34th European Mask and Lithography Conference EMLC 2018

Monday, June 18th to Wednesday, June 20th, 2018 at the MINATEC Conference Center, Grenoble, France

Welcome to the EMLC2018 in Grenoble

On behalf of VDE/VDI-GMM, the EMLC2018 Sponsors, and the EMLC2018 Organizing Committee, we would like to welcome you to the 34th European Mask and Lithography Conference, EMLC2018 at the MINATEC Conference Centre in the City of Grenoble, France.

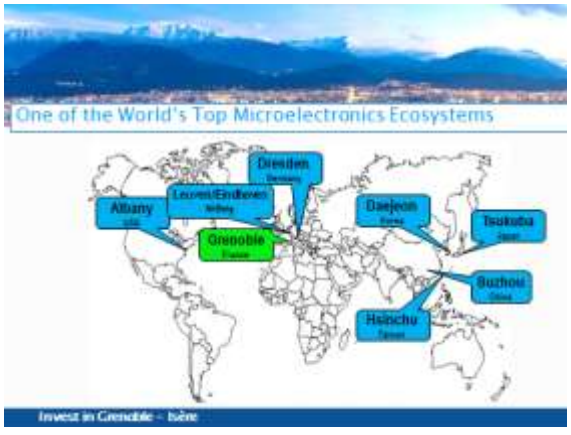
The conference has annually brought together scientists, researchers, engineers, and technologists from research institutes and companies from around the world to present innovations at the forefront of mask lithography and mask technology.

The two and a half days conference (starting on Monday June 18th at 02:00 PM with a Tutorial Session (ending at 05:00 PM) and continued on Tuesday, June 19th from 09:00 AM till 06:15 PM), and on Wednesday, June 20th from 09:00 AM till 06:30 PM.
The EMLC2018 conference is dedicated to the science, technology, engineering and application of mask and lithography technologies and associated processes, giving an overview of the present status in mask and lithography technologies and the future strategy where mask producers and users have the opportunity of becoming acquainted with new developments and results. This year the EMLC2018 Program Committee defined the following sessions:

“Wafer Lithography – 193i and EUV”; “Mask-Less Lithography, Nano-Imprint Lithography, and Directed Self Assembly”; “Mask Patterning, Metrology and Process”; “Non-IC Applications, Plasmonics and Photonics”; “Mask2Wafer and Wafer2Wafer Metrology” ; and “Using Big Data / Deep Learning”.

Of course, papers outside these predefined areas of interest were welcome for submission as well.

As Welcome Speaker from the City of Grenoble Mme Marie-José Salat, representative of Grenoble-Alpes Métropole, will demonstrate the importance of Grenoble as one of the three “High Technology Centres in Europe”. Besides Dresden and Leuven/Eindhoven, Grenoble, Europe’s Smart Valley, offers thousands of jobs in computing & software as well as in Micro-Nanotechnology & Electronics.



Regarding the Tutorial Session on Monday afternoon, we asked Paul van Adrichem, from ASML Netherlands B.V., Veldhoven, Netherlands to give a “**Review of OPC / RET / SMO”.**

This tutorial will provide an overview of advanced Optical Proximity Correction, Resolution Enhancement Technology as well as Source-Mask-Optimization.

As second tutor we asked Aviram Tam, from Applied Materials PDC Israel. He will explain the **"Inspection Challenges in the EUV Area"**
This tutorial will cover the use cases for blank inspection, pattern inspection, outgoing inspection and the possible solution for DUV mask inspection ,e-Beam MI, Actinic blank inspection, on-wafer qualification and how those evolve in each of the different scenarios for pellicle (no pellicle/detachable/13.5nm only/193nm friendly). The tutor will be from the Mask Inspection Product Group of Applied Materials, Israel.

As first Keynote Speaker we have invited Olivier Noblanc from STMicroelectronics, Crolles, France. He will talk about "**Technology for Optical Sensors**"**.**

The second Keynote Speaker is Laurent Pain from CEA-Leti, Grenoble, France. His presentation is entitled: "**The Battle Field of Lithography**"**.**

The third Keynote Speaker is Frédéric Boeuf from STMicroelectronics, Crolles, France. He will present the newest technologies on "**Silicon Photonics: from research to industrial reality".**

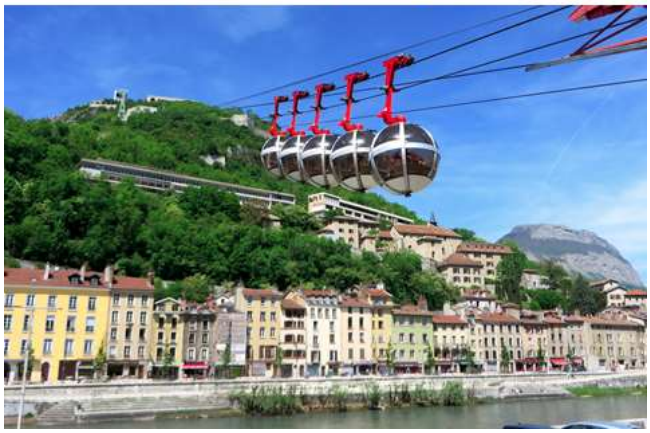
There are several invited talks: on Multi-Beam Mask Writing, on Multi-Trigger Resist for Electron Beam and Extreme Ultraviolet Lithography, on Photonic Superlattice Multilayers for EUV Lithography Infrastructure, on EUV Pellicle Industrialization Progress, on Mask-Less Lithography, on Wafer-Level UV-Nanoimprint Lithography, on Directed Self-Assembly, on Lithography Technology and Trends for More than Moore Devices, on Reticle Critical Dimension Uniformity Improvement, and on Automatic Defect Classification of SEM images using Deep Learning.

As every year, we have invited the authors of the Best Poster of BACUS (SPIE Photomask Technology) 2017 and we will invite the Best Paper from Photo Mask Japan 2018 to present their papers.

Technical Exhibition
Parallel to the Conference Presentations, a Technical Exhibition will take place on Tuesday (10:00 AM to 06:00 PM) and on Wednesday (10:00 AM to 04:00 PM) where companies (mask suppliers, material suppliers and equipment suppliers) will exhibit their companies and products.
To foster the exchange between the conference attendees and the exhibitors, the exhibition area will also be the place for all coffee and lunch breaks.

Conference Dinner Banquet
For Tuesday evening, June 19th, after the Poster Session we have organized the Conference Banquet Dinner at the Bastille", 300 meters above Grenoble with a fantastic view over the City.

Cable Car to the Bastille – we will have the Conference Dinner on Tuesday, June 19th 2018 at the Bastille



So, please enjoy the Tutorial and Technical Sessions of the EMLC2018 as well as the Technical Exhibition, but also allow yourself to visit the beautiful city of Grenoble.

Uwe Behringer,

EMLC2018 Conference Chair

EMLC2018 Preliminary PROGRAM

Monday, June 18th, 2018

14:00-17:00 **The EMLC2018 Tutorial Class**

14:00 Welcome
Uwe Behringer, UBC Microelectronics, EMLC2018 Conference Chair

Introduction of the 1st Tutorial Speaker
Izak Kapilevic, Applied Materials, USA

14:05-15:20 **Inspection Challenges in the EUV Area**
Aviram Tam, Applied Materials PDC, Israel

This Tutorial will cover the use cases for blank inspection, pattern inspection, outgoing inspection, and the possible solution for DUV mask inspection, eBeam MI, Actinic blank inspection, on-wafer qualification, and how those evolve in each of the different scenarios for pellicle (no pellicle / detachable / 13.5nm only / 193nm friendly).

15:20-15:40 Coffee Break

15:40-15:45 Introduction of the 2nd Tutorial Speaker
Jo Finders, ASML Netherlands B.V., EMLC2018 Conference Chair

15:45-17:00 **Review of OPC / RET / SMO**
Paul van Adrichem, ASML Netherlands B.V., Veldhoven, Netherlands

This tutorial will provide an overview of advanced Optical Proximity Correction, Resolution Enhancement Technology as well as Source-Mask-Optimization.

Tuesday, June 19th, 2018

09:00 **Welcome and introduction**
U. Behringer, UBC Microelectronics, EMLC2018 Conference Chair

09:10 **City of Grenoble Welcome**
Grenoble-Alpes Métropole Welcomes You (Invited)
Marie-José Salat, Grenoble-Alpes Métropole, Grenoble, France

09:30-10:25 **Session 1 - 1st Plenary**
Chair: J. Finders, ASML Netherlands B.V., EMLC2018 Conference Chair

09:30 **Technology for Optical Sensors (Keynote)**
Olivier Noblanc, STMicroelectronics, Crolles, France

10:00 **Best Poster of BACUS 2017 (Invited)**
Transparent and conductive backside coating of EUV Lithography Masks for ultrashort pulse Laser Correction
R. A. Maniyarau, ICFO - Institute of Photonic Sciences, Barcelona, Spain

10:25-10:50 *Coffee Break*

10:50-12:10 **Session 2 - 2nd Plenary**
Chair: R. Galler, EQUIcon, Jena, Germany

10:50 **The Battle Field of Lithography (Keynote)**
Laurent Pain, CEA-LETI, Genoble, France

11:20 **Multi-Beam Mask Writer – Enabling Tool for EUV Lithography (Invited)**
P. Mayrhofer et al., IMS Nanofabrication GmbH, Vienna, Austria

11:45 **Multi-beam mask writer MBM-1000 (Invited)**
H. Matsumoto et al., NuFlare Technology Inc., Japan

12:10-13:30 *Lunch Break*

13:30-15:20 **Session 3 – Wafer Lithography - 193i and EUV**
Chair: J. Finders, ASML Netherlands B.V., Veldhoven, Netherlands
Co-Chair: S. Wurm, ATICE-LLC, Albany, NY, USA

13:30 **Multi-Trigger Resist for Electron Beam and Extreme Ultraviolet Lithography (Invited)**
C. Popescu, A. McClelland, G. Dawson, J. Roth, and A.P.G. Robinson*
*Irresistible Materials Ltd., Birmingham, UK

13:55 **Photonic superlattice multilayers for EUV lithography infrastructure (Invited)**
F. Kuchar and R. Meisels, Institute of Physics, Montanuniversität Leoben, Leoben, Austria

14:20 **EUV pellicle industrialization progress (Invited)**
J.-W. van der Horst et al., ASML Netherlands B.V., Veldhoven, Netherlands

14:45 **NXE:3400B imaging performance assessed from a customer perspective**
G. Schiffelers et al., ASLM Netherlands B.V., Veldhoven, Netherlands

15:05 **Reticle CDU improvement by Zeiss CDC and the impact on real circuit pattern (Invited)**
R. Seltmann et al., GLOBALFOUNDRIES, Dresden, and CARL ZEISS, Oberkochen, Germany

15:30-15:55 *Coffee Break*

15:55-17:50 **Session 4 – ML2, NIL, and DSA**
Chair: I. Stolberg, Vistec Electron Beam GmbH, Jena, Germany
Co-Chair: B. Connolly, TOPPAN Photomask, Dresden, Germany

15:55 **Performance Validation of Mapper's FLX-1200 (Invited)**
M. Wieland et al., Mapper Lithography, Delft, Netherlands

16:20 **Feasibility of monitoring a multiple e-beam tool using scatterometry and machine learning: CD and stitching error detection**
G. Rademaker et al., CEA-LETI Minatec, Grenoble, France

16:40 **Wafer-Level UV-Nanoimprint Lithography for high resolution and complex 3D Structures (Invited)**
T. Glinsner et al., EVG, St. Florian, Austria

17:05 **Application of rules-based corrections for wafer scale nanoimprint processes and evaluation of predictive models**
H. Teyssedre et al., CEA-LETI, Grenoble, France

17:25 **Silicon nanowires patterning using UV-assisted graphoepitaxy DSA lithography (Invited)**
M. Argoud et al. CEA-LETI, MINATEC, Grenoble, France

17:50-18:15 **Session 5 - Poster Presentations**

Chair: U. Behringer, UBC Microelectronics, Ammerbuch, Germany
Co-Chair: R. Seltmann, GLOBALFOUNDRIES, Dresden, Germany

POSTER – WAFER LITHOGRAPHY (193i, EUV)

Alternative absorber materials for mitigation of mask 3D effects in high NA EUV lithography
F.J. Timmermans et al., ASML Netherlands B.V., Veldhoven, Netherlands

Revival of grayscale technique in power semiconductor processing under low-cost manufacturing constraints
J. Schneider et al., Infineon, Dresden, Germany

POSTER – ML2, NANO-IMPRINT LITHOGRAPHY and DSA

Fabrication of nanoparticles for biosensing using UV-NIL and lift-off
T. Mitteramskogler, et al., Profactor GmbH, Steyr, Austria

Dry etching challenges for high-chi block copolymers
P. Bézard et al., CEA-LETI, Grenoble, France

POSTER – MASK PATTERNING, METROLOGY and PROCESS

Machine learning methods applied to process qualification
C. Utzny et al., AMTC, Dresden, Germany

Deposition Repair Durability
T. Krome, AMTC, Dresden, Germany

Nikon's Large-Size Photomask Blanks for Production of High Resolution Panels
T. Yagami, Nikon, Japan

Maximizing Utilization of Large-Scale Mask Data Preparation Clusters
P. Gilgenkrantz et al., Mentor Graphics, Ireland, USA, and Korea

POSTER – NON-IC APPLICATIONS, PLASMONICS & PHOTONICS

ElectroHydroDynamic Lithography for complex polymer structures
C. Gourgon, et al., CNRS-UGA-Minatec, Grenoble, France

Plasmonic Resonances in Metal Covered 2D Hexagonal Gratings Fabricated by Interference Lithography
A.A. Ushkov, et al., Univ. Lyon, Saint-Etienne, France

Electron-Beam Lithography and Two-Photon Polymerization for enhanced nano-channels in network-based biocomputation devices
D. Reuter et al., Fraunhofer ENAS, Chemnitz, Germany

POSTER – MASK2WAFER and WAFER2WAFER METROLOGY

Limits of model-based CD-SEM metrology
J. Bellisard, et al., CEA-LETI, Grenoble France

Manufacturing of roughness standard samples based on ACF/PSD model programming
J. Reche, et al., Univ. Grenoble Alpes, CEA-LETI, Grenoble, France

POSTER – USING BIG DATA / DEEP LEARNING

Research on data augmentation for lithography hotspot detection using deep learning
V. Borisov, et al., Reutlingen University, Reutlingen, Germany

18:15 *⇨ Cable Car Station for transport to Conference Dinner*

19:00-22:00 ***Conference Dinner at "Restaurant du Téléphérique" at the "Bastille"*** *(300m above Grenoble)*

after 22:00 *From Cable Car ground station individual walk or taxi back to Hotels*

Wednesday, June 20th, 2018

09:00-10:00 **Session 6 - 3rd Plenary**
Chair: U. Behringer, UBC Microelectronics, Ammerbuch, Germany

09:00 **Announcement: Best Poster EMLC2018**

09:05 **Silicon Photonics: from research to industrial reality (Keynote)**
Frédéric Bœuf, STMicroelectronics, Crolles, France

09:35 **Lithography technology and trends for More than Moore devices – *Advanced Packaging and MEMS devices* (Invited)**
A. Pizzagalli, Yole Dévelopment, Lyon, France

10:00 **Best Paper of Photomask Japan 2018 (Invited)**
Title: t.b.d. when nominated
Author: t.b.d. when nominated

10:25-10:50 *Coffee Break*

10:50-12:30 **Session 7 - Mask Patterning, Metrology and Process**
Chair: M. Tschinkl, AMTC, Dresden, Germany
Co-Chair: K.-D. Roeth, KLA-Tencor MIE, Weilburg, Germany

10:50 **Lithographic solution for yield detracting patterning defect signatures caused by Layout and Unit Process Recipe interaction**
M. Voigt, R. Gärtner, R. Seltmann, Globalfoundries Dresden, Germany

11:10 **CK-MASK semi-manual tool for mask inspection and blowing**
A. Lesseri et al., STMicroelectronics, Italy

11:30 **The (almost) completely automated 12"-lithography**
J. Seyfert, Infineon, Dresden, Germany

11:50 **Fast local registration measurements for efficient e-beam writer qualification and correction**
K.-D. Roeth et al., KLA-Tencor MIE, Weilburg, Germany

12:10 **Failure analysis and prevention of patterning issues using OPC simulation and advanced method of contour analysis**
C. Beylier et al., STMicroelectronics, Crolles, France

12:30-13:50 *Lunch Break*

13:50-15:10 **Session 8 – Non-IC Applications, Plasmonics & Photonics**
Chair: Raluca Tiron, CEA-LETI, Grenoble, France
Co-Chair: T. Onanuga, Fraunhofer IISB, Erlangen, Germany

13:50 **Accurate determination of 3D PSF and resist effects in grayscale laser lithography**
T. Onanuga et al., Fraunhofer IISB, Erlangen, Germany

14:10 **Photonic IC Lithography Software - Challenges and Solutions**
N. Ünal et al., GenISys, Taufkirchen (Munich), Germany

14:30 **Curvilinear Data Processing Methods and Verification**
C. Browning et al., ASELTA Nanographics, Grenoble, France

14:50 **A Resist Reflow 3D Compact Model Approach for Imager Microlens Applications**
S. Berard-Bergery et al., CEA-LETI MINATEC, Grenoble, France

15:10-15:35 *Coffee Break*

15:35-16:55 **Session 9 - Mask2Wafer and Wafer2Wafer Metrology**
Chair: J. H. Peters, bmbg consult, Radebeul, Germany
Co-Chair: F. Weisbuch, GLOBALFOUNDRIES, Dresden, Germany

15:35 **Tilted beam SEM, a novel approach for industry 3D metrology**
C. Valade et al., STMicroelectronics, Crolles, France

15:55 **On the Road to Automated Production Workflows in the Back End of Line**
G. Tabbone et al., Carl Zeiss SMT, Jena, Germany

16:15 **Measuring inter-layer edge placement error with SEM contour**
F. Weisbuch et al., GLOBALFOUNDRIES, Dresden, Germany

16:35 **FEM Simulation of Charging Effect during SEM Methodology**
D.D. Nguyen et al., ASELTA Nanographics, Grenoble, France

16:55-18:20 **Session 10 – Using Big Data / Deep Learning**
Chair: B. Le Gratiet, STMicroelectronics, Crolles, France
Co-Chair: S. A. Savari, Texas A&M University, College Station, TX, USA

16:55 **Automatic Defect Classification (ADC) of SEM images using Deep Learning (Invited)**
L. Bidault et al., STMicroelectronics, Rousset, France

17:20 **Deep supervised learning to estimate true rough line images from SEM images**
N. Chaudhary, S. A. Savari, and S. S. Yeddulapalli, Texas A&M University, College Station, TX, USA

17:40 **Microlens under Melt In-Line Monitoring based on application of Neural Network Automatic Defect Classification**
J. Ducoté et al., STMicroelectronics, Crolles, France

18:00 **Machine Learning applications in overlay prediction**
A. Lam, STMicroelectronics, Crolles, France

18:20 **Thanks to EMLC2018 participants & Announcement of EMLC2019**
U. Behringer, UBC Microelectronics, Ammerbuch, Germany

18:30 ***End of EMCL2018 Conference***