PROCEEDINGS OF SPIE

Advanced Etch Technology for Nanopatterning III

Gottlieb S. Oehrlein
Qinghuang Lin
Editors

24–25 February 2014
San Jose, California, United States

Sponsored by
SPIE

Cosponsored by
LAM Research Corp. (United States)

Published by
SPIE

Volume 9054

Proceedings of SPIE 0277-786X, V. 9054

Advanced Etch Technology for Nanopatterning III, edited by Gottlieb S. Oehrlein,
Qinghuang Lin, Proc. of SPIE Vol. 9054, 905401 · © 2014 SPIE
CCC code: 0277-786X/14/$18 · doi: 10.1117/12.2064485

Please use the following format to cite material from this book:
Author(s), "Title of Paper," in *Advanced Etch Technology for Nanopatterning III*, edited by Gottlieb S. Oehrlein, Qinghuang Lin, Proceedings of SPIE Vol. 9054 (SPIE, Bellingham, WA, 2014) Article CID Number.

ISSN: 0277-786X
ISBN: 9780819499776

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

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

SESSION 1 REVIEWS AND OVERVIEWS OF NANOPATTERNING CHALLENGES

SESSION 2 NANOPATTERNING FOR ADVANCED LOGIC AND MEMORY TECHNOLOGY NODES

SESSION 3 PLASMA AND RESIST INTERACTIONS, INCLUDING PATTERNING QUALITY CONTROL (LER, CD UNIFORMITY, ETC.)

SESSION 4 PATTERNING INTEGRATION SCHEMES (MULTILAYER PATTERNING, SELF-ALIGNED PATTERNING, ETC.)

SESSION 5 NEW PLASMA SOURCES AND NEW ETCHING TECHNOLOGIES

SESSION 6 EMERGING PATTERNING TECHNOLOGIES (DSA AND OTHERS)

POSTER SESSION

Conference Committee

Symposium Chair

Harry J. Levinson, GLOBALFOUNDRIES, Inc. (United States)

Symposium Co-chair

Mircea V. Dusa, ASML US, Inc. (United States)

Conference Chair

Gottlieb S. Oehrlein, University of Maryland, College Park (United States)

Conference Co-chair

Qinghuang Lin, IBM Thomas J. Watson Research Center (United States)

Conference Program Committee

Julie Bannister, Tokyo Electron America, Inc. (United States)
Charles T. Black, Brookhaven National Laboratory (United States)
Maxime Darnon, LTM CNRS (France)
Sebastian U. Engelmann, IBM Thomas J. Watson Research Center (United States)
Eric A. Hudson, LAM Research Corporation (United States)
Catherine B. Labelle, GLOBALFOUNDRIES Inc. (United States)
Nae-Eung Lee, Sungkyunkwan University (Korea, Republic of)
Erwine Pargon, LTM CNRS (France)
Ricardo Ruiz, HGST (United States)
Seiji Samukawa, Tohoku University (Japan)
Denis Shamiryan, MAPPER Lithography B.V. (Netherlands)
Rich Wise, IBM Corporation (United States)
Anthony Yen, TSMC Taiwan (Taiwan)
Ying Zhang, Applied Materials, Inc. (United States)
Jeff Xu, Qualcomm Technologies Inc. (United States)

Session Chairs

1 Reviews and Overviews of Nanopatterning Challenges
Cathy Labelle, GLOBALFOUNDRIES Inc. (United States)
Rich Wise, IBM Corpoation (United States)

2 Nanopatterning for Advanced Logic and Memory Technology Nodes
Denis Shamiryan, MAPPER Lithography (Netherlands)
Eric A. Hudson, LAM Research Corporation (United States)

3 Plasma and Resist Interactions, Including Patterning Quality Control (LER, CD Uniformity, etc.)
Sebastian U. Engelmann, IBM Thomas J. Watson Research Center (United States)

4 Patterning Integration Schemes (multilayer patterning, self-aligned patterning, etc.)
Maxime Darnon, LTM CNRS (France)
Nae-Eung Lee, Sungkyunkwan University (Korea, Republic of)

5 New Plasma Sources and New Etching Technologies
Seiji Samukawa, Tohoku University (Japan)
Julie Bannister, Tokyo Electron America, Inc. (United States)

6 Emerging Patterning Technologies (DSA and others)
Ying Zhang, Applied Materials, Inc. (Taiwan)
Ricardo Ruiz, HGST (United States)

Introduction

This proceedings volume contains selected papers presented at the conference Advanced Etch Technology for Nanopatterning III held February 24-25, 2014 as part of the SPIE Advanced Lithography Symposium 2014. The meeting featured six sessions of oral presentations to highlight important achievements and challenges in the following areas of Advanced Etch Technology for Nanopatterning:

Session 1: Reviews and Overviews of Nanopatterning Challenges
Session 2: Nanopatterning for Advanced Logic and Memory Technology Nodes
Session 3: Plasma and Resist Interactions, Including Patterning Quality Control (LER, CD Uniformity, etc.)
Session 4: Patterning Integration Schemes (multilayer patterning, self-aligned patterning, etc.)
Session 5: New Plasma Sources and New Etching Technologies
Session 6: Emerging Patterning Technologies (DSA and others)

Additionally, there was a poster session.

We would like to thank all speakers and presenters for their stimulating contributions to the conference. We also would like to express our gratitude to the SPIE Advanced Lithography "Advanced Etch Technology for Nanopatterning III" Conference Committee members for their contributions in organizing this very successful conference. Finally, we would like to thank SPIE and its staff for support of this conference and their arrangements.

Gottlieb S. Oehrlein
Qinghuang Lin