

2024 IEEE International Interconnect Technology Conference (IITC 2024)

**San Jose, California, USA
3-6 June 2024**



**IEEE Catalog Number: CFP24ITR-POD
ISBN: 979-8-3503-8518-2**

**Copyright © 2024 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP24ITR-POD
ISBN (Print-On-Demand):	979-8-3503-8518-2
ISBN (Online):	979-8-3503-8517-5
ISSN:	2380-632X

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

TABLE OF CONTENTS

Enhancement of Electromigration Performance of Molybdenum Nanowires by CoMo Capping	1
<i>Sijie Gu, Haijun Cheng, Chun-Feng Hu, Xin-Ping Qu</i>	
Data Analytics to Identify Improved Low K Films	4
<i>William R. Entley, Jennifer Achtyl, Robert Ridgeway</i>	
Front-Side Integration of Middle-Of-Line Stacked Contacts for Monolithic CFET	7
<i>V. Vega-Gonzalez, K. Stiers, C. Sheng, S. Demuynck, C Toledo De Carvalho Cavalcante, L. Petersen, T. Chiarella, J. Boemmels, T. Sarkar, N. Franchina Vergel, D. Radisic, R. Loo, E. Rosseel, C. Porret, G. Mannaert, S. Choudhury, V. Brissonneau, E. Dupuy, A. Peter, N. Jourdan, J-P. Soulié, T. Hakamata, A. Romo-Negreira, R. Clark, K. Vandersmissen, F. Sebaai, P. Puttarame Gowda, J. G. Lai, A. Mingardi, S. Kumar Sarkar, B. T. Chan, A. Sepulveda Marquez, R. Langer, I. Gyo Koo, E. Altamirano Sanchez, K. Devriendt, P. Rincon Delgadillo, F. Lazzarino, J. Mitard, J. Geypen, D. Batuk, Y-F. Chen, F. Verbeeck, F. Holsteyns, S. Subramanian, Zs. Tokei, N. Horiguchi, S. Biesemans</i>	
Improvement of Ru-Co Liner for Void-Free Cu Interconnect in Extremely Small Pitch	10
<i>Hehsang Ahn, Hoyun Jeon, Seungwook Lee, Wonhyuk Hong, Eunji Jung, Rakhwan Kim, Teahong Ha</i>	
Ultra Low-K Properties of Atomic Layer Deposited Amorphous Boron Nitride for Futuristic Inter Metal Dielectric	13
<i>Inkyu Sohn, Taejin Choi, Jaewon Kim, Hyungjun Kim</i>	
Surface Characterization and Modification for Cu/SiCN Hybrid Bonding	16
<i>Kenta Hayama, Kohei Nakayama, Ryosuke Sato, Yutetsu Kamiya, Ken Harada, Masahiro Yokoyama, Yasuhiro Kawase, Fumihiko Inoue</i>	
Halogen Free Low Temperature ALD Mo-Based Films for Interconnects Applications.....	19
<i>Aein Babadi, Randall Higuchi, Mike Savo, Charlene Chen, Bhushan Zope, Sergei Ivanov</i>	
Atomic Layer Deposition of TiN in Horizontal Vias Using Hydrazine as Nitrogen Precursor	22
<i>Jannick Fammels, Ping-Che Lee, Dipayan Pal, Julian Pilz, Dmytro Solonenko, Jeffrey Spiegelman, Andrew C. Kummel</i>	
200nm-Pitched, Superconducting Nb Interconnects for Cryo-CMOS Application.....	25
<i>N. Iguchi, H. Numata, M. Tanaka, K. Okamoto, T. Tanaka, K. Uchida, H. Ishikuro, T. Sakamoto, M. Tada</i>	
Characterization of Siliconcarbonitride Bonding Layer for Plasma Activated Direct Fusion Bonding	28
<i>David Doppelbauer, Christoph Floetgen, Ignacio Gabriel Vicente Gabás, Serena Iacovo, Steven Brems, Eric Beyne, Jiri Duchoslav, Heiko Groiss</i>	
Low Resistance Stacked Via Metallization for Future Interconnects	31
<i>Marleen H. Van Der Veen, A. Farokhnejad, A. Kumar Mandal, H. Struyf, S. Park, Z. Tokei</i>	
Investigation of the Enlargement of Ru Grains and Failure Modes Analysis in Microsecond UV Laser Annealing.....	34
<i>Zeinab Chehadi, Richard Daubriac, Lu Lu, Karim Huet, Zsolt Tokei, Leonardo Cancellara, Fuccio Cristiano, Louis Thuries</i>	

Fabrication of Superconducting Nb Airbridges in a 300 mm Pilot Line for Quantum Technologies.....	37
<i>Danny Wan, Massimo Mongillo, Yann Canvel, Daniel Perez Lozano, Bert Tobbyack, Tsvetan Ivanov, Antoine Pacco, Xiaoyu Piao, Shana Massar, Anton Potocnik, Kristiaan De Greve</i>	
Lateral Metal Deposition and the Formation of Interconnection.....	40
<i>Weidu Qin, Jiabao Sun, Jiao Jin, Chao Tian, Chaoyang Guan, Hongbo Sun, Chao Zhao</i>	
Dielectric Relaxation in HfO ₂ /Al ₂ O ₃ MIM Capacitors.....	43
<i>Jeff Gambino, Vincent McGahay, Gyana Biswal, Akihiro Hasegawa, Michael Cook, Thomas Long, Karen Barker, David Price, Rick Mauritzson</i>	
Selective CVD Ru on W by Sequential Small Molecule Inhibitor Treatments	46
<i>Kai-Hung Yu, Ryota Yonezawa, Hiroaki Kawasaki, Joshua Mayersky, Hirokazu Aizawa, Hidenao Suzuki, Cory Wajda</i>	
Proposal for Improved Electrical Efficiency Through Thermal Modeling of Interconnect Structure	49
<i>Tae Yeong Hong, Seul Ki Hong</i>	
Low Contact Resistance Copper-Copper Bonding with Selective Electroless Plating Cobalt Interlayer	51
<i>Yun-Hao Shao, Zi-Hong Ni, Gui Chen, Hao Wang, Xin-Ping Qu</i>	
Formation of Lateral-Type High-Tc Superconductor Josephson Junction by Helium Ion Microscopy	54
<i>Shinichi Ogawa, Tetsuro Misawa, Kosuke Kurushima, Yuji Otsuka, Yukinori Moritta, Chiharu Urano</i>	
Selective Co ALD for Chiplet-To-Wafer and Wafer-To-Wafer Bonding.....	57
<i>Cheng-Hsuan Kuo, Madison Manley, Dipayan Pal, Rohan Sahay, Ravindra Kanjolia, Jacob Woodruff, Muhannad Bakir, Andrew C. Kummel, Mansour Moinpour, Jeff Spiegelman</i>	
Modeling of Via Resistance Considering Spatially-Resolved Conductivity and Temperature-Dependence	59
<i>Xinkang Chen, Sumeet Kumar Gupta</i>	
Study and Control of the Distortion Induced by the Bonding Process for BSPDN Approaches.....	62
<i>Karine Abadie, Ivania Mendes, Marie-Line Pourteau, Frank Fournel, Hadi Hijazi, Viorel Balan, Richard Van Haren, Suwen Li, Blandine Minghetti, Leon Van Dijk, Mart Baars, Laurent Michaud, Thomas Plach, Gernot Probst</i>	
A Design Approach for Ultra-Low-K Dielectric Organosiloxane Polymers	65
<i>Hanna Luusua, Thomas Gädda, Jagadish Salunke, Zhongmei Han, Heli Kekkonen, Juha Rantala, Hsiaokang Chang, Hsin-Yen Huang, Ting-Ya Lo, Gary Liu</i>	
Investigation of Graphene Cap Formation on NiAl by Low Temperature Thermal CVD.....	68
<i>Yumehito Temmyo, Jean-Philippe Soulié, Christoph Adelman, Zsolt Tökei, Kazuyoshi Ueno</i>	
Bonding Induced Distortion in Wafer-To-Wafer Bonding Applications: How the Scanner and Yieldstar Can Enable 3D Integration.....	71
<i>V. M. Blanco Carballo, V. Renaud, S. Iacovo, A. Jourdain, A. Hsu, Y. Tseng, C. Tabery, E. P. De Poortere</i>	
Ligand Engineering to Machine Learning : Optimizing Ru ALD for Ultrathin Film Deposition	74
<i>Jay Chiu, Isiah Liu, Chang-Won Lee, Guo Liu, Bhushan Zope</i>	
Chip Size Reduction and Performance Enhancement in CBA-Type 3D Flash Memory.....	77
<i>Shigeki Kobayashi</i>	

Reconfigured Wafer-On-Wafer 3D Integration with Meta Bonding Technologies.....	80
<i>Takafumi Fukushima</i>	
BEOL-Compatible On-Chip DC-DC Converters	83
<i>Sunbin Deng, Jungyoun Kwak, Junmo Lee, Shimeng Yu, Suman Datta</i>	
Assessing Impact of Non-Uniform Localized Heating on Reliability	86
<i>Yoon Jo Kim, Edwin B. Ramayya, Lei Jiang, Jason Jopling, Rahim Kasim</i>	
Redefining 2-Level Semi-Damascene Interconnect Technology: Benchmarking Three Different Fully Self-Aligned Via Options	89
<i>Giulio Marti, Gilles Delie, Gayle Murdoch, Anshul Gupta, Souvik Kundu, Stefan Decoster, Olalla Varela Pedreira, Alicja Lesniewska, Yanick Hermans, Bart Kenens, Fulya Ulu Okudur, Seongho Park, Zsolt Tokei</i>	
Investigation of Cu Barrier Properties of 1-Nm-Thick PVD-Co(W) Films as a Single Liner/Barrier in Next-Generation ULSI-Cu Interconnect	92
<i>Yubin Deng, Takeshi Momose, Yukihiro Shimogaki</i>	
Barrier-Less W Metallization Processes for Low-Resistance Contacts at Sub-3 nm Logic Devices	95
<i>Seongdong Lim, Seongheum Choi, Jeongik Kim, Byungchul Kang, Daeun Kim, Yeji Song, Donghyun Kim, Sanghoon Uhm, Chunghwan Shin, Taehong Ha, Rak-Hwan Kim</i>	
Self-Aligned 8nm T2T as Cell Boundary in the Middle-Of-Line.....	98
<i>P. Marien, Y. Hermans, S. Choudhury, S. Kundu, S. Decoster, F. U. Okudur, N. Reddy, B. Kenens, N. Jourdan, G. Delie, G. Marti, C. Wu, V. V. Gonzalez, G. Murdoch, S. Park, Z. Tokei</i>	
Demonstration of MP18-26nm Ru Semi-Damascene Spacer-Is-Dielectric SADP Integration	101
<i>Chen Wu, Stefan Decoster, Vincent Renaud, Yannick Hermans, Philippe Marien, Giulio Marti, Nancy Heylen, Bart Kenens, Syamashree Roy, Fulya Ulu Okudur, Quoc Toan Le, Naveen Reddy, Alfonso Sepulveda Marquez, Gilles Delie, Anshul Gupta, Alicja Lesniewska, Gayle Murdoch, Seongho Park, Zsolt Tokei</i>	
Reliability of a High Capacitance Density Topographic MIM	104
<i>Christopher Perini, James Palmer, Shahriar Imam, Neena Gilda, Che-Yun Lin, Rahim Kasim, James Waldemer, Chris Pelto</i>	
Impact of ESD Events on TSV Liner Reliability.....	107
<i>Emmanuel Chery, Michele Stucchi, Stefaan Van Huylbroeck, Eric Beyne</i>	
Ion Beam Deposition of Low-Resistivity Tungsten and Molybdenum for Interconnect Applications.....	110
<i>Rutvik J. Mehta, Yuejing Wang, Ashish Kulkarni, Robert Walko, Paul Turner, Frank Cerio, Robert Caldwell</i>	
Interconnect Delay Modeling of Critical Paths in Angstrom Nodes	113
<i>Francesco Dell'Atti, Anita Farokhnejad, Odysseas Zografos, Pieter Weckx, Julien Ryckaert, Paul Heremans</i>	
Highly Reliable Ruthenium-Cobalt Binary Liner for Advanced Node Cu Interconnect.....	116
<i>Gyuho Myeong, Junki Jang, Kihyun Kim, Jaeho Lee, Eunyoung Park, Hoyun Jeon, Kyounghee Nam, Eunji Jung, Sung-Yeol Baek, Ji-Hwan Lee, Sungjun Kim, Won-Joon Son, Yoon-Suk Kim, Chin Kim, Doowhan Park, Rak-Hwan Kim, Jeonghoon Ahn, Jongho Lee</i>	
Technology Benchmarking of Copper Electromigration Using a Grain-Sensitive Simulation Framework.....	119
<i>A. S. Saleh, K. Croes, H. Ceric, I. De Wolf, H. Zahedmanesh</i>	

Two Metal Level Semi-Damascene Interconnects for Superconducting Digital Logic.....	122
<i>Sara Iraci, Ankit Pokhrel, Daniel Perez Lozano, Jean-Philippe Soulié, Sujan Kumar Sarkar, Rajendra Kumar Saroj, Yann Canvel, Vincent Renaud, Amey Mahadev Walke, Bart Kenens, Blake Hodges, Seifallah Ibrahim, Trent Josephsen, Benjamin Huet, Gayle Murdoch, Min-Soo Kim, Sabine O'Neal, Quentin Herr, Anna Herr, Zsolt Tokei</i>	
Patterning Process and Electrical Yield Optimization at the Limits of Single Exposure EUV 0.33 NA: A Pitch 26nm Damascene Process.....	125
<i>V. M. Blanco Carballo, K. Vandersmissen. B. De Wachter, K. Nafus, Y. Feurprier, A. Thiam, A. Hsu, C. Tabery, J. Doise, P. De Schepper</i>	
300mm Wafer-Scale ALD-Grown MoS ₂ for Cu Diffusion Barrier	128
<i>Thong Ngo, Angelica Zacatzi, Yuanqiu Tan, Daniel Lee, Anand Waknis, Nguyen Vu, Ravi Kanjolia, Mansour Moinpour, Zhihong Chen</i>	
The Investigation of Ar Plasma Treatment on the Contact Resistance Between Metal-Metal by a Simple Metal Bonding Simulation Approach.....	131
<i>Gui Chen, Yun-Hao Shao, Xin-Ping Qu</i>	
Advanced Interconnect Capacitance and Interface Engineering Beyond 1.4nm Logic Devices (Invited).....	134
<i>Kang Sub Yim, Jong Min Baek, Hoon Seok Seo</i>	
Thermally Conductivity Study of One Micron AlN Deposition by Bipolar High Power Impulse Magnetron Sputtering.....	137
<i>Ping-Che Lee, Aaron J. McLeod, Mingeun Cho, Diego Vaca, Satish Kumar, Andrew C. Kummel</i>	
Mechanistic and Performance Aspects for Co-Designed Process Technology to Enable Mo as the Next Generation Conductor.....	139
<i>Michael White, Kevin Dockery, Paul Besser, Bryan Hendrix, Don Frye, Maryam Farmand, Jun Liu, Daniela White, Lennon Ko, Fernando Hung, Jason Seabold, Brian Sneed, Shawn Nguyen, Phil Chen, Atanu Das, John Clement, David Balog, Michael Owens, Youngmin Kim, Sudeep Kuttiaator, Roger Luo, Volley Wang, Chun-I Lee, Tessa Goodwin, Satish Rai</i>	
Nano-Chemical Characterization of SiO ₂ and Cu Surfaces for Cu-Cu Hybrid Bonding.....	142
<i>Padraic O'Reilly, Beihang Yu, Chenghsuan Kuo, Andrew C. Kummel, Ricardo Ruiz, Sung Park</i>	
Doping Effects in Grain Boundaries of Tungsten: Insights from First-Principle Study	145
<i>Yeongjun Lim, Mincheol Shin</i>	
Airgap Integration in MP18 Two-Level Semi-Damascene Interconnects with Fully Self-Aligned Vias.....	148
<i>Gilles Delie, Gayle Murdoch, Giulio Marti, Anshul Gupta, Chen Wu, Alicja Lesniewska, Anton Gavrilov, Ivan Ciofi, Souvik Kundu, Stefan Decoster, Seongho Park, Zsolt Tokei</i>	
The Feasibility of the Lateral Wet-Etching on TiN Layers in 3D Multilayer Stack Structures	151
<i>Jiao Jin, Jiabao Sun, Tuo Xin, Weidu Qin, Chaoyang Guan, Wenjun Chen, Chao Tian, Baodong Han, Hongbo Sun, Chao Zhao</i>	
A Novel Single Damascene Process for Via Metal Corrosion-Free Interconnects in Advanced Nodes.....	154
<i>K. Motoyama, D. Metzler, J. Church, H. Shobha, H. Zhang, H. Huang, K. Choi</i>	

Wafer-Level Electrochemical Deposition and Processing of Nanotwinned Cu RDL.....	157
<i>Chih-Hao Hsia, Sungho Park, Soichi Watanabe, Marco Arnold, Zaid El-Mekki, Martine Delande, Ehsan Shafahian, Punith K. M. K. Gowda, Herbert Struyf, Aleksandar Radisic</i>	
Ion Beam Deposition of Epitaxial 0001 In-Plane and Out-Of-Plane Low-Resistivity Ruthenium for Interconnect Applications.....	160
<i>Rutvik J. Mehta, Yuejing Wang, Frank Cerio, Robert Caldwell, Christopher J Jezewski, I-Cheng Tung, Jimmy Wang, Matthew V. Metz</i>	
Metal-Metal Contact Resistance Measurements.....	163
<i>Poyen Shen, Daniel Gall</i>	
Resolving Nanoscale Composition Fluctuations and Defects in Advanced Interconnects: A Crucial Step to Comprehend Thin Film Resistivity	166
<i>Claudia Fleischmann, Akira Uedono, Jeroen E. Scheerder, Jean-Philippe Soulié, Seongho Park, Christoph Adelmann, Zsolt Tokei</i>	
Exploration of Barrier Materials for Cu ₂ Mg/SiO ₂ and Resistivity Scaling of Twinned Cu ₂ Mg.....	169
<i>Toshihiro Kuge, Masaya Iwabuchi, Mansour Moinpour, Ravindra Kanjolia, Masataka Yahagi, Junichi Koike</i>	
Low-Resistivity Subtractive-Etched W Lines and Highly Reliable High Aspect Ratio Fully Self-Aligned Vias for 3D Flash Memory	172
<i>Mitsuhiko Noda, Genki Sawada, Seiya Hirano, Sota Araki, Atsushi Rikukawa, Yusuke Goki, Katsumi Yamamoto, Toshiyuki Sasaki, Daichi Nishikawa, Toshiyuki Morita, Masayoshi Tagami, Norio Ohtani, Masaru Kito</i>	
Interface Engineering for Performance and Reliability Boosting of Logic Devices	175
<i>Jongmin Baek, Suhyun Bark, Yeonggil Kim, Minchul Ahn, Geun-Tae Yun, Deokyoung Jung, Hoonseok Seo, Sungsoo Kim, Kyuhee Han, Woojin Lee, Youngwoo Cho, Eunji Jung, Rak-Hwan Kim, Kang Sub Yim, Sunjung Kim</i>	
Process Control for the Modification of Ruthenium Resistivity in Scaled Subtractive Interconnects	178
<i>Jack Rogers, Hirokazu Aizawa, Nicholas Joy, Rinus Lee, Kenichi Imakita, Hojin Kim, Toru Hisamatsu</i>	
Enhanced Process Control for Plasma Triggered Oxide Growth in Plasma Activated Wafer Bonding.....	181
<i>Christoph Floetgen, Ignacio Gabriel Vicente Gabás, David Doppelbauer</i>	
Advanced Black Diamond® for <2nm BEOL Low K Integration	184
<i>Bo Xie, Rui Lu, Orlando Trejo, Akansha Singh, Michael Haverty, Lauren Bagby, Kent Zhao, Lakmal Kalutarage, Monika Jamieson, Chi-I Lang, Chandru Ramalingam, Li-Qun Xia</i>	

Author Index