

# ***Advanced Chemical Microscopy for Life Science and Translational Medicine***

**Ji-Xin Cheng**  
**Wei Min**  
**Garth J. Simpson**  
*Editors*

**1–3 February 2020**  
**San Francisco, California, United States**

*Sponsored by*  
SPIE

*Cosponsored by*  
Photothermal Spectroscopy Corporation (United States)  
DRS Daylight Solutions (United States)  
APE Angewandte Physik & Elektronik GmbH (Germany)  
VibroniX, Inc. (United States)  
Leica Microsystems GmbH (Germany)  
Spectra-Physics (United States)

*Published by*  
SPIE

**Volume 11252**

Proceedings of SPIE, 1605-7422, V. 11252

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 [SPIEDigitalLibrary.org](http://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 *Advanced Chemical Microscopy for Life Science and Translational Medicine*, edited by Ji-Xin Cheng, Wei Min, Garth J. Simpson, Proceedings of SPIE Vol. 11252 (SPIE, Bellingham, WA, 2020) Seven-digit Article CID Number.

ISSN: 1605-7422

ISSN: 2410-9045 (electronic)

ISBN: 9781510632677

ISBN: 9781510632684 (electronic)

Published by

**SPIE**

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

Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

[SPIE.org](http://SPIE.org)

Copyright © 2020, Society of Photo-Optical Instrumentation Engineers.

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 copying fees. The Transactional Reporting Service base fee for this volume is \$21.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online 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. The CCC fee code is 1605-7422/20/\$21.00.

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](http://SPIEDigitalLibrary.org)

---

**Paper Numbering:** *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article 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	<i>Authors</i>
vii	<i>Conference Committee</i>

---

## NEW METHODS FOR CHEMICAL IMAGING

---

11252 0H	<b>Thermo-elastic optical coherence microscopy</b> [11252-15]
----------	---

---

## TRANSIENT ABSORPTION AND HARMONIC MICROSCOPY

---

11252 0O	<b>Polarization dependent second harmonic generation microscopy in turbid media</b> [11252-22]
11252 0P	<b>In vivo high-resolution multimodal nonlinear optical microscopy of spinal cord in mice</b> [11252-23]

---

## CARS, SRS, RAMAN INNOVATION AND APPLICATIONS II

---

11252 0V	<b>Hyper-Raman spectroscopy of biologically important molecules</b> [11252-28]
11252 0W	<b>High speed imaging of B-cells by stimulated Raman scattering</b> [11252-29]

---

## INFRARED CHEMICAL IMAGING I

---

11252 10	<b>Polarimetric infrared spectroscopic imaging using quantum cascade lasers</b> [11252-34]
----------	--

---

## DATA SCIENCE IN CHEMICAL MICROSCOPY

---

11252 17	<b>Incorporating machine learning with Raman spectroscopy to differentiate bone types</b> [11252-40]
----------	---

---

## CARS, SRS, RAMAN INNOVATION AND APPLICATIONS III

---

11252 1A	<b>Novel narrow linewidth 785 nm diode laser with enhanced spectral purity facilitates low-frequency Raman spectroscopy</b> [11252-43]
----------	--

- 11252 1C     **High-speed super-multiplex organelle imaging** [11252-45]
- 11252 1D     **Feasibility study of the portable Raman spectroscopy based on Bessel beam** [11252-46]

---

**INFRARED CHEMICAL IMAGING II**

---

- 11252 1L     **Peak force infrared microscopy for label-free chemical imaging at sub 10 nm spatial resolution (Invited Paper)** [11252-56]
- 11252 1N     **Bioimaging by molecular-vibration-sensitive quantitative phase microscopy based on wide-field mid-infrared photothermal excitation** [11252-58]

---

**CARS, SRS, RAMAN INNOVATION AND APPLICATIONS IV**

---

- 11252 1T     **Hyper-raman spectroscopy of hydrogen bonding in DMSO-water mixtures** [11252-63]

---

**POSTER SESSION**

---

- 11252 22     **Generative adversarial network based sparse reconstruction for stimulated Raman projection tomography** [11252-47]