PROCEEDINGS OF SPIE

Emerging Technologies and Materials for Security and Defence 2025

Chantal Andraud Roberto Zamboni Andrea Camposeo Luana Persano Martin Laurenzis Gerald S. Buller Robert A. Lamb Editors

15–16 September 2025 Madrid, Spain

Sponsored by SPIE

General Sponsors FiberBridge Photonics (Germany) Iberoptics Sistemas Ópticos (Spain)

Published by SPIE

Volume 13678

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 SPIEDigitalLibrary.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 Emerging Technologies and Materials for Security and Defence 2025, edited by Chantal Andraud, Roberto Zamboni, Andrea Camposeo, Luana Persano, Martin Laurenzis, Gerald S. Buller, Robert A. Lamb, Proc. of SPIE 13678, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510692954

ISBN: 9781510692961 (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.



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

	MATERIALS FOR ENERGY GENERATION AND DETECTION I
13678 03	Next generation quantum dot extended SWIR sensors [13678-2]
13678 06	Self-diffraction of continuous wave laser radiation in various nanomaterial suspensions [13678-5]
	MATERIALS FOR ENERGY GENERATION AND DETECTION II
13678 08	Automated quality inspection for high-precision monolithic optics with reduced SWaP-factor [13678-7]
13678 09	Mechanosensitive photonic polymers for stress sensing in soft robotics [13678-8]
13678 0A	Zero-power, optical H ₂ S gas sensors utilizing printed nematic liquid crystal patterns on metal salt-based reactive substrates (Best Student Paper Award) [13678-9]
	APPLICATIONS OF EMERGING TECHNOLOGIES
13678 OC	Applications of Fourier analysis in high-resolution SPAD sensing: from time-of-flight to passive imaging in real-world environments (Invited Paper) [13678-11]
13678 0D	Fast SPAD array error compensation for real-time NLOS imaging [13678-12]
13678 OE	Influence of some acquisition parameters in non-line-of-sight imaging [13678-13]
13678 OF	Assessment of FMCW RADAR and solid-state LiDAR technologies for C-UAS systems [13678-15]
	NEW SENSOR DEVICES
13678 0G	Colloidal quantum dot image sensors with optimized pixel dimensions (Invited Paper) [13678-16]
13678 OH	Avalanche photodetectors for the extended SWIR [13678-17]

13678 OI	Advanced dual-mode phototransistor for noise reduction and enhanced dynamic range [13678-18]
13678 OJ	Leonardo avalanche photodetectors: exquisite cross-domain performance [13678-19]
	EMERGING SENSING TECHNOLOGIES
13678 OK	Accurate and precise quantum sensing for space weather monitoring [13678-21]
13678 OL	Big data and AI-empowered classification of IR spectra acquired with a QCL-based standoff spectrometer: applications in forensics and security [13678-22]
13678 OM	Enhancing object recognition through camera-radar fusion and micro-Doppler signature integration [13678-23]
13678 00	Innovative touch and pressure sensing with LiDAR technology in waveguide systems [13678-25]
13678 OP	Towards DAS ship detection using signal-based features [13678-14]
	POSTER SESSION
13678 0\$	Cobalt nitrate as a saturable absorber in pulsed fiber lasers [13678-31]
13678 OU	Optimizing HfO ₂ -supported surface plasmon resonance biosensor sensitivity through MXene integration [13678-33]