PROCEEDINGS OF SPIE

SPIDigitalLibrary.org/conference-proceedings-of-spie

Front Matter: Volume 6448

, "Front Matter: Volume 6448," Proc. SPIE 6448, Colloidal Quantum Dots for Biomedical Applications II, 644801 (10 March 2007); doi: 10.1117/12.728825

SPIE.

Event: SPIE BiOS, 2007, San Jose, California, United States

Colloidal Quantum Dots for Biomedical Applications II

**Marek Osiński
Thomas M. Jovin
Kenji Yamamoto**
Editors

**20–21 and 23 January 2007
San Jose, California, USA**

Sponsored and Published by
SPIE—The International Society for Optical Engineering

Volume 6448

The International Society
for Optical Engineering

Proceedings of SPIE—The International Society for Optical Engineering 9780819465610, v. 6448

SPIE is an international technical society dedicated to advancing engineering and scientific applications of optical, photonic, imaging, electronic, and optoelectronic technologies.

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Colloidal Quantum Dots for Biomedical Applications II*, edited by Marek Osiński, Thomas M. Jovin, Kenji Yamamoto, Proceedings of SPIE Vol. 6448 (SPIE, Bellingham, WA, 2007) Article CID Number.

ISSN 1605-7422
ISBN 9780819465610

Published by
SPIE—The International Society for Optical Engineering
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone 1 360/676-3290 (Pacific Time) · Fax 1 360/647-1445
<http://www.spie.org>

Copyright © 2007, The Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at <http://www.copyright.com>. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 1605-7422/07/\$18.00.

Printed in the United States of America.

Contents

vii Conference Committee

SESSION 1 SYNTHESIS AND CHARACTERIZATION OF NANOCRYSTALS FOR BIOMEDICAL APPLICATIONS I

- 644804 **Fabrication of silicon-based nanoparticles for biological imaging** [6448-03]
X. Zhang, D. Neiner, S. Wang, A. Y. Louie, S. M. Kauzlarich, Univ. of California, Davis (USA)
- 644806 **Synthesis and characterization of ZnO and ZnO/ZnS colloidal nanocrystals** [6448-05]
M. R. Greenberg, G. A. Smolyakov, CHTM/Univ. of New Mexico (USA); T. J. Boyle, Sandia National Labs. (USA); M. Osiński, CHTM/Univ. of New Mexico (USA)

SESSION 2 SYNTHESIS AND CHARACTERIZATION OF NANOCRYSTALS FOR BIOMEDICAL APPLICATIONS II

- 644807 **Development of dual-function microbeads embedded with quantum dots and iron oxide nanocrystals for biomedical applications (Invited Paper)** [6448-06]
T. Sathe, S. Nie, Emory Univ. (USA) and Georgia Institute of Technology (USA)
- 64480A **Synthesis and properties of water-soluble CdSe/Zn_{1-x}Mn_xS semiconductor quantum dots using an amphiphilic polymer** [6448-08]
S. Wang, A. Y. Louie, S. M. Kauzlarich, Univ. of California, Davis (USA)

SESSION 3 NOVEL BIOMEDICAL NANOSENSORS BASED ON COLLOIDAL NANOCRYSTALS

- 64480D **Plasmon-resonant nanorods as multimodal agents for two-photon luminescent imaging and photothermal therapy (Invited Paper)** [6448-11]
T. B. Huff, M. N. Hansen, L. Tong, Y. Zhao, H. Wang, D. A. Zweifel, J.-X. Cheng, A. Wei, Purdue Univ. (USA)
-

Pagination: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon they are published online, and connects the same identifier to all online, print, and electronic versions of the publication.

SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages.

- 64480F **Luminescent lanthanide-ion doped nanoparticles as single-biomolecule labels and oxidant sensors** [6448-13]
D. Casanova, Lab. for Optics and Biosciences, Ecole Polytechnique, CNRS (France); D. Giaume, M. Moreau, T. Gacoin, J. P. Boilot, Lab. of Condensed Matter Physics, Ecole Polytechnique, CNRS (France); A. Alexandrou, Lab. for Optics and Biosciences, Ecole Polytechnique, CNRS (France)

SESSION 4 FRET-BASED NANOSENSING

- 64480G **Quantum dot-DNA bioconjugates for fluorescence-resonance-energy-transfer-based biosensing (Invited Paper)** [6448-14]
I. L. Medintz, Naval Research Lab. (USA); L. Berti, S3-INFM-CNR (Italy); T. Pons, H. Mattoussi, Naval Research Lab. (USA)
- 64480H **Investigation of quantum dot FRET in the far-red spectral region** [6448-15]
E. Z. Chong, D. R. Matthews, H. D. Summers, Cardiff Univ. (United Kingdom); K. L. Njoh, R. J. Errington, P. J. Smith, School of Medicine, Cardiff Univ. (United Kingdom)
- 64480I **Single quantum dot fluorescence resonant energy transfer: probing the heterogeneity in macroscopic samples** [6448-16]
T. Pons, I. L. Medintz, Naval Research Lab. (USA); X. Wang, D. S. English, Univ. of Maryland, College Park (USA); H. Mattoussi, Naval Research Lab. (USA)
- 64480K **Homogeneous FRET immunoassay based on lanthanides to quantum dots energy transfer** [6448-18]
N. Hildebrandt, Univ. Potsdam (Germany); L. J. Charbonnière, R. F. Ziessel, Lab. de Chimie Moléculaire, ECPM (France); H.-G. Löhmannsröben, Univ. Potsdam (Germany)
- 64480M **Quantum dot systems for specific biosensing applications** [6448-41]
J. L. Nadeau, S. J. Clarke, C. A. Hollmann, D. M. Bahcheli, R. A. Khatchadourian, A. Bachir, P. Wiseman, McGill Univ. (Canada)

SESSION 5 MOLECULAR-LEVEL SENSING AND IMAGING WITH NANOPARTICLES

- 64480O **A new class of nontoxic nanoparticle tags based on surface enhanced Raman scattering** [6448-20]
X.-M. Qian, D. Ansari, S. Nie, Emory Univ. (USA)
- 64480P **Nanocrystal clusters in combination with spectral imaging to improve sensitivity in antibody labeling applications of fluorescent nanocrystals** [6448-21]
J. S. Maier, J. L. Panza, ChemImage Corp. (USA); M. Bootman, Crystalplex (USA)
- 64480Q **Nanosecond imaging of quantum dots in highly fluorescent media** [6448-22]
A. C. Mitchell, C. G. Morgan, Univ. of Salford (United Kingdom) and Photonic Research Systems Ltd. (United Kingdom)

SESSION 6 APPLICATIONS OF COLLOIDAL NANOCRYSTALS IN CELL BIOLOGY I

- 64480U **Selective cellular delivery of self-assembled quantum dot-peptide bioconjugates** [6448-26]
J. B. Delehanty, I. L. Medintz, Naval Research Lab. (USA); T. Pons, Naval Research Lab. (USA) and Johns Hopkins Univ. (USA); P. E. Dawson, F. M. Brunel, The Scripps Research Institute (USA); H. Mattoussi, Naval Research Lab. (USA)

SESSION 7 APPLICATIONS OF COLLOIDAL NANOCRYSTALS IN CELL BIOLOGY II

- 64480X **Imaging ligand-gated ion channels with quantum dots** [6448-27]
I. D. Tomlinson, R. L. Orndorff, Vanderbilt Univ. (USA); H. Gussin, Univ. of Illinois at Chicago (USA); J. N. Mason, R. D. Blakely, Vanderbilt Univ. (USA); D. R. Pepperberg, Univ. of Illinois at Chicago (USA); S. J. Rosenthal, Vanderbilt Univ. (USA)
- 64480Y **Exploring membrane protein dynamics by multicolor single quantum dot imaging using wide field, TIRF, and hyperspectral microscopy** [6448-28]
D. S. Lidke, N. L. Andrews, J. R. Pfeiffer, Univ. of New Mexico (USA); H. D. T. Jones, M. B. Sinclair, D. M. Haaland, A. R. Burns, Sandia National Labs. (USA); B. S. Wilson, J. M. Oliver, Univ. of New Mexico (USA); K. A. Lidke, Sandia National Labs. (USA)

SESSION 8 APPLICATIONS OF COLLOIDAL QUANTUM DOTS IN CANCER DIAGNOSTICS AND THERAPY

- 644810 **Multiplexed molecular profiling of prostate cancer specimens using semiconductor quantum dot bioconjugates (Invited Paper)** [6448-30]
Y. Xing, Emory Univ. (USA) and Georgia Institute of Technology (USA); T. Numora, L. Chung, H. Zhau, Emory Univ. School of Medicine (USA); S. Nie, Emory Univ. (USA), Georgia Institute of Technology (USA), and Emory Univ. School of Medicine (USA)
- 644812 **Quantum dots as contrast agents for endoscopy: mathematical modeling and experimental validation of the optimal excitation wavelength** [6448-32]
M. Roy, R. S. DaCosta, R. Weersink, G. Natchev, Univ. of Toronto (Canada); S. R. H. Davidson, Ontario Cancer Institute, Univ. Health Network (Canada); W. Chan, Univ. of Toronto (Canada); B. C. Wilson, Univ. of Toronto (Canada) and Ontario Cancer Institute, Univ. Health Network (Canada)

SESSION 9 APPLICATIONS OF COLLOIDAL QUANTUM DOTS IN NEUROSCIENCE, DRUG DELIVERY, AND BIOMECHANICS

- 644813 **Ligand-bound quantum dots for intracellular imaging of neural receptors (Invited Paper)** [6448-42]
T. Q. Vu, S. Sundara Rajan, H. Liu, Oregon Health & Science Univ. (USA)
- 644815 **Nanometer tracking of single quantum dot array fluorescence: application to bone biomechanics** [6448-34]
K. Golcuk, T. M. Vanasse, M. D. Morris, S. A. Goldstein, Univ. of Michigan (USA)

POSTER SESSION

- 644816 **Silicon nanocrystals as handy biomarkers** [6448-35]
K. Fujioka, A. Hoshino, N. Manabe, Y. Futamura, International Medical Ctr. of Japan (Japan); R. Tilley, Victoria Univ. of Wellington (New Zealand); K. Yamamoto, International Medical Ctr. of Japan (Japan)
- 644817 **Multiplexed immunoassays for biomonitoring of exposure to agrochemicals using quantum dots as fluorescent reporters** [6448-36]
M. Nichkova, Univ. of California, Davis Cancer Ctr. (USA); D. Dosev, Univ. of California, Davis (USA); A. E. Davies, S. J. Gee, Univ. of California, Davis Cancer Ctr. (USA); I. M. Kennedy, Univ. of California, Davis (USA); B. D. Hammock, Univ. of California, Davis Cancer Ctr. (USA)

Author Index

Conference Committee

Symposium Chairs

James G. Fujimoto, Massachusetts Institute of Technology (USA)
R. Rox Anderson, Wellman Center for Photomedicine (USA),
Massachusetts General Hospital (USA) and Harvard Medical School
(USA)

Program Track Chairs

Paras N. Prasad, University at Buffalo, State University of New York (USA)
Dan V. Nicolau, The University of Liverpool (United Kingdom)

Conference Chairs

Marek Osinski, Center for High Technology Materials, The University of
New Mexico (USA)
Thomas M. Jovin, Max-Planck-Institut für biophysikalische Chemie
(Germany)
Kenji Yamamoto, International Medical Center of Japan (Japan) and
Tokyo Medical and Dental University Graduate School of Medicine
(Japan)

Program Committee

Antigoni Alexandrou, Laboratory for Optics and Biosciences, Ecole
Polytechnique, CNRS (France)
Moungi G. Bawendi, Massachusetts Institute of Technology (USA)
Warren C. W. Chan, University of Toronto (Canada)
Maxime Dahan, École Normale Supérieure (France)
Alexander Eychmüller, Technische Universität Dresden (Germany)
Victor I. Klimov, Los Alamos National Laboratory (USA)
Hedi Mattoussi, Naval Research Laboratory (USA)
Paul Mulvaney, The University of Melbourne (Australia)
Shuming Nie, Emory University (USA) and Georgia Institute of Technology
(USA)
Wolfgang J. Parak, Ludwig-Maximilians-Universität München (Germany)
Sandra J. Rosenthal, Vanderbilt University (USA)
Michael S. Wong, Rice University (USA)

Session Chairs

- 1 Synthesis and Characterization of Nanocrystals for Biomedical
Applications I
Hedi Mattoussi, Naval Research Laboratory (USA)

- 2 Synthesis and Characterization of Nanocrystals for Biomedical Applications II
Dmitri V. Talapin, IBM Thomas J. Watson Research Center (USA)
- 3 Novel Biomedical Nanosensors Based on Colloidal Nanocrystals
Arturo López-Quintela, Universidade de Santiago de Compostela (Spain)
- 4 FRET-based Nanosensing
Jennifer A. Hollingsworth, Los Alamos National Laboratory (USA)
- 5 Molecular-Level Sensing and Imaging with Nanoparticles
Wolfgang J. Parak, Ludwig-Maximilians-Universität München (Germany)
- 6 Applications of Colloidal Nanocrystals in Cell Biology I
Tania Q. Vu, Oregon Health & Science University (USA)
- 7 Applications of Colloidal Nanocrystals in Cell Biology II
Thomas M. Jovin, Max-Planck-Institut für biophysikalische Chemie (Germany)
- 8 Applications of Colloidal Quantum Dots in Cancer Diagnostics and Therapy
Kenji Yamamoto, International Medical Center of Japan (Japan) and Tokyo Medical and Dental University Graduate School of Medicine (Japan)
- 9 Applications of Colloidal Quantum Dots in Neuroscience, Drug Delivery, and Biomechanics
Diane S. Lidke, The University of New Mexico (USA)