

PROCEEDINGS OF SPIE

***Quantum Dots and Nanostructures:  
Synthesis, Characterization, and  
Modeling VII***

**Kurt G. Eyink  
Frank Szmulowicz  
Diana L. Huffaker**  
*Editors*

**24–25 and 27 January 2010  
San Francisco, California, United States**

*Sponsored and Published by*  
SPIE

**Volume 7610**

Proceedings of SPIE, 0277-786X, v. 7610

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

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 *Quantum Dots and Nanostructures: Synthesis, Characterization, and Modeling VII*, edited by Kurt G. Eyink, Frank Szmulowicz, Diana L. Huffaker, Proceedings of SPIE Vol. 7610 (SPIE, Bellingham, WA, 2010) Article CID Number.

ISSN 0277-786X

ISBN 9780819480064

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 © 2010, 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](http://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 0277-786X/10/\$18.00.

Printed in the United States of America.

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

**SPIE**   
Digital Library

[SPIDigitalLibrary.org](http://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 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

vii Conference Committee

---

## QUANTUM DOT GROWTH

- 7610 0D **Growth of InAs/Sb:GaAs quantum dots by the antimony surfactant mediated metal organic chemical vapor deposition for laser fabrication in the 1.3  $\mu\text{m}$  band** [7610-12]  
D. Guimard, Institute for Nano Quantum Information Electronics, The Univ. of Tokyo (Japan) and QD Laser Inc. (Japan); D. Bordel, Institute for Nano Quantum Information Electronics, The Univ. of Tokyo (Japan) and LIMMS/CNRS-IIS, The Univ. of Tokyo (Japan); M. Ishida, Institute for Nano Quantum Information Electronics, The Univ. of Tokyo (Japan); M. Nishioka, Y. Wakayama, Institute of Industrial Science, The Univ. of Tokyo (Japan); Y. Tanaka, H. Sudo, T. Yamamoto, Fujitsu Labs., Ltd. (Japan); H. Kondo, QD Laser Inc. (Japan); M. Sugawara, Fujitsu Labs., Ltd. (Japan) and QD Laser Inc. (Japan); Y. Arakawa, Institute for Nano Quantum Information Electronics, The Univ. of Tokyo (Japan) and Institute of Industrial Science, The Univ. of Tokyo (Japan) and LIMMS/CNRS-IIS, The Univ. of Tokyo (Japan)

---

## LASER I

- 7610 0G **Quantum dots for single and entangled photon emitters (Invited Paper)** [7610-15]  
D. Bimberg, E. Stock, A. Lochmann, A. Schliwa, W. Unrau, M. Münnix, S. Rodt, Technische Univ. Berlin (Germany); A. I. Toropov, A. Bakarov, A. K. Kalagin, V. A. Haisler, Institute of Semiconductor Physics (Russian Federation)
- 7610 0J **Recent progress towards acoustically mediated carrier injection into individual nanostructures for single photon generation** [7610-18]  
S. Völkl, F. J. R. Schüle, F. Knall, A. Wixforth, H. J. Krenner, Univ. Augsburg (Germany); A. Laucht, J. J. Finley, Walter Schottky Institut, Technische Univ. München (United States); J. Riihonen, M. Mattila, M. Sopanen, H. Lipsanen, Helsinki Univ. of Technology (Finland); J. He, T. A. Truong, H. Kim, P. M. Petroff, Univ. of California, Santa Barbara (United States)

---

## ORDERED STRUCTURES

- 7610 0L **Influence of ex-situ AFM treatment on epitaxial growth of self-organized InAs quantum dots (Invited Paper)** [7610-20]  
N. Yu. Gordeev, Ioffe Physico-Technical Institute (Russian Federation) and Nanotechnology Research and Education Ctr., St. Petersburg Academic Univ. (Russian Federation); V. V. Goncharov, S. A. Mintairov, N. A. Kalyuzhnyy, V. M. Lantsov, Ioffe Physico-Technical Institute (Russian Federation); P. N. Brunkov, Ioffe Physico-Technical Institute (Russian Federation) and St. Petersburg State Polytechnical Univ. (Russian Federation)
- 7610 0N **1.55- $\mu\text{m}$  InAs quantum dot number and size control on truncated InP pyramids and integration by selective area epitaxy** [7610-37]  
H. Wang, J. Yuan, P. J. van Veldhoven, R. Nötzel, Eindhoven Univ. of Technology (Netherlands)

- 7610 0O **Shape changes in patterned planar InAs as a function of thickness and temperature** [7610-22]  
K. G. Eyink, Air Force Research Lab. (United States); L. Grazulis, Univ. of Dayton (United States); K. Mahalingam, Universal Technology Corp. (United States); M. Twyman, J. Shoaf, J. Hoelscher, C. Claflin, Wright State Univ. (United States); D. Tomich, Air Force Research Lab. (United States)

---

## LASER II

- 7610 0Q **Self-assembled InAs quantum dots within a vertical cavity structure for all-optical switching devices** [7610-24]  
C. Y. Jin, O. Kojima, T. Inoue, T. Kita, O. Wada, Kobe Univ. (Japan); M. Hopkinson, The Univ. of Sheffield (United Kingdom); K. Akahane, National Institute of Information and Communications Technology (Japan)
- 7610 0R **Theory of relaxation oscillations and modulation response of a quantum dot laser** [7610-25]  
L. V. Asryan, Virginia Polytechnic Institute and State Univ. (United States); R. A. Suris, Ioffe Physico-Technical Institute (Russian Federation)
- 7610 0T **Double tunneling-injection quantum dot laser: effect of the wetting layer** [7610-27]  
D.-S. Han, L. V. Asryan, Virginia Polytechnic Institute and State Univ. (United States)

---

## QUANTUM WIRES AND ADDITIONAL TOPICS

- 7610 0V **Lithography-free synthesis of freestanding gold nanoparticle arrays encapsulated within dielectric nanowires (Invited Paper)** [7610-29]  
W. Hu, B. Liu, N. S. Dellas, S. M. Eichfeld, S. E. Mohny, J. M. Redwing, T. S. Mayer, The Pennsylvania State Univ. (United States)
- 7610 0X **Coupled thermo-electromechanical effects in quantum dots and nanowires** [7610-31]  
S. R. Patil, R. V. N. Melnik, Wilfrid Laurier Univ. (Canada); O. I. Tsviliuk, JSC Rodovid Bank (Ukraine)

---

## ADDITIONAL TOPICS

- 7610 0Z **The effects of electric and magnetic field on the hydrogenic donor impurity in GaN/Al<sub>x</sub>Ga<sub>1-x</sub>N spherical quantum dot** [7610-33]  
H.-L. Wang, H.-T. Wu, Qufu Normal Univ. (China); Q. Gong, S.-L. Feng, Shanghai Institute of Microsystem and Information Technology (China)

---

## POSTER SESSION

- 7610 11 **Optical characterization of ZnO nanoparticles and nanorods prepared by wet chemical technique at low temperature** [7610-35]  
K. Murari, R. Kumar, Ctr. of Excellence in Lasers and Optoelectronic Sciences, CUSAT (India); M. Kailasnath, International School of Photonics, CUSAT (India); P. Radhakrishnan, Ctr. of Excellence in Lasers and Optoelectronic Sciences, CUSAT (India); V. P. N. Nampoori, International School of Photonics, CUSAT (India)

- 7610 12    **Optical properties in InGaAs quantum dots on SiO<sub>2</sub>-patterned vicinal (001) GaAs substrate**  
[7610-36]  
H. J. Kim, S. Y. Yoo, H. J. Ko, M. S. Han, D. G. Kim, S. Han, S. H. Kim, H. C. Ki, Korea Photonics  
Technology Institute (Korea, Republic of)

*Author Index*



# Conference Committee

## *Symposium Chair*

**E. Fred Schubert**, Rensselaer Polytechnic Institute (United States)

## *Symposium Cochairs*

**Liang-Chy Chien**, Kent State University (United States)

**James G. Grote**, Air Force Research Laboratory (United States)

## *Program Track Chair*

**Ali Adibi**, Georgia Institute of Technology (United States)

## *Conference Chairs*

**Kurt G. Eyink**, Air Force Research Laboratory (United States)

**Frank Szmulowicz**, University of Dayton Research Institute (United States)

**Diana L. Huffaker**, University of California, Los Angeles (United States)

## *Program Committee*

**Pallab K. Bhattacharya**, University of Michigan (United States)

**C. Jeffrey Brinker**, Sandia National Laboratories (United States)

**Dennis G. Deppe**, CREOL, The College of Optics and Photonics,  
University of Central Florida (United States)

**Alfred W. B. Forchel**, Julius-Maximilians-Universität Würzburg (Germany)

**L. Jay Guo**, University of Michigan (United States)

**Axel G. Hoffmann**, Technische Universität Berlin (Germany)

**Yong-Hee Lee**, Korea Advanced Institute of Science and Technology  
(Korea, Republic of)

**Luke F. Lester**, The University of New Mexico (United States)

**James A. Loff**, VI Systems GmbH (Germany)

**Manijeh Razeghi**, Northwestern University (United States)

**Kevin L. Silverman**, National Institute of Standards and Technology  
(United States)

**Jian Xu**, The Pennsylvania State University (United States)

## *Session Chairs*

1 Collodial Quantum Dots I

**Theresa S. Mayer**, The Pennsylvania State University (United States)

- 2    Colloidal Quantum Dots II  
     **Jian Xu**, The Pennsylvania State University (United States)
- 3    Quantum Dot Growth  
     **Ping-Show Wong**, University of California, Los Angeles (United States)
- 4    Laser I  
     **Kurt G. Eyink**, Air Force Research Laboratory (United States)
- 5    Ordered Structures  
     **Ping-Show Wong**, University of California, Los Angeles (United States)
- 6    Laser II  
     **Kurt G. Eyink**, Air Force Research Laboratory (United States)
- 7    Quantum Wires and Additional Topics  
     **Kurt G. Eyink**, Air Force Research Laboratory (United States)
- 8    Additional Topics  
     **Kurt G. Eyink**, Air Force Research Laboratory (United States)