2023 21st International Workshop on Junction Technology (IWJT 2023)

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Technical Program of 21st International Workshop on Junction Technology (IWJT2023)

June 8 (Thursday)

9:30 **Opening Remarks**
Hitoshi Wakabayashi (General Chair and IEEE EDS)
Toshiro Hiramoto (JSAP)
Kazunari Ishimaru (EDS/IEEE)
Tetsuo Narita (Program Chair)
IWJT Award ceremony

Commemorative Symposium Part 1

10:00 **Keynote Speech 1**
History of junction technologies
Commemorative talk for the 75th anniversary of the transistor..........1
Hiroshi Iwai
[International College of Semiconductor Technology,
National Yang Ming Chiao Tung University, Hsinchu, Taiwan
Tokyo Institute of Technology, Japan]

Commemorative Symposium Part 1

11:10 **Panel Discussion**
～Challenges to Innovate Junction Technologies: from the Past to the Future～
Panelist
Hitoshi Wakabayashi [Tokyo Institute of Technology]
Michael I. Current [Current Scientific John Borland / JOB Technologies]
Kazuya Ohuchi [Kioxia Corp. Ichiro Mizushima / NuFlare Technology Inc.]
Naoto Horiguchi [IMEC]

12:40 **Group Photo, Committee Meeting with Lunch** (80 min)

Session 1 Novel Process and Its Characterization

14:00 **S1-1** **Room-temperature atomic layer deposition : a review..........78**
[Invited] Fumihiko Hirose
[Graduate School of Science and Engineering, Yamagata University]

14:30 **S1-2** **A Novel Method to Improve CMP Selectivity by Ultra-High-Dose Ion Implantation..........80**
S. Yuan[1], K. Omori[1], T. Yamaguchi[1], T. Ide[2], S. Muranaka[1], and M. Inoue[1]
[[1] Process Production Technology Division, Production and Technology Unit, Renesas Electronics Corp.
[2] Device Technology Division, Production and Technology Unit, Renesas Electronics Corp.]

14:50 **S1-3** **Two-Stage Shrinkage Behavior of Multielement-Molecular-Ion-Implantation-Induced Dislocation Loops Revealed by Real-Time TEM Observation..........84**
Akihiro Suzuki, Ryosuke Okuyama, Koji Kobayashi, Takeshi Kadono, Ayumi Onaka-Masada, Ryo Hirose, Yoshihiro Koga, and Kazunari Kurit
[SUMCO CORPORATION]

15:10 **S1-4** **Sheet resistance reduction of sputtered WS2 film by Cl2 plasma treatment for thermoelectric devices..........87**
Keita Kurohara, Shinya Imai, Takuya Hamada,Tetsuya Tatsumi, Shigetaka Tomiya and Hitoshi Wakabayashi
[Department of Electrical and Electronic Engineering, Tokyo Institute of Technology]

15:30 **Coffee Break, Exhibition (2F)** (20 min)

Session 2 Widegap Power Device 1

15:50 **S2-1** **Junction Technology on SiC Power Devices..........91**
[Invited] Yasunori Tanaka [Advanced Power Electronics Research Center (ADPERC) National Institute of Advanced Industrial Science and Technology (AIST)]

16:20 **S2-2** **Ion implantation induced damage in 4H SiC detected by photo modulated reflectance..........94**
Z. Zolnai, J. Szívós, Ö. Sepsi, F. Újhelyi, Z. Bozóki, B. Dénes, D. Ullrich, R. Flender, D. Miron, B. M. Kovács, Z. F. Deli, K. Kovács, G. Nádudvari, and L. Balogh
[Semilab Semiconductor Physics Labratory Ltd]

16:40 **S2-3** **Effects of Long-Term Low-Temperature Annealing on Lightly Mg-Implanted GaN..........97**
Masamichi Akazawa, Yuliu Luo, and Yuki Hatakeyama
[Research Center for Integrated Quantum Electronics, Hokkaido University]

17:00 **S2-4** **Ion Implantation Doping Technology for Ga_2O_3 and Its Application to Device Fabrication..........99**
[Invited] Masataka Higashiwaki[1,2], Ken Goto[3], Hisashi Murakami[3], and Yoshinao Kumagai[3]
[[1] Department of Physics and Elkomeectronics, Osaka Metropolitan University,
[2] National Institute of Information and Communications Technology
[3] Department of Applied Chemistry, Tokyo University of Agriculture and Technology]

17:30 **Preparation**

18:00 **Conference Banquet (2F)** (120 min)

June 9 (Friday)

Keynote Speech 2 Widegap Power Device 2

9:20 **KN-2** **Exploring Next-Generation GaN Power Devices with Ferroelectric Charge Trap Gate Stack Technology for Normally-OFF Operations..........103**

Edward-Yi Chang[1], Jui-Sheng Wu[2], Tsung-Ying Yang[1], and Chen-Hsi Tsai[2]
[[1] International College of Semiconductor Technology, National Yang Ming Chiao Tung University, Hsinchu, Taiwan
[2] Department of Materials Science and Engineering National Yang Ming Chiao Tung University, Hsinchu, Taiwan]

Session 3 Widegap Power Device 2

10:00 **S3-1** **Temporary and spatially resolved luminescence studies of p-GaN segments fabricated by vacancy-guided redistribution of Mg using sequential ion implantation of Mg and N..........107**

K. Shima[1], R. Tanaka[2], S. Takashima[2], K. Ueno[2], M. Edo[2], A. Uedono[3], S. Ishibashi[4], and S. F. Chichibu[1]
[[1] Institute of Multidisciplinary Research for Advanced Materials, Tohoku University
[2] Advanced Technology Laboratory, Fuji Electric Co., Ltd.
[3] Division of Applied Physics, Faculty of Pure and Applied Sciences, University of Tsukuba
[4] Research Center for Computational Design of Advanced Functional Materials, National Institute of Advanced Industrial Science and Technology]

10:20 **S3-2** **The Detailed Analysis of Diffusion Behavior of implanted ions in 4H-S..........111**

Ryota Wada, Tsutomu Nagayama, Takashi Kuroi and Nariaki Hamamoto
[NISSIN ION EQUIPMENT CO., LTD.]

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[Invited]

Ryo Tanaka[1], Shinya Takashima[1], Katsunori Ueno[1], Masahiro Horita[2], Jun Suda[2], Jun Uzuhashi[3], Tadakatsu Ohkubo[3], and Masaharu Edo[1]
[[1] Advanced Technology Lab., Fuji Electric Co., Ltd.
[2] Nagoya Univ.,
[3] National Institute for Materials Science]

11:10 **Coffee Break, Exhibition (2F)** (20 min)

Session 4 Bonding and Image Sensor

11:30 **S4-1** **The Evolution of Bonding from Packaging to the Front End..........120**

[Invited]

Sitaram Arkalgud
[TEL Technology Center, America, LLC]

12:00 **S4-2** **Overview of Pixel Scaling Technology in CMOS Image Sensor..........123**

[Invited]

Tomoharu Ogita
[Sony Semiconductor Solutions Corporation]

12:30 **Lunch** (60 min)

Session 5 Ion Implantation and its Modeling

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Ryosuke Okuyama, Takeshi Kadono, Ayumi Masada, Akihiro Suzuki,
Koji Kobayashi, Ryo Hirose, Yoshihiro Koga, and Kazunari Kurita
[SUMCO CORPORATION]

13:50 **S5-2** **Kinetic Monte Carlo Simulations for Recrystallization Process of Discrete Amorphous Regions in C_3H_5-Molecular-Ion-Implanted Silicon Substrate Surface..........131**
Koji Kobayashi[1,2], Ryosuke Okuyama[1], Takeshi Kadono[1], Ayumi Onaka-Masada[1], Ryo Hirose[1], Akihiro Suzuki[1], Yoshihiro Koga[1], Kazunari Kurita[1], and Koji Sueoka[2]
[[1] SUMCO Corporation,
[2] Okayama Prefectual University]

14:10 **S5-3** **Effects of Ion Channeling and Co-implants on Ion Ranges and Damage in Si: Studies with PL, SRP, SIMS and MC models..........135**
[Invited] Michael I. Current[1], Takuya Sakaguchi[2], Yoji Kawasaki[2], Viktor Samu[3],
Anita Pongracz[3], Luca Sinko[3], Árpád Kerekes[3], Zsolt Durkó[3]
[[1] Current Scientific, [2] SMIT, [3] Semilab]

14:40 **Coffee Break, Exhibition (2F)** (20 min)

Session 6 Contact and Annealing Technology 1

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[Invited] Oleg Gluschenkov, Yasir Sulehria, Shogo Mochizuki, and Kevin Brew
[IBM Semiconductor Technology Research]

15:30 **S6-2** **EZ-FET junctions activation by nanosecond laser annealing..........145**
N. Zerhouni Abdou[1,2], P. Acosta-Alba[1], L. Brunet[1], M. Opprecht[1],
F. Milesi[1], M. Gallard[1], S. Reboh[1], and I. Ionica[2]
[[1] CEA-Leti, Univ.
[2] Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, Grenoble INP, IMEP-LAHC]

15:50 **S6-3** **Novel Scanning Nanosecond Laser Anneal with Variable Dwell and Real-time Process Control for Advanced Logic and Memory Applications..........149**
[Invited] Joseph Kassim, Michael Willemann, Fareen Khaja, and
Thirumal Thanigaivelan
[Veeco, Inc.]

16:20 **Coffee Break, Exhibition (2F)** (20 min)

Session 7 Contact and Annealing Technology 2

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[Univ. Grenoble Alpes, CEA, LETI]

17:00 **S7-2** **Doping of silicon by phosphorus end-terminated polymers: shallow junction formation by thermal and laser annealing..........157**
Michele Perego[1], Gianluca Barin[1,2], Riccardo Chiarcos[3], Michele Laus[3] and Enrico Napolitani[4]
[[1] CNR-IMM, Unit of Agrate Brianza,
[2] Universita` degli Studi di Milano,
[3] Universita` del Piemonte Orientale ''A. Avogadro'',
[4] Università di Padova and CNR-IMM,]

17:20 **S7-3** **Advances in Materials and Junction engineering enabled by Epi..........159**
[Invited] Saurabh Chopra, Papo Chen, Masato Ishii, and Shawn Thomas.
[Yi-Chiau Huang Applied Materials]

17:50 **S7-4** **Modulating Electron Energy Barrier at Metal/Semiconductor and Metal/Insulator Contacts with Thin Interfacial Layer..........161**
[Invited] Kibog Park
[Department of Physics and Department of Electrical Engineering, Ulsan National Institute of Science and Technology].

18:10 **Short Break** (10 min)

Session 8 Advanced CMOS

18:20 **S8-1** **Nanosheet-based Device Architectures with Front/Backside Connectivity: Opportunities for S/D Engineering to Enable Advanced CMOS Logic Scaling..........164**
[Invited] A. Veloso, G. Eneman, P. Matagne, A. De Keersgieter, A. Hikavyy, P. Favia, and N. Horiguchi
[imec]

18:50 **S8-2** **Advanced contacts on 3D nanostructured channels for vertical transport gate-all-around transistors..........169**
[Invited] Guilhem Larrieu[1]*, Jonas Müller[1], Sylvain Pelloquin[1], Abhishek Kumar[1], Konstantinos Moustakas[1], Pawel Michałowski[2], Aurélie Lecestre[1].
[[1] LAAS-CNRS, CNRS, Université de Toulouse
[2] Łukasiewicz Research Network Institute of Microelectronics and Photonics]

19:20 **Preparation of Closing and Award Ceremony** (10 min)

19:30 **Award Ceremony and Closing Remarks** (15 min)