

PROCEEDINGS OF SPIE

Nano-, Bio-, Info-Tech Sensors, and 3D Systems IV

Jaehwan Kim
Editors

27 April–8 May 2020
Online Only, United States

Sponsored by
SPIE

Cooperating Organizations
Jet Propulsion Laboratory (United States)

Published by
SPIE

Volume 11378

Proceedings of SPIE 0277-786X, V. 11378

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

Nano-, Bio-, Info-Tech Sensors, and 3D Systems IV, edited by Jaehwan Kim, Proc. of SPIE Vol. 11378
1137801 · © 2020 SPIE · CCC code: 0277-786X/20/\$21 · doi: 10.1117/12.2572574

Proc. of SPIE Vol. 11378 1137801-1

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 SPIDigitalLibrary.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 *Nano-, Bio-, Info-Tech Sensors, and 3D Systems IV*, edited by Jaehwan Kim, Proceedings of SPIE Vol. 11378 (SPIE, Bellingham, WA, 2020) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510635333

ISBN: 9781510635340 (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 © 2020, 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 \$21.00 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/20/\$21.00.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

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

**SPIE. DIGITAL
LIBRARY**

SPIDigitalLibrary.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 seven-digit CID article numbering system structured as follows:

- The first five 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

WEARABLE TECHNOLOGY

- 11378 06 **A piezoelectric-based advanced wearable: obstacle avoidance for the visually impaired built into a backpack (Invited Paper)** [11378-5]
- 11378 09 **Industrially knittable CNT/cotton sheath-core yarns for smart textiles** [11378-9]

NANOMATERIALS AND APPLICATIONS I

- 11378 0A **Design and test of continuous fabrication process for high-strength nanocellulose based long-fiber (Invited Paper)** [11378-10]
- 11378 0C **Effects of acid treatments on physical properties of CNT wires for wiring applications** [11378-12]
- 11378 0E **Gamma irradiation effect studies on monolayer CVD grown graphene on metallic substrates (Invited Paper)** [11378-14]

3D PRINTING AND BIOMATERIALS

- 11378 0N **Effect of biocides to odor-producing microorganisms in the hydrophilic coating** [11378-24]

NANOMATERIALS AND APPLICATIONS II

- 11378 0O **CWA detection using functionalized surface acoustic wave sensors (Invited Paper)** [11378-25]

SIMULATION AND BIO-, NANO-APPLICATIONS

- 11378 0X **Simulation of radiation effects of cellphones on humans (Invited Paper)** [11378-32]
- 11378 10 **Comparison of heat transfer coefficient according to the materials and structures** [11378-36]

POSTER SESSION

- 11378 1I **Experimental verification of 3D polymer based 1x4 Y-branch splitter** [11378-37]
- 11378 18 **Research on smart operation method of industrial robot based on laser sensor** [11378-44]
- 11378 1A **Optical coherence tomography-based intraocular pressure monitoring principle** [11378-46]
- 11378 1E **Damage detection in smart composite structures using low frequency structural vibration**
[11378-50]
- 11378 1G **Label-free biosensor for viruses and bacteria detection** [11378-54]