PROCEEDINGS OF SPIE

Low-Dimensional Materials and Devices 2016

Nobuhiko P. Kobayashi
A. Alec Talin
M. Saif Islam
Albert V. Davydov
Editors

30–31 August 2016
San Diego, California, United States

Sponsored and Published by
SPIE

Volume 9924

Proceedings of SPIE 0277-786X, V. 9924

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

Low-Dimensional Materials and Devices 2016, edited by Nobuhiko P. Kobayashi, A. Alec Talin, M. Saif Islam,
Albert V. Davydov, Proc. of SPIE Vol. 9924, 992401 · © 2016 SPIE · CCC code: 0277-786X/16/$18
doi: 10.1117/12.2258072

The papers 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. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers 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 these proceedings:
Author(s), "Title of Paper," in *Low-Dimensional Materials and Devices 2016*, edited by Nobuhiko P. Kobayashi, A. Alec Talin, M. Saif Islam, Albert V. Davydov, Proceedings of SPIE Vol. 9924 (SPIE, Bellingham, WA, 2016) Six-digit Article CID Number.

ISSN: 0277-786X
ISSN: 1996-786X (electronic)

ISBN: 9781510602397
ISBN: 9781510602403 (electronic)

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 © 2016, 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/16/$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

SPIEDigitalLibrary.org

Paper Numbering: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of 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 and print versions of the publication. SPIE uses a six-digit CID article numbering system structured as follows:

- 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.

Contents

SESSION 1 0D AND 1D NANODEVICES

SESSION 2 BATTERY TRANSPORT

SESSION 3 NANO-INTERFACES

SESSION 4 CHARACTERIZATION OF BULK AND NANO-STRUCTURES

SESSION 5 SENSORS AND MEMRISTORS

SESSION 6 NANOFIBER AND NANO-OPTICAL CHARACTERIZATION

POSTER SESSION

Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Conference Committee

Symposium Chairs

Harry A. Atwater Jr., California Institute of Technology (United States)
Nikolay I. Zheludev, Optoelectronics Research Centre (United Kingdom) and Nanyang Technological University (Singapore)

Symposium Co-chairs

David L. Andrews, University of East Anglia (United Kingdom)
James G. Grote, Air Force Research Laboratory (United States)

Conference Chairs

Nobuhiko P. Kobayashi, University of California, Santa Cruz (United States)
A. Alec Talin, Sandia National Laboratories (United States)
M. Saif Islam, University of California, Davis (United States)
Albert V. Davydov, National Institute of Standards and Technology (United States)

Conference Program Committee

Kristine A. Bertness, National Institute of Standards and Technology (United States)
Shadi A. Dayeh, Los Alamos National Laboratory (United States)
Supratik Guha, IBM Thomas J. Watson Research Center (United States)
Jung Han, Yale University (United States)
Chennupati Jagadish, The Australian National University (Australia)
Mutsumi Kimura, Ryukoku University (Japan)
Takhee Lee, Gwangju Institute of Science and Technology (Korea, Republic of)
Marina S. Leite, University of Maryland, College Park (United States)
François Léonard, Sandia National Laboratories (United States)
Samuel S. Mao, Lawrence Berkeley National Laboratory (United States)
Sanjay Mathur, Universität zu Köln (Germany)
Samuel T. Picraux, Los Alamos National Laboratory (United States)
Paola Prete, Istituto per la Microelettronica e Microsistemi (Italy)
Sharka M. Prokes, U.S. Naval Research Laboratory (United States)
Zhifeng Ren, Boston College (United States)

Atsuhito Sawabe, Aoyama Gakuin University (Japan)
Fred Semendy, U.S. Army Research Laboratory (United States)
Loucas Tsakalakos, GE Global Research (United States)
Emanuel Tutuc, The University of Texas at Austin (United States)
Lionel Vayssieres, Xi'an Jiaotong University (China)
George T. Wang, Sandia National Laboratories (United States)

Session Chairs

1 0D and 1D Nanodevices
A. Alec Talin, Sandia National Laboratories (United States)
Marina S. Leite, University of Maryland, College Park (United States)

2 Battery Transport
A. Alec Talin, Sandia National Laboratories (United States)
Marina S. Leite, University of Maryland, College Park (United States)

3 Nano-interfaces
Nobuhiko P. Kobayashi, University of California, Santa Cruz (United States)
George T. Wang, Sandia National Laboratories (United States)

4 Characterization of Bulk and Nano-structures
Albert V. Davydov, National Institute of Standards and Technology (United States)

5 Sensors and Memristors
Kimberlee C. Collins, Sandia National Laboratories (United States)
François Léonard, Sandia National Laboratories (United States)

6 Nanofiber and Nano-optical Characterization
Ekaterina Pomerantseva, Drexel University (United States)
Kimberlee C. Collins, Sandia National Laboratories (United States)