

PROCEEDINGS OF SPIE

***International Workshop on  
Thin Films for Electronics,  
Electro-Optics, Energy and  
Sensors 2022***

**Guru Subramanyam  
Partha Banerjee  
Akhlesh Lakhtakia  
Nian X. Sun**  
*Editors*

**10–12 August 2022  
Boston, Massachusetts, United States**

*Sponsored by*  
CETRASE—Center of Excellence for Thin-film Research and Surface Engineering,  
University of Dayton (United States)  
The Pennsylvania State University (United States)  
Northeastern University (United States)

*Published by*  
SPIE

**Volume 12477**

Proceedings of SPIE 0277-786X, V. 12477

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 *International Workshop on Thin Films for Electronics, Electro-Optics, Energy and Sensors 2022*, edited by Guru Subramanyam, Partha Banerjee, Akhlesh Lakhtakia, Nian X. Sun, Proc. of SPIE 12477, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510660618

ISBN: 9781510660625 (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

vii *Workshop Committee*

---

## NANOPHOTONICS I

---

- 12477 03 **Compact, multiplexed, energy-efficient silicon nanophotonic switches (Invited Paper)** [12477-33]
- 12477 04 **On exceptional plane, surface, and compound waves (Invited Paper)** [12477-12]
- 12477 05 **Two-dimensional wide-bandgap materials for integrated quantum photonics (Invited Paper)** [12477-16]
- 12477 06 **Study on GaAs photocathode band structure and inbuilt electric field under exponential doping** [12477-19]

---

## CONTEMPORARY THIN FILM ELECTRONICS I

---

- 12477 07 **Controlling light polarization with VO<sub>2</sub> films (Invited Paper)** [12477-15]
- 12477 08 **Reconfigurable opto-chirality enabled by chalcogenide phase change nanomaterials (Invited Paper)** [12477-7]
- 12477 09 **Film thickness dependence of electrical hysteresis and Hall effect of thermochromic VO<sub>2</sub> thin films** [12477-36]
- 12477 0A **Transport properties of V<sub>1-x</sub>W<sub>x</sub>O<sub>2</sub> around the metal insulator transition temperature** [12477-21]

---

## PLENARY TALK II

---

- 12477 0B **Interface-engineered barium hexaferrite-wide-bandgap semiconductor integration enabling 5G system-on-wafer solutions (Plenary Paper)** [12477-17]

---

## NANOPHOTONICS II

---

- 12477 0C **Hyperdoped Si thin films for infrared detection (Invited Paper)** [12477-38]
- 12477 0D **CoFe<sub>2</sub>O<sub>4</sub>@SiO<sub>2</sub>@TiO<sub>2</sub> core-shell nanoparticles for photocatalytic water decontamination (Invited Paper)** [12477-20]

- 12477 OE **Double-layer antireflection coatings for CIGS thin-film solar cells** [12477-6]
- 12477 OF **Architecting the columnar morphology of sculptured thin films for polarization-universal bandgaps** [12477-14]
- 12477 OG **Analysis of the composite response of a polygonal array of chiral slab resonators via superposition of transverse modes at the centroid** [12477-3]

---

#### CONTEMPORARY THIN FILM ELECTRONICS II

---

- 12477 OH **Cluster formation and charge transfer in molecular doping of molybdenum disulfide (Invited Paper)** [12477-2]
- 12477 OI **Metal-oxide RRAM with rGO as oxygen exchange layer (Invited Paper)** [12477-10]
- 12477 OJ **Protein nanowire thin films for the potential of constructing green electronic devices (Invited Paper)** [12477-26]
- 12477 OK **Atomic force microscopy electrostatic nanolithography (AFMEN): a versatile tool for nano-patterning in thin films and beyond (Invited Paper)** [12477-11]

---

#### PLENARY TALK III

---

- 12477 OL **Bio-mimetic nanostructured thin films for surface-active devices (Plenary Paper)** [12477-30]

---

#### NANOPHOTONICS III

---

- 12477 OM **Growth of  $\text{Ge}_{1-x}\text{Sn}_x$  alloys for MWIR sensing applications (Invited Paper)** [12477-23]
- 12477 ON **Design principles of tunable optical filters using phase change materials (Invited Paper)** [12477-32]
- 12477 OO **Multifunctional metamaterial tunable filters using liquid crystals and electro-optic materials** [12477-22]

---

#### CONTEMPORARY THIN FILM ELECTRONICS III

---

- 12477 OP **Black phosphorus ink formulation for aerosol jet printing of planar and conformal optoelectronics (Invited Paper)** [12477-25]
- 12477 OQ **Conductivity effects on printed RF interconnects due to printed dielectric ramps** [12477-13]

- 12477 OR **Laser sintering of printed silver thin films for fabrication of strain sensors directly on a structure** [12477-4]
- 12477 OS **Development and evaluation of an autonomous and portable solar water disinfection reactor based on TiO<sub>2</sub> supported films** [12477-37]

---

#### MULTIFUNCTIONAL OXIDES AND MULTIFERROICS I

---

- 12477 OU **Ultrafast magnetoacoustics in ferromagnetic and antiferromagnetic thin-film heterostructures (Invited Paper)** [12477-27]
- 12477 OV **Ultrafast all-optical manipulation of magnetization in ferromagnetic thin films (Invited Paper)** [12477-28]
- 12477 OW **Novel phase formation and magnetism at the Sb<sub>2</sub>Te<sub>3</sub>/Ni<sub>80</sub>Fe<sub>20</sub> interface** [12477-31]

---

#### MULTIFUNCTIONAL OXIDES AND MULTIFERROICS II

---

- 12477 OY **Low-temperature crystallization of BST thin films on RT/Duroid substrate for tunable microwave devices (Invited Paper)** [12477-8]
- 12477 OZ **Magnetoelectric thin films by solution methods (Invited Paper)** [12477-29]
- 12477 IO **Multimode magnon-phonon interaction in ferrimagnetic thin films (Invited Paper)** [12477-35]
- 12477 II **Integrated magnetoelectrics: a path toward novel electronics with ultra-low SWaP-C (Invited Paper)** [12477-39]