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Uwe F. W. Behringer
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Preface

The Catholic University of Leuven, Belgium, hosted the 37th EMLC 2022 from Monday, June 20th to Thursday, June 23rd, 2022. After the cancellation of the conference in 2020 and a digital conference in 2021, the European Mask and Lithography Conference EMLC 2022 was organized as a face-to-face event.

About 160 attendees listened to 53 presentations starting with a Tutorial Session on Monday afternoon. Peter De Bisschop from imec talked about "Stochastic effects in lithography, the ultimate resolution limit?" These effects manifest themselves in local CD variability (which in the case of a line/space pattern is usually quantified by the "Line Width Roughness," LWR) as well as in local pattering failure (micro bridging in space or randomly missing contact holes). Rogier Verberk from TNO-Netherlands Organization for Applied Scientific Research informed that QuTech (TNO and TU Delft) has agreed to make quantum technology accessible to society and industry via its full-stack prototype: Quantum Inspire.

Most conference presentations reflected the development of the last 3 years at the forefront of lithography technology. While in 2019 people were still discussing how EUV lithography would prove itself in semiconductor mass production, this has now become the norm. It was particularly clear in the very first Keynote presentation by Luc van den Hove, President and CEO of imec. In an outlook on the year 2036, he talked about "The endless progression of Moore's law" and explained that we are today at the dawn of the 5th disruptive innovation wave. This emerging 5th deep tech wave builds on the convergence of technologies such as AI, material science, biology, and semiconductors to disrupt virtually every aspect of the world we live in. Semiconductors will be the core of virtually all deep tech innovations thanks to their massive integration power, accessible mass production, and low cost.

But despite the fame of EUV, as of 2022, we have to realize that global non-EUV-based wafer production is in fact higher than that of EUV. This proportion should remain as such for the foreseeable future as stated by Taguhi Yeghoyan from Yole Development. She pointed out that wafer production for More than Moore (MtM) applications is growing with a 5% CAGR and the non-EUV lithography equipment market dedicated to MtM applications exceeds $ 1B and is expected to reach almost $ 2B in 2027.

Frank Abboud from Intel Mask Operations pointed out in his Keynote "Photomask Challenges for Upcoming Technology Nodes" that the continuation of Moore's law in semiconductor manufacturing will benefit from the technological advancement in patterning of ever smaller devices with advanced lithography and mask techniques. One key enabler, he stated, are innovations in photomasks. EUV mask

technologies in materials, tooling, and infrastructure exhibit the most complex and revolutionary changes in the history of the mask industry.

Jos P.H. Benschop from ASML explained in his Keynote that Extreme Ultraviolet lithography has come a long way since the pioneering work in the mid-1980s. EUV with 0.33 numerical aperture is currently being used in volume production of logic as well as DRAM devices. The next step in the EUV technology will be with 0.55 numerical aperture. Further innovations in scanner, mask, and resist technologies will further reduce the "k1" factor and enable a continuation of shrinkage well into the next decade.

New for the EMLC: For the first time in its history, the 2022 Program Committee and Carl Zeiss Semiconductor Mask Solutions (SMS) announced the "ZEISS Award for Talents in Photomask Industry – 1st Place at EMLC 2022". Ms Canpolat-Schmidt from the Fraunhofer Institute for Electronic Nano Systems (ENAS) at Chemnitz (Germany) received the ZEISS Award for "Lithographic Performance of Resist ma-N 1402 in an E-beam/i- line Stepper Intra-level Mix and Match Approach."

In addition, two EMLC 2022 Best Presentations were selected: One from Natallia Karlitskaya from Cymer/ASML on "Holistic imaging for yield improvements enabled by high availability, and low-environmental impact Cymer ArFi Lightsource" - this presentation was invited for BACUS 2022 - and one from Tatiana Kovalevich from imec, Leuven on "Spatial frequency breakdown of CD variation" which will be an invited talk at PMJ 2023.

Three EMLC 2022 sessions were held in new formats: A Panel discussion about "Data Analytics in Manufacturing" organized by Bertrand Le-Gratiet, STMicroelectronics and Serap Savari, Texas A&M University, as well as a two Sessions dedicated for 10 student oral talks (in addition, presented in the poster session).

On June 23rd, 2022 the EMLC 2022 attendees were invited by Kurt Ronse, Advanced Patterning Program Director to imec, for an overview of imec presentations and a window tour of the impressive 300 mm wafer fab facility.

In summary: The EMLC International Program Committee members and many positive comments from Conference Attendees allow us to state: "The EMLC2022 has been a great success!"

Please mark your calendar: The EMLC 2023 will take place from Monday, June 19th, till Wednesday, June 21st, 2023 at the Hilton Hotel in Dresden, Germany.

Uwe Behringer
UBC Microelectronics
EMLC 2022 Conference Chair

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