PROCEEDINGS OF SPIE

Micromachining and Microfabrication Process Technology XVII

Mary Ann Maher
Paul J. Resnick
Editors

24 and 26 January 2012
San Francisco, California, United States

Sponsored by
SPIE

Cosponsored by
Dyoptyka (Ireland)
VUZIX Corporation (United States)

Published by
SPIE

Volume 8248

Proceedings of SPIE, 0277-786X, v. 8248

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

The papers included 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. The papers published in these proceedings 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 this book:
Author(s), "Title of Paper," in *Micromachining and Microfabrication Process Technology XVII*, edited by Mary Ann Maher, Paul J. Resnick, Proceedings of SPIE Vol. 8248 (SPIE, Bellingham, WA, 2012) Article CID Number.

ISSN 0277-786X
ISBN 9780819488916

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

Copyright © 2012, 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 $18.00 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. 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 0277-786X/12/$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIE Digital Library

SPIEDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first 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, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four 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. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID number.

Contents

v *Conference Committee*

vii *New optical, acoustic, and electrical diagnostics for the developing world (Plenary Paper) [8251-103]*
S. L. Neale, C. Witte, Y. Bourquin, C. Kremer, A. Menachery, Y. Zhang, R. Wilson, J. Reboud, J. M. Cooper, Univ. of Glasgow (United Kingdom)

PLENARY SESSION

8248 02 **Powering the wireless world with MEMS (Plenary Paper)** [8248-102]
S. B. Schaevitz, Lilliputian Systems, Inc. (United States)

SESSION 1 DEVICES AND APPLICATIONS

8248 03 **Optically transparent, flexible pressure sensor array micromachined utilizing plasma assisted bonding** [8248-01]
J. Yan, Univ. of California, Davis (United States)

8248 04 **Rotary MEMS comb-drive actuator with large deflection for photonic applications** [8248-02]
M. Q. Huda, T. M. F. Amin, Univ. of Alberta (Canada); Y. Ning, G. McKinnon, Norcada Inc. (Canada); J. Tulip, Boreal Laser, Inc. (Canada); W. Jäger, Univ. of Alberta (Canada)

8248 05 **Photovoltaic retinal prosthesis for restoring sight to the blind: implant design and fabrication** [8248-03]
L. Wang, Stanford Univ. (United States); K. Mathieson, Stanford Univ. (United States) and Univ. of California, Santa Cruz (United States); T. I. Kamins, J. Loudin, L. Galambos, J. S. Harris, D. Palanker, Stanford Univ. (United States)

8248 06 **Micromachined edge illuminated optically transparent automotive light guide panels** [8248-04]
R. A. Ronny, G. K. Knopf, The Univ. of Western Ontario (Canada); E. Bordatchev, M. Tauhiduzzaman, S. Nikumb, National Research Council Canada (Canada)

SESSION 2 MICROSTRUCTURE ENGINEERING

8248 07 **Fabrication of microstructures with continuous surface profiles and very large sag heights by laser lithography** [8248-06]
J. Dunkel, Fraunhofer Institute for Applied Optics and Precision Engineering (Germany) and Friedrich-Schiller-Univ. Jena (Germany); F. Wippermann, A. Bräuer, Fraunhofer Institute for Applied Optics and Precision Engineering (Germany)

8248 08 **Design of experiment for the optimisation of deep reactive ion etching of silicon inserts for microfabrication** [8248-07]
K. Wallis, C. P. Shaw, J. R. Alcock, Cranfield Univ. (United Kingdom)

8248 09 **Impact of initial surface parameters on the final quality of laser micro-polished surfaces** [8248-08]
M. Chow, The Univ. of Western Ontario (Canada); E. V. Bordatchev, National Research Council Canada (Canada); G. K. Knopf, The Univ. of Western Ontario (Canada)

SESSION 3 LASER PROCESSING

8248 0C **High aspect ratio microfeatures with laser texturing in mixed ablative-melting regime** [8248-11]
P. M. Romero, N. Otero, A. González, P. Vázquez, Asociación de Investigación Metalúrgica del Noroeste (Spain)

8248 0F **Fabrication qualities of micro-gratings encoding dependence on laser parameters by two-beam femtosecond lasers interference** [8248-14]
X. Wang, F. Chen, H. Liu, H. Bian, Q. Yang, J. Si, X. Hou, Xi'an Jiaotong Univ. (China)

SESSION 4 MEMS FABRICATION

8248 0G **Bosch-like method for creating high aspect ratio poly(methyl methacrylate) (PMMA) structures** [8248-15]
M. Haiducu, Simon Fraser Univ. (Canada); D. Sameoto, Univ. of Alberta (Canada); I. Foulds, King Abdullah Univ. of Science and Technology (Saudi Arabia); R. W. Johnstone, Teledyne DALSA Semiconductor (Canada); A. M. Parameswaran, Simon Fraser Univ. (Canada)

8248 0H **Stress engineering for free-standing SU-8 2002 thin film devices** [8248-16]
K. W. Oliver, S. J. Lukes, M. J. Moghimi, D. L. Dickensheets, Montana State Univ. (United States)

8248 0I **Numerical simulation of hot imprint process of periodical lamellar microstructure into polycarbonate** [8248-17]
R. Gaidys, B. Narijauskaitė, A. Palevičius, G. Janušas, Kaunas Univ. of Technology (Lithuania)

POSTER SESSION

8248 0J **Electro-hydrodynamic printing using hole-type electrode** [8248-18]
S. Lee, H. Kim, J. Chung, Korea Univ. (Korea, Republic of)

8248 0K **Laser-based microstructuring of materials surfaces using low-cost microlens arrays** [8248-19]
D. Nieto, CIDETEC (Spain), National Univ. of Ireland, Galway (Ireland), and Univ. de Santiago de Compostela (Spain); G. Vara, J. A. Diez, CIDETEC (Spain); G. M. O'Connor, National Univ. of Ireland, Galway (Ireland); J. Arines, C. Gómez-Reino, M. Flores-Arias, Univ. de Santiago de Compostela (Spain)

Author Index

Conference Committee

Symposium Chair

Harald Schenk, Fraunhofer Institute for Photonic Microsystems (Germany)

Symposium Cochair

David L. Dickensheets, Montana State University (United States)

Conference Chairs

Mary Ann Maher, SoftMEMS (United States)
Paul J. Resnick, Sandia National Laboratories (United States)

Program Committee

Mu Chiao, The University of British Columbia (Canada)
Sanjay Krishna, The University of New Mexico (United States)
Tamal Mukherjee, Carnegie Mellon University (United States)
Metin Ozen, Ozen Engineering, Inc. (United States)
Yu-Chuan Su, National Tsing Hua University (Taiwan)
T. C. Yih, Oakland University (United States)