

Colloidal Nanoparticles for Biomedical Applications IX

Wolfgang J. Parak
Marek Osiński
Kenji I. Yamamoto
Editors

1–4 February 2014
San Francisco, California, United States

Sponsored and Published by
SPIE

Volume 8955

Proceedings of SPIE, 1605-7422, V. 8955

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Colloidal Nanoparticles for Biomedical Applications IX, edited by Wolfgang J. Parak,
Marek Osinski, Kenji I. Yamamoto, Proc. of SPIE Vol. 8955, 895501 · © 2014 SPIE
CCC code: 1605-7422/14/\$18 · doi: 10.1117/12.2062785

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 Nanoparticles for Biomedical Applications IX*, edited by Wolfgang J. Parak, Marek Osinski, Kenji I. Yamamoto, Proceedings of SPIE Vol. 8955 (SPIE, Bellingham, WA, 2014) Article CID Number.

ISSN: 1605-7422

ISBN: 9780819498687

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

Copyright © 2014, 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 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 1605-7422/14/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.



SPIDigitalLibrary.org

Paper Numbering: 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 as 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. Numbers in the index correspond to the last two digits of the six-digit CID Number.

Contents

ix *Conference Committee*

SESSION 1 SYNTHESIS AND CONJUGATION I

- 8955 02 **Lipid-modified dendrimers as a tool for the design of nanoparticle-based multimodal MRI contrast agents** [8955-1]
A. Boni, M. Gemmi, Istituto Italiano di Tecnologia (Italy); C. Innocenti, Univ. degli Studi di Firenze (Italy); G. Bardi, A. Bertero, G. Signore, A. Bifone, Istituto Italiano di Tecnologia (Italy)
- 8955 04 **Toward efficient modification of large gold nanoparticles with DNA (Invited Paper)** [8955-3]
R. Gill, K. Göeken, Univ. Twente (Netherlands); V. Subramaniam, Univ. Twente (Netherlands) and FOM Institute AMOLF (Netherlands)

SESSION 2 SYNTHESIS AND CONJUGATION II

- 8955 07 **Impact of solvent mixture on iron nanoparticles generated by laser ablation** [8955-6]
M. Chakif, Ruhr-Univ. Bochum (Germany); O. Prymak, Univ. Duisburg-Essen (Germany); M. Slota, E. Heintze, Univ. Stuttgart (Germany); E. L. Gurevich, C. Esen, Ruhr-Univ. Bochum (Germany); L. Bogani, Univ. Stuttgart (Germany); M. Epple, Univ. Duisburg-Essen (Germany); A. Ostendorf, Ruhr-Univ. Bochum (Germany)

SESSION 3 SYNTHESIS AND CONJUGATION III

- 8955 0B **Multidentate oligomeric ligands to enhance the biocompatibility of iron oxide and other metal nanoparticles** [8955-10]
W. Wang, G. Palui, X. Ji, F. Aldeek, H. Mattoussi, The Florida State Univ. (United States)
- 8955 0C **Surface plasmon influence on two-photon luminescence from single gold nanorods** [8955-11]
J. Olesiak-Banska, K. Brach, M. Klekotko, M. Gordel, K. Matczyszyn, Wroclaw Univ. of Technology (Poland); J. Zyss, Lab. de Photonique Quantique, CNRS, Ecole Normale Supérieure de Cachan (France); M. Samoc, Wroclaw Univ. of Technology (Poland)
- 8955 0D **Multidentate polymeric ligands for long-term bioimaging using highly stable and functionalized quantum dots** [8955-13]
E. Giovanelli, E. Muro, M. Tasso, G. Sitbon, Lab. de Physique et d'Etude des Matériaux, CNRS, Univ. Pierre et Marie Curie (France); M. Hanafi, Lab. Physico-chimie des Polymères et Milieux Dispersés, CNRS, Univ. Pierre et Marie Curie (France); T. Pons, B. Dubertret, N. Lequeux, Lab. de Physique et d'Etude des Matériaux, CNRS, Univ. Pierre et Marie Curie (France)

SESSION 4 SYNTHESIS AND CONJUGATION IV

- 8955 0E **Peptide-modified gold nanoparticles for improved cancer therapeutics (Invited Paper)** [8955-14]
C. Yang, Ryerson Univ. (Canada); M. Van Prooijen, Univ. Health Network (Canada);
D. B. Chithrani, Ryerson Univ. (Canada)
- 8955 0I **Delivery of tobramycin coupled to iron oxide nanoparticles across the biofilm of mucoidal Pseudomonas aeruginosa and investigation of its efficacy** [8955-18]
L. M. Armijo, M. Kopciuch, The Univ. of New Mexico (United States); Z. Olszówka, The Univ. of New Mexico (United States) and Albuquerque Institute for Math and Science (United States); S. J. Wawrzyniec, A. C. Rivera, J. B. Plumley, N. C. Cook, Y. I. Brandt, The Univ. of New Mexico (United States); D. L. Huber, Sandia National Labs. (United States);
G. A. Smolyakov, N. L. Adolphi, The Univ. of New Mexico (United States); H. C. Smyth, The Univ. of Texas at Austin (United States); M. Osiński, The Univ. of New Mexico (United States) and Univ. Carlos III de Madrid (Spain)

SESSION 5 OPTICAL PROPERTIES: INTERACTION OF LIGHT WITH PARTICLES I

- 8955 0O **Combining ligand design and photo-ligation to provide optimal quantum dot-bioconjugates for sensing and imaging (Invited Paper)** [8955-24]
N. Zhan, G. Palui, M. Safi, H. Mattoussi, The Florida State Univ. (United States)

SESSION 6 OPTICAL PROPERTIES: INTERACTION OF LIGHT WITH PARTICLES II

- 8955 0P **Interactions of gold nanoparticles with biological structures (Invited Paper)** [8955-25]
R. Fernandes, Univ. of Southampton (United Kingdom); N. Smyth, Ctr. for Biological Sciences, General Hospital (United Kingdom); A. G. Kanaras, Univ. of Southampton (United Kingdom)
- 8955 0Q **Plasmonics with silver nanowires: plasmons affect the energy transfer (Invited Paper)** [8955-26]
A. Prymaczek, S. Maćkowski, Nicolaus Copernicus Univ. (Poland)
- 8955 0R **The use of real-time optical feedback to improve outcomes** [8955-27]
I. B. Magaña, P. Adhikari, R. B. Yendluri, Louisiana Tech Univ. (United States);
G. P. Goodrich, J. A. Schwartz, D. P. O'Neal, Nanospectra Biosciences, Inc. (United States)
- 8955 0S **Photoluminescence quantum yield of CdSe-ZnS/CdS/ZnS core-multishell quantum dots approaches 100% due to enhancement of charge carrier confinement** [8955-28]
P. Samokhvalov, P. Linkov, National Research Nuclear Univ. MEPhI (Russian Federation);
J. Michel, M. Molinari, Univ. de Reims Champagne-Ardenne (France); I. Nabiev, National Research Nuclear Univ. MEPhI (Russian Federation) and Univ. de Reims Champagne-Ardenne (France)

SESSION 7 OPTICAL PROPERTIES: INTERACTION OF LIGHT WITH PARTICLES III

- 8955 0T **Plasmonic biodegradable gold nanoclusters with high NIR-absorbance for biomedical imaging** [8955-29]
R. Stover, A. Murthy, S. Gourisankar, G. Nie, M. Martinez, T. Truskett, The Univ. of Texas at Austin (United States); K. Sokolov, The Univ. of Texas at Austin (United States) and The Univ. of Texas M.D. Anderson Cancer Ctr. (United States); K. Johnston, The Univ. of Texas at Austin (United States)
- 8955 0U **Evaluation of quantum dot-based concentric FRET configurations with a fluorescent dye and dark quencher for multiplexed bioanalyses (Invited Paper)** [8955-30]
E. M. Conroy, W.-R. Algar, The Univ. of British Columbia (Canada)

SESSION 8 OPTICAL PROPERTIES: INTERACTION OF LIGHT WITH PARTICLES IV

- 8955 13 **Noncytotoxic Mn-doped ZnSe/ZnS quantum dots for biomedical applications** [8955-38]
J. B. Plumley, B. A. Akins, The Univ. of New Mexico (United States); G. J. Alas, M. E. Fetrow, J. Nguyen, The Univ. of New Mexico (United States) and Volcano Vista High School (United States); P. Jain, The Univ. of New Mexico (United States) and La Cueva High School (United States); S. Yang, The Univ. of New Mexico (United States) and Albuquerque Academy (United States); Y. I. Brandt, G. A. Smolyakov, The Univ. of New Mexico (United States); W. Ornatowski, E. D. Milligan, UNM Health Sciences Ctr., The Univ. of New Mexico (United States); M. Osiński, The Univ. of New Mexico (United States)

SESSION 9 BIOMEDICAL APPLICATIONS I

- 8955 14 **Nanocapsules of perfluorooctyl bromide for theranostics: from formulation to targeting (Invited Paper)** [8955-40]
O. Diou, E. Fattal, LabEX LERMIT, CNRS, Univ. Paris-Sud (France); T. Payen, S. L. Bridal, LIP, CNRS, Univ. Pierre et Marie Curie (France); J. Valette, Institut d'Imagerie Biomédicale, CEA (France); N. Tsapis, LabEX LERMIT, CNRS, Univ. Paris-Sud (France)
- 8955 16 **Investigation of magnetic field enriched surface enhanced resonance Raman scattering performance using Fe₃O₄@Ag nanoparticles for malaria diagnosis** [8955-42]
C. Yuen, Q. Liu, Nanyang Technological Univ. (Singapore)
- 8955 17 **Iron-oxide colloidal nanoclusters: from fundamental physical properties to diagnosis and therapy (Invited Paper)** [8955-43]
A. Kostopoulou, Foundation for Research and Technology-Hellas (Greece); K. Brintakis, Foundation for Research and Technology-Hellas (Greece) and Aristotle Univ. of Thessaloniki (Greece); A. Lascialfari, Univ. degli studi di Milano (Italy) and Consorzio Interuniversitario Nazionale per la Scienza e Tecnologia dei Materiali (Italy); M. Angelakeris, Aristotle Univ. of Thessaloniki (Greece); M. Vasilakaki, K. Trohidou, National Ctr. for Scientific Research Demokritos (Greece); A. P. Douvalis, Univ. of Ioannina (Greece); S. Psycharakis, A. Ranella, Foundation for Research and Technology-Hellas (Greece); L. Manna, Istituto Italiano di Tecnologia (Italy); A. Lappas, Foundation for Research and Technology-Hellas (Greece)

SESSION 10 BIOMEDICAL APPLICATIONS II

- 8955 19 **Specific markers, micro-environmental anomalies and tropism: opportunities for gold nanorods targeting of tumors in laser-induced hyperthermia** [8955-45]
F. Tatini, F. Ratto, Istituto di Fisica Applicata Nello Carrara, CNR (Italy); S. Centi, I. Landini, S. Nobili, E. Witort, F. Fusi, S. Capaccioli, E. Mini, Univ. degli Studi di Firenze (Italy); R. Pini, Istituto di Fisica Applicata Nello Carrara, CNR (Italy)

SESSION 11 BIOMEDICAL APPLICATIONS III

- 8955 1E **Gold nanoparticles based colorimetric nanodiagnostics for cancer and infectious diseases** [8955-50]
P. Valentini, S. Persano, P. Cecere, S. Sabella, P. P. Pompa, Istituto Italiano di Tecnologia (Italy)
- 8955 1G **Intracellular light-induced release of signaling molecules from gold-coated liposomes** [8955-52]
G. V. Orsinger, The Univ. of Arizona (United States); J. D. Williams, The Univ. of Arizona (United States) and The Univ. of Arizona Cancer Ctr. (United States); M. Romanowski, The Univ. of Arizona (United States)

SESSION 12 BIOMEDICAL APPLICATIONS IV

- 8955 1M **Light-addressable amperometric electrodes for enzyme sensors based on direct quantum dot-electrode contacts (Invited Paper)** [8955-58]
M. Riedel, G. Göbel, Technische Fachhochschule Wildau (Germany); W. J. Parak, Philipps- Univ. Marburg (Germany); F. Lisdat, Technische Fachhochschule Wildau (Germany)

POSTER SESSION

- 8955 1P **Iron oxide nanoparticles in different modifications for antimicrobial phototherapy** [8955-59]
E. S. Tuchina, K. V. Kozina, N. A. Shelest, V. I. Kochubey, N.G. Chernyshevsky Saratov State Univ. (Russian Federation), V. V. Tuchin, N.G. Chernyshevsky Saratov State Univ. (Russian Federation), Institute of Precision Mechanics and Control (Russian Federation), and Univ. of Oulu (Finland)
- 8955 1T **Photoirradiation study of gold nanospheres and rods in Vero and Hela cell lines** [8955-63]
G. Poorani, P. Aruna, S. Ganesan, Anna Univ. Chennai (India); M. Elanchezhiyan, Univ. of Madras Taramani Campus (India)
- 8955 1W **Thin film mesoscale organization of nanoparticles by using biomolecular peptide tools** [8955-66]
E. Kasotakis, Univ. of Crete (Greece) and Foundation for Research and Technology-Hellas (Greece); A. Kostopoulou, M. Spuch-Calvar, M. Androulidaki, Foundation for Research and Technology-Hellas (Greece); N. T. Pelekanos, Univ. of Crete (Greece) and Foundation for Research and Technology-Hellas (Greece); A. G. Kanaras, Univ. of Southampton (United Kingdom); A. Mitraki, Univ. of Crete (Greece) and Foundation for Research and Technology-Hellas (Greece); A. Lappas, Foundation for Research and Technology-Hellas (Greece)

8955 1X **Shielding of quantum dots using diblock copolymers: Implementing copper catalyzed click chemistry to fluorescent quantum dots** [8955-67]
J.-P. Merkl, J. Ostermann, C. Schmidtke, H. Kloust, R. Eggers, A. Feld, C. Wolter, A.-M. Kreuziger, S. Flessau, Univ. Hamburg (Germany); H. Mattoussi, Florida State Univ. (United States); H. Weller, Univ. Hamburg (Germany)

Author Index

Conference Committee

Symposium Chairs

James G. Fujimoto, Massachusetts Institute of Technology
(United States)

R. Rox Anderson, Wellman Center for Photomedicine, Massachusetts
General Hospital (United States) and Harvard School of Medicine
(United States)

Program Track Chairs

Paras N. Prasad, University at Buffalo (United States)

Dan V. Nicolau, McGill University (Canada)

Conference Chairs

Wolfgang J. Parak, Philipps-Universität Marburg (Germany)

Marek Osiński, The University of New Mexico (United States)

Kenji I. Yamamoto, National Center for Global Health and Medicine
(Japan)

Conference Program Committee

Antigoni Alexandrou, Ecole Polytechnique (France)

Jesus M. de la Fuente, Universidad de Zaragoza (Spain)

James B. Delehanty III, U.S. Naval Research Laboratory
(United States)

Niko Hildebrandt, Institut d'Électronique Fondamentale (France)

Jennifer A. Hollingsworth, Los Alamos National Laboratory
(United States)

Thomas M. Jovin, Max-Planck-Institut für Biophysikalische Chemie
(Germany)

Antonios G. Kanaras, University of Southampton (United Kingdom)

Hedi Mattoussi, The Florida State University (United States)

Igor Medintz, U.S. Naval Research Laboratory (United States)

Paul Mulvaney, The University of Melbourne (Australia)

Jay L. Nadeau, McGill University (Canada)

Subramanian Tamil Selvan, A*STAR Institute of Materials Research
and Engineering (Singapore)

Claudia Tortiglione, Istituto di Cibernetica Eduardo Caianiello (Italy)

Tania Q. Vu, Oregon Health & Science University (United States)

Horst Weller, Universität Hamburg (Germany)

Session Chairs

- 1 Synthesis and Conjugation I
Marek Osiński, The University of New Mexico (United States)
- 2 Synthesis and Conjugation II
Antonios G. Kanaras, University of Southampton (United Kingdom)
- 3 Synthesis and Conjugation III
Ron Gill, Universiteit Twente (Netherlands)
- 4 Synthesis and Conjugation IV
Davide Prosperi, Università degli Studi di Milano-Bicocca (Italy)
- 5 Optical Properties: Interaction of Light with Particles I
Thomas A. Klar, Johannes Kepler Universität Linz (Austria)
- 6 Optical Properties: Interaction of Light with Particles II
Alf B. Mews, Universität Hamburg (Germany)
- 7 Optical Properties: Interaction of Light with Particles III
Hedi Mattoussi, The Florida State University (United States)
- 8 Optical Properties: Interaction of Light with Particles IV
Ute Resch-Genger, Bundesanstalt für Materialforschung und -prüfung (Germany)
- 9 Biomedical Applications I
Pablo del Pino, Universidad de Zaragoza (Spain)
- 10 Biomedical Applications II
Marc Schneider, Philipps-Universität Marburg (Germany)
- 11 Biomedical Applications III
Pavel S. Samokhvalov, National Research Nuclear University MEPhI (Russian Federation)
- 12 Biomedical Applications IV
Ralph Sperling, Fraunhofer, ICT-LMM (Germany)