PROCEEDINGS OF SPIE

Laser-based Micro- and Nanoprocessing XVIII

Rainer Kling Wilhelm Pfleging Koji Sugioka Editors

29 January – 1 February 2024 San Francisco, California, United States

Sponsored and Published by SPIE

Volume 12873

Proceedings of SPIE 0277-786X, V. 12873

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Laser-based Micro- and Nanoprocessing XVIII, edited by Rainer Kling, Wilhelm Pfleging, Koji Sugioka, Proc. of SPIE Vol. 12873, 1287301 · © 2024 SPIE 0277-786X · doi: 10.1117/12.3029984 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 Laser-based Micro- and Nanoprocessing XVIII, edited by Rainer Kling, Wilhelm Pfleging, Koji Sugioka, Proc. of SPIE 12873, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510670068 ISBN: 9781510670075 (electronic)

Published by **SPIE** P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) SPIE.org Copyright © 2024 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

FUNCTIONAL GLASS: JOINT SESSION WITH CONFERENCES 12872 AND 12873

12873 02 Comparative analysis of waveguide fabrication in BK7 and fused silica by ultrashort-pulsed lasers using long focal length [12873-2]

GLASS DRILLING AND SELECTIVE LASER ETCHING (SLE): JOINT SESSION WITH CONFERENCES 12872 AND 12873

- 12873 03 Selective laser-induced etching for novel 3D microphotonic devices [12873-3]
- 12873 04 Processing of thin, curved borosilicate glass with selective laser-induced etching [12873-4]

BEAM ENGINEERING FOR ADVANCED PROCESSING

- 12873 05 Photonic shaping tools for large-scale micro-machining (Invited Paper) [12873-6]
- 12873 06 Adaptive optics solution to improve laser-induced periodic surface structuring (LIPSS) [12873-9]

BURST MODE PROCESSING

12873 07 Ablation rate assessment of GHz femtosecond laser in burst mode through fast numerical simulation [12873-10]

MICRO/NANO PROCESSING OF METALS

- 12873 08 High-speed heat accumulation temperature measurement in high-throughput laser surface texturing for advanced coating substrate preparation [12873-18]
- 12873 09 Unveiling laser percussion drilling in metals with ultrashort pulses: insights from high-speed synchrotron x-ray imaging on microhole formation and side channel phenomena [12873-19]

3D PROCESSING

- 12873 0A Selective laser-induced etching (SLE) of transparent materials for microelectronic components and quantum computing applications (Invited Paper) [12873-20]
- 12873 OB Polymeric scaffolds fabricated by two photon polymerization for 3D cancer cell invasion assay [12873-23]
- 12873 OC Profile and microstructure accuracy of two-photon polymerization fabricated structures: the case study of the Phloeodes diabolicus [12873-24]

AI AND MACHINE LEARNING BASED PROCESSING

- 12873 0D Building artificial intelligence and science-and-theory-based simulations toward cyberphysical-system (CPS) laser manufacturing (Invited Paper) [12873-25]
- 12873 OE Creating microfluidic channels functionalized with micro- and nano-scale features via femtosecond laser surface processing [12873-27]

ADDITIVE MANUFACTURING AND BONDING

- 12873 OF Laser-induced forward transfer (LIFT) process for flexible construction of advanced 3D silicon anode designs in high-energy lithium-ion batteries [12873-30]
- 12873 0G Laser assisted micro and nano additive manufacturing processes in multiphase reacting fluid for wearable electronics [12873-31]
- 12873 0H Optical parameters impact on glass-to-metal welding [12873-32]

PROCESSING FOR LI-ION BATTERY

12873 01	Efficiency enhancement of Li-ion battery electrode structuring by pulse burst processing: results of an automated study (Invited Paper) [12873-34]
12873 OJ	Laser-assisted processing of nano-graphite/silicon anode materials for improved performance of Li-ion batteries [12873-35]
12873 OK	Ultrafast laser structuring of high-voltage cathode materials for lithium-ion batteries [12873-36]
12873 OL	Investigation of process mechanisms in laser-based microstructure adaptation of lithium-ion electrodes by fast IR-emission measurement [12873-37]
12873 OM	An electrode design study: laser structuring of anodes for fast-charging of batteries [12873-38]

LASERS IN ENERGY STORAGE AND CONVERSION

- 12873 0N High speed laser drilling of micro-holes for hydrogen applications [12873-40]
- 12873 00 Functionalization of copper for enhanced electrocatalytic reduction of carbon dioxide via ultrashort pulse laser surface processing [12873-41]
- 12873 OP Meeting the challenges in e-mobility with laser welding and sophisticated system technology (Invited Paper) [12873-42]

DIRECT WRITE PROCESSING

- 12873 0Q Sub-diffraction limited direct diode laser patterning of methacrylic polymer thin films doped with silver nanoparticles [12873-44]
- 12873 OR Ultrashort pulsed laser ablation of stainless steel with MHz bursts [12873-82]
- 12873 0S Novel liquid atomization technique based on photothermal generation of the metallic thin film [12873-47]

INNOVATIONS IN LASER MICRO/NANOPROCESSING

- 12873 0T Intensity distribution on cylindrical surfaces in ultrashort pulse laser turning [12873-50]
- 12873 0U Towards process control by detecting acoustic emissions during ultrashort pulsed laser ablation of multilayer materials [12873-51]

LARGE AREA MICRO/NANO-STRUCTURING

- 12873 0V Expanding direct laser interference patterning towards large areas, high throughputs, and 3D microstructuring: new configurations and strategies [12873-54]
- 12873 0W Surface patterning on zirconia dental implants by laser imprinting [12873-56]
- 12873 0X Parameter optimization for laser cutting of technical relevant glasses like alkaline free Borosilicate and high index glasses [12873-58]

FABRICATION OF FUNCTIONAL MICRODEVICES

12873 0Y Soliton optical frequency comb generation from polygon modes in weakly perturbed lithium niobate microdisks [12873-63]

12873 OZ	Femtosecond laser-induced nano structures on 4H-SiC surface [12873-65]
12873 10	Processing CoCrMo and AZ91D magnesium alloys with direct laser interference patterning, limits, and possibilities [12873-66]
12873 11	Experimental study on material ablation of dental alumina toughened zirconia ceramics with ps-pulses operating in burst mode [12873-67]
12873 12	Computational optimization of borehole sequences for the reduction of heat accumulation in drilling processes using ultrashort pulse lasers [12873-68]
12873 13	Combination of an axicon and a spatial light modulator for the generation of multi-Bessel beams for microdrilling using ultrashort pulsed laser [12873-69]
12873 14	Laser turning of PMMA with ultrashort laser pulses using UV and IR [12873-70]
12873 15	Microfabrication of polyimide film by helium-free short-pulse CO ₂ laser [12873-72]
12873 16	Drilling of various glass materials by short pulse CO2 laser with controllable laser parameters [12873-77]
12873 17	Electrically conductive polymer-graphene composite material for selective laser sintering additive manufacturing [12873-78]
12873 18	Laser sintering of various film compositions used in flexible hybrid electronics [12873-81]
	DIGITAL POSTER SESSION

12873 19 Experimental study on electrochemical machining parameters of synchronized laser and electrochemical machining drilling for micro-hole process [12873-74]

Conference Committee

Symposium Chairs

Stefan Kaierle, Laser Zentrum Hannover e.V. (Germany) John Ballato, Clemson University (United States)

Symposium Chairs

 Vassilia Zorba, Lawrence Berkeley National Laboratory (United States)
Kaoru Minoshima, University of Electro-Communications (Japan)

Program Track Chairs

Henry Helvajian, The Aerospace Corporation (United States) Guido Hennig, Daetwyler Graphics AG (Switzerland)

Conference Chairs

Rainer Kling, Berner Fachhochschule (Switzerland) Wilhelm Pfleging, Karlsruhe Institute of Technology (Germany) Koji Sugioka, RIKEN Center for Advanced Photonics (Japan)

Conference Program Committee

Claude Aguergaray, The University of Auckland (New Zealand) Antonio Ancona, University degli Studi di Bari Aldo Moro (Italy) Ya Cheng, Shanghai Institute of Optics and Fine Mechanics (China) Jiyeon Choi, Korea Institute of Machinery and Materials (Korea, Republic of) Francois Courvoisier, FEMTO-ST (France) Martí Duocastella, University de Barcelona (Spain) Oliver Haupt, Coherent LaserSystems GmbH and Company KG (Germany) Miguel Holgado Bolaños, University Politécnica de Madrid (Spain) **SeungYeon Kang**, University of Connecticut (United States) Andrés-Fabián Lasagni, TU Dresden (Germany) **Yongfeng Lu**, University of Nebraska-Lincoln (United States) Futoshi Matsumoto, Kanagawa University (Japan) Razvan Stoian, Laboratory Hubert Curien (France) Emmanuel Stratakis, Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas (Greece) Mitsuhiro Terakawa, Keio University (Japan) Michael J. Withford, Macquarie University (Australia)

Xin Zhao, Clemson University (United States)