PROCEEDINGS OF SPIE

Advanced Fabrication Technologies for Micro/Nano Optics and Photonics XV

Georg von Freymann Eva Blasco Debashis Chanda Editors

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

20–24 February 2022 ONLINE

Co- Sponsored by e-skin Displays Inc. (United States) Opti-Cal GmbH (Germany)

Published by SPIE

> Volume 12012

Proceedings of SPIE 0277-786X, V. 12012

Advanced Fabrication Technologies for Micro/Nano Optics and Photonics XV, edited by Georg von Freymann, Eva Blasco, Debashis Chanda, Proc. of SPIE Vol. 12012, 1201201 · © 2022 SPIE · 0277-786X · doi: 10.1117/12.2635779

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 Advanced Fabrication Technologies for Micro/Nano Optics and Photonics XV, edited by Georg von Freymann, Eva Blasco, Debashis Chanda, Proc. of SPIE 12012, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510648951 ISBN: 9781510648968 (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

v Conference Committee

PRINTED MICRO- AND NANOOPTICS

12012 02	Printed glass freeform optics with high surface quality (Invited Paper) [12012-2]
12012 03	Photoinitiator-free micro/nano fabrication of biomaterials with nonlinear deep UV excitation [12012-7]
	METAMATERIALS AND METASURFACES
12012 04	Laser-based techniques for micro-optics and photonics (Invited Paper) [12012-11]
	VOLUMETRIC PRINTING I: JOINT SESSION WITH CONFERENCES 11992 AND 12012
12012 05	Rapid microfabrication of helical structures for industrial applications (Invited Paper) [12012-23]
	ADVANCED MANUFACTURING USING A DMD OR SLM: JOINT SESSION WITH 12012 AND 12014
12012 06	Structuring of liquid crystal elastomer actuators with selective polymerization for MEMS devices [12012-28]
12012 07	Computational optimization and the role of optical metrology in tomographic additive manufacturing (Invited Paper) [12012-31]
	LARGE AREA FABRICATION
12012 08	Improving silicon-photonics inverse-design printability by leveraging SEM contours for advanced Optical Proximity Correction techniques [12012-42]
	POSTER SESSION
12012 09	3D nano-printing coupler for silicon nitride suspended waveguide [12012-45]

- 12012 0A A method for fabricating ARS on glass lens using RIE [12012-46]
- 12012 OB Fabrication of 3-D light concentrating microphotonic structures by anisotropic wet etching of silicon [12012-51]

Conference Committee

Symposium Chairs

 Bernd Witzigmann, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany)
 Sonia M. García-Blanco, University of Twente (Netherlands)

Symposium Co-Chairs

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

Conference Chairs

Georg von Freymann, Technische University Kaiserslautern (Germany) Eva Blasco, Ruprecht-Karls-Univ. Heidelberg (Germany) Debashis Chanda, University of Central Florida (United States)

Program Track Chairs

Holger Becker, microfluid ChipShop GmbH (Germany) George von Freymann, Technische Universität Kaiserslautern (Germany)

Conference Program Committee

Andrea Alù, The City University of New York Advanced Science Research Center (United States)
Cornelia Denz, Westfälische Wilhelms-Univ. Münster (Germany)
Lingjie Jay Guo, University of Michigan (United States)
Ruth Houbertz, Multiphoton Optics GmbH (Germany)
Saulius Juodkazis, Swinburne University of Technology (Australia)
Stephen M. Kuebler, University of Central Florida (United States)
Mangirdas Malinauskas, Vilnius University (Lithuania)
Robert R. McLeod, University of Colorado at Boulder (United States)
Hernán R. Míguez García, Institute of Materials Science of Seville (Spain)
Christophe Moser, Ecole Polytechnique Fédérale de Lausanne (Switzerland)
Aaron J. Pung, Sandia National Labs. (United States)
Junsuk Rho, Pohang University of Science and Technology (Korea,

Junsuk kno, Pohang University of Science and Technology (Korea, Republic of)

Raymond C. Rumpf, The University of Texas at El Paso (United States)

Winston V. Schoenfeld, CREOL, The College of Optics and Photonics, University of Central Florida (United States)

Thomas J. Suleski, The University of North Carolina at Charlotte (United States)

Michael Thiel, Nanoscribe GmbH & Company KG (Germany) Sandra Wolff, Technische University Kaiserslautern (Germany)