Terahertz, RF, Millimeter, and Submillimeter-Wave Technology and Applications XV

Laurence P. Sadwick Tianxin Yang Editors

22–27 January 2022 San Francisco, California, United States

20–24 February 2022 ONLINE

Sponsored and Published by SPIE

Volume 12000

Proceedings of SPIE 0277-786X, V. 12000

Terahertz, RF, Millimeter, and Submillimeter-Wave Technology and Applications XV, edited by Laurence P. Sadwick, Tianxin Yang, Proc. of SPIE Vol. 12000, 1200001 · © 2022 SPIE · 0277-786X · doi: 10.1117/12.2635666

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 Terahertz, RF, Millimeter, and Submillimeter-Wave Technology and Applications XV, edited by Laurence P. Sadwick, Tianxin Yang, Proc. of SPIE 12000, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510648715 ISBN: 9781510648722 (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.



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

SESSION 1 ANTENNAS

12000 02	Cross-polarization tuning of circularly polarized phased array antennas [12000-47]
12000 03	A logarithmic spiral antenna for polarization and incident angle insensitive broadband electromagnetic wave absorption [12000-2]
12000 04	Circularly polarized, long-wave-infrared nanoantennas [12000-3]
12000 05	3D printed Luneburg-style lens for beamforming and passive beamsteering in mmWave applications [12000-4]
SESSION 2	ELECTRONICS FOR DETECTION, MIXING, PROCESSING, AND COMMUNICATIONS
12000 06	Plasmonic Si CMOS TeraFETs for detection, mixing, and processing sub-THz radiation (Invited Paper) [12000-7]
12000 07	Feasibility demonstration of terahertz-wave communication with physical-layer security [12000-10]
SESSION 3	THZ SOURCES
12000 08	Passive terahertz source based on graded composition InGaAs structures [12000-15]
SESSION 4	SPECTROSCOPY AND RELATED TECHNOLOGIES
12000 09	Characterization of the dynamics of the tunable topological crystalline insulator $Pb_{1-x}Sn_xSe$ using optical pump-terahertz probe measurements [12000-18]
12000 0A	THz generation with photoconductive emitters with a low-noise GHz repetition rate laser [12000-19]

SESSION 5 RF, MILLIMETER AND SUBMILLIMETER-WAVE GENERATION, MODULATION, AND DETECTION

12000 OB	Progress toward instantaneous microwave photonic spatial-spectral localization [12000-20]
12000 OC	RF and microwave photonic signal generation and processing based on Kerr micro-combs [12000-21]

12000 0D Pulse amplitude modulation communication in terahertz-band using asymmetric Mach-Zehnder interferometer-type optical signal emulator [12000-22]

SESSION 6 THZ FRONTIERS

12000 OE Spoof terahertz surface plasmon polaritons on metasurface pathways and networks (Invited Paper) [12000-32]

SESSION 7 INNOVATIONS IN THZ AND IR

SESSION 9	THZ APPLICATIONS
12000 OM	PL and PLE characterization of high current density resonant tunnelling diodes for THz applications [12000-41]
12000 OL	Estimating dielectric parameters by reflecting evanescent waves at THz frequencies [12000-40]
12000 OK	Design, fabrication, and spectral characterization of temperature-dependent liquid crystal- based metamaterial to tune dielectric metasurface resonances [12000-50]
12000 OJ	Time-dependent degradation of hydrogen-terminated diamond MESFETs [12000-38]
SESSION 8	CHARACTERIZATION OF MATERIALS AND DEVICES
	narrowband infrared filter [12000-49]
12000 01	Design, fabrication, and spectral characterization of TM-polarized metamaterials-based
12000 OH	Fiber-based arrayed waveguide grating for spectral sensing [12000-36]
12000 0G	Optical processing for phased-array and beamspace mapping [12000-34]
12000 OF	Investigation of tunable fishnet metamaterials for optimal phase shift effect [12000-33]

12000 0N High stable optical beats in laser chaos for CW THz-TDS system [12000-42]

- 12000 00 Direct demultiplexing method of terahertz-wave multiple carrier channels in terahertz domain utilizing terahertz-wave asymmetric interferometer [12000-43]
- 12000 OP Printed terahertz metasurfaces for multipsectral imaging by thermo-conversion [12000-44]

SESSION 10 THZ AND SUB-MILLIMETER NOVEL DETECTORS AND APPLICATIONS

- 12000 0Q Discrimination between cosmological and stellar phenomena by the intensity interferometry II [12000-52]
- 12000 OR Self-driven broadband terahertz detector based on platinum telluride (PtTe₂) [12000-53]

Conference Committee

Symposium Chairs

Sonia M. García-Blanco, Universiteit Twente (Netherlands) Bernd Witzigmann, Friedrich-Alexander-Universität Erlangen-Nürnberg (Germany)

Symposium Co-Chairs

 Sailing He, KTH Royal Institute of Technology (Sweden) and Zhejiang University (China)
 Yasuhiro Koike, Keio University (Japan)

Program Track Chairs

James G. Grote, Photonics Engineering Consultant (United States) Shibin Jiang, AdValue Photonics, Inc. (United States) Yakov Sidorin, Quarles & Brady LLP (United States) Jean-Emmanuel Broquin, IMEP-LACH (France)

Conference Chairs

Laurence P. Sadwick, InnoSys, Inc. (United States) Tianxin Yang, Tianjin University (China)

Conference Program Committee

René Beigang, Technische Universität Kaiserslautern (Germany) Jianji Dong, Huazhong University of Science and Technology (China) Frank Ellrich, Technische Hochschule Bingen (Germany) Fabian Friederich, Fraunhofer-Institut für Techno- und Wirtschaftsmathematik ITWM (Germany) Robert H. Giles, University of Massachusetts Lowell (United States) **R. Jennifer Hwu**, InnoSys, Inc. (United States) Mona Jarrahi, UCLA Samueli School of Engineering (United States) Karen K. Lin, A*STAR Institute of Materials Research and Engineering (Sinaapore) Daniel Molter, Fraunhofer-Institut für Techno- und Wirtschaftsmathematik ITWM (Germany) J. Anthony Murphy, National University of Ireland, Maynooth (Ireland) Créidhe O'Sullivan, National University of Ireland, Maynooth (Ireland) Kyung Hyun Park, Electronics and Telecommunications Research Institute (Korea, Republic of) Alessia Portieri, TeraView Ltd. (United Kingdom)

Marco Rahm, Technische Universität Kaiserslautern (Germany)
Jinghua Teng, A*STAR Institute of Materials Research and Engineering (Singapore)
Michael Weibel, Joint Research and Development, Inc. (United States)

Maddy Woodson, Freedom Photonics, LLC (United States) Jiangfeng Zhou, University of South Florida (United States)