# ISPEC 2014

**The 4th International Symposium on Photonics and Electronics Convergence**

**-Advanced Nanophotonics and Silicon Device Systems-**

# Technical Digest

**November 17-18, 2014**
**Venue: The University of Tokyo, Tokyo, Japan**
**ENEOS Hall, Komaba Research Campus**
**November 19, 2014**
**Venue: The University of Tokyo, Tokyo, Japan**
**Convention Hall, Komaba Research Campus**

# Symposium Committee

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| | Ken Morito (*PETRA, Fujitsu*) |
| | Koji Yamada (*PETRA, NTT*) |
| | Tsuyoshi Yamamoto (*PETRA, Fujitsu*) |

# Symposium Information

## Scope of the Symposium

The purpose of this 4th international symposium on photonics and electronics convergence (ISPEC 2014) is to provide a forum for discussing recent advances in photonics for future LSI systems and related technologies. The scope of this symposium includes designs, fabrication technologies, and characterizations of photonics-electronics convergence systems and devices. Subjects on Si-photonics, nano-photonics (photonic crystals, plasmonics and so on) and photonic-electronics integration circuits are also covered.

## List of Invited Speakers

Philippe Absil (*IMEC*)

Peter De Dobbelaere (*Luxtera*)

Lionel C. Kimerling (*Massachusetts Institute of Technology*)

Mitsumasa Koyanagi (*Tohoku University*)

Tomohiro Kita (*Tohoku University*)

Yoichi Koyanagi (*Fujitsu Laboratories*)

Alan. Y. Liu (*University of California, Santa Barbara*)

Hai-Feng Liu (*Intel*)

Shu Namiki (*AIST*)

Takeshi Okada (*New Energy and Industrial Technology Development Organization*)

Shinichi Saito (*Southampton University*)

Yurii A. Vlasov (*IBM*)

Lars Zimmermann (*IHP*)

## Venue

The Symposium will be held in Komaba Campus of the University of Tokyo on November 17-19. The sessions of November 17-18 take place at the ENEOS Hall and that of November 19 take place at the Convention Hall. Komaba Campus is close to Shinjuku and Shibuya city in Tokyo.

## Language

The conference language is English.

## Climate

The climate in late November in Tokyo area is relatively dry and mild. The average temperature during the symposium period is around 13 °C (55 °F).

## Sponsors

Sponsored by

The University of Tokyo,

Photonics Electronics Technology Research Association (PETRA).

Co-sponsored by

The National Institute of Advanced Industrial Science and Technology (AIST).

Supported by

New Energy and Industrial Technology Development Organization (NEDO),

Optoelectronics Industry and Technology Development Association (OITDA),

The Japan Society of Applied Physics (JSAP),

IEICE Technical Group on Silicon Photonics.

# Symposium Program

## 17th November (Monday)

**Venue:** ENEOS Hall
Komaba Research Campus, the University of Tokyo

**Registration (9:00-9:40)**

**Welcome Address (9:40-9:50)**

T. Nakamura (*PETRA*)

**Session A: Opening (9:50-12:30)**

9:50 **A-1 (Keynote)**

**Advances in Photonics and Electronics Convergence System Technology: Overview of the FIRST & NEDO Projects**

Y. Arakawa (*The University of Tokyo*)

10:20 **A-2 (Invited)**

**NEDO's Strategy and Technology Roadmap for Next Generation IoT**

T. Okada (*New Energy and Industrial Technology Development Organization*)

**11:00-11:10 Break**

(Session A contd.)

11:10 **A-3 (Invited)**

**Silicon Microphotonics: High Volume Manufacturing**

L. C. Kimerling (*Massachusetts Institute of Technology*)

11:50 **A-4 (Invited)**

**IBM Silicon Nanophotonics Technology for Optical Interconnects**

Y. A. Vlasov (*IBM*)

**12:30-14:00 Lunch break**

**Session B: Silicon Nanophotonics Devices & Systems I (14:00-17:30)**

14:00 **B-1 (Invited)**

**High Speed Silicon Photonics Links for Data Center Applications**

H. Liu (*Intel*)

14:40 **B-2**

**A Chip Scale Optical Transmitter/Receiver "Optical I/O Core" Based on Si Photonics Platform for Future Photonics and Electronics Convergence System**

K. Kurata (*PETRA*)

15:10 **B-3**

**Silicon Photonics Devices for WDM Optical Interconnect Systems**

K. Morito (*PETRA*)

## 15:40-16:00 Break

(Session B contd.)

16:00 **B-4**

**Athermal Silicon Optical Interposers with Quantum Dot Lasers Operating up to 125 °C**

Y. Urino (*PETRA*)

16:30 **B-5**

**CMOS Back-end Processes Photonics**

M. Mori (*AIST*)

17:00 **B-6**

**Strained SiGe Technology for High-performance Optical Modulators and Attenuators**

M. Takenaka (*The University of Tokyo*)

## Banquet (18:00-20:00): Foyer of Convention Hall

# 18th November (Tuesday)

**Venue:** ENEOS Hall (Oral Sessions & Poster Preview) / Convention Hall (Poster Presentation)
Komaba Research Campus, The University of Tokyo

## Session C: Silicon Nanophotonics Devices & Systems II (9:30-11:30)

9:30 **C-1 (Invited)**
**Silicon Photonics: Photonic Device Libraries for Optical Transceivers**
P. De Dobbelaere (*Luxtera*)

10:10 **C-2 (Invited)**
**Photonics and BiCMOS Technology - How to Combine**
L. Zimmermann (*IHP*)

10:50 **C-3 (Invited)**
**Optoelectronic Three-dimensional LSI**
M. Koyanagi (*Tohoku University*)

## 11:30-13:00 Lunch break

## Poster Session (13:00-16:10)

13:00 **Poster Preview**

14:10 **Poster Presentation (core time for the odd-numbered posters)**

15:10 **Poster Presentation (core time for the even-numbered posters)**

## Session D: Silicon Nanophotonics Devices & Systems III (16:20-18:10)

16:20 **D-1 (Invited)**
**Review of a 200mm SOI Silicon Photonics Platform Performance for Low-power Optical Integrated Circuits Development**
P. Absil (*IMEC*)

17:00 **D-2 (Invited)**
**High Speed Interconnect Technology for Server Systems**
Y. Koyanagi (*Fujitsu Labs.*)

17:40 **D-3**
**Coherent CFP Transceiver by a Low-power DSP and Hybrid-integrated Optical Devices**
S. Yamanaka (*PETRA/NTT*)

# 19th November (Wednesday)

**Venue**: Convention Hall
Komaba Research Campus, The University of Tokyo

## Session E: Silicon Nanophotonics Devices & Systems IV (9:30-12:35)

9:30 **E-1 (Invited)**
**Test Bed Operation of Dynamic Optical Path Network: A Network beyond SDN and SDM**
S. Namiki (*AIST*)

10:10 **E-2**
**Design and Fabrication of Silicon Cross-waveguide Reflection-type Optical Switch**
K. Utaka (*Waseda University*)

10:40 **E-3**
**Silicon Photonic Crystal as a Terahertz-Wave Technology Platform**
M. Fujita (*Osaka University*)

10:55 **E-4**
**Crosstalk Reduction in Si Arrayed Waveguide Grating with Parabolic Tapers**
T. Ye (*Chinese Academy of Science*)

## 11:10-11:20 Break

(Session E contd.)

11:20 **E-5**
**Polarization-insensitive 2×2 Diversity Switch with Silicon-wire Waveguides**
S. H. Kim (*AIST*)

11:35 **E-6**
**Enhancement of DC Optical Responsivity of Ge-on-Si Photodetector by Metallization with Contact Segmentation**
S. Cho (*Gachon University*)

11:50 **E-7**
**Silicon Waveguide Optical Isolator Integrated with TE-TM Mode Converter**
A. Fujie (*Tokyo Institute of Technology*)

12:05 **E-8**
**Equivalent Circuit Model of Silicon Photonic Devices for Photonics-Electronics Convergence Design**
K. Takeda (*NTT*)

12:20 **E-9**
**25-Gbps MMF Link Using Silicon Optical Modulator and Germanium Photodiode**
Y. Wakayama (*Hitachi*)

**12:35-14:00 Lunch break**

## Session F: Silicon Nanophotonics Devices & Systems V (14:00-16:30)

14:00 **F-1 (Invited)**

**Quantum Dot Lasers for Silicon Photonics by Heteroepitaxy**

A. Y. Liu (*University of California Santa Barbara*)

14:40 **F-2 (Invited)**

**Group IV Light Sources for Si Photonics**

S. Saito (*University of Southampton*)

15:20 **F-3 (Invited)**

**Silicon Photonic Devices for a Large Capacity Optical Communication System**

T. Kita (*Tohoku University*)

16:00 **F-4**

**Developments of Innovative Light Sources for Photonic Electronic Convergence Systems**

S. Iwamoto (*The University of Tokyo*)

## Closing Session (16:30-16:40)

# Poster Session (Tuesday)

**P-1**

**Analysis and Design Algorithm of Millimeter Wave Regulated Cascode Bandpass Amplifier and Oscillator by Startup Principle**

Kittipong Tripetch[1] and Nobuhiko Nakano[1]

(*1 Keio Univ.*)

**P-2**

**Spectral and Temporal Photoluminescence Behavior of Colloidal PbS Quantum Dots**

S. Kitamura[1], M. Senshu[1], H. Tokushige[1], T. Katsuyama[1], N. Ozaki[2], I. Tanaka[2] and Y. Sugimoto[3]

(*1 Univ. Fukui, 2 Wakayama Univ., 3 NIMS*)

**P-3**

**Photonic crystals composed of β-$FeSi_2$ with amorphous Si cladding -Comparison with air/$SiO_2$ claddings-**

H. Tokushige[1], T. Endo[1], K. Hiidome[1], K. Saiki[1], S. Kitamura[1], T. Katsuyama[1], N. Ikeda[2], Y. Sugimoto[2], and Y. Maeda[3]

(*1 Univ. Fukui, 2 NIMS, 3 Kyushu Inst. Tech.*)

**P-4**

**Optical Interconnection between III-V chips on Si by using Photonic Wire Bonding**

Z. Gu[1], T. Amemiya[2,3], A. Ishikawa[3,4], J. H. Kang[1], T. Hiratani[1], Y. Hayashi[1], J. Suzuki[1], N. Nishiyama[1], T. Tanaka[3,5], S. Arai[1,2]

(*1 Tokyo Inst. Tech., 2 QNERC, 3 RIKEN, 4 Okayama Univ., 5 Hokkaido Univ.*)

**P-5**

**Optical characteristics of polymer based optical and electrical hybrid print circuit board**

T. Amano[1,2], S. Ukita[2], Y. Egashira[2], M. Sasaki[2], K. Watanabe[2], M. Mori[1,2] and K. Kurata[1,2]

(*1 AIST, 2 PETRA*)

**P-6**

**Low-threshold Current Operation of GaInAsP/InP Membrane DFB Laser with Butt-jointed Built-in Waveguide Bonded on Si Substrate**

D. Inoue[1], J. Lee[1], T. Hiratani[1], Y. Atsuji[1], T. Amemiya[2], N. Nishiyama[1], and S. Arai[1,2]

(*1 Tokyo Inst. Tech., 2 QNERC*)

**P-7**

**Inter-Layer Apodized a-Si Grating Coupler with Metal Mirrors toward 3D Optical Interconnection**

Y. Kuno[1], J. H. Kang[1], Y. Hayashi[1], J. Suzuki[1], T. Amemiya[2], N. Nishiyama[1], and S. Arai[1,2]

(*1 Tokyo Inst. Tech., 2 QNERC*)

**P-8**

**GaInAsP/SOI Hybrid Laser with Ring-resonator-type Reflector Fabricated by Plasma Activated Bonding**

Y. Hayashi[1], J. Suzuki[1], S. Inoue[1], J. H. Kang[1], Y. Kuno[1], T. Amemiya[2], N. Nishiyama[1], and S. Arai[1,2]

(*1 Tokyo Inst. Tech., 2 QNRC*)

**P-9**

**Investigation of III-V Layer Removing Process in III-V/SOI Hybrid Devises**

J. Suzuki[1], Y. Hayashi[1], Y. Kuno[1], J. H. Kang[1], T. Amemiya[2], N. Nishiyama[1], and S. Arai[1,2]

(*1 Tokyo Inst. Tech., 2 QNRC*)

**P-10**

**Design of Electrode Position in the Lateral-Current-Injection Membrane Lasers**

T. Hiratani[1], Y. Atsuji[1], J. Lee[1], D. Inoue[1], T. Amemiya[2], N. Nishiyama[1] and S. Arai[1,2]

(*1 Tokyo Inst. Tech., 2 QNRC*)

**P-11**

**High temperature plasmonic lasing using GaAs-AlGaAs core-shell nanowires dispersed on a silver thin film**

J. Ho[1], J. Tatebayashi[1], S. Sergent[1], C. F. Fong[1], S. Iwamoto[1,2] and Y. Arakawa[1,2]

(*1 NanoQuine, Univ. Tokyo*)

**P-12**

**A Photonics Platform on 300mm SOI wafers for Multi-applications**

T. Mogami[1], T. Horikawa[1], K. Kinoshita[1], H. Sasaki[1], K. Morito[1], K. Kurata[1] and Y. Arakawa[2]

(*1 PETRA, 2 Univ. Tokyo*)

**P-13**

**Spontaneous and Stimulated Raman Scattering in Silica-Cladded Silicon Hole-Shape-Modulated Photonic Crystal Waveguides**

Y. H. Hsiao[1], W. Wang[1], S. Iwamoto[1], and Y. Arakawa[1]

(*1 Univ. Tokyo*)

**P-14**

**On-chip WDM transmission with Si photonic crystal optical modulators**

H. Ito[1], Y. Terada[1], N. Ishikura[1] and T. Baba[1]

(*1 Yokohama Nat'l Univ.*)

**P-15**

**Optimizing doping profile of Si photonic crystal slow light modulator for increasing phase shift**

Y. Terada[1], H. Ito[1] and T. Baba[1]

(*1 Yokohama Nat'l Univ.*)

**P-16**

**Silica-Clad Photonic Crystal Waveguides for Generating Wideband Dispersion-Free Slow Light with High $n_g$**

T. Tamura[1], N. Ishikura[1], K. Kondo[1], and T. Baba[1]

(*1 Yokohama Nat'l Univ.*)

**P-17**

**High Performance Si Optical Modulator with MOS Junction and Vertically-Illuminated p-i-n Ge Photodetector**

J. Fujikata[1], S. Takahashi[1], M. Noguchi[1], M. Takahashi[2], M. Miura[1], T. Horikawa[1,2], T. Nakamura[1], and Y. Arakawa[3]

(*1 PETRA, 2 AIST, 3 Univ. Tokyo*)

**P-18**

**Analysis of coupling between parallel horizontal waveguides in three-dimensional photonic crystals**

K. Gondaira[1], K. Ishizaki[1], K. Kitano[1], T. Asano[1], and S. Noda[1]

(*1 Kyoto Univ.*)

**P-19**

**Low-crosstalk carrier-injection Mach-Zehnder interferometer optical switches with 50-μm-long phase shifters on III-V CMOS photonics platform**

Y. Ikku[1,2], M. Yokoyama[1], M. Takenaka[1,2], and S. Takagi[1,2]

(*1 Univ. Tokyo, 2 JST-CREST*)

**P-20**

**InGaAs MSM photodetector with InAlAs and InP cap layers on III-V CMOS photonics platform for low dark current operation**

Y. Cheng[1], Y. Ikku[1], M. Takenaka[1] and S. Takagi[1]

(*1 Univ. Tokyo*)

**P-21**

**Observation of low dark current of Ge layer on Si (001) using ultrathin Ge seed layer**

S. Okumura[1], T. Simoyama[1], H. Ono[1], M. Okuno[1], M. Miura[1], J. Fujikata[1], M. Noguchi[1], T. Mogami[1], T. Horikawa[1], Y. Tanaka[1], and K. Morito[1]

(*1 PETRA*)

**P-22**

**Strong Sensitization Effect in $Er_xYb_yY_{2-x-y}SiO_5$ Crystals Fabricated by PLD**

F. Kondo[1] and H. Isshiki[1]

(*1 Univ. Electro-Communications*)

**P-23**

**Experimental Realization of On-Demand Light Transfer among Distant Photonic Crystal Nanocavities**

R. Konoike[1], H. Nakagawa[1], T. Asano[1], Y. Tanaka[1], and S. Noda[1]

(*1 Kyoto Univ.*)

**P-24**

**Fabrication and optical characterization of germanium L3-type photonic crystal nanobeam cavity**

M. Kuroki[1], S. Kako[1], S. Ishida[1], K. Oda[2-4], T. Ido[2-4], S. Iwamoto[1] and Y. Arakawa[1,4]

(*1 NanoQuine, 2 Hitachi, 3 PETRA, 4 PECST*)

**P-25**

**Pulse Compression by Dynamic Tuning in Photonic Crystal Slow-Light Waveguide**

K. Kondo[1], N. Ishikura[1], T. Tamura[1], and T. Baba[1]

(*1 Yokohama Nat'l Univ.*)

**P-26**

**Si wire waveguide polarization independent wavelength filter using cascaded Mach-Zehnder interferometers**

H. Okayama[1,2], D. Shimura[1,2], Y. Onawa[1,2], H. Takahashi[1,2], H. Yaegashi[1,2], and H. Sasaki[1,2]

(*1 Oki, 2 PETRA*)

**P-27**

**Fabrication of 1.3-μm InAs/GaAs quantum dot lasers metal-stripe-bonded onto silicon-on-insulator substrates**

Y. H. Jhang[1], K. Tanabe[2], S. Iwamoto[1,2], and Y. Arakawa[1,2]

(*1 Univ. Tokyo, 2 NanoQuine*)

**P-28**

**Edge-Emitting Laser Stack based on Flip-chip Bonding using Electrically Conductive Silver-filled Adhesive**

B. T. Tung[1], L. Ma[1], T. Amano[1], K. Kikuchi[1], M. Mori[1] and M. Aoyagi[1]

(*1 AIST*)

**P-29**

**Demonstration of 25-Gbps Optical Data Links on Silicon Optical Interposer Using FPGA Transceiver**

D. Okamoto[1], Y. Urino[1], T. Akagawa[1], S. Akiyama[1], T. Baba[1], T. Usuki[1], M. Miura[1], J. Fujikata[1], T. Shimizu[1], M. Okano[2], N. Hatori[1], M. Ishizaka[1], T. Yamamoto[1], H. Takahashi[1], Y. Noguchi[2], M. Noguchi[1], M. Imai[1], M. Yamagishi[2], S. Saitou[2], N. Hirayama[2], M. Takahashi[2], E. Saito[1], D. Shimura[1], H. Okayama[1], Y. Onawa[1], H. Yaegashi[1], H. Nishi[1], H. Fukuda[1], K. Yamada[1], M. Mori[2], T. Horikawa[2], T. Nakamura[1] and Y. Arakawa[3]

(*1 PETRA, 2 AIST, 3 Univ. Tokyo*)

**P-30**

**25 Gbps Operation in 90-μm-Long Phase Shifter Mach-Zehnder Modulators Using High-Group-Index Silica-Cladded Si Photonic Crystal Waveguides**

Y. Hinakura[1], T. Tamura[1], Y. Terada[1], H. Ito[1], T. Baba[1]

(*1 Yokohama Nat'l Univ.*)

**P-31**

**Design of Amorphous Silicon Waveguide for Polarization-Independent Optical Isolator**

E. Ishida[1], Y. Shoji[1], K. Miura[1], H. Yokoi[2], and T. Mizumoto[1]

(*1 PETRA, 2 Shibaura Inst. Tech.*)

**P-32**

**Electroluminescence at 1.3 μm from Stacked InAs/GaAs Quantum Dots Monolithically Grown on Ge/Si Substrate by Metal Organic Chemical Vapor Deposition**

M. Rajesh[1], K. Tanabe[1,2], S. Kako[1,2], M. Nishioka[3] and Y. Arakawa[1-3]

(*1 NanoQuine, 2 PECST, 3 Univ. Tokyo*)

**P-33**

**Examination of modulation efficiency of graphene optical modulator based on semiconductor-metal transition**

T. Kayoda[1], M. Takenaka[1] and S. Takagi[1]

(*1 Univ. Tokyo*)

**P-34**

**A Low Coupling Loss Triple Core SSC for A Hybrid Integrated Quantum Dot Laser on A Si Platform**

N. Hatori[1], T. Shimizu[1], M. Okano[2], T. Yamamoto[1], Y. Urino[1], M.Mori [2], T. Nakamura[1], and Y. Arakawa[3]

(*1 PETRA, 2 AIST, 3 IIS, Univ. Tokyo*)

**P-35**

**Theoretical and Experimental Thermal Analysis of A Hybrid Integrated Light Source**

N. Hatori[1], T. Shimizu[1], M. Okano[2], T. Yamamoto[1], Y. Urino[1], M. Mori[2], T. Nakamura[1], and Y. Arakawa[3]

(*1 PETRA, 2 AIST, 3 IIS, Univ. Tokyo*)

**P-36**

**25-Gb/s Error-Free Operation of Forward-biased PIN Microring Modulator**

T. Baba[1], S. Akiyama[1], M. Imai[1], S. Tanaka[1] and T. Usuki[1]

(*1 PETRA*)

**P-37**

**Silicon photonics integrated circuit for bidirectional optical transceivers in passive optical networks**

H. Sasaki[1], H. Okayama[1], Y. Onawa[1], D. Shimura[1], S. Miyamura[1], Y. Okabe[1], M. Tokushima[1], T. Horikawa[1], H. Ono[1], K. Nakamura[1], H. Takahashi[1], Y. Morino[1], and H. Yaegashi[1]

(*1 PETRA*)

**P-38**

**Low-Loss Vertical Interlayer Transition for 3D Integrated Optical Circuits**

R. Takei[1], Y. Maegami[1], E. Omoda[1], T. Kamei[1], Y. Sakakibara[1] and M. Mori[1]

(*1 AIST*)

**P-39**

**Ge-on-Insulator Substrate Fabrication for Ge CMOS Photonics Platform**

J. Kang[1,2], X. Yu[1,2], M. Takenaka[1,2], and S. Takagi[1,2]

(*1 Univ. Tokyo, 2 JST-CREST*)

**P-40**

**Low-Loss and Polarization Insensitive Knife-Edge Taper Fiber-to-Chip Coupling Spot-Size Converter**

Y. Maegami[1], R. Takei[1], E. Omoda[1], T. Amano[1], M. Okano[1], M. Mori[1], T. Kamei[1], and Y. Sakakibara[1]

(*1 AIST*)

**P-41**

**Investigation of Band-Filling Effect at Low Temperatures in InAs/GaAs Quantum Dot Lasers with p-Type Doping**

T. Rae[1], K. Tanabe[1], S. Iwamoto[1], and Y. Arakawa[1]

(*1 University of Tokyo*)

**P-42**

**Polarization independent coupler utilizing different order modes**

Y. Onawa[1,2], H. Okayama[1,2], H. Yaegashi[1,2], and H. Sasaki[1,2]

(*1 Oki, 2 PETRA*)

**P-43**

**Fabrication of Vertically Curved Silicon Wire Waveguides for Vertical Light Coupling**

T. Yoshida[1], R. Takei[1], T. Nishi[1], S. Tajima[2], E. Omoda[1], N. Miura[2], M. Mori[1] and Y. Sakakibara[1,2]

(*1 AIST, 2 Meiji Univ.*)

**P-44**

**Towards the Realization of QD Evanescent Hybrid Si Lasers**

K. Tanabe[1], N. Hatori[2], M. Ishizaka[2], S. Kako[3], S. Iwamoto[1,3], T. Nakamura[2] and Y. Arakawa[1,3]

(*1 Nano-Quine, 2 PETRA, 3 Univ. Tokyo*)

**P-45**

**Highly-Stacked Quantum Dot Intermixed Waveguide for All-optical Logic Gate Devices**

Y. Takei[1], T. Ozaki[1], A. Matsumoto[1,2], K. Akahane[2], Y. Matsushima[3], H. Ishikawa[1], and K. Utaka[1]

(*1 Waseda Univ., 2 NICT, 3 GCS*)

**P-46**

**Femto-Second Optical Pulse Response of 1550nm-Band QD-SOA for Ultra-Fast All-Optical Logic Gate Devices**

A. Matsumoto[1,2], Y. Takei[1], K. Akahane[2], Y. Matsushima[3], H. Ishikawa[1], and K. Utaka[1]

(*1 Waseda Univ., 2 NICT, 3 GCS*)

**P-47**

**1200-Channel Hybrid Integrated Light Source for Ultra-high-bandwidth Optical Interconnections**

T. Shimizu[1], N. Hatori[1], M. Okano[2], H. Takahashi[1], M. Ishizaka[1], T. Yamamoto[1], M. Mori[2], T. Horikawa[2], Y. Urino[1], T. Nakamura[1], and Y. Arakawa[3]

(*1 PETRA, 2 AIST, 3 Univ. Tokyo*)

**P-48**

**Amorphous Silicon Waveguide Optical Isolator on Ce:YIG Substrate**

K. Miura[1], T. Hirasawa[1], J. Kang[1], Y. Shoji[1], Y. Okada[2], H. Yokoi[2], N. Nishiyama[1], S. Arai[1,3], and T. Mizumoto[1]

(*1 Tokyo Inst. Tech., 2 Shibaura Inst. Tech., 3 QNERC*)

**P-49**

**Titanium Silicide Stressor on Germanium for Silicon Photonics Application**

M. Yasuda[1], N. J. Kawai[1] and K. Wada[1]

(*1 Univ. Tokyo*)

**P-50**

**Connection of Si-wire waveguides with single-mode fibers by inverse-taper spot-size converters**

H. Nishi[1,2], T. Tsuchizawa[1,2], H. Fukuda[1,3], H. Okayama[1,4], and K. Yamada[1,2]

(*1 PETRA, 2 Device Technology Labs., NTT, 3 Device Innovation Ctr., NTT, 4 Oki*)

**P-51**

**The Effects of Doping and Si/Ge Interface on the Carrier Lifetime of Germanium Grown on Silicon**

S. Kako[1], K. Oda[2-4], K. Tani[2-4], T. Ido[2-4], and Y. Arakawa[1]

(*1 Univ. Tokyo, 2 PETRA, 3 PECST, 4 Hitachi*)

**P-52**

**Multistage Delayed Interferometer Based Si-wire WDM DeMUX based on 300-mm Waferscale ArF-immersion Lithography Process**

S.-H. Jeong[1], D. Shimura[1], T. Simoyama[1], T. Horikawa[1], Y. Tanaka[1] and K. Morito[1]

(*1 PETRA*)

**P-53**

**Ring Resonator Assisted Multiple Delayline Based Si-wire WDM DeMUX with the Highest Spectral Flatness**

S.-H. Jeong[1], D. Shimura[1], Y. Tanaka[1] and K. Morito[1]

(*1 PETRA*)

**P-54**

**Low Injection-current Variable Optical Attenuator by using strained SiGe with Optimized Lateral PIN junction**

Y. Kim[1], J. Fujikata[2], S. Takahashi[2], M. Takenaka[1], and S. Takagi[1]

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**P-55**

**MBE Growth of S-K InAs Quantum Dots on GaAs Nanowire on Si (100) Substrate**

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**P-56**

**Low density InAs/GaAs quantum dots grown with high temperature partial capping under $As_2$ irradiation**

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**P-57**

**High-temperature, stable operation of eight-wavelength DFB laser array integrated on Si photonics chip**

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**P-58**

**Improving Crystallinity of Ge on Si by High-Precision Epitaxial Growth**

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**Highly alignment tolerant vertically illuminated Germanium Photodiode for 25 Gbps silicon photonics and multi-mode fiber link**

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**P-60**

**Process Control and Monitoring for Silicon Photonics Devices Fabricated by using 40-nm-node CMOS Technology**

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**P-61**

**Lasing oscillation in a single GaAs nanowire cavity with multi-stacked InGaAs/GaAs quantum dots**

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