

PROCEEDINGS OF SPIE

# ***Nano-, Bio-, Info-Tech Sensors, and Wearable Systems 2023***

**Jaehwan Kim  
Ilkwon Oh  
Maurizio Porfiri  
Hargsoon Yoon**  
*Editors*

**13–14 March 2023  
Long Beach, California, United States**

*Sponsored and Published by*  
SPIE

**Volume 12485**

Proceedings of SPIE 0277-786X, V. 12485

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

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 2023*, edited by Jaehwan Kim, Ilkwon Oh, Maurizio Porfiri, Hargsoon Yoon, Proc. of SPIE 12485, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510660779

ISBN: 9781510660786 (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 © 2023 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*

---

## ELECTRODES FOR SENSORS

---

12485 02 **Stretchable piezoelectric polymer blend for dynamic stress and strain sensing (Invited Paper)**  
[12485-2]

---

## BIOMEDICAL ELECTRONICS AND DEVICES

---

12485 04 **A multiplayer virtual reality platform to evaluate electronic travel aid performance for persons with blindness and low vision** [12485-6]

12485 05 **Cochlea-inspired sound visualization method** [12485-7]

12485 06 **High accurate and efficient electrical impedance tomography for fast brain imaging** [12485-8]

12485 07 **A cost-effective, accessible Reduced Graphene Oxide (rGO) multifunctional wearable sensor via transfer printing** [12485-9]

---

## NANOCOMPOSITES

---

12485 08 **Aramid nanofibers-based multidimensional structure (Invited Paper)** [12485-10]

12485 09 **Strong, functional and hydro-stable straws for plastic replacement** [12485-13]

---

## SMART DEVICES I

---

12485 0A **Object classification robot hand system using thermal conductivity** [12485-21]

12485 0B **Skin-printable and self-adhesive hydrogel electrodes for functional electrical stimulation therapy** [12485-22]

12485 0C **Hybrid piezoelectric-magnetic, self-sensing actuator for vibration damping** [12485-24]

## SMART DEVICES II

---

- 12485 OD **Effect of heat generation in PVDF based electro-active polymer actuators** [12485-26]
- 12485 OE **Developing a novel electro-optic scanner for potential micro display and head-mounted display application** [12485-27]

## POSTER SESSION

---

- 12485 OF **Environment-friendly bio-based epoxy resin/cellulose nanofiber film for triboelectric nanogenerator application** [12485-15]
- 12485 OG **3D-printed flexural sensor devices for smart packaging of agrifood products** [12485-32]