

PROCEEDINGS OF SPIE

# ***Nano-, Bio-, Info-Tech Sensors, and Wearable Systems 2022***

**Jaehwan Kim**  
**Kyo D. Song**  
**Ilkwon Oh**  
**Maurizio Porfiri**  
*Editors*

**6–10 March, 2022**  
**Long Beach, United States**

**4–10 April, 2022**  
**ONLINE**

*Sponsored and Published by*  
SPIE

**Volume 12045**

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](http://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 Wearable Systems 2022*, edited by Jaehwan Kim, Kyo D. Song, Ilkwon Oh, Maurizio Porfiri, Proc. of SPIE 12045, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510649651

ISBN: 9781510649668 (electronic)

Published by

**SPIE**

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

Telephone +1 360 676 3290 (Pacific Time)

[SPIE.org](http://SPIE.org)

Copyright © 2022 Society of Photo-Optical Instrumentation Engineers (SPIE).

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 fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center 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.

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](http://SPIDigitalLibrary.org)

---

**Paper Numbering:** A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE 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

v *Conference Committee*

---

## SMART OPTICS

---

- 12045 03 **Wavelength-selective light sensor fabricated on a photoactive azobenzene film (Invited Paper)** [12045-4]
- 12045 04 **Learning to use electronic travel aids for visually impaired in virtual reality** [12045-6]
- 12045 05 **RF and microwave radiation safety for 5G communications** [12045-7]

---

## 3D PRINTING AND NANOCOMPOSITES

---

- 12045 06 **Fabrication and characterization of nanocomposite based on aramid nanofibers (Invited Paper)** [12045-25]
- 12045 07 **Esterified lignin-based resin for cellulose-long-filament reinforced polymer composites** [12045-30]
- 12045 08 **Development, characterization, and properties of vanillin-based epoxy resins for natural fiber composites** [12045-32]

---

## SENSOR TECHNOLOGY

---

- 12045 09 **A strain-sensitive webbing structure** [12045-10]
- 12045 0A **Mitigating photo-induced artifacts on neural probes to understand CNS-related damage from space radiation** [12045-13]
- 12045 0B **Design of a hybrid SET-TFET nanoscale IC for RF and microwave frequencies** [12045-41]

---

## ACTIVE DEVICES

---

- 12045 0C **Aerosol jetted PZT actuated fiber MEMS scanner for potential microscopic imaging** [12045-17]

## ENERGY DEVICES

---

12045 0D **On integral resonant vibration control and the negative direct feedthrough term of a piezoelectric bimorph beam** [12045-24]

## POSTER SESSION

---

12045 0E **Development of innovative sensing devices and methodologies for ensuring agri-food quality and safety** [12045-15]

12045 0F **Sound visualization based on mechanoluminescent diaphragms** [12045-34]

12045 0G **Molecular dynamics study on cellulose nanofiber (CNF) alignment under the influence of external electric fields** [12045-35]

12045 0H **A study in bio-nanocomposite based on polycaprolactone reinforced by cellulose nanocrystal** [12045-37]

12045 0I **Simulation of the hydrogen reduction process for the production of direct reduced iron** [12045-40]