PROCEEDINGS OF SPIE

[SPIDigitalLibrary.org/conference-proceedings-of-spie](https://spiedigitallibrary.org/conference-proceedings-of-spie)

Front Matter: Volume 8269

, "Front Matter: Volume 8269," Proc. SPIE 8269, Photonic and Phononic Properties of Engineered Nanostructures II, 826901 (27 March 2012); doi: 10.1117/12.931591

SPIE.

Event: SPIE OPTO, 2012, San Francisco, California, United States

PROCEEDINGS OF SPIE

Photonic and Phononic Properties of Engineered Nanostructures II

**Ali Adibi
Shawn-Yu Lin
Axel Scherer**
Editors

**23–26 January 2012
San Francisco, California, United States**

Sponsored and Published by
SPIE

Volume 8269

Proceedings of SPIE, 0277-786X, v. 8269

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 *Photonic and Phononic Properties of Engineered Nanostructures II*, edited by Ali Adibi, Shawn-Yu Lin, Axel Scherer, Proceedings of SPIE Vol. 8269 (SPIE, Bellingham, WA, 2012) Article CID Number.

ISSN 0277-786X

ISBN 9780819489128

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 © 2012, 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 0277-786X/12/\$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*

OPTO PLENARY SESSION

- 8269 02 **Spinoptics: Spin degeneracy removal in nanostructures (Plenary Paper)** [8269-100]
V. Kleiner, N. Shitrit, E. Hasman, Technion-Israel Institute of Technology (Israel)

PHOTONIC CRYSTAL WAVEGUIDES AND FIBERS

- 8269 07 **Design and fabrication of hollow-core photonic crystal fibers for high power fast laser beam transportation and pulse compression (Invited Paper)** [8269-05]
Y. Y. Wang, Univ. of Bath (United Kingdom) and Xlim Research institute, CNRS, Univ. of Limoges (France); X. Peng, Raydiance, Inc. (United States); M. Alharbi, Univ. of Bath (United Kingdom) and Xlim Research institute, CNRS, Univ. of Limoges (France); C. F. Dutin, Univ. of Bath (United Kingdom); T. D. Bradley, Univ. of Bath (United Kingdom) and Xlim Research institute, CNRS, Univ. of Limoges (France); M. Mielke, T. Booth, Raydiance, Inc. (United States); F. Benabid, Univ. of Bath (United Kingdom) and Xlim Research institute, CNRS, Univ. of Limoges (France)
- 8269 0A **Broadband optical resonator based on coupled positive- and negative-index waveguides** [8269-08]
M. Bethune-Waddell, K. J. Chau, The Univ. of British Columbia (Canada)

PHOTONIC CRYSTAL RESONATORS AND LIGHT EMITTERS

- 8269 0G **Control of the Purcell effect of quantum dots embedded in photonic crystal nanocavity by manipulating Q-factor** [8269-13]
T. Nakamura, T. Asano, K. Kojima, T. Kojima, S. Noda, Kyoto Univ. (Japan)

PHOTONIC METAMATERIALS

- 8269 0K **Enhanced nonlinear effects in metamaterials and plasmonic materials (Invited Paper)** [8269-17]
C. Argyropoulos, A. Alù, The Univ. of Texas at Austin (United States)
- 8269 0L **Science meets magic: photonic metamaterials (Invited Paper)** [8269-18]
E. Ozbay, Bilkent Univ. (Turkey)
- 8269 0Q **Design of metamaterials with predetermined optical properties for broadband applications** [8269-23]
A. V. Goncharenko, National Cheng Kung Univ. (Taiwan) and Institute of Semiconductor Physics (Ukraine); V. U. Nazarov, Research Ctr. for Applied Sciences, Academia Sinica (Taiwan); K.-R. Chen, National Cheng Kung Univ. (Taiwan)

MODELING AND SIMULATION OF PHOTONIC CRYSTAL STRUCTURES

- 8269 OT **Fourier-Bessel expansions of localized light in disorder dielectric lattices** [8269-26]
S. R. Newman, R. C. Gauthier, Carleton Univ. (Canada)
- 8269 OW **Photonic band gaps of increasingly isotropic crystals at high dielectric contrasts** [8269-29]
M. E. Pollard, G. J. Parker, M. D. B. Charlton, Univ. of Southampton (United Kingdom)
- 8269 OX **From electromagnetically induced transparency to superscattering with a single structure: a coupled-mode theory for doubly resonant structures** [8269-30]
L. Verslegers, Z. Yu, Z. Ruan, P. B. Catrysse, S. Fan, Stanford Univ. (United States)

PHONONIC CRYSTAL STRUCTURES

- 8269 OY **Homogenized dynamic constitutive relation for Bloch-wave propagation in periodic composites: structure and symmetries (Invited Paper)** [8269-31]
S. Nemat-Nasser, A. Srivastava, Univ. of California, San Diego (United States)
- 8269 11 **Topologically evolved phononic material: breaking the world record in band gap size (Invited Paper)** [8269-34]
O. R. Bilal, M. I. Hussein, Univ. of Colorado Boulder (United States)
- 8269 12 **Phononic crystal strips for engineering micromechanical resonators (Invited Paper)** [8269-35]
J.-C. Hsu, National Yunlin Univ. of Science and Technology (Taiwan); F.-C. Hsu, P. Chang, Industrial Technology Research Institute South (Taiwan)

PLASMONIC METAMATERIALS

- 8269 1B **Multipolar effects and strong coupling in hybrid plasmonic metamaterials** [8269-44]
A. Farhang, Ecole Polytechnique Fédérale de Lausanne (Switzerland); A. Ramakrishna, Indian Institute of Technology Kanpur (India); O. J. F. Martin, Ecole Polytechnique Fédérale de Lausanne (Switzerland)
- 8269 1C **Plasmonic nanoparticles for a bottom-up approach to fabricate optical metamaterials** [8269-45]
J. Dintinger, T. Scharf, Ecole Polytechnique Fédérale de Lausanne (Switzerland)
- 8269 1D **Optimal arrangement of meta-atoms composing metamaterials** [8269-46]
Y.-C. Chuang, Nanyang Technological Univ. (Singapore); R. Dudley, M. A. Fiddy, The Univ. of North Carolina at Charlotte (United States)
- 8269 1E **Metamaterials based on plasmonic nanoshells and loss-compensation using fluorescent dye molecules and quantum dots** [8269-47]
S. Campione, F. Capolino, Univ. of California, Irvine (United States)

NANOPLASMONIC STRUCTURES AND DEVICES

- 8269 1J **Plasmonic absorbers for multispectral and broadband absorption** [8269-52]
S. Ayas, H. Guner, B. Turker, O. Ekiz, A. Dana, Bilkent Univ. (Turkey)

PLASMONIC ANTENNAS AND APERTURES

- 8269 1M **Characterization of high order modes of plasmonic antenna formed by nanoparticle/thin film hybrid structures** [8269-55]
S.-Y. Chen, National Chi Nan Univ. (Taiwan) and Duke Univ. (United States); Y. Urzhumov, D. R. Smith, A. A. Lazarides, Duke Univ. (United States)

DESIGN AND CHARACTERIZATION OF PLASMONIC STRUCTURES

- 8269 1R **Holographic eight-fold photonic quasi-crystal** [8269-60]
W. Mao, Univ. of Miami (United States) and Zhongshan Univ. (China); K. Shen, M. R. Wang, Univ. of Miami (United States)

NOVEL PHENOMENA IN PLASMONIC STRUCTURES

- 8269 1X **Tunable plasmonic nanostructures for light trapping and strong field enhancement at the metal surface** [8269-66]
A. Polyakov, K. F. Thompson, Lawrence Berkeley National Lab. (United States) and Univ. of California Berkeley (United States); S. Cabrini, P. J. Schuck, H. A. Padmore, Lawrence Berkeley National Lab. (United States)
- 8269 1Y **3D analysis of surface plasmon dispersion for SERS sensor based on inverted pyramid nanostructures** [8269-67]
S. Z. Oo, M. D. B. Charlton, M. E. Pollard, S. J. Pearce, R. Y. Chen, Univ. of Southampton (United Kingdom)
- 8269 1Z **Nonlinear plasmonics of metallic heptamers** [8269-68]
K. Thyagarajan, S. Rivier, O. J. F. Martin, Ecole Polytechnique Fédérale de Lausanne (Switzerland)
- 8269 20 **Coupling of guided surface plasmon polaritons to proximal self-assembled InGaAs Quantum Dots** [8269-69]
G. Bracher, K. Schraml, M. Blauth, C. Jakubeit, K. Müller, G. Koblmüller, M. Bichler, M. Kaniber, J. J. Finley, Technische Univ. München (Germany)

POSTER SESSION

- 8269 23 **Surface plasmon propagation in novel multilayered metallic thin films** [8269-72]
F. A. Ferri, V. A. G. Rivera, O. B. Silva, S. P. A. Osorio, A. R. Zanatta, B.-H. V. Borges, J. Weiner, E. Marega, Jr., Univ. de São Paulo (Brazil)

- 8269 24 **Theoretical analysis of the modal behavior of 2D random photonic crystals** [8269-73]
S. Hamada, S. Takeda, Keio Univ. (Japan); P. Viktorovitch, Institute des Nanotechnologies de Lyon, CNRS (France); M. Obara, Keio Univ. (Japan)
- 8269 27 **Fractal complementary bowtie aperture for confining and enhancing optical magnetic field** [8269-76]
Y. Yang, H. T. Dai, Tianjin Univ. (China); X. W. Sun, Tianjin Univ. (China) and Nanyang Technological Univ. (Singapore)
- 8269 28 **Integrated plasmonic Moiré cavity in photonic crystal cavity for luminescence enhancement** [8269-77]
S. P. A. Osório, O. B. Silva, F. A. Ferri, V. A. G. Rivera, A. R. Zanatta, E. Marega, Jr., Univ. de São Paulo (Brazil)
- 8269 2B **Demonstration of self-imaging effect without paraxial approximation** [8269-80]
W. Zhao, Rochester Institute of Technology (United States); X. Huang, Michigan Technological Univ. (United States); Z. Lu, Rochester Institute of Technology (United States)
- 8269 2C **The surface plasmon resonance sensor with the metallic nanostructure for biosensing** [8269-81]
B.-H. Lee, G.-Y. Oh, H.-S. Kim, T.-K. Lee, Chung-Ang Univ. (Korea, Republic of); S.-H. Kim, H.-C. Ki, D.-G. Kim, Korea Photonics Technology Institute (Korea, Republic of); Y.-W. Choi, Chung-Ang Univ. (Korea, Republic of)
- 8269 2D **Dispersion engineering for surface waves on multilayer metal-insulator stacks** [8269-82]
R. Yang, Z. Lu, Rochester Institute of Technology (United States)
- 8269 2F **Negative refraction in the third photonic band of a two-dimensional elliptical rod photonic crystal in a centered rectangular lattice** [8269-84]
J. Lutkenhaus, K. Ohlinger, H. Zhang, Y. Lin, Univ. of North Texas (United States)
- 8269 2G **Optimization of a localized surface plasmon resonance biosensor for heat shock protein 70** [8269-85]
R. C. Denomme, Z. Young, L. Brock, P. M. Nieva, M. M. Vijayan, Univ. of Waterloo (Canada)
- 8269 2H **Luminescence enhancement of Er³⁺ ions from electric multipole nanostructure arrays** [8269-87]
V. A. G. Rivera, F. A. Ferri, S. P. A. Osorio, L. A. O. Nunez, A. R. Zanatta, E. Marega, Jr., Univ. de São Paulo (Brazil)
- 8269 2I **Focusing surface plasmons on Er³⁺ ions with convex/concave plasmonic lenses** [8269-88]
V. A. G. Rivera, F. A. Ferri, S. P. A. Osorio, L. A. O. Nunez, A. R. Zanatta, E. Marega, Jr., Univ. de São Paulo (Brazil)
- 8269 2M **GaAs thin film nanostructure arrays for III-V solar cell applications** [8269-92]
D. Liang, Y. Kang, Y. Huo, K. X. Wang, A. Gu, M. Tan, Z. Yu, S. Li, J. Jia, X. Bao, S. Wang, Y. Yao, S. Fan, Y. Cui, J. Harris, Stanford Univ. (United States)
- 8269 2N **Numerical study of helix photonic metamaterial** [8269-93]
Y.-R. Li, H.-H. Huang, Y.-C. Ling, Y.-C. Hung, National Tsing Hua Univ. (Taiwan)

- 8269 2O **Characterization of guiding properties of metallic nanorod metamaterials** [8269-94]
Y.-C. Ling, L.-Y. Chang Chien, Y.-C. Hung, National Tsing Hua Univ. (Taiwan)
- 8269 2P **Phase measurement interferometric microscopy of stacked fishnet metamaterials** [8269-95]
T. Matsui, A. Miura, T. Nomura, H. Fujikawa, K. Sato, Toyota Central R&D Labs., Inc. (Japan);
N. Ikeda, D. Tsuya, M. Ochiai, Y. Sugimoto, H. T. Miyazaki, National Institute for Materials
Science (Japan); M. Ozaki, M. Hangyo, Osaka Univ. (Japan); K. Asakawa, Univ. of Tsukuba
(Japan)
- 8269 2R **Colorimetric polarization sensing with single plasmonic gold nanorods** [8269-97]
S. Biswas, D. Nepal, K. Park, R. Vaia, Air Force Research Lab. (United States)

Author Index

Conference Committee

Symposium Chair

Klaus P. Streubel, OSRAM AG (Germany)

Symposium Cochairs

David L. Andrews, University of East Anglia Norwich (United Kingdom)
Liang-Chy Chien, Kent State University (United States)

Program Track Chair

Ali Adibi, Georgia Institute of Technology (United States)

Conference Chairs

Ali Adibi, Georgia Institute of Technology (United States)
Shawn-Yu Lin, Rensselaer Polytechnic Institute (United States)
Axel Scherer, California Institute of Technology (United States)

Program Committee

Shanhui Fan, Stanford University (United States)
Abdelkrim Khelif, CNRS-Georgia Tech Lorraine (France)
Maryanne C. J. Large, The University of Sydney (Australia)
Susumu Noda, Kyoto University (Japan)
Masaya Notomi, NTT Basic Research Laboratory (Japan)
Ekmel Ozbay, Bilkent University (Turkey)
Domenico Pacifici, California Institute of Technology (United States)
Dennis W. Prather, University of Delaware (United States)
William J. Wadsworth, University of Bath (United Kingdom)
Yong Xu, Virginia Polytechnic Institute and State University (United States)
Eli Yablonovitch, University of California, Berkeley (United States)

Session Chairs

- 1 Recent Advances in Engineered Nanostructures
Ali Adibi, Georgia Institute of Technology (United States)
- 2 Photonic Crystal Waveguides and Fibers
Luca Dal Negro, Boston University (United States)

- 3 Novel Phenomena in Photonic Crystals
Masaya Notomi, NTT Basic Research Laboratory (Japan)
- 4 Photonic Crystal Resonators and Light Emitters
Martin Wegener, Karlsruher Institut für Technologie (Germany)
- 5 Photonic Metamaterials I
Serap Aksu, Boston University (United States)
- 6 Photonic Metamaterials II
Christos Argyropoulos, The University of Texas at Austin (United States)
- 7 Modeling and Simulation of Photonic Crystal Structures
Ekmel Ozbay, Bilkent University (Turkey)
- 8 Phononic Crystal Structures I
Jin-Chen Hsu, National Yunlin University of Science and Technology (Taiwan)
- 9 Phononic Crystal Structures II
Gianluca Piazza, University of Pennsylvania (United States)
- 10 Optomechanical Structures
Mahmoud I. Hussein, University of Colorado at Boulder (United States)
- 11 Plasmonic Metamaterials
Yan Pennec, Institut d'Electronique, de Microélectronique, et de Nanotechnologie (France)
- 12 Nanoplasmonic Structures and Devices
Maysamreza Chamanzar, Georgia Institute of Technology (United States)
- 13 Plasmonic Antennas and Apertures
Maysamreza Chamanzar, Georgia Institute of Technology (United States)
- 14 Design and Characterization of Plasmonic Structures
Domenico Pacifici, Brown University (United States)
- 15 Novel Phenomena in Plasmonic Structures
Joseph W. Perry, Georgia Institute of Technology (United States)