PROCEEDINGS OF SPIE

Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Sensing XXIII

Jason A. Guicheteau
Chris R. Howle
Editors

3–7 April 2022
Orlando, Florida, United States

6–12 June 2022
ONLINE

Sponsored and Published by
SPIE

Volume 12116

Proceedings of SPIE 0277-786X, V. 12116

Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Sensing XXIII,
edited by Jason A. Guicheteau, Chris R. Howle, Proc. of SPIE Vol. 12116,
1211601 · © 2022 SPIE · 0277-786X · doi: 10.1117/12.2643293

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 *Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Sensing XXIII*, edited by Jason A. Guicheteau, Chris R. Howle, Proc. of SPIE 12116, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X
ISSN: 1996-756X (electronic)

ISBN: 9781510651081
ISBN: 9781510651098 (electronic)

Published by
SPIE
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time)
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. 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
SPIEDigitalLibrary.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 *Conference Committee*

STANDOFF SENSING OF CBRNE HAZARDS I

12116 02 **A solid-state deep ultraviolet spatial heterodyne Raman system for standoff chemical detection** [12116-1]

EXPLOSIVE MATERIAL SENSING

12116 03 **Enabling detection technologies for explosive threats** [12116-6]

12116 04 **Stand-off explosive sensing and imaging with scanning dual-comb spectrometer** [12116-8]

12116 05 **Portable chemical fingerprint identification system (PCFIS)** [12116-10]

ADVANCES IN CBE SIGNATURE MODELING AND SENSOR ALGORITHMS

12116 06 **Performance analysis through predictive modeling: application to an anomaly detection algorithm in operational scenarios** [12116-11]

12116 07 **Determining infrared optical constants for dolomite using single angle reflectance and spectroscopic ellipsometry** [12116-13]

12116 08 **Using spectroscopic ellipsometry and single-angle reflectance to derive accurate optical constants for chemical forms of aspartame** [12116-14]

12116 09 **Hybrid method to calculate the spectral optical constants (n, k) of smooth and rough bulk samples** [12116-12]

CHEMICAL HAZARDS SENSING I

12116 0A **Trace field identification of solid, liquid, and aerosolized CBRNE materials via handheld mass spectrometry** [12116-15]

12116 0B **Trace detection of threat agents using portable instrumentation combined with pressure sensitive adhesive sampling** [12116-16]

12116 0C **High-sensitivity spectroscopic detection of vapor mixtures using sorbent films on hyper-bounce ATR crystals** [12116-18]

INTEGRATED PHOTONICS FOR CBE SENSING

12116 0D **Towards hand-held infrared photonic integrated circuits (PICs) using quantum cascade lasers (QCLs) for chemical and biological hazard detection in water** [12116-19]

12116 0E **New polymer sorbents for waveguide-enhanced Raman spectroscopy (WERS) and refractive index-based photonic sensing** [12116-20]

12116 0F **Waveguide Enhanced Raman Spectroscopy (WERS) for biomarker detection and identification** [12116-21]

REMOTE AND DISTRIBUTED SENSING OF CBRNE HAZARDS

12116 0G **Interpreting chemical detection alarms with live analysis of ML algorithms** [12116-23]

12116 0H **Developing a network of inexpensive electrical conductivity sensors to map ammonia release** [12116-24]

12116 0I **Automation platform for remote use of colorimetric chemical sensors** [12116-25]

12116 0J **Active illumination source for hyperspectral spectrometer in UAV/UGV mounted applications** [12116-26]

RADIOLOGICAL AND NUCLEAR SENSING

12116 0K **Regional infrasonic and seismic event classification with machine learning** [12116-28]

BIOLOGICAL HAZARD SENSING

12116 0L **MAESTRO: high speed, wide field microbial detection using deep uv spectroscopy** [12116-29]

12116 0M **Monitoring deactivation processes of bacterial spores using fluorescence spectroscopy** [12116-32]

STANDOFF SENSING OF CBRNE HAZARDS II

12116 0N **Detection of chemical liquid hazards on surfaces using biomimetic stand-off sensing** [12116-34]

12116 0O **Status of hand-held 1 to 5 m standoff analyzer for real-time detection of trace CBE materials on surfaces** [12116-35]

12116 0P **Development of a family of new handheld UV raman sensors for standoff detection** [12116-36]

12116 0Q **Infrared backscatter imaging spectroscopy for standoff detection of hazardous materials** [12116-37]

CHEMICAL HAZARDS SENSING II

12116 0R **Multipath extinction detector for chemical sensing** [12116-39]

12116 0S **Chemical vapor detection using a passive infrared bioinspired sensor** [12116-42]

CHEMICAL HAZARDS SENSING III

12116 0T **"Snapshot" stand-off detection of target chemicals using broadband infrared lasers** [12116-43]

12116 0U **Carbon dioxide mid-infrared laser spectroscopy with a circular multi-reflection (CMR) cell** [12116-45]

12116 0V **Broadband infrared laser characterization for use in snapshot stand-off detection of hazardous materials** [12116-46]

12116 0W **Performing IR spectroscopy inside a gas chromatographic column** [12116-44]

DETECTION OF LANDMINE AND IED OBJECTS: IMAGING

12116 0X **Explosive hazard pre-screener based on simulated data with perfect annotation and imprecisely labeled real data** [12116-47]

12116 0Y **Scalable FFT-Krylov subspace method for landmine imaging problem** [12116-48]

12116 0Z **Determining the utility of a new metric using an object detector** [12116-49]

12116 10 **Environmentally informed buried object recognition** [12116-50]

12116 11 **Procedurally generated simulated datasets for aerial explosive hazard detection** [12116-51]

12116 12 **Parallel high-resolution compact partial FFT-type direct algorithms for subsurface scattering problems** [12116-53]

DETECTION OF LANDMINE AND IED OBJECTS: RADAR

12116 13 **Validation of a UAV-mounted GPR system for landmine and IED detection under operational conditions** [12116-54]

12116 14 **Evaluation of multi-polarization GPR for detection of buried command wires** [12116-55]

12116 15 **Exploring ellipse feature in GPR image for wire detection** [12116-56]

DETECTION OF LANDMINE AND IED OBJECTS: INDUCTION

12116 16 **Wideband EMI signatures of conductive pipes and wires** [12116-57]

12116 17 **Improved mechanisms of active magnetic sensing for subterranean target discrimination** [12116-58]

POSTER SESSION

12116 18 **Rapid and high-sensitive LSPR sensor for coronavirus detection** [12116-59]

12116 19 **Machine learning approach to assess sensitivity of wavelength modulation spectroscopy signals in trace gas sensing** [12116-61]

12116 1A **Rapid, broadband sensing of chemical warfare simulants using mid-infrared spectroscopy** [12116-62]

12116 1B **Inverse-spectral-analysis of diffuse reflectance for surface-distributed particles** [12116-60]

Conference Committee

Symposium Chairs

Augustus W. Fountain III, University of South Carolina (United States)
Teresa L. Pace, L3Harris Technologies, Inc. (United States)

Program Track Chair

Tien Pham, CCDC Army Research Laboratory (United States)

Conference Chairs

Jason A. Guicheteau, DEVCOM Chemical Biological Center (United States)
Chris R. Howle, Defence Science and Technology Laboratory (United Kingdom)

Conference Program Committee

Justin Bickford, DEVCOM Army Research Laboratory (United States)
Christopher C. Carter, Johns Hopkins University Applied Physics Laboratory (United States)
Darren K. Emge, DEVCOM Chemical Biological Center (United States)
Augustus Way Fountain III, University of South Carolina (United States)
Timothy J. Johnson, Pacific Northwest National Laboratory (United States)
Lars Landström, FOI-Swedish Defence Research Agency (Sweden)
Aaron LaPointe, DEVCOM C5ISR (United States)
Morgan Minyard, Defense Threat Reduction Agency (United States)
Tanya L. Myers, Pacific Northwest National Laboratory (United States)
Paul M. Pellegrino, DEVCOM Army Research Laboratory (United States)