

WORKSHOP SCIENTIFIC PROGRAM

January 29 (Friday), 2010

**5th International WorkShop on
New Group IV Semiconductor Nanoelectronics**
Jan. 29(Fri.) - 30(Sat.), 2010
Laboratory for Nanoelectronics and Spintronics, Research Institute of
Electrical Communication, Tohoku Univ., Sendai, Japan

Session 0: Opening 13:00-13:10 (4F Conference Room)

13:00-13:10 **Introductory**
Junichi Murota,
Laboratory for Nanoelectronics and Spintronics, Research Institute of
Electrical Communication, Tohoku University, Japan

Session I: Invited Presentation (1) 13:10-14:50 (4F Conference Room)

- 13:10-13:35 I-01: **“High frequency behaviour of Ge pin junctions”**, . . . 1
Erich Kasper¹, M. Oehme¹, J. Schulze¹, S. Klinger² and M. Berroth²,
¹ Institut für Halbleitertechnik (IHT), Universität Stuttgart, Germany,
² Institut für Elektrische und Optische Nachrichtentechnik (INT),
Universität Stuttgart, Germany
- 13:35-14:00 I-02: **“Fluctuations in Electronic Properties of Interface Traps
in Nano-MOSFETs”**, . . . 3
Toshiaki Tsuchiya¹, Yuki Mori¹, Yuta Morimura¹ and Tohru Mogami²,
¹ Shimane University, Japan,
² Semiconductor Leading Edge Technologies (Selete), Japan
- 14:00-14:25 I-03: **“Effective passivation of Ge surface by high-quality GeO₂ formed by
Electron-Cyclotron-Resonance plasma oxidation
for Ge-based electronic and photonic devices”**, . . . 5
Yukio Fukuda¹, Yohei Otani¹, Tetsuya Sato², Hiroshi Toyota³ and Toshiro Ono³
¹ Tokyo University of Science, Suwa, Japan,
² Clean Energy Research Center, University of Yamanashi, Japan,
³ Hirosaki University, Japan
- 14:25-14:50 I-04: **“Si_{1-x}Ge_x GS-MBE and Sputter Epitaxy Techniques and
Their Application to Devices with Low Dimensional Structures”**, . . . 7
Yoshiyuki Suda, Hiroaki Hanafusa, Takafumi Okubo,
Kouta Kunugi and Hiroyuki Ohhashi,
Graduate School of Engineering, Tokyo University of Agriculture and Technology,
Japan

14:50-15:10 **Break**

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Session II: Invited Presentation (2) 15:10-17:15 (4F Conference Room)

- 15:10-15:35 I-05:
“Atomic Level Control for Group IV Semiconductor Processing”, . . . 9
Bernd Tillack^{1,2}, Yuji Yamamoto¹ and Junichi Murota³,
¹ IHP, Germany,
² Technische Universität Berlin, Germany,
³ Laboratory for Nanoelectronics and Spintronics, Research Institute of
Electrical Communication, Tohoku University, Japan
- 15:35-16:00 I-06:
**“Germanium surface segregation in the silicon passivation of
Ge pMOSFETs: influence of the Si precursor”**, . . . 11
Matty Caymax, Benjamin Vincent, Wilfried Vandervorst and Roger Loo,
IMEC, Belgium
- 16:00-16:25 I-07:
**“Defect Annihilation of *a*-GeO₂ on Ge and Passivation of
Ge/GeO₂ Interface”**, . . . 13
Akira Toriumi,
Department of Materials Engineering, The University of Tokyo, Japan
- 16:25-16:50 I-08:
“Formation of graphene on 3C-SiC ultrathin film on Si substrates”, . . . 15
Maki Suemitsu^{1,2},
¹ Research Institute of Electrical Communication, Tohoku University, Japan,
² CREST, Japan Science and Technology Agency, Japan
- 16:50-17:15 I-09:
**“Si Single-Dopant FETs and Observation of Single-Dopant Potential
by LT-KFM”**, . . . 17
Michiharu Tabe¹, D. Moraru¹, M. Anwar¹, Y. Kawai¹, S. Miki¹,
Y. Ono² and T. Mizuno¹,
¹ Research Institute of Electronics, Shizuoka University, Japan,
² NTT Basic Research Laboratories, Japan

Banquet 18:30-20:00 (Hotel Bel Air 1F)

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Session III: Poster Presentation 9:30-11:30 (4F Room 401)

(Boards for posters are available during Workshop.)

- P-01:** “**Interfacial Oxide Layer Controlled Al-Induced Crystallization of Si on Insulator for Epitaxial Template**”, ••• 19
Masashi Kurosawa, Naoyuki Kawabata, Kaoru Toko,
Taizoh Sadoh and Masanobu Miyao,
Department of Electronics, Kyushu University, Japan
- P-02:** “**Spin injection into Si channels through Fe₃Si/Si Schottky tunnel barriers**”, ••• 21
Kenji Kasahara¹, Y. Ando¹, Y. Enomoto¹, K. Yamane¹, K. Sawano²,
K. Hamaya^{1,3} and M. Myao¹,
¹Department of Electronics, Kyushu University, Japan,
²Department of Electrical and Electronic Engineering, Tokyo City University, Japan,
³PRESTO, Japan Science and Technology Agency, Japan
- P-03:** “**High-quality Co₂FeSi/Si(111) heterointerfaces for spin injection into Si**”, ••• 23
Shinya Yamada¹, Y. Enomoto¹, K. Kasahara¹, T. Murakami¹, K. Yamane¹,
K. Yamamoto¹, Y. Ando¹, K. Hamaya^{1,2} and M. Miyao¹,
¹Department of Electronics, Kyushu University, Japan,
²PRESTO, Japan Science and Technology Agency, Japan
- P-04:** “**Adsorption and Desorption of Hydrogen on Si(100) in H₂ or Ar Heat Treatment**”, ••• 25
Atsushi Uto¹, Masao Sakuraba¹, Matty Caymax² and Junichi Murota¹,
¹Laboratory for Nanoelectronics and Spintronics, Research Institute of
Electrical Communication, Tohoku University, Japan,
²IMEC, Belgium
- P-05:** “**Temperature-programmed-desorption study of graphene on silicon substrate**”, ••• 27
Shunsuke Abe¹, Hiroyuki Handa¹, Yu Miyamoto¹, Ryota Takahashi¹,
Hirokazu Fukidome¹ and Maki Suemitsu^{1,2},
¹Research Institute of Electrical Communication, Tohoku University, Japan,
²CREST, Japan Science and Technology Agency, Japan
- P-06:** “**Effectiveness of (001) vicinal substrates on fabrication of high-quality diamond films using high-power-density microwave-plasma chemical-vapor-deposition method**”, ••• 29
Osamu Maida, Shota Iguchi, Yasuhide Sunada, Teruhiro Hidaka and Toshimichi Ito,
Graduate School of Engineering, Osaka University, Japan
- P-07:** “**Carbon condensation and 3C-SiC growth caused by oxidizing Si_{1-x}C_x alloy layers on Si(001) substrate**”, ••• 31
Hideaki Hozumi¹, S. Ogawa¹, A. Yoshigoe², S. Ishizuka³, J.R. Harries²,
Y. Teraoka² and Y. Takakuwa¹,
¹ Institute of Multidisciplinary Research for Advanced Materials,
Tohoku University, Japan,
²Quantum Beam Science Directorate, Japan Atomic Energy Agency, Japan,
³Department of Applied Chemistry, Akita National College of Technology, Japan

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- P-08:** **“Microstructure Change of As-ion, B-ion, and Si-ion implanted Si_{0.99}C_{0.01} Thin Films by Thermal Annealing”** . . . 33
 Shigenori Inoue¹, Keisuke Arimoto¹, Junji Yamanaka¹, Kiyokazu Nakagawa¹,
 Kentarou Sawano², Yasuhiro Shiraki²,
 Atsushi Moriya³, Yasuhiro Inokuchi³ and Yasuo Kunii³,
¹Center for Crystal Science and Technology, University of Yamanashi, Japan,
²Research Center for Silicon Nano-Science, Advanced Research Laboratories,
 Tokyo City University, Japan,
³Hitachi Kokusai Electric Inc., Japan
- P-09:** **“Growth of SiGeC thin film on Si substrate by metal organic chemical vapor deposition”** . . . 35
 Kouichi Kawasaki, S. Kitamura, Y. Naoi and S. Sakai,
 Faculty of Engineering, The University of Tokushima, Japan
- P-10:** **“Microscopic characterization of Si(011)/Si(001) direct silicon bonding substrates”** . . . 37
 Tetsuji Kato¹, T. Ueda¹, Y. Ohara¹, J. Kikkawa¹, Y. Nakamura¹, A. Sakai¹,
 O. Nakatsuka², S. Zaima², E. Toyoda³, K. Izunome³,
 Y. Imai⁴, S. Kimura⁴ and O. Sakata⁴,
¹Graduate School of Engineering Science, Osaka University, Japan,
²Graduate School of Engineering, Nagoya University, Japan,
³Covalent Materials Co., Ltd., Japan,
⁴JASRI/SPring-8, Japan
- P-11:** **“Mobility Enhancement by Highly Strained Si on Relaxed Ge(100) Buffer Grown by Plasma CVD”** . . . 39
 Katsutoshi Sugawara, Masao Sakuraba and Junichi Murota,
 Laboratory for Nanoelectronics and Spintronics, Research Institute of
 Electrical Communication, Tohoku University, Japan
- P-12:** **“Control of Local Strain Structures by Microfabricated Shapes of Ge/Si_{1-x}Ge_x Layers”** . . . 41
 Kenta Mochizuki, Takuya Mizutani, Osamu Nakatsuka,
 Hiroki Kondo and Sigeaki Zaima,
 Graduate School of Engineering, Nagoya University, Japan
- P-13:** **“Strain Relaxation Behavior of Ge_{1-x}Sn_x Buffer Layers on Si and Virtual Ge Substrates”** . . . 43
 Yosuke Shimura¹, Shotaro Takeuchi¹, Norimasa Tsutsui¹, Osamu Nakatsuka¹,
 Akira Sakai² and Shigeaki Zaima¹,
¹Graduate School of Engineering, Nagoya University, Japan,
²Graduate School of Engineering Science, Osaka University, Japan
- P-14:** **“Effective Mass and Mobility of Strained Ge (110) Inversion Layer for PMOSFET”** . . . 45
 Wei-Ching Wang and Shu-Tong Chang,
 Department of Electrical Engineering, National Chung Hsing University,
 Taiwan, R.O.C.
- P-15:** **“A Method of Selective Annealing of Ge Epitaxial Layers for Si-CMOS Backend Process”** . . . 47
 Yu Horie, Yoichi Takada, Jiro Osaka, Yasuhiko Ishikawa and Kazumi Wada,
 Department of Materials Engineering, The University of Tokyo, Japan

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- P-16: “Electronic States of Group IV Nanocompounds Probed by Soft X-ray Photoemission electron microscopy”** . . . 49
Hirokazu Fukidome¹, Arnold Alguino¹, Yu Miyamoto¹, Ryota Takahashi¹, Kei Imaizumi¹, Hiroyuki Handa¹, Yoshiharu Enta², Maki Suemitsu¹, Masato Kotsugi³, Takuo Ohkochi³, Toyohiko Kinoshita³ and Yoshio Watanabe³,
¹ Research Institute of Electrical Communication, Tohoku University, Japan,
² Faculty of Science and Technology, Hirosaki University, Japan,
³ JASRI/Spring-8, Japan
- P-17: “Atomic Level Control of B doping in Ge”**, . . . 51
Yuji Yamamoto¹, Rainer Kurps¹, Junichi Murota² and Bernd Tillack^{1,3},
¹ IHP, Germany,
² Laboratory for Nanoelectronics and Spintronics, Research Institute of Electrical Communication, Tohoku University, Japan,
³ Technische Universität Berlin, Germany
- P-18: “Vapor phase doping for ultra shallow junction formation in advanced Si CMOS devices”**, . . . 53
Yasuo Shimizu^{1,2}, N. D. Nguyen¹, S. Jiang¹, E. Rosseel¹, S. Takeuchi³, J.-L. Everaert¹, R. Loo¹, W. Vandervorst^{1,4} and M. Caymax¹,
¹ IMEC, Belgium,
² Department of Applied Physics and Physico-Informatics, Keio University, Japan,
³ Department of Crystalline Materials Science, Nagoya University, Japan,
⁴ Department of Physics - IKS, KU Leuven, Belgium
- P-19: “Heavy P Atomic-Layer Doping between Si and Si_{0.3}Ge_{0.7}(100) by Ultraclean Low Pressure CVD”**, . . . 55
Yohei Chiba¹, Masao Sakuraba¹, Bernd Tillack^{2,3} and Junichi Murota¹,
¹ Laboratory for Nanoelectronics and Spintronics, Research Institute of Electrical Communication, Tohoku University, Japan,
² IHP, Germany,
³ Technische Universität Berlin, Germany
- P-20: “Evaluation of Valence Band Offsets for SiO₂/Si/SiGe_{0.5}/Si Heterostructures Using by X-ray Photoelectron Spectroscopy”**, . . . 57
Akio Ohta¹, K. Makihara¹, S. Miyazaki¹, M. Sakuraba² and J. Murota²,
¹ Graduate School of Advanced Sciences of Matter, Hiroshima University, Japan,
² Laboratory for Nanoelectronics and Spintronics, Research Institute of Electrical Communication, Tohoku University, Japan
- P-21: “Effect of Heavy Carbon Atomic-Layer Doping upon Intermixing and Strain at Si_{1-x}Ge_x/Si(100) Heterointerface”**, . . . 59
Tomoya Hirano¹, Masao Sakuraba¹, Bernd Tillack^{2,3} and Junichi Murota¹,
¹ Laboratory for Nanoelectronics and Spintronics, Research Institute of Electrical Communication, Tohoku University, Japan,
² IHP, Germany,
³ Technische Universität Berlin, Germany
- P-22: “N Atomic-Layer Doping in Si/Si_{1-x}Ge_x/Si(100) Heterostructure Growth By Low-Pressure CVD”**, . . . 61
Tomoyuki Kawashima¹, Masao Sakuraba¹, Bernd Tillack^{2,3} and Junichi Murota¹,
¹ Laboratory for Nanoelectronics and Spintronics, Research Institute of Electrical Communication, Tohoku University, Japan,
² IHP, Germany,
³ Technische Universität Berlin, Germany

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11:30-13:00 **Lunch**

Session IV: Invited Presentation (3) 13:00-14:40 (4F Conference Room)

- 13:00-13:25 I-10: **“SiGe and GaAsP Metamorphic Systems: 1.9-2.3eV III-V Band-GaP Integration on Si”** . . . 63
Eugene A. Fitzgerald, M.J. Mori, N. Yang and M.T. Bulsara,
Department of Materials Science and Engineering, Massachusetts Institute of
Technology (MIT), USA
- 13:25-13:50 I-11: **“Effects of 193 nm Excimer laser radiation on SiO₂/Si/SiGe heterostructures grown on s-SOI substrates”** . . . 65
Stefano Chiussi¹, J.C. Conde¹, A. Benedetti², C. Serra², M. Sakuraba³ and J. Murota³,
¹Departamento de Física Aplicada, E.T.S.I.Industriales, Universidade de Vigo, Spain,
²C.A.C.T.I., Universidade de Vigo, Spain,
³Laboratory for Nanoelectronics and Spintronics, Research Institute of
Electrical Communication, Tohoku University, Japan
- 13:50-14:15 I-12: **“Potential of Ge_{1-x}Sn_x alloys as high mobility channel materials and stressors”** . . . 67
Shotaro Takeuchi¹, Yosuke Shimura¹, Norimasa Tsutsui¹, Osamu Nakatsuka¹,
Akira Sakai² and Shigeaki Zaima¹,
¹Graduate School of Engineering, Nagoya University, Japan,
²Graduate School of Engineering Science, Osaka University, Japan
- 14:15-14:40 I-13: **“Epitaxial Growth of Group IV Semiconductor Nanostructures Using Atomically Controlled Plasma Processing”** . . . 69
Masao Sakuraba, Takayuki Nosaka, Katsutoshi Sugawara and Junichi Murota,
Laboratory for Nanoelectronics and Spintronics, Research Institute of
Electrical Communication, Tohoku University, Japan

14:40-15:00 **Break**

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Session V: Invited Presentation (4) 15:00-17:05 (4F Conference Room)

- 15:00-15:25 I-14:
“Mn₅Ge₃/Ge heterostructures: perspectives for applications in spintronics and magnetic sensors” . . . 71
Vinh Le Thanh, A. Spiesser, M.-T. Dau, L.A. Michez, J.-M. Raimondo, M. Petit, A. Glachant and J. Derrien,
Centre Interdisciplinaire de Nanoscience de Marseille (CINaM)-CNRS, Aix-Marseille Université, France
- 15:25-15:50 I-15:
“SiGe Mixing-Triggered Liquid-Phase Epitaxy for Defect-Free GOI (Ge on Insulator)” . . . 73
Kaoru Toko, M. Kurosawa, T. Tanaka, T. Sadoh and M. Miyao,
Department of Electronics, Kyushu University, Japan
- 15:50-16:15 I-16:
“Fabrication method for triple coupled dots based on pattern-dependent oxidation” . . . 75
Yasuo Takahashi¹, Mingyu Jo¹, Yuki Kato¹, Masashi Arita¹, Akira Fujiwara², Yukinori Ono², Katsuhiko Nishiguchi², Hiroshi Inokawa³ and Jung-Bum Choi⁴,
¹ Graduate School of Information Science and Technology, Hokkaido University, Japan,
² NTT Basic Research Labs., NTT Corporation, Japan,
³ Research Inst. Electronics, Shizuoka University, Japan,
⁴ Physics and Research Inst. NanoScience and Technology, Chungbuk National University, Korea
- 16:15-16:40 I-17:
“Formation of Hybrid Nanodots Floating Gate for Functional Memories –Charge Storage Characteristics and Optical Response–” . . . 77
Seiichi Miyazaki, N. Morisawa, S. Nakanishi, K. Makihara and M. Ikeda,
Graduate School of Advanced Sciences of Matter, Hiroshima University, Japan
- 16:40-17:05 I-18:
“High Mobility Ge CMOS Technologies”, . . . 79
Shinichi Takagi and Mitsuru Takenaka,
Department of Electrical Engineering, The University of Tokyo, Japan
- 17:05-17:10 **Closing Remarks**