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Thomas B. Faure
Paul W. Ackmann
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Introduction

This proceedings volume contains accepted papers from the SPIE conference on Photomask Technology 2013. The conference was arranged through the Bay Area Chrome Users Society (BACUS) and held as part of the 33rd International Symposium on Photomask Technology 10-12 September 2013 in Monterey, California, United States of America.

This year's conference included four invited papers in addition to the annual invited Mask Industry Assessment presentation by SEMATECH, the best paper by the European Mask and Lithography Conference (EMLC) 2013, the best paper by Photo Mask Japan (PMJ) 2013 and a summary of the PMJ 2013 Panel Discussion.

The conference presentations this year were organized in a single track format, allowing every participant the time to get a comprehensive overview of all of the subjects in the field of Photomask technology. The best oral papers were selected by voting of the program committee members, and a subset of the program committee members selected the best poster papers. In addition, two sessions on Mask Materials and Processes were held this year which reflects an increase in paper submissions in this important area.

One of the true highlights of the conference was the keynote presentation by Michael Mayberry from Intel titled "Delivering Complexity at the Frontier of Electronics." Dr. Mayberry stated that there are 1 trillion features on critical level masks at the advanced nodes due to the need for complexity, and that the key for the industry is to deliver complexity at the right price point. He also pointed out that the huge increase in complexity is one of the reasons the merchant mask maker market share is decreasing and captive mask maker market share is increasing at the advanced nodes. Finally, he stressed the importance for mask makers to measure and reduce variability on the more advanced 2d/complex structures on the mask. A question about why the value of mask making is not well understood by the industry. Dr. Mayberry pointed to the fact that the masks are far down the food chain for the end customer. They are clearly enabling but in the end critical only when they are not delivered in time to meet customer expectations.

The technical focus of this year's conference was an extension of optical lithography down to the 10 nm logic node while simultaneously continuing work to develop EUV technology for the 7 nm logic node and beyond. Both of these patterning solutions rely on the mask industry to execute and deliver mask technology on time and at the right quality and price. The technical papers in the conference showed that good progress continues to be made to address the challenges of advanced optical photomasks and EUV masks. However, this year's Sematech mask industry survey indicated that mask makers remain concerned about critical tool readiness for advanced technologies and the need for continued improvement in defect mitigation as well as the challenge of better addressing and managing ebeam write time.

This year's panel discussion titled "Big Glass: Will It Return?" covered the very hot industry topic of the potential need to switch to larger size glass for both EUV and advanced optical masks. The session was chaired by Paul Ackmann. A group of our industry's top experts were assembled for the discussion:

- Donis G. Flagello, Nikon Research Corp. of America
- Janice M. Golda, Intel Corp.
- Brian J. Grenon, RAVE LLC
- Franklin D. Kalk, Toppan Photomasks Inc.
- Pawitter J. Mangat, GLOBALFOUNDRIES Inc.
- Daniel C. Wack, KLA-Tencor Corp.

The animated discussion covered all aspects of the big glass issue including the pros and cons from each of the panelists' unique perspectives. Wolf Staud and Bob Naber rounded out the panel discussions by looking back to past industry recommendations and trying to assess where the panel had taken the discussion. Ultimately, the timing of when or if there is a change in glass size has a critical relationship to return on investment (ROI). There is a belief that only if there is a compelling ROI justification linked to implementation timing then the change to large glass will happen. For now, it appears that 6 inch material will be the choice for high volume optical and EUV manufacturing.

We thank all of the conference participants and especially the authors for providing excellent technical papers. We also thank all of the members of the program committee for their hard work to help make this year's conference a success. Their efforts included soliciting abstracts, reviewing abstracts, chairing sessions, voting for best paper, and insuring final manuscripts were submitted. Our sponsors also deserve special thanks for their continued support of Photomask Technology. The SPIE organization has our gratitude for their tireless efforts in organizing the conference and ensuring that things ran smoothly as well as their efforts to provide a timely publication of these proceedings.

We hope you find the papers contained in this volume of proceedings to be informative and helpful in your professional endeavors.

Thomas B. Faure
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Paul W. Ackmann
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Symposium Co-Chair