben Assayag, P. Periwal,
T. Baron, P. Normand, A. Chehaidar, V. Paillard*

Influence of Size Purification and Self-Assembly on the Photoluminescence of Silicon Nanocrystal Ensembles	199
<i>J. Miller, A. Van Sickle, R. Anthony, U. Kortshagen, D. Kroll, E. Hobbie</i>	
Investigation of e-h Trapping Efficiency in Eu ³⁺ Doped YPO ₄ Using VUV Spectroscopy	205
<i>M. K. Wallace, A. L. Diaz</i>	
Luminescent Electrochromic Device Based on a Biohybrid Electrolyte Doped with a Mixture of Potassium Triflate and a Europium β-diketonate Complex	213
<i>M. Fernandes, A. M. P. Botas, R. Leones, S. Pereira, M. M. Silva, R. S. Ferreira, L. D. Carlos, E. Fortunato, R. Rego, V. de Zea Bermudez</i>	

Chapter 9 Poster Session

Correlation of Surface Composition to Optical Properties of CdSe Nanocrystals	229
<i>B. Shakeri, R. W. Meulenber</i>	
Author Index	237