

PROCEEDINGS OF SPIE

Biologically Inspired Materials, Processes, and Systems (BIMPS) 2025

Akhlesh Lakhtakia
Matko Knez
Raúl J. Martín-Palma
Editors

17–20 March 2025
Vancouver, B.C., Canada

Sponsored and Published by
SPIE

Volume 13430

Proceedings of SPIE 0277-786X, V. 13430

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.

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 *Biologically Inspired Materials, Processes, and Systems (BIMPS) 2025*, edited by Akhlesh Lakhtakia, Mato Knez, Raúl J. Martín-Palma, Proc. of SPIE 13430, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510686465

ISBN: 9781510686472 (electronic)

Published by

SPIE

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

Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2025 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. 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

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*

SOFT ROBOTICS: JOINT SESSION WITH 13430 AND 13431

- 13430 02 **Design and performance optimization of tubular IPMC actuators for biomedical applications** [13430-2]
- 13430 03 **Analysis of torsional response in pneumatic artificial muscles (Best Student Presentation Award - First Place)** [13430-3]

LOCOMOTION

- 13430 04 **Development of bio-inspired amphibious AUVs based on the morphological and swimming kinematics of secondarily aquatic vertebrates (Invited Paper)** [13430-4]
- 13430 05 **Development of a biomimetic Milky Way dark sky compass (Invited Paper)** [13430-5]
- 13430 06 **Multidisciplinary design optimization of the flapping-wing air vehicle using artificial neural network surrogate model** [13430-6]

MATERIALS II

- 13430 07 **Experimental study of the skeletal adaptations of deep-sea glass sponges (Best Student Presentation Award - Second Place)** [13430-12]

DEVICES

- 13430 08 **Cooperative effects in pixelated metasurface absorbers for terahertz waves using graphene and vanadium dioxide** [13430-16]
- 13430 09 **Bioinspired rubber composites for superior ice traction: enhancing winter safety through innovative laboratory testing in tribology** [13430-17]

MATERIALS AND DEVICES

- 13430 0A **Taking advantage of biological binders to solidify granular material: manufacture and recyclability of lignin-based biopolymer composites** [13430-20]

- 13430 0B **Fabrication process of *Morpho*-type optical diffuser using feasible double-step design**
[13430-21]
- 13430 0C **Biomimetic super-cholesteric materials** [13430-22]