

# DSA 2018 Program

November 11-13, 2018, 2F Pearl Room, Sapporo Park Hotel, Sapporo, Japan



## Sunday, November 11, 2018

17:00 – 19:00 Opening Reception

## Monday, November 12, 2018

9:20 - 9:30 Opening Remarks  
T. Azuma (EIDECE)

**Keynote Presentation** Chair: T. Hayakawa (Tokyo Institute of Technology)

9:30 - 10:10 Pattern Defect Reduction Efforts for Chemo-Epitaxy DSA Process (Keynote)  
M. Muramatsu, Tokyo Electron Kyushu

**Session 1: Materials 1** Chair: T. Hayakawa (Tokyo Institute of Technology)

9:50 – 10:10 Revolutionary or Evolutionary DSA Chemistry for IC Device Adoption? Withdrawn  
M.A. Hockey, K. Xu and R. Daugherty, Brewer Sci., USA

10:10 – 10:30 In-Situ Measurement of Self-Assembling Blockcopolymer Thin Film with GISAXS  
T. Omosu 1, M. Takenaka 1,2, K. Yoshimoto 1,4, T. Azuma 4, K. Kodera 4, 1 Kyoto Univ., 2 RIKEN 3 C-PIER and 4 EIDECE, Japan

10:30 - 10:50 Rapid Self-Assembled High  $\chi$  Block Copolymer for Large-Scale Sub-10 nm Nanopattern by Flash Light  
J.H. Kim, H.M. Jin, D.y. Park, K.J. Lee and S.O. Kim, KAIST, Korea

10:50 – 11:10 Carbohydrate-Based Block Copolymer Self-Assemblies: Ultra-fast Nanorganization of sub-10nm Highly Nanostructured Thin Films  
R. Borsali, Univ. Grenoble Alpes, France

11:10 – 11:25 Coffee Break

**Session 2: Etch, Simulation and Integration** Chair: K. Yoshimoto (Kyoto Univ.)

11:25 – 11:45 Directed Self-Assembly of Block Copolymer for the Fabrication of Nanowire-Based Electromechanical Devices  
C. Pinto-Gómez, R. Mas, F. Pérez-Murano, J. Bausells, M. Fernández-Regúlez, IMB-CNM, Spain

11:45 – 12:05 Continuum Models for Directed Self-Assembly  
M. Müller and J.C.O. Rey, Georg-August Universität Göttingen, Germany

**Lunch**

12:05 – 13:05 Lunch

**Poster session (13:05 – 14:05)**

**Poster session** Chair: S. Nagahara (TEL)

P01 Wet Etch Challenges for Wide-Range Directed Self-Assembly  
C. Nakayama 1, M. Harumoto 1, Y. Tanaka 1, Y. Arisawa 1, M. Asai 1, K. Yamamoto 2 and K. Morita 2, 1 SCREEN Semiconductor Solutions and 2 Oji Holdings, Japan

P02 Oligosaccharide-Based Monodisperse Block Copolymers for Sub-10 nm Microphase Separation  
T. Isono 1, R. Komaki 1, N. Kawakami 1, H. Mamiya 2, K. Tajima 1, R. Borsali 3 and T. Satoh 1, 1 Hokkaido Univ., 2 NIMS, Japan and 3 Univ. Grenoble Alps, France

P03 Impact of Topography of Chemical Pattern on Directed Self-Assembly Process: Focusing on Defectivity  
D. Bae 1,2, H.S. Suh 2 and Y.S. Jung 1, 1 KAIST, Korea and 2 imec, Belgium

P04 Resist-Free DSA Chemoepitaxy Approach for Line/Space Patterning  
T.J. Giammaria 1, A. Gharbi 1, A. Paquet 1,2, C. Navarro 2, C. Nicolet 2, P. Nealey 3 and R. Tiron 1, 1 CEA-LETI and 2 Arkema GRL, France and 3 Univ. of Chicago, USA

P05 High- $\chi$  Modified Fluorine-Containing Block Copolymer and Thin Film  
S. Jo, S. Jeon, T. Jun and D.Y. Ryu, Yonsei Univ., Korea

P06 Silicon Containing High- $\chi$  Block Copolymers for Directed Self-Assembly (DSA) for Sub-10 nm L/S Patterning.  
K. Aizu 1, K. Watanabe 1, K. Watabe 1, K. Hirahara 2, A. Takano 3, Y. Matsushita 3, 1 Hitachi Chemical, 2 Yamagata Univ. and 3 Nagoya Univ., Japan

P07 DSA Technology with Metal Nanocomposites for Advanced Interconnection  
T. Fukushima, M. Murugesan and M. Koyanagi, Tohoku Univ., Japan

P08 Influence of PS-b-PMMA Block Copolymer Quality on L/S Perpendicular Orientation  
Y. Kawaguchi, T. Kosaka, R. Matsuki and R. Ogaki, HORIBA STEC, Japan

P09 Order to Disorder Transition of Block Copolymer Thin Films on Preferential Wetting Condition  
Y. Kim 1, H. Ahn 2, J.U. Kim 3 and D.Y. Ryu 1, 1 Yonsei Univ., 2 POSTECH and 3 Ulsan Natl. Inst. of Sci. and Technol., Korea

**Invited Paper I** Chair: J. Kline (NIST)

14:05 – 14:35 Integration Challenges for DSA Implementation (Invited)  
R. Tiron, CEA-Leti, France

**Session 3: Processing 1** Chair: J. Kline (NIST)

14:35 – 14:55 Kinetics of Defect Annihilation in Chemo-Epitaxy DSA  
J. Li 1, P.A.R. Delgadillo 2, H.S. Suh 2, G. Mannaert 2, N. Vandenbroeck 2, P.F. Nealey 1, 1 Univ. of Chicago, USA and 2 IMEC, Belgium

14:55 – 15:15 Extracting Block Copolymer Dynamics from GISAXS  
M. Fernández-Regúlez 1,2, E. Solano 3, S. Gottlieb 1, C. Pinto-Gómez 1, L. Evangelio 1,3, G. Rius 1, J. Fraxedas 3, F. Pérez-Murano 1, H. Amenitsch 5, E. Gutiérrez 6, A. Nogales 6, M.C. García-Gutiérrez 6 and T. Ezquerro 6, 1 IMB-CNM, 2 Univ. Autònoma de Barcelona, 3 NCD-SWEET beamline, 4 ICN2, Spain, 5 Graz Univ. of Technol., Austria and 6 IEM-CSIC, Spain

15:15 – 15:35 Defect Mitigation in sub-20 nm Patterning with High-Chi, Silicon Containing Block Copolymers  
J. Doise 1, G. Mannaert 1, H.S. Suh 1, P. Rincon 1, G. Vandenberghe 1, C.G. Willson 2 and C.J. Ellison 3, 1 imec, Belgium, 2 Univ. of Texas and 3 Univ. of Minnesota, USA

15:35 – 15:55 Chemical Patterns Obtained with Spacer Patterning Lithography for Directed Self-Assembly of Block Copolymer: Process ACE  
A. Paquet 1,2, A. Gharbi 1, P. Pimenta-Barros 1, G. Chamiot-Maitral 1, X. Chevalier 2, C. Navarro 2, C. Nicolet 2, K. Sakavuyi 3, K. Xu 3, L. Pain 1, I. Cayrefourcq 2, P. Nealey 4, R. Tiron 1, 1 CEA-LETI, 2 Arkema, France, 3 Brewer Science and 4 Univ. of Chicago, USA

15:55 – 16:10 Coffee Break

**Session 4: Materials 2** Chair: H. S. Suh (imec)

16:10 – 16:30 Evolution of Perpendicular Lamellae in High- $\chi$  Block Copolymers via In-Situ Atomic Force Microscopy  
A. Chandra 1, R. Nakatani 1, Y. Nabae 1, Y. Seino 2, H. Sato 2, Y. Kasahara 2, T. Azuma 2 and T. Hayakawa 1, 1 Tokyo Inst. of Technol. and 2 EIDECE, Japan

16:30 – 16:50 Fabrication of Refractive Index Tunable Visible-Light Metasurface by Block Copolymer Self-Assembly  
K.H. Han, J.Y. Kim, J. Shin, and S.O. Kim, KAIST, Korea

16:50 – 17:10 Hemicellulose Block Copolymer Enabling Wider Range DSA and High Fabrication Property for Feasible DSA Application  
K. Morita 1, K. Yamamoto 1, M. Harumoto 2, Y. Tanaka 2, C. Nakayama 2, Y. Arisawa 2 and M. Asai 2, 1 Oji Holdings and 2 SCREEN Semiconductor Solutions, Japan

17:10 – 17:30 Sub-10 nm Self-Assembly in a High-Chi Block Copolymer with Versatile Etch Selectivity  
K. Azuma 1,2, J. Sun 2, Y. Choo 3, Y. Rokhelenko 3, B. Schweitzer 4, T. Hayakawa 1, C.O. Osuji 3 and P. Gopalan 2, 1 Tokyo Inst. of Technol., Japan, 2 Univ. of Wisconsin-Madison, 3 Yale Univ. and 4 Berea College, USA

17:30 – 17:50 Ordering Kinetic in Two-Dimensional Hexagonal Pattern of Cylinder-Forming PS-b-PMMA Block Copolymer Thin Films  
M. Perego 1, G. Seguin 1, F. Zanenga 1,2 and M. Laus 2, 1 IMM-CNR and 2 Univ. del Piemonte Orientale, Italy

**Conference Dinner**

18:25 - 18:40 Bus Transportation (18:10 at the 1F lobby)

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19:00 – 21:00	Conference Dinner (Sapporo Beer Museum)	
<b>Tuesday, November 13, 2018</b>		
<b>Invited paper II</b>		Chair: M. Takenaka (Kyoko Univ.)
9:20 – 9:50	Strategies for Small to Large Scale Block Copolymer Self-Assembly (Invited)	D.Y. Ryu, Yonsei Univ., Korea
<b>Session 5: Processing 2</b>		Chair: M. Takenaka (Kyoko Univ.)
9:50 – 10:10	Defect Reduction Strategy for LiNe Flow: Back to Basics	H.S. Suh, P.R. Delgadillo, D. Bae, J. Li, J. Doise, N. Vandembroeck, G. Mannaert, G. Vandenberghe, imec, Belgium
9:50 – 10:10	Impact of Topography of Chemical Pattern on Directed Self-Assembly Process: Focusing on Defectivity	D. Bae 1,2, H.S. Suh 2 and Y.S. Jung 1, 1 KAIST, Korea and 2 imec, Belgium
10:10 – 10:30	Silicon Nanowires Patterning and Integration Using DSA Lithography	M. Argoud 1, P.P. Barros 1, Z. Chalupa 1, G. Claveau 1, G. Chamiot-Maitral 1, A. Bernadac 1, C. Navarro 2, C. Nicolet 2, I. Cayrefourcq 2, R. Tiron 1, 1 CEA-LETI and 2 ARKEMA FRANCE, France
10:30 – 10:45	<b>Coffee Break</b>	
10:45 – 11:05	Time-Resolved Investigation of TMA Diffusion Process in PS, PMMA and PS-r-PMMA Thin Films during SIS by In-Situ Spectroscopic Ellipsometry	E. Cianci 1, D. Nazzari 1,2, G. Seguini 1 and M. Perego 1, 1 IMM-CNR and Univ. Statale di Milano, Italy
11:05 – 11:25	DSA Materials Filtration	T. Umeda and S. Tsuzuki, Nihon Pall, Japan
11:25 – 11:45	Block Copolymer Nanopatterning of Dielectric Mask for Selective Area InAs Vertical Nanowire Growth	A. Löfstrand, M. Graczyk, D. Suyatin, A. Kvennefors, I. Maximov, J. Svensson and L.-E. Wernersson, Lund Univ., Sweden
<b>Session 6: 2D and 3D Metrology</b>		Chair: D. Sunday (NIST)
11:45 – 12:05	DSA Process Roughness Characterization Through Power Spectral Density (PSD)	R.L. Tiec 1, S. Levi 1, P. Pimenta-Barros 2, M. Argoud 2, Z. Chalupa 2, A. Bernadac 2, C. Vannuffel 2, S. Rey 2, G.C. Maitral 2, R. Tiron 2, 1Applied Materials and 2 Univ. Grenoble, France
12:05 – 12:25	Accelerate the Analysis and Optimization of Lamellar BCP Process Using Machine Learning	A. Derville, G. Gey, J. Baderot, X. Chevalier, G. Bernard, J. Foucher and I. Cayrefourcq, POLLEN Metrology, France
<b>Lunch</b>		
12:25 – 13:25	<b>Lunch</b>	
<b>Session 7: Materials 3</b>		Chair: T. Nagai (JSR)
13:25 – 13:45	Microdomain Orientation of Self-Assembled Block Copolymer Vertically to the Substrate by Polymer Brush Grafting	W. Lee 1, S. Park 1 and V. Sethuraman 2, N. Rebello 2, V. Ganesan 2 and D.Y. Ryu 1, 1 Yonsei Univ. and 2 Univ. of Texas Austin, USA
13:45 – 14:05	Post-Polymerization Modification of Polystyrene-block-Poly(Methyl Methacrylate) for Fabricating Sub-10 nm Feature Size	K. Yoshida 1, S. Tanaka 1, K. Miyagi 2, A. Yamazaki 2, T. Isono 1, T. Yamamoto 1, K. Tajima 1, R. Borsali 3 and T. Satoh 1, 1 Hokkaido Univ., 2 Tokyo Ohka Kogyo, Japan and 3 Cermav, France
14:05 – 14:25	Block Copolymer Self-Assembly on the Light-absorbing Graphene Layer by Using Laser Writing	G.G. Yang, H.M. Jin and S.O. Kim, KAIST, Korea
14:25 – 14:45	Evaluation of high- $\chi$ silicon-containing BCPs performances for DSA applications Withdrawn	X. Chevalier 1, M. Zelsmann 2, P. Bezdard 2, G. Floury 3, C. Nicolet 1, K. Sakavuyi 4, L. Pain 5, C. Navarro 1, D. Jurajda 3, I. Cayrefourcq 1, 1 ARKEMA FRANCE, 2 Univ. Grenoble Alpes, 3 Univ. Bordeaux, France, 4 Brewer-Sci., USA and 5 CEA-LETI, France
14:25 - 14:45	Sub-5 nm Patterning by Self-Assembly of Hydroxyl-Containing Block Copolymers	C. Wang, X. Li and H. Deng, Fudan Univ., China
14:45 - 15:05	<b>Coffee Break</b>	
Chair: T. Nagai (JSR)		
15:00 - 15:20	$\chi$ N effect on Composition Fluctuation of Block Copolymer Self-	T. Jun, Y. Lee, S. Jo, and D.Y. Ryu, Yonsei Univ., Korea
15:20 - 15:40	Ultra-Fast Directed Self-Assembly Materials for Sub-5 nm Patterning Application	X. Li, J. Zhou, Y. Peng, H. Deng, Fudan Univ., China
15:40 - 16:00	Visualization of NL Polymer Distribution in NIL Guides for DSA	K. Asakawa, N. Sasao, T. Sawabe and S. Sugimura, Toshiba Memory, Japan
16:00 - 16:20	High-Chi Silicon Containing Block Copolymers: Materials and Processes for Orientation Control and Directed Self-Assembly	C.J. Ellison 1 and C.G. Willson 2, 1 Univ. of Minnesota and 2 Univ. of Texas, USA
<b>Discussion, Voting and adjourn</b>		
16:20 - 16:40	Debate and Voting T. Azuma (EIDEC)	
16:40 - 16:50	Closing Remarks S. Nagahara (TEL)	

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