YOUNGHYUN KIM

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EDUCATION

The University of Tokyo, Ph.D. Apr '12 – Mar '15
Dept. of Electrical Engineering,
Graduate School of Engineering (GPA : 3.9/4.0)
Thesis: "Study on strain-induced enhancement of plasma dispersion effect and free-carrier absorption for SiGe optical modulators/attenuators"
Advisor: Prof. Mitsuru Takenaka and Prof. Shinichi Takagi

The University of Tokyo, M.E. Apr '10 – Mar '12
Dept. of Electrical Engineering,
Graduate School of Engineering (GPA : 3.9/4.0)
Thesis: "Research on SiGe based Modulator for Opto-Electronic Integrated Circuit"
Advisor: Prof. Mitsuru Takenaka and Prof. Shinichi Takagi

The University of Tokushima, B.E. Apr '07 – Mar '10
Electrical Electronic Engineering,
Faculty and School of Engineering (GPA : 5.0/5.0),
Department Rank 1, First early graduation for 6 semesters in E.E. department
Thesis: "Study on C-V Characteristics of GaN MOSFETs"
Advisor: Prof. Yasuo Ohno and Prof. Jin-Ping Ao

WORK EXPERIENCE

Yonsei University, Postdoctoral Researcher Apr '17 – Present
High Speed Circuit & System Lab., Prof. Woo-young Choi
Alternative military service in South Korea (3-years obligation, Apr '15 – Apr '18)

Seoul Semiconductor/Viosys, Senior engineer Apr '15 – Mar '17
Frontier R&D center
Alternative military service in South Korea (3-years obligation, Apr '15 – Apr '18)

IMEC, Belgium, Internship Aug '14 – Sept '14
Silicon photonics team,
Advisor: Dr. Marianna Pantouvaki and Dr. Joris Van Compenhout

Samsung Advanced Institute of Technology, Korea, Internship Jul '13 – Aug '13
Graphene transistor team,
Advisor: Dr. Hyun Jae Song and Dr. Seongjun Park

RESEARCH INTERESTS

Semiconductor Device Physics and Engineering
Demonstration of the new-generation photonic and electronic device with novel material and CMOS-compatible technology

Silicon Photonics, Nano Photonics, 2D materials, Mid-IR or biomedical applications

RESEARCH EXPERIENCE

Systematic design guide for high-speed Si micro ring modulator
Yonsei Univ. Apr '17 - present

The Si micro-ring modulator is expected to play an important role in optical interconnect systems thanks to the large modulation bandwidth and small device footprints. There are many reports for analysis and experimental demonstrations. However, a systematic device design guide for

determining optimal doping concentrations, ring radius, and coupling strength between ring and bus waveguides for a target data rate is not available. In this work, we study on realizing such a design guide.

Numerical analysis on high-power laser diode **Yonsei Univ.** **Apr '17 - present**

High-power laser diodes are highly attractive for material processing and military applications. However, the performance of a laser diode is easily deteriorated by thermal effect due to high-power operation; e.g. thermal lens effect which induces low beam quality. In this work, we numerically analyze the mechanism of the deterioration of laser diodes, and suggest the improved device structures.

Micro LED display **Seoul Semiconductor/Viosys** **Apr '15 – Mar '17**

Micro LED is considered to be a key enabling technology for the next-generation display technology. Micro LED is based on inorganic materials, mainly GaN or GaAs, which is much more efficient than organic LEDs. However, it is difficult to package millions of micro LEDs for millions of sub-pixels of a display. In this project, we have demonstrated the packaging methods, micro-LED structures, and display structures.

Strained SiGe optical modulator **Univ. of Tokyo** **Apr '10 – Mar '15**

Silicon photonics is one of the most promising technologies for electronic-photonic integrated circuit. The Si optical modulator is a key component to encode electrical signals into light. However, the bottleneck of a Si optical modulator is low modulation efficiency due to weak electrooptical effects in Si. In this work, we introduced strained SiGe technology to boost the performance of a Si optical modulator, and successfully demonstrated as follows:

- First demonstration of strain-induced enhancement of free-carrier effects in strained SiGe
- Record-low injection-current strained SiGe Mach-Zehnder optical modulator.

BTO-on-Si optical modulator **IMEC** **Aug '14 – Sept '14**

The objective of this work is to improve the modulation efficiency of a Si-based optical modulator, in conjunction with Barium titanate (BTO). We numerically analyzed the device performance and optimized the device structure.

Graphene transistor **SAIT (SAMSUNG)** **Jul '13 – Aug '13**

Graphene has attracted a lot of attention in recent years for the extremely outstanding physical properties. The main aim of this project is to investigate ozone cleaning effect on graphene for removal of PMMA residue.

GaN Power MOSFET **Univ. of Tokushima** **Sept '09 – Mar '10**

GaN power transistors have the potential to reduce energy comparing to the conventional Si-based power transistors due to high breakdown voltage and speed switching. In this work, we demonstrated a GaN MOSFET with a silane-based SiO_2 insulator by PECVD, which enables operation of 15-V gate voltage with ignorable leakage current.

SKILLS

Device Layout Cadense, Klayout etc.
Device Simulation Sentaurus, Lumerical, HSPICE, MATLAB, Python, TCL, Perl etc.
Device Fabrication many experience of device fabrications such as optical modulators, waveguides, gratings, interferometers, pn-diodes, MOSFETs, and LEDs using CMOS-compatible process such as MBE, E-beam litho., RIE, ICP, PECVD, ALD, Sputter, thermal evaporator, wet station, etc.
Device Process Inspection Raman spectroscopy, PL, SEM, AFM, XRD, SIMS etc.
Device Measurement LCR meter, Semiconductor Parameter Analyzer, Tunable CW laser source, Oscilloscope, InGaAs PD, Attenuator, Polarizer, Network analyzer, LabView, etc.
Device Analysis Electrical and optical characterization such as I-V, C-V, L-I curves, frequency responses, eye diagrams etc.

HONORS AND AWARD

Award for Doctoral thesis in School of engineering	Mar 24 '15
Japan Government Scholarship (MEXT) for Ph.D. student	Apr '12 – Mar '15
Japan Government Scholarship (MEXT) for M.S. student	Apr '10 – Mar '12
Early Graduation in 3 years and *Summa Cum Laude*	Mar 23 '10
Best student Awards of Nichia Co. for outstanding academic records	Jun 25 '09
Best student Awards of Nichia Co. for outstanding academic records	Jul 3 '08
Award for International Communication of English Ability	Jul 2 '08
Best student Award for courses in liberal arts	Jun '08
Korea-Japan Government Joint Scholarship	Mar '06 – Mar '10

CITATIONS

Google Scholar: **97 citations** on May 31 '18
https://scholar.google.com/citations?hl=en&user=-X-RZCgAAAAJ&imq=Younghyun+Kim&authuser=1
ResearchGate: **44 citations** on Apr 22 '17
https://www.researchgate.net/profile/Younghyun_Kim4

PATENT

US20170287887A1, Display apparatus and manufacturing method thereof	Oct. 5 '17
US20170250329A1, Display apparatus and manufacturing method thereof	Aug. 31 '17
US20170250164A1, Display apparatus and manufacturing method thereof	Aug. 31 '17
US 20170194304A1, Display apparatus	Jul. 6 '17
WO2017014564A1, Display device and method for manufacturing same,	Jan 26 '17
US20170025388A1, Display apparatus and manufacturing method thereof,	Jan 26 '17
WO2016125772A1, Optical modulator and method of manufacturing same,	Aug 11 '16

REFEREES

Prof. Mitsuru Takenaka Advisor in ME, PhD degree at Univ. of Tokyo	takenaka@mosfet.t.u-tokyo.ac.jp
Prof. Shinichi Takagi Co-advisor in ME, PhD degree at Univ. of Tokyo	takagi@ee.t.u-tokyo.ac.jp
Prof. Woo-young Choi Advisor in Post-Doc. Research at Yonsei Univ.	wchoi@yonsei.ac.kr

LIST OF PUBLICATION

Academic Paper

1. **Yougnhyun Kim**, Youngkwan Jo, Minkyu Kim, Byung-Min Yu, Stefan Lischke, Dieter Knoll, Lars Zimmermann, and Woo-Young Choi "Parametric Optimization for High-speed Si Micro Ring Modulators", (*To be submitted*)
2. **Yougnhyun Kim**, Jung-Tack Yang and Woo-Young Choi, "Performance improvement of high-power broad-area laser diodes with an improved heat-sinking structure", (*Submitted*)
3. Junichi Fujikata, Masataka Noguchi, **Younghyun Kim**, Jaehoon Han, Shigeki Takahashi, Takahiro Nakamura and Mitsuru Takenaka "High-speed and highly efficient Si optical modulator with strained SiGe layer", *Applied Physics Express,* vol. 11, no. 3, Mar, 2018.
4. M. Takenaka, **Y. Kim**, J. Han, J. Kang, Y. Ikku, Y. Cheng, J. Park, M. Yoshida, S. Takashima, and S. Takagi: "Heterogeneous CMOS Photonics based on SiGe/Ge and III-V Semiconductors Integrated on Si Platform," Journal of Selected Topics of Quantum Electronics, *Invited paper*, Vol. 23, Iss. 3 (2017)
5. Mitsuru Takenaka, **Younghyun Kim**, Jae-Hoon Han, Jian Kang, and Shinichi Takagi: "Challenges and Opportunities of Near and Mid-Infrared Photonics Based on SiGe and Ge," ECS Trans. 2016 volume 75, issue 8, 447-459 (2016)
6. **Younghyun Kim**, Junichi Fujikata, Shigeki Takahashi, Mitsuru Takenaka, and Shinichi Takagi: "First demonstration of SiGe-based carrier-injection Mach-Zehnder modulator with enhanced

plasma dispersion effect," Optics Express, Vol. 24, No. 3, p.1979 (2016)

7. **Younghyun Kim**, Junichi Fujikata, Shigeki Takahashi, Mitsuru Takenaka, and Shinichi Takagi: "Demonstration of record-low injection-current variable optical attenuator based on strained SiGe with optimized lateral pin junction," Optics Express, Vol. 23, No. 9, p.12354 (2015)
8. **Younghyun Kim**, Mitsuru Takenaka, and Shinichi Takagi: "Numerical Analysis of Carrier-Depletion Strained SiGe Optical Modulators With Vertical p-n Junction", IEEE Journal of Quantum Electronics, vol. 51, no. 4, Apr 2015.
9. **Younghyun Kim**, Mitsuru Takenaka, Takenori Osada, Masahiko Hata, and Shinichi Takagi: "Strain-induced enhancement of plasma dispersion effect and free-carrier absorption in SiGe optical modulators", Scientific Reports **4**, no.4683 (2014).
10. **Younghyun Kim**, Jaehoon Han, Mitsuru Takenaka, and Shinichi Takagi: "Low temperature Al_2O_3 surface passivation for carrier-injection SiGe optical modulator," Optics Express, Vol. 22, No. 7, p.7458 (2014)
11. **Younghyun Kim**, Mitsuru Takenaka, Takenori Osada, Masahiko Hata, and Shinichi Takagi: "Fabrication and evaluation of propagation loss of Si/SiGe/Si photonic-wire waveguides for Si based optical modulator", Thin Solid Films 557, pp. 342-345(2014).
12. Minsoo Kim, **Younghyun Kim**, Masafumi Yokoyama, Ryosho Nakane, SangHyeon Kim, Mitsuru Takenaka, and Shinichi Takagi: "Tunnel field-effect transistors with germanium/strained-silicon hetero-junctions for low power applications", Thin Solid Films 557, pp. 298-301 (2014).
13. **Younghyun Kim**, Masafumi Yokoyama, Noriyuki Taoka, Mitsuru Takenaka, and Shinichi Takagi : "Ge-rich SiGe-on-insulator for waveguide optical modulator application fabricated by Ge condensation and SiGe regrowth," Optics Express, Vol. 21, Iss. 17, pp. 19615-19623 (2013).
14. **Younghyun Kim**, Mitsuru Takenaka, Takenori Osada, Masahiko Hata, and Shinichi Takagi : "Strain-induced enhancement of plasma dispersion effect and free-carrier absorption in SiGe optical modulators", arXiv:1304.1229, 2013.
15. Jin-Ping Ao, Nakatani Katsutoshi, Sogawa Yuji, Akamatsu Shiro, **Kim Young Hyun**, Miyashita Takahiro, Motoyama Shin-ichi and Yasuo Ohno : GaN MOSFET with a gate SiO2 insulator deposited by silane-based plasma-enhanced chemical vapor deposition, *physica status solidi (c)*, Vol.8, No.2, pp.457-460, 2011.

International Conference

1. **Y. Kim**, J.-T Yang and W.-Y Choi: "Simulation of high-power laser diode with improved heat sinking structure using epitaxial liftoff technique", SPIE Photonics West, San Franscisco, USA roc. SPIE 10514, High-Power Diode Laser Technology XVI, 105140C (27 February 2018); doi: 10.1117/12.2288639
2. M. Takenaka, **Y. Kim**, J. Han, J. Kang and S. Takagi: "CMOS Photonics Based on SiGe and Ge for near and Mid-infrared Photonic Integrated Circuits (Invited)", Solid State Devices and Materials (SSDM), Tsukuba, Japan, (2016)
3. M. Takenaka, **Y. Kim**, J. Han, J. Kang, Y. Ikku, Y. Cheng, J. Park, S. Kim and S. Takagi: "Heterogeneous integration of SiGe/Ge and III-V for Si photonics (Invited)", SPIE Photonics Europe 2016, Brussels, (2016)
4. M. Takenaka, **Y. Kim**, J. Han, J. Kang, Y. Ikku, Y. Cheng, J. Park, S. Kim and S. Takagi: "CMOS Photonics Technologies Based on Heterogeneous Integration of SiGe/Ge and III-V on Si (Invited)", International Electron Devices Meeting (IEDM), Washington, DC, USA, (2015)
5. Junichi Fujikata, Masataka Noguchi, **Younghyun Kim**, Shigeki Takahashi, Takahiro Nakamura, and Mitsuru Takenaka: "High speed and highly efficient Si optical modulator with strained SiGe layer", Proc. GFP, Vancouver, BC (2015).
6. **Younghyun Kim**, Junichi Fujikata, Shigeki Takahashi, Mitsuru Takenaka, and Shinichi Takagi: "SiGe-based carrier-injection Mach-Zehnder modulator with enhanced plasma dispersion effect in strained SiGe", OFC2015, Tu2A.7, Los Angeles, 24th Mar. 2015.
7. **Younghyun Kim**, Junichi Fujikata, Shigeki Takahashi, Mitsuru Takenaka, and Shinichi Takagi: "Low Injection-current Variable Optical Attenuator by using strained SiGe with Optimized Lateral PIN junction", *ISPEC*, Tokyo, Nov. 2014.
8. **Younghyun Kim**, Junichi Fujikata, Shigeki Takahashi, Mitsuru Takenaka, and Shinichi Takagi: "Record-low Injection-current Strained SiGe Variable Optical Attenuator with Optimized Lateral

PIN junction", Proc. ECOC, P.2.6, Cannes (2014).

9. **Younghyun Kim**, Mitsuru Takenaka, and Shinichi Takagi: "Simulation of carrier-depletion strained SiGe optical modulators with vertical p-n junction", Proc. GFP, ThP.5, Paris (2014).
10. **Younghyun Kim**, Mitsuru Takenaka, Takenori Osada, Masahiko Hata, and Shinichi Takagi: "Strain-induced enhancement of free-carrier effects in SiGe for optical modulator and VOA applications", OFC2014 at San Francisco, Th1C.4. 13th Mar 2014.
11. **Younghyun Kim**, Jaehoon Han, Mitsuru Takenaka, Shinichi Takagi, "Low temperature Al2O3 surface passivation for carrier injection type Si/strained SiGe/Si waveguide modulator", *ISPEC*, Tokyo, Nov. 2013.
12. WuKang Kim, Yufei Kin, **Younghyun Kim**, SangHyeon Kim, Takenori Osada, Masahiko Hata, Mitsuru Takenka, and Shinichi Takagi, "Sb-diffused Source/Drain Ultra-thin Body Ge-On Insulator nMOSFETs Fabricated by Ge Condensation," D-6-5L, SSDM, Fukuoka, 2013.
13. **Younghyun Kim**, Jaehoon Han, Mitsuru Takenaka, Shinichi Takagi, "Low temperature surface passivation for carrier injection type SiGe optical modulator," 10th International Conf. of Group IV Photonics at Seoul, 29th Aug 2013.
14. **Younghyun Kim**, Takenori Osada, Masahiko Hata, Mitsuru Takenaka, Shinichi Takagi, "Evaluation of propagation loss of Si/SiGe/Si photonic-wire waveguides for Si based optical modulator," ICSI-8, Fukuoka, 4th Jun 2013.
15. Minsoo Kim, **Younghyun Kim**, Masafumi Yokoyama, Ryosho Nakane, SangHyeon Kim, Mitsuru Takenaka and Shinichi Takagi, "Tunnel Field-Effect Transistors with Germanium/Strained-Silicon Hetero-junctions for Low Power Applications," ICSI-8, Fukuoka, 4th Jun 2013.
16. **Younghyun Kim**, Mitsuru Takenaka, Shinichi Takagi, "Simulation of Si/SiGe/Si double heterostructure based carrier-injection modulator", *ISPEC*, Nov. 2012.
17. **Younghyun Kim**, Mitsuru Takenaka, Shinichi Takagi, "Numerical analysis of strained SiGe-based carrier-injection optical modulators," 9th International Conf. of Group IV Photonics at San Diego, WP18, Aug. 2012.
18. **Younghyun Kim**, Masafumi Yokoyama, Noriyuki Taoka, Mitsuru Takenaka, Shinichi Takagi, "Fabrication of Ge-rich SiGe-On-Insulator by Ge Condensation and Regrowth Technique for Optical Modulator," *ISPEC*, 14th Nov 2011.
19. **Younghyun Kim**, Masafumi Yokoyama, Noriyuki Taoka, Mitsuru Takenaka, Shinichi Takagi, "Fabrication of Ge-rich SiGe-on-Insulator waveguide for Optical Modulator", *IEEE Photonics Conference*, Oct. 2011.
20. Jin-Ping Ao, Nakatani Katsutoshi, Sogawa Yuji, **Kim YoungHyun**, Miyashita Takahiro, Motoyama Shin-ichi *and* Yasuo Ohno : GaN MOSFET with Gate SiO2 Deposited by Silane-Based PECVD, *The 37th International Symposium on Compound Semiconductors*, Takamatsu, May 2010.