# Programme

**Location all presentations:** “de Hallen” KULeuven, Naamsestraat 22, 3000 Leuven  
**Room oral presentations:** “Promotion hall”

## Monday 3 September 2018

### Session 1 - Welcome and Opening 08:30 – 09:30

**Chair:** Takeshi Hattori - Hattori Consulting International, Japan  
**Co-chair:** Mauro Allesandri - STMicroelectronics, Italy

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Speaker(s)</th>
<th>Institution(s)</th>
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<tbody>
<tr>
<td>08:30 - 08:50</td>
<td>Welcome and opening address</td>
<td>Paul Mertens</td>
<td>imec, Belgium</td>
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<tr>
<td>08:50 - 09:30</td>
<td>Keynote presentation: Industry Context for Semiconductor Wet Etch and Surface Preparation (p.3)</td>
<td>Glenn Gale</td>
<td>TEL, Japan/USA</td>
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### Session 2A - Surface Cleaning and Functionalisation 09:30 – 10:30

**Chair:** Christiane Le Tiec (Gottschalk) - MKS Instruments Deutschland GmbH, Germany  
**Co-chair:** Rita Vos - imec, Belgium

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<tr>
<td>09:30 - 09:50</td>
<td>Surface Recombination Velocity Imaging of HF-Etched Si Wafers Using Dynamic Heterodyne Lock-In Carrierography (p.13)</td>
<td>Qiming Sun(^1,2), Alexander Melnikov(^1,3), Andreas Mandelis(^1,2,3), Robert Pagliaro(^4)</td>
<td>University of Toronto, Toronto, M5S 3G8, Canada; School of Optoelectronic Science and Engineering, University of Electronic Science and Technology of China, Chengdu, 610054, China; Diffusion-Wave Diagnostic Technologies, Toronto, M1M 2V3, Canada; Advanced Processing Equipment Technology (APET) Co., Ltd, 20-15, Sukwoo-Dong, Hwaseong-City, Gyunggi-Do, 463-802, Korea</td>
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<tr>
<td>09:50 - 10:10</td>
<td>Organic Material Removal by Thermally Activated Ozone Gas (p.19)</td>
<td>Kota Sotoku, Masaki Inaba, Hiroaki Takahashi</td>
<td>SCREEN Semiconductor Solutions Co., Ltd., Japan</td>
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<tr>
<td>10:10 - 10:30</td>
<td>Carbon Removal and Native Oxide Cleaning on Si and SiGe Surfaces in Previum Chamber (p.25)</td>
<td>Fei Wang, Bubesh Babu Jotheswaran, John Tolle, Xing Lin, Peipei Gao, Alex Demos</td>
<td>ASM America, United States of America</td>
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### Coffee Break 10:30 - 10:50
10:50 - 11:30
2.4 Invited presentation:
Surface functionalization of silicon-rich materials: chemistry at the outmost nanometer
Han Zuilhof
University of Wageningen, The Netherlands

11:30 - 11:50
2.5 - Vapor-Phase Deposition of N₃-Containing Monolayers on SiO₂ and Si₃N₄ for Wafer Scale Biofunctionalization (p.31)
Rita Vos, Tim Steylaerts, Karolien Jans, Tim Stakenborg
imec, Belgium
Each poster author is allocated 3 minutes to advertise his/her poster using max 3 slides.

**P01 - Versatile aqueous chemistry for selective Ru or WNx Etch and Implant BARC Removal in 5/3 nm Applications** (p.288)
Chien-Pin S. Hsu, Polly Yi-Ting Chen
Avantor, Taiwan

**P02 - Is highly selective Si3N4/SiO2 etching feasible without phosphoric acid?** (p.147)
Changjin Son, Taehyeon Kim, Taegun Park, Sangwoo Lim
Yonsei University, Korea, Republic of (South Korea)

**P03 - Developing Integrated Solutions and Wet Cleans to Eliminate Tungsten Contact Attack in Sub 1x nm Nodes** (p.273)
Akshey Sehgal, Michael DeVre, Elango Balu
GLOBALFOUNDRIES Inc., United States of America

**P04 - BEOL Post-etch clean robustness improvement with ultra-diluted HF for 28nm node.** (p.244)
Lucile Broussous¹, Remy Fabre¹, Thomas Massin¹, Fabrice Buisine², Alain Lamaury², Hidekazu Ishikawa²
¹STMicroelectronics, France; ²SCREEN SPE, Germany

**P05 - Influence of VPT-Induced Trace Particles on Sensitivity in TXRF Measurements** (p.309)
Koichiro Saga, Rikiichi Ohno
Sony Semiconductor Solutions Corporation, Japan

**P06 - Post-CMP Cleaners for Tungsten Advanced Nodes: 10nm and 7nm** (p.278)
Ruben Lieten¹, Daniela White², Thomas Parson², Michael White²
¹Entegris, Gmbh; ²Entegris, Inc

**P07 - Investigation of defectivity coming from the back side of wafers during AlCu polymer removal processes performed in a batch spray tool** (p.220)
Ivan Venegoni, Silvia Brazzelli, Roberta Gomarasca, Francesco Pipia, Mauro Alessandri
STMicroelectronics, Italy

**P08 - Advanced Data Analysis Strategies for Understanding Particle Contamination in Chemical Distribution Systems** (p.314)
Duncan Cooper, David Green, Dan Rodier
Particle Measuring Systems, Germany

**P09 - Electrostatic Discharge Control and Visualization in Spray Nozzle** (p.77)
JI HOON CHA, TAE-HONG KIM, YOUNG-HOO KIM, KUNTACK LEE, YONGSUN KOH
SAMSUNG ELECTRONICS, Korea, Republic of (South Korea)

**P10 - Drying Stability and Critical Height of Repeating Line/Space Structures** (p.161)
Derek Bassett
Tokyo Electron America, United States of America
SESSION 3A - WETTING, DRYING AND PATTERN COLLAPSE
14:00 - 15:00

14:00 - 14:20  3.1 - Exploring the dynamics superhydrophobic breakdown at the nanoscale using ATR-FTIR (p.175)
Nandi Vrancken1,2, Stefanie Sergeant1, Guy Vereecke1, Frank Holsteyns1, Herman Terryn2, Stefan De Gendt1,2, XiuMei Xu1
1imec, Belgium; 2VUB, Belgium; 3KU Leuven, Belgium
(student paper)

14:20 - 14:40  3.2 - Fixed charge control of silylated surface for stiction-free drying with surface energy reduction process (p.168)
Tatsuhiko Koidé, Shinsuke Kimura, Kobayashi Takashi, Imori Hiroyasu, Sugita Tomohiko, Sato Katsuhiro, Ogawa Yoshihiro
Toshiba Memory Corporation, Japan

14:40 - 15:00  3.3 - Effect of 1-D nano-confinement on the kinetics of a click-chemistry surface reaction (p.182)
Guy Vereecke1, Haroen Debruyn2, Quinten De Keyzer2, Rita vos1, Abhishek Dutta2, Frank Holsteyns1
1imec, Belgium; 2Faculty of Engineering Technology Campus Group T, Katholieke Universiteit Leuven, Belgium

15:00 - 15:30 COFFEE BREAK

SESSION 3B - WETTING, DRYING AND PATTERN COLLAPSE
15:30 - 16:50

15:30 - 15:50  3.4 - Cleaning of high aspect ratio STI structures for advanced logic devices by implementation of a surface modification drying technique (p.190)
Farid Sebaai1, Guy Vereecke1, XiuMei Xu1, Sylvain Baudot1, Fumihiro Amemiya2, Kana Komori3, Frank Holsteyns1
1imec, Belgium; 2Central Glass; 3SCREEN

15:50 - 16:10  3.5 - Pattern Collapse-Free Drying with Sacrificial Gap Fill Polymers (p.194)
Evelyn A Kennedy, Desaraju Varaprasad, Songyuan Xie, Amanuel Gebrebrhan, Hongmin Huang, Joseph Kennedy
Honeywell International Inc, United States of America

16:10 - 16:30  3.6 - Factors Influencing Drying Induced Pattern Collapse (p.201)
David Mui, Nathan Musselwhite, Mark Kawaguchi
Lam Research, United States of America

16:30 - 16:50  3.7 - 300 mm wafer development for pattern collapse evaluations (p.207)
XiuMei Xu1, Tao Zheng1, Mohamed Saib1, Farid Sebaai1, Jeroen van de Kerkhove1, Nandi Vrancken1,2, Guy Vereecke1, Frank Holsteyns1
1imec, Belgium; 2VUB, Pleinlaan 2, 1050 Elsene, Belgium

17:30 - 18:30 POSTER RECEPTION
TUESDAY 4 SEPTEMBER 2018

SESSION 4 - SURFACE PREPARATION OF III-V SEMICONDUCTORS 08:20 - 10:00

Chair: Joel Barnett – TEL, USA
Co-chair: Anthony Muscat – University of Arizona, USA

08:20 - 09:00  4.1 Invited presentation:
Toward the Surface Preparation of InGaAs for the Future CMOS Integration (p.39)
Sangwoo Lim
Yonsei University, Seoul, Korea

09:00 - 09:20  4.2 - Effect of Wet treatment on Group III-V Compound Semiconductor Surface (p.43)
Kenya Nishio, Suguru Saito, Yoshiya Hagimoto, Hayato Iwamoto
Sony Semiconductor Solutions Corporation, Japan

09:20 - 09:40  4.3 - Nanoscale Etching of GaAs and InP in Acidic H₂O₂ Solution: a Striking Contrast in Kinetics and Surface Chemistry (p.48)
Dennis Henri van Dorp¹, Sophia Arnauts¹, Mikko Laitinen², Timo Sajavaara², Johan Meersschaut¹, Thierry Conard¹, Frank Holsteyns¹, John Kelly³
¹imec, Belgium; ²University of Jyväskylä, Finland; ³Utrecht University, The Netherlands

09:40 - 10:00  4.4 - Ion Implanted Photoresist Removal by Material Loss-Free Organic Solvent (p.52)
Eunseok Oh, Sangwoo Lim
Yonsei University, Korea, Republic of (South Korea)
(student paper)

10:00 - 10:30 COFFEE BREAK

SESSION 5 - Si AND Ge ETCHING 10:30 - 11:30

Chair: Simon Braun – imec, Belgium
Co-chair: Sangwoo Lim – Yonsei University, Korea

10:30 - 10:50  5.1 - Behavior Analysis of Si Etching Process with HF/HNO₃ Mixture in Single-Spin Wafer Process (p.83)
Takashi Oinoue¹, Suguru Saito², Atsushi Okuyama², Yoshiya Hagimoto², Hayato Iwamoto²
¹Sony Semiconductor Manufacturing, Japan; ²Sony Semiconductor Solutions, Japan

10:50 - 11:10  5.2 - Study of the Anisotropic Wet Etching of Nanoscale Structures in Alkaline Solutions. (p.88)
Antoine Pacco¹, Zainul Aabdin³, Utkarsh Anand², Jens Rip¹, Utkur Mirsaidov², Frank Holsteyns¹
¹imec, Belgium; ²National University of Singapore; ³A*STAR Singapore

11:10 - 11:30  5.3 - Unexpected Pyramid Texturization of n-type Ge (100) via Electrochemical Etching: Bridging Surface Chemistry and Morphology (p.94)
Granuel Harne Abrenica¹², Mikhail Lebedev³, Hy Le², Andreas Hajduk⁴, Mathias Fingerle⁴, Thomas Mayer⁴, Stefan de Gendt¹², Dennis van Dorp²
¹KU Leuven; ²imec, Belgium; ³Ioffe Institute; ⁴TU Darmstadt
SESSION 6 - SELECTIVE Si,Ge ETCHING FOR NANOWIRE RELEASE  11:30 - 12:30

Chair: Kurt Wostyn – imec, Belgium
Co-chair: Olivier Vatel – Screen Semiconductor Solutions, Japan

11:30 - 11:50  6.1 - Selective Wet Etching in Fabricating SiGe and Ge Nanowires for Gate-All-Around MOSFETs (p.101)
Wen Dar Liu¹, Yi Chia Lee¹, Ryo Sekiguchi², Yukifumi Yoshida³, Kana Komori³, Kurt Wostyn⁴, Farid Sebaai⁴, Frank Holsteyns⁴
¹Versum Materials Technology, Taiwan; ²Versum Materials Japan, INC; ³SCREEN Semiconductor Solutions Co., Ltd; ⁴imec vzw

11:50 - 12:10  6.2 - SiGe vs. Si Selective Wet Etching for Si Gate-All-Around (p.107)
Kana Komori¹, Jens Rip², Yukifumi Yoshida¹, Kurt Wostyn², Farid Sebaai², Wen Dar Liu², Yi Chia Lee², Ryo Sekiguchi³, Hans Mertens², Andriy Hikavyy², Frank Holsteyns², Naoto Horiguchi²
¹SCREEN Semiconductor Solutions Co., Ltd.; ²IMEC VZW; ³Versum Materials Technology LLC.; ⁴Versum Materials Japan, INC

12:10 - 12:30  6.3 - A New Method to Fabricate Ge Nanowires: Selective Lateral Etching of GeSn:P/Ge Multi-Stacks (p.113)
Clement Porret¹, Anurag Vohra¹,², Farid Sebaai¹, Bastien Douhard¹, Andriy Hikavyy¹, Roger Loo¹
¹imec, Kapeldreef 75, B-3001 Leuven, Belgium; ²K.U. Leuven, Dept. of Physics, Celestijnenlaan 200D, 3001 Leuven, Belgium

12:30 - 14:00 LUNCH

13:30  gather on the stair case: group picture will be taken

SESSION 7 – GATE-ALL-AROUND GATE STACK PROCESSING  14:00 - 15:00

Chair: Glen Gale – TEL, Japan/USA
Co-chair: Mauro STMicroelectronics, Italy

14:00 - 14:20  7.1 - Customized Chemical Compositions Adaptable for Cleaning Virtually All Post-Etch Residues (p.121)
Jerome DAVIOT¹, Marine Audoui¹, Christian Pizzetti¹, Philippe Garnier², lucile Broussous², Pascal Besson³, Laurence Gabette³, David Maloney¹
¹Technic, France; ²ST microelectronics; ³LETI

14:20 - 14:40  7.2 - Low Temperature SiGe Steam Oxide – Aqueous HF and NH3/NF3 Remote Plasma Etching and its Implementation as Si GAA Inner Spacer (p.126)
Kurt Wostyn, Karine Kenis, Hans Mertens, Andriy Hikavyy, Frank Holsteyns, Naoto Horiguchi
imec, Belgium

14:40 - 15:00  7.3 - RMG Patterning by Digital Wet Etching of Polycrystalline Metal Films (p.132)
Yusuke Oniki, Guy Vereecke, Eugenio Dentoni Litta, Lars-Ake Ragnarsson, Harold Dekkers, Tom Schram, Frank Holsteyns, Naoto Horiguchi
imec, Belgium
15:00 - 15:30  COFFEE BREAK

SESSION 8 - MECHANICAL PARTICLE REMOVAL  
15:30 - 16:30

Chair: Ara Philipossian – University of Arizona, USA  
Co-chair: Harold Okorn-Schmidt – LLRC OG, Austria

15:30 - 15:50  8.1 - Removal of CrN Contamination from EUV Mask Backside using Dry Cleaning  
(p.59)

Hyuntae Kim, Nagendra Prasad, Hee-Jin Song, Jin-Goo Park  
Hanyang University, Korea, Republic of (South Korea)  
(student paper)

15:50 - 16:10  8.2 – Damage-Free Cleaning of Advanced Structure using Timely Energized Bubble Oscillation Megasonic Technology (p.64)

David Wang1, Fuping Chen1, Xiaoyan Zhang1, Sally-An Henry1, Zhenming Chu1, Feng Liu1, Yang Chen1, Kwangkee Chae1, Fufa Chen1, Yefang Zhu2, Lihua Ni2, Yu Zhang2, haibo Lei2, Fang Li2, Tao Zhang2, Xi Wang1

1ACM Research Inc, United States of America; 2Shanghai Huali Microelectronics Corporation

16:10 - 16:30  8.3 - An Observation Method of Real Contact Area during PVA Brush Scrubbing  
(p.73)

Toshiyuki Sanada1, Masanao Hanai1, Akira Fukunaga2, Hirokuni Hiyama2

1Shizuoka University; 2Ebara Corporation

SESSION 9 - NON-SEMICONDUCTOR FILM ETCHING  
16:30 - 17:10

Chair: Francesco Pipia – STMicroelectronics, Italy  
Co-chair: Martin Knotter –NXP Semiconductors, Nijmegen, The Netherlands

16:30 - 16:50  9.1 - Wet Etchants Penetration through Photoresist during Wet Patterning (p.141)

Philippe Garnier  
STMicroelectronics, France

16:50 - 17:10  9.2 - Self-Aligned Contacting Processes for the 80 nm p-MTJ Device Fabrication by Wet Approach (p.152)

Hushan Cui1,2,3, Kaihua Cao1,2,3, Youguang Zhang1,2, Huagang Xiong2, Jiaqi Wei1,2,3, Junjie Li3, Guobin Bai3, Junfeng Li3, Chao Zhao1,2,3, Weisheng Zhao1,2

1Fert Beijing Institute, BDBC, Beihang University, 100191, P.R. China; 2School of Electronic and Information Engineering, Beihang University, 100191, P.R. China; 3Institute of Microelectronics of Chinese Academy of Sciences, 100029, P.R. China  
(student paper)

18:00  Short guided walk: from Naamsestraat 22 towards the Faculty Club (conference diner)

19:00 - 22:00  CONFERENCE DINNER (Faculty Club)
SESSION 10 - BIOSENSING SURFACES  

Chair: Jin-Goo Park – Han-Yang University, Korea  
Co-chair: Rita Vos – imec, Belgium  

08:30 - 09:10  
10.1 - Invited presentation:  
Putting DNA Nanotechnology to Work:  
the Art of DNA Origami towards Innovative Biosensing Surfaces for Medical Diagnostics  
Jeroen Lammertijn  
KU Leuven, Belgium

SESSION 11A – INTERCONNECTS  

Chair: Els Kesters – imec, Belgium  
Co-chair: Lucille Brousous – STMicroelectronics, France  

09:10 - 10:10  
11.1 - AlCu Pitting Prevention in Post Etch Cleaning (p.213)  
Annamaria Votta, Roberto Morandi, Marcello Ravasio, Giovanni Tagliaabue, Francesco Pipia, Mauro Alessandri  
STMicroelectronics, Italy  

11.2 - Aluminum Cleaning on Single Wafer Tool: a Case Study with Diluted HF (p.226)  
Lucile Broussous  
STMicroelectronics, France  

11.3 - Atomic Layer Deposition of TiN below 600 K using N2H4 (p.232)  
Adam Hinckley, Anthony Muscat  
University of Arizona, United States of America

10:10 - 10:30 COFFEE BREAK

SESSION 11B: INTERCONNECT  

Chair: Els Kesters – imec, Belgium  
Co-chair: Lucille Brousous – STMicroelectronics, France  

10:30 - 11:10  
11.4 - Process Parameter Control for BEOL TiN Hard Mask Etch-Back (p.238)  
Harald Okorn-Schmidt¹, Philipp Engesser¹, Manuel Linder², Jörg Hofer-Moser²  
¹LLRC OG, Austria; ²4Tex GmbH

11.5 - Optimization of Wet Strip for Metal Void Reduction in Trench-First Metal Hard Mask Back-End of Line Process (p.250)  
Asha Sharma, Bruce Gondeck, Sunil Singh, Teck Jung Tang, SherJang Singh, Silas Scott, Philippe Helal  
GlobalFoundries, United States of America

11:10 - 11:30  
11.6 - Corrosion of Co in BEOL Interconnects in Dilute HF Solution (p.256)  
Yuya Akanishi¹, Els Kesters², Quoc Toan Le², Frank Holsteeyns²  
¹National Institute of R&D in Micro- & Nanotechnology, Japan; ²imec, Belgium
### 11:30 - 11:50

#### 11.7 - Effect of Cleaning Chemistries on Cobalt: Surface Chemistries and Electrical Characterization (p.263)

Quoc-Toan Le\(^1\), Els Kesters\(^1\), Yuya Akanishi\(^2\), Marleen van der Veen\(^1\), Atsushi Mizutani\(^3\), Frank Holsteyns\(^1\)

\(^1\)IMEC vzw, Belgium; \(^2\)SCREEN Semiconductor Solutions Co., Ltd., Japan; \(^3\)FUJIFILM Electronic Materials (Europe) N.V., Belgium

### 11:50 - 12:10

#### 11.8 - Optimization of Post Etch Cobalt Compatible Clean by pH and Oxidizer (p.268)

Hideaki Iino\(^1\), Nobuko Gan\(^1\), Yuichi Ogawa\(^1\), Toru Masaoka\(^1\), Quoc Toan Le\(^2\), Els Kesters\(^2\), Jens Rip\(^2\), Yusuke Oniki\(^2\), Yuya Akanishi\(^3\), Frank Holsteyns\(^2\)

\(^1\)KURITA WATER INDUSTRIES Ltd., Japan; \(^2\)imec vzw; \(^3\)SCREEN Semiconductor Solutions Co., Ltd.

### 12:10 - 12:30

#### 11.9 - Wet-Chemical Etching of Ruthenium in Acidic Ce4+ Solution (p.284)

Harold Philipsen\(^1\), Sander Teck\(^1,2\), Nils Mouwen\(^1,2\), Wouter Monnens\(^1,3\), Quoc Toan Le\(^1\)

\(^1\)IMEC, Kapeldreef 75, 3001, Leuven, Belgium; \(^2\)KU Leuven, Technology Campus Groep T Leuven, Andreas Vesaliusstraat 13, 3000, Leuven, Belgium; \(^3\)KU Leuven, Celestijnenlaan 200F, 3001, Leuven, Belgium

### 12:30 - 14:00 LUNCH BREAK

### SESSION 12 - WET PROCESSING FOR PHOTOVOLTAIC SOLUTIONS 14:00 - 14:40

#### Chair: Dennis van Dorp – imec, Belgium

#### Co-chair: Simon Braun – imec, Belgium

### 14:00 - 14:20

#### 12.1 - Wet Processing in State-of-the-Art Cu(In,Ga)(S,Se)2 Thin Film Solar Cells (p.300)

Dilara Gokcen Buldul\(^1,2\), Jessica de Wild\(^1,2\), Thierry Kohl\(^1,2\), Sunil Suresh\(^3,5\), Gizem Birant\(^1,2\), Guy Brammertz\(^1,2\), Marc Meuris\(^1,2\), Jef Poortmans\(^1,3,4\), Bart Vermang\(^1,2\)

\(^1\)Institute for Material Research (IMO), Hasselt University, Belgium; \(^2\)imec division IMOMEC (partner in Solliance & EnergyVille), Belgium; \(^3\)imec (partner in Solliance & EnergyVille), Belgium; \(^4\)Department of Electrical Engineering, KU Leuven, Belgium; \(^5\)Photovoltaic Materials and Device, Delft University of Technology, Netherlands

*(student paper)*

### 14:20 - 14:40

#### 12.2 - Impact of Controlled Ni Contamination on Silicon Solar Wafer Material (p.295)

Mateusz Gocyla, Michael Haslinger, Paul W. Mertens, Joachim John

Imec, Belgium

### 14:40 - 15:00 COFFEE BREAK
SESSION 13 - CONTAMINATION: METROLOGY AND CONTROL 15:00 - 15:40

Chair: Philippe Garnier – STMicroelectronics, France
Co-chair: Takeshi Hattori – Hattori Consulting International, Japan

15:00 - 15:20  13.1 - Determination of HCl Transport Coefficients in Real FOUP Polymers for HCI Cross-Contamination Assessment from FOUP to Wafer (p.321)
Minh-Phuong TRAN¹, Hervé FONTAINE¹, Carlos BEITIA¹, Paola GONZALEZ-AGUIRRE², Jorgen LUNGREN², Sung-In MOON²
¹CEA TECH, France; ²ENTEGRIS, France

15:20 - 15:40  13.2 - Yield Enhancement due to Addition of Bevel Cleans at Middle of Line(MOL) Zone (p.329)
Tsultrim Tharchin, Elango Balu
GLOBALFOUNDRIES, United States of America

CLOSING SESSION 15:40 - 16:15

15:40 - 16:00  Student paper award announcement
Kurt Wostyn
Imec, Belgium

16:00 – 16:15  Closing remarks
Paul Mertens
Imec, Belgium