



WELCOME

**2nd LETI LITHOWORKSHOP
SPIE 2019**

Special thanks to



MAPPER FLX-1200

A UNIQUE INFRASTRUCTURE



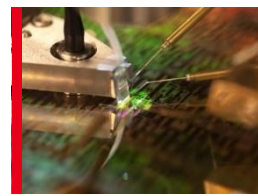
Nano-electronics Micro & Nano-systems



IC & Embedded System Design



Nano-biotechnology



Photonics



Nano-characterization



Clinatec



300 mm



200 mm

- | | | |
|----|---------------|--|
| 1 | CMOS / FDSOI | |
| 2 | BEYOND CMOS | |
| 3 | POWER | |
| 4 | MEMS | |
| 5 | MEMORIES | |
| 6 | IMAGERS | |
| 7 | DISPLAY/LED | |
| 8 | Si PHOTONIC | |
| 9 | 3D | |
| 10 | SOI SUBSTRATE | |

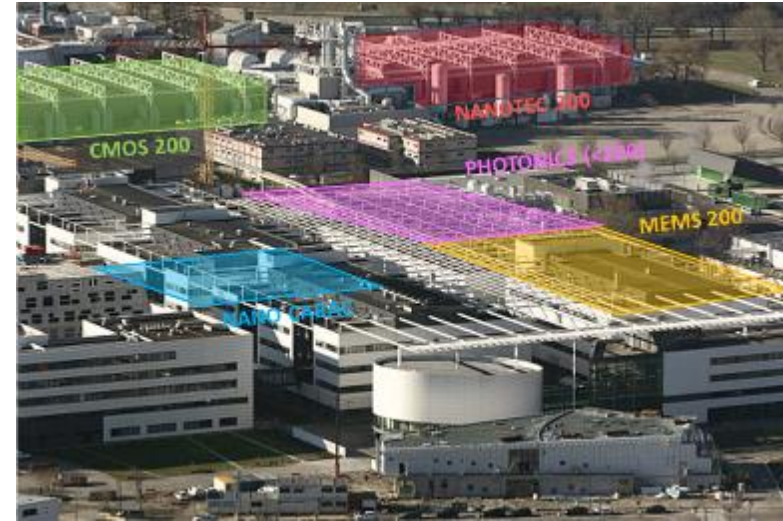
SILICON TECHNOLOGY PLATFORM – KEY FIGURES

- **300mm & 200mm Si components Platforms**
 - ~270@200mm equipments
 - ~105@300mm equipments
 - 5600 square meters Cleanroom - ISO3-5
 - 24/7 operations

- **200mm MEMS Platform**
 - ~130@200 mm equipments
 - 2200 square meters - ISO 4-5
 - 24/7 operations

- **Substrates <200 mm, III-V and II-VI Platform**
 - ~230 @ various diameter equipments
 - 1000+1000 square meters - ISO 4-5
 - 1shift/day

- **Nano-CHARACTERIZATION Platform**
 - ~ 40 huge equipments
 - 2200 square meters
 - 8 centers of competences



Concentration of Means to Address Large Photonics Challenges Closely with the Silicon Platform

LATEST 300 MM INVESTMENTS



- **Best student paper award of the SPIE 2019 Metrology conference**
 - Paper 10959-32 « Tilted beam SEM, 3D metrology for industry »
 - Charles Valade, Jérôme Hazart, Sebastien Berard-Bergery, Elodie Sungauer, Maxime Besacier, Cecile Gourgon

CONGRATULATION

CHARLES !!!



AGENDA –

- **L Pain Head of Program & Business Development – Silicon Technologies Division**
Welcome & Introduction
- **J Chen – NanoPatterning Technology Co., Ltd.**
The challenges of lithography
- **Lithography session**
 - Optical lithography
 - **N Allouti – R&D lithography team leader / CEA-Leti** - Lithography development around imager
 - **C Lapeyre- Immersion lithography program manager / CEA-Leti** : Programs take off around immersion platform
 - Alternative lithography solutions
 - **R Tiron DSA program manager CEA-Leti** - DSA technology development status
 - **H. Teysseudre NIL program manager CEA-Leti** - Full wafer scale imprint
- **Break**
- **Outlook on computational developments around lithography**
 - **S Berard-Bergery Computational lithography Group / CEA-Leti** - Computational Lithography infrastructure & developments
 - **T Figueiro ASELT**A - How to boost SEM metrology and inspection ?
- **B Le Gratiet – Senior Fellow – STMicroelectronics**
Lithography challenges for derivatives



Jack Chen is the CEO of NanoPatterning Technology Co., Ltd. He together with Distinguished Prof. Burn Lin and Prof Po-Wen Chiu launched the “Massively E-Beam Direct Write Academia-Industry Alliance” based on Mapper technology in NTHU, but the project was terminated in January. He resigned from TSMC, where he was the department manager of RD Litho after 21-year work, and became a freelancer in 2016. He joined TSMC in 1995 right after he received the master’s degree in physics from NTU, and since then continuously focused on the new generation lithography development with full spectrum from 365nm, to 248nm, 193nm, and then 193nm immersion, multiple e-beam, and EUV, under the litho guru Dr. Burn Lin. He was assigned to Holland between 2005-2007 to jointly develop the 193nm immersion and EUV technology with ASML, and participated the IMEC consortium in Belgium. In 2007, he was called back to start the MEBDW program and later join the EUV program. In these projects, he formed and led the team, with brainstorming to file more than 100 patents, and with communication to drive the industry to develop the technologies fulfilling TSMC’s requirements and realize the new generation lithography in production.



- Nacima is Lithography 300mm engineering team leader at CEA-Leti. She holds an Engineer and Master degrees in materials science from Grenoble-Alpes University, France. She started in 2001 at Crolles 300mm wafer fab start-up as R&D lithography engineer working for Philips / NXP. She was responsible of new 300mm lithography tracks process tool qualification set-up. She was defectivity coordinator within lithography group for yield improvement on CMOS 90/65/45 technologies. In 2005, she was appointed as team leader in Lithography team for production support. In 2007; she joined the CEA Leti on MEMS platform as Lithography process coordinator. Since 2011, she works as transversal manager, centralises the engineering needs in 300mm lithography for different applications : advanced CMOS, MEMS, 3D, Image Sensor... And pilots their implementation in different teams.



- **Céline Lapeyre** received her PhD degree in materials science from the University of Bordeaux I in France in 1998. After 2 years as a researcher in the Interdisciplinary Laboratory of Electronic Spectroscopy in Namur (Belgium), she joined the European Synchrotron Radiation Facility in Grenoble (France) for three years working on nanomagnetism and spin electronic. In 2005, she integrated the Department of Nanotechnology in CEA-LETI at Grenoble to set-up 193nm optical lithography cell and develop processes for double patterning and negative tone development. In 2012, she integrated STMicroelectronic Crolles as CEA assignee to develop 28nm and 14nm FDSOI CMOS technology in addition to Imager BEOL and SPAD microlenses. After 6 years in the industrial environment, she came back to CEA-Leti Grenoble to set-up and take leadership of 300mm Immersion Lithography Cell.



- **Raluca Tiron joined Leti's lithography group in 2004, working on e-beam lithography. In 2005, she integrates Resist Expertise Center, where she worked on advanced lithographic process development, resist characterization and mechanisms comprehension in 193 nm lithography. Starting in 2008, her research interest focused on directed self-assembly (DSA) of block copolymers, and she currently leads this activity at Leti. Dr. Tiron has been Leti project leader in several projects, including national, European and industrial projects. She is currently also in charge of an industrial collaboration around the DSA. She has authored and coauthored more than 80 papers in international reviews and she is the owner of more than 15 patents. Dr. Tiron received her PhD degree in molecular magnetism from Joseph Fourier University France in 2004.**



- **Hubert TEYSSEDE attended the "Ecole Normale Supérieure de Cachan" in Paris and received his master degree in mechanical engineering and material sciences in 2010. Since then, he has focused his activities on nanoimprint and was sponsored by a private micro and nano-patterning company as a PhD student to model and simulate the process. He obtained his PhD in material science and polymer material for nano-fabrication from the inter-institutional Paristech organization in 2013. He was awarded by the Arts et métiers community and distinguished as a "confirmed talent" by the French Overseas Talent Organization in 2013. Since 2014, Dr Teyssède is a member of the CEI-Europe faculty and is in charge of the nanoimprint lecture.**
- **In 2014 he joined the CEA LETI in Grenoble and works for the department of Silicon technology on nanoimprint, process development and process assessment. In 2017 he was given the operational nanoimprint activities coordination at CEA LETI and project leader for the INSPIRE program.**



SEBASTIEN BERARD-BERGERY



Sebastien joined the CEA-Leti in 2010, and is part of the Computational Lithography Group as Data-Preparation engineer. In LETI, his work involves multiple areas such as resolution enhancement technologies, data-preparation for e-beam lithography, resist modeling solutions and computational metrology development. His current research interests include innovative microlens manufacturing for CMOS image sensors by using reflow modeling and Grayscale lithography, 3D computational metrology, and advanced OPC solutions for Silicon Photonics.



- **Thiago FIGUEIRO holds an Engineer and Master degrees from the Federal University of Rio Grande do Sul, Brazil and a PhD from Grenoble-Alpes University, France. He has worked for over 15 years combining experiences in the fields of microelectronics and image/signal processing. Thiago holds 8 patents. He has joined Asetla in 2011 and currently contributes in developing the company solutions for Metrology and Inspection applications.**



- **Bertrand Le-Gratiet is Senior Member of Technical Staff of the Lithography Metrology department of STMicroelectronics Crolles 300mm wafer fab. He holds a PhD of Physical Chemistry from Paris XI Orsay university and an engineering degree on material science from Nantes University. He is working in the field of lithography since 23 years starting in Start-up and MEMS industry in Switzerland in late 90's. In 2000 he joined Philips Semiconductors in Nijmegen (NL) developing 0.18/0.14 μ m processes and moved in 2004 to Crolles 300mm wafer fab as R&D lithography engineer working for Philips / NXP and later STMicroelectronics developing 90/65/45/28/14nm technologies. Since 2014 his work is focusing on patterning process control and process variability reductions solutions.**