

CONFERENCE PROGRAM

M◎C '11

17th MICROOPTICS CONFERENCE

<http://www.comemoc.com/moc11/>

Oct. 30 (Sun.) - Nov. 2 (Wed.), 2011
SENDAI INTERNATIONAL CENTER, Sendai, Japan

Sponsored by The Japan Society of Applied Physics (JSAP)
Operated by Microoptics Group, Optical Society of Japan, JSAP



Technical co-sponsorship by

- IEEE / Photonics Society
- IEICE / Electronics Society
- The Chemical Society of Japan
- The Laser Society of Japan
- Optical Society of America
- The Society of Polymer Science, Japan
- Optoelectronic Industry and Technology Development Association
- Japan Optoelectro-Mechanics Association
- JSPS / The 125th Committee on Mutual Conversion between Light and Electricity
- JSPS / The 130th Committee on Optoelectronics



Financial supports were gratefully received from

- Support Center for Advanced Telecommunications Technology Research, Foundation (SCAT)



- Konica Minolta Science and Technology Foundation



- Nippon Sheet Glass Foundation for Materials Science and Engineering (NSG Foundation)



- SENDAI TOURISM & CONVENTION BUREAU



The MOC Awards were supported by

- HOYA Corporation



OBJECTIVE

The 17th MICROOPTICS CONFERENCE (MOC '11) will be held at SENDAI INTERNATIONAL CENTER, Sendai, Miyagi, Japan on Oct. 30 (Mon.) – Nov. 2 (Wed.), 2011. This conference is sponsored by the Japan Society of Applied Physics (JSAP) and operated by Microoptics Group, the Optical Society of Japan (OSJ), JSAP and in cooperation with several academic societies and associations. The MOC '11 is intended to provide a central forum for an update and review of scientific and technical information covering a wide range of microoptics field from fundamental researches to systems and applications.

PLENARY SESSION

Plenary session will be held on Oct. 31 (Mon.). The following papers are invited as the plenary talks.

R. Baets, Ghent Univ., Belgium

"Silicon Photonics: Lasers and Amplifiers", A-1

S. L. Chuang, Univ. Illinois, USA

"Metal-Cavity Nanolasers: How Small Can They Go?", A-2

F. Koyama, Tokyo Inst. Tech., Japan

"Advances of VCSEL Photonics", A-3

INVITED SPEAKERS

MOC '11 invited speakers are chosen through a highly selective nominations process to keep attendees at the forefront of a wide range of microoptics field from fundamental researches to systems and applications.

A. Cobo, University of Cantabria, Spain

"Optical Fiber Sensors for Welding Quality Monitoring", B-1

S. Combrié, Thales, France

"Slow Light Devices in III-V Photonic Crystals: State of the Art and Open Issues", C-1

M. Qiu, KTH Royal Inst. Tech., Sweden,

"Photothermal Effects in a Plasmonic Metamaterial Structure", D-1

E. H. Cho, Samsung, Korea,

"Nanoimprinted Photonic Crystal Color Filters for Solar-Powered Reflective Displays", F-1

M. Sieler, Fraunhofer IOF, Germany

"Design and Realization of an Ultra-Slim Array Projector", F-5

H. F. Liu, Intel Corp., USA

"Demonstration of a 4λ x 12.5 Gb/s Fully Integrated Silicon Photonic Link", G-1

C. F. Lin, National Taiwan Univ., Taiwan

"Nano-Structured Materials and Devices for Green Photonics", J-1

H. Qu, Ecole Polytech. Montreal, Canada

"All-polymer Photonic Bandgap Bragg Fibers for Bio-chemical Sensors and Spectrometers", K-1

T. Mappes, Karlsruhe Inst. Tech., Germany

"Integrated Lasers for Biophotonic Lab-on-a-Chip Systems in Polymer", L-1

G. Jolley, Australian National Univ., Australia

"Growth and Confinement Effects in III-V Semiconductor Nanostructures", L-6

SPECIAL SESSION "Nano-carbon photonics"

A special session will be held on Oct. 31 (Mon.), which focuses on the photonic applications of nano-carbon. One and two dimensional (1D and 2D) forms of nano-carbon, Carbon nanotube (CNT) and graphene, have attracted researchers' attention because of their unique not only electrical but also photonic properties. It became more evident since the Nobel Prize in Physics 2010 went to graphene. In this special session, we invited world-famous researchers in this area for applications in nano-LEDs, displays, mode-locked lasers, and their commercialization.

Organizer

S. Yamashita, Univ. Tokyo

Invited Speakers (Presentation order of special session on Oct. 31 has been changed from the initial announcement.)

K. Matsuda, Kyoto Univ., Japan

"Novel Excitonic Properties of Carbon Nanotubes Toward Nano-Carbon Optics", E-5

Y. Saito, Nagoya Univ., Japan

"Field Emission Property of Carbon Nanotubes and Their Application to Display Devices", E-1

M. Nakazawa, Tohoku Univ., Japan

"CNT-Based Mode-Locked Lasers", E-2

F. Bonaccorso, Univ. Cambridge, U.K.

"Graphene Composites for Ultrafast Photonics", E-3

S. Y. Set, Alnair Labs, Japan

"Commercial Applications of Carbon-Nanotube Photonic Technologies", E-4

OFFICIAL LANGUAGE

The official language of MOC '11 is English.

ORAL PRESENTATION

The presentation time (including discussion) will be 30 minutes for invited papers, 15 minutes for regular papers, and 10 minutes for post deadline papers. All the speakers are requested to present the paper with a data projector. Prior to the starting time of the session, the speakers are asked to contact the session chairs and to confirm the connection between your computer and the projector. Please take a seat in the front row at the starting time of the session.

POSTER SESSION

Poster session will be held in Sakura Hall 1, on Nov. 1 (Tue.). For the convenience of the participants, this session will be divided into two parts. The first half is for authors with the paper of odd-number (H-1, H-3, ...) and the second half is for authors with the paper of even-number (H-2, H-4, ...). Authors should stay by turns in the vicinity of the bulletin board for discussion. Each author is requested to display materials on a 120 cm wide and 180 cm high bulletin board.

PHOTOGRAPH

No photograph is permitted during the oral and poster sessions.

SOCIAL EVENTS & EXHIBITION

Get Together

"Get Together" will be held in Meeting Room 1 in the evening of Oct. 30 (Sun.). All the attendees of MOC '11 are cordially invited.

MOC Award Ceremony

MOC Award ceremony will be held in Tachibana Conference Hall at 16:15, Nov. 2 (Wed.).

Micro Concert

"Micro Concert" will be performed by Machida Philharmony Baroque Ensemble (MPB) in Hagi Conference Hall in the evening of Nov. 1 (Tue.). All the attendees of MOC '11 and their accompanying family are invited to the concert.

Conference Party

In the evening of Nov. 1 (Tue.), Conference Party will be held after Micro Concert at Sakura Hall 2. The party will start at 18:00. All the attendees of MOC '11 and their accompanying persons are cordially invited.

Technical Exhibition

Table-top technical exhibition is planned during MOC '11. Take this opportunity to see the latest products and technologies in relation to Microoptics. Exhibition will be held in Sakura Hall 1.

Exhibition Hours

Oct. 31 (Mon.)	Nov. 1 (Tue.)	Nov. 2 (Wed.)
11:00 – 17:00	9:00 – 17:00	9:00 – 14:00

Exhibitors

Alnair Labs Corporation
ICS Convention Design Inc.
Indeco. Inc.
MITSUBISHI RAYON CO., LTD.
OPTOQUEST CO., LTD.
RSoft Design Group Japan KK

REGISTRATION

Registration Fees

	Before/On Sept. 28	After Sept. 28
Conference (General)	¥45,000	¥50,000
Conference (Student, Retiree)	¥15,000	¥18,000
Extra Copy of Digest (Electronic medium)	¥6,000	¥6,000

The registration fee includes admission to MOC '11 and a copy of Technical Digest. MOC '11 Organizing Committee entrusts **Event & Convention House, Inc.** with a part of the management.

Those who wish to attend MOC'11 should register online at <http://www.comemoc.com/moc11/>.

If you have any questions, please contact

MOC'11 Registration Desk

Event & Convention House, Inc.

Shuwa-Okachimachi Bldg. 8F
4-27-5 Taito, Taito-ku, Tokyo 110-0016, Japan
Phone: +81-3-3831-2601, Fax: +81-3-5807-3019
E-mail: regdesk@moc2011.com

Payment

All payment should be made in Japanese yen by one of the following methods:

1. Bank transfer

(For overseas attendees)

Bank Name: The 77 Bank, Ltd.,
Shintenmachi Branch
Account Name: Kinki Nippon Tourist Co., Ltd.
Manager Hideyuki Arai
Account No.: Ordinary Deposit No. 5354242
Phone: +81-22-221-5511
Swift Code: BOSSJPJT

(For domestic attendees)

七十七銀行新伝馬町支店
口座番号：普通 5354242
口座名：近畿日本ツーリスト株式会社

2. Credit card

Master Card, VISA, American Express, JCB, and Diners Club are available. Personal checks are NOT accepted.

Pre-registration, by **Sep. 28, 2011**, is encouraged and will be entitled to reduced fees. Upon receipt of registration information and payment, MOC '11 Registration Desk will send an e-mail of confirmation which should be printed and presented at the Conference Registration Desk.

Registration Cancellation Policy

No refunds of the registration fee will be made for any reasons whatever. In the event of registrant unable to attend the conference, a copy of Technical Digest will be sent after the conference.

Registration Site at Conference Site

During the conference, the registration desk will be open **in front of Tachibana Conference Hall**.

GENERAL INFORMATION

Visa

Visitors from countries whose citizens must have visas should apply to a Japanese consular office or diplomatic mission in their respective country. For details, please contact your travel agent or the local consular office in your country.

Climate

The weather in Sendai during the period of the conference is typically sunny with temperature ranges between 7 °C and 17 °C.

Currency Exchange

Only Japanese yen (JPY, ¥) is acceptable at regular stores and restaurants. Certain foreign currencies may be accepted at a limited number of hotels, restaurants and souvenir shops. You can exchange your currency with Japanese yen at foreign exchange banks and other authorized money exchangers on presentation of your passport.

Traveler's Checks and Credit Cards

Traveler's checks are accepted only by leading banks and major hotels in principal cities, and the use of traveler's checks in Japan is not as popular as in some other countries. VISA, Master Card, Diners Club, and American Express are widely accepted at hotels, department stores, shops, restaurants and nightclubs.

Tipping

In Japan, tips are not necessary anywhere, even at hotels and restaurants.

Electrical Appliances

Japan operates on 100 volts for electrical appliances. The frequency is 50 Hz in eastern Japan including Sendai, and 60 Hz in western Japan.

Location of Conference Site

The MOC '11 will take place at Sendai International Center, Sendai, Miyagi, Japan. Sendai is located approximately 300 kilometers (180 miles) north of Tokyo on the Pacific coast of Honshu (the largest of Japan's four major islands). Sendai lies in the center of the Tohoku (northeast) Region, one of the seven major regions in Japan. It takes about 1 hour and 40 minutes to reach Sendai from Tokyo on the Tohoku Bullet Train (Tohoku Shinkansen). Sendai also has regular flights to and from major domestic and international cities.

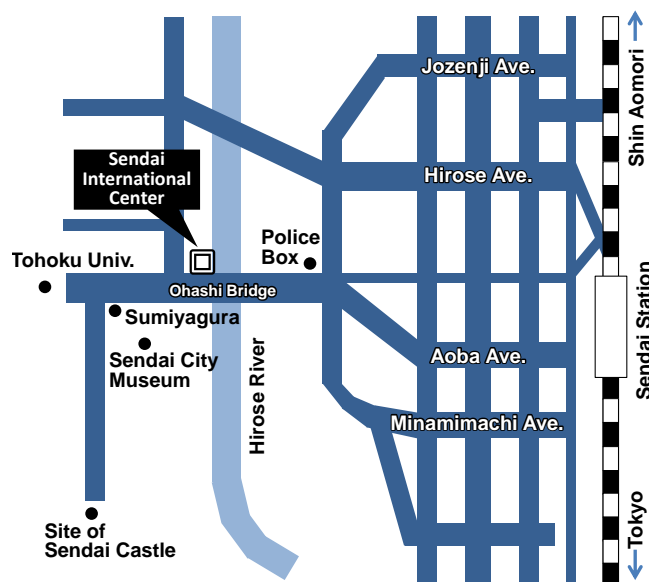
Sendai International Center

Aobayama, Aoba-ku, Sendai, Miyagi, 980-0856 Japan
TEL: 022-265-2450, FAX: 022-265-2485
<http://www.sira.or.jp/icenter/english/index.html>
Sendai City: <http://www.sentabi.jp/1000/10000000.html>

Access

Bus: 10 min. from Sendai Station (bus stop No.9). Take bus marked: "710(AOBADAI)", "713(NARITASAN)", "715 (MIYAKYODAI)", or "719(DOUBUTSUKOUEN-JUNKAN)". Get off at HAKUBUTSUKAN-KOKUSAI CENTER MAE. It is the 5th stop.

Walk: 30 min. from Sendai Station straight down AOBA DORI Avenue, across the OHASHI-Bridge.



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MOC '11

17th MICROOPTICS CONFERENCE

MOC '11 Conference Program

	October 30 Sunday <i>Meeting Room 1</i>	October 31 Monday <i>Tachibana Conference Hall</i>	November 1 Tuesday <i>Tachibana Conference Hall</i>	November 2 Wednesday <i>Tachibana Conference Hall</i>
8:30		Registration (8:30-17:30)	Registration (8:30-16:30)	Registration (8:30-15:00)
8:45				
9:00		Opening		
9:15				
9:30		A. Plenary	F. Display & Lighting	J. Green Photonics
9:45				
10:00				
10:15				
10:30				Break
10:45			Break	
11:00		Break		
11:15				
11:30		B. Measurement & Sensing	G. Active Devices	K. Fiber Based Devices
11:45				
12:00				
12:15				
12:30				
12:45		Lunch	Lunch	Lunch
13:00				
13:15				
13:30				
13:45				
14:00		C. Slow Light	H. Poster Session @ Sakura Hall 1	L. O/E Applications
14:15				
14:30				
14:45				
15:00				
15:15				
15:30		Break		Break
15:45				PD. Post Deadline Papers
16:00		D. Terahertz	Break	Award/Closing
16:15				
16:30	Registration (16:00-18:30)			
16:45				
17:00				
17:15		Break	Micro Concert	
17:30				
17:45				
18:00				
18:15				
18:30				
18:45	Get Together	E. Special Session	Conference Party	
19:00				
19:15				
19:30				
19:45				
20:00				
20:15				

Session Chairs

A. Plenary	M. Nakazawa, Tohoku Univ. H. Shoji, Sumitomo Electric Ind., Ltd.
B. Measurement and Sensing	S. Y. Set, Alnair Labs. K. Hotate, Univ. Tokyo
C. Slow light	M. Qiu, KTH Royal Inst. Tech. M. Watanabe, AIST
D. Terahertz	R. Baets, Ghent Univ. H. Ito, Tohoku Univ.
E. Special Seccion	Organizer: S. Yamashita, Univ. Tokyo
F. Display & Lighting	S. L. Chuang, Univ. Illinois N. Arai, Konica Minolta Opto, Inc.
G. Active Devices	Y. K. Yeo, A*STAR S. Tsuji, Hitachi Ltd.
J. Green Photonics	E. H. Cho, Samsung A. Arimoto, PrimeOptics Co., Ltd.
K. Fiber Based Devices	P. B. García-Allende, Institute for Biological and Medical Imaging Y. Koike, Keio Univ.
L. O/E Applications	H. F. Liu, Intel Corp. H. Sasaki, Oki Electric Industry Co., Ltd.
PD. Post Deadline Papers	C.-F. Lin, National Taiwan Univ. S. Ozawa, Furukawa Electric Co., Ltd.

TECHNICAL PROGRAM

Oct. 31 (Mon.)

Opening Oct. 31(Mon.) 9:15-9:30
Tachibana Conference Hall

A. Plenary Oct. 31(Mon.) 9:30-11:00

Tachibana Conference Hall

Chairs: M. Nakazawa, Tohoku Univ.

H. Shoji, Sumitomo Electric Ind., Ltd.

A-1 9:30

SILICON PHOTONICS: LASERS AND AMPLIFIERS

Roel Baets (1,2), (1) Photonics Research Group, INTEC-department, Ghent University – IMEC, (2) Center for Nano- and Biophotonics (NB-Photonics), Ghent University

In this presentation research on light emission and amplification in the context of a silicon photonics platform will be discussed. Two distinct approaches will be covered. The first is the "hybrid silicon laser". It relies on the bonding of thin InP-InGaAsP epi-layers on patterned silicon photonics wafers and subsequent processing into electrically driven microlasers. A range of different hybrid lasers for different applications will be discussed. The second approach is based on four-wave-mixing in silicon and allows to generate new optical frequencies on the basis of optical pumping. Progress in this area both at telecom and longer wavelengths will be discussed, both for crystalline and amorphous silicon-on-insulator.

A-2 10:00

METAL-CAVITY NANOLASERS: HOW SMALL CAN THEY GO?

Shun Lien Chuang, Chien-Yao Lu, and Akira Matsudaira, University of Illinois at Urbana-Champaign, Department of Electrical and Computer Engineering,

We present a theory of metal-cavity nanolasers and our progress in experiments of metal-cavity surface-emitting microlasers and nanoLEDs with electrical injection at room temperature. After substrate removal, the devices are flip-chip bonded to silicon. The fabrication concepts represent significant progress toward integration of active nanophotonic devices with silicon electronics.

A-3 10:30

ADVANCES OF VCSEL PHOTONICS

Fumio Koyama, Precision and Intelligence Laboratory, Tokyo Institute of Technology

We have seen a lot of unique features for VCSELs, such as low power consumption, wafer-level testing, small packaging capability and so on. Recent advances in VCSEL photonics for optical interconnects will be reviewed. In addition, we address our research activity on slow light photonic devices based on VCSEL structures, which include a miniature slow light switch, the monolithic integration of VCSEL with slow light modulator/amplifier and giant beam steering functions.

Break 11:00-11:15

B. Measurement and Sensing Oct. 31(Mon.) 11:15-12:30

Tachibana Conference Hall

Chairs: S. Y. Set, Alnair Labs.

K. Hotate, Univ. Tokyo

B-1 11:15 Invited

OPTICAL FIBER SENSORS FOR WELDING QUALITY MONITORING

A. Cobo, J. Mirapeix, J. J. Valdiande, P. B. García-Allende (1), O. M. Conde, L. Rodríguez-Cobo, F. Anabitarte, J. M. López-Higuera, Photonics Engineering Group, University of Cantabria, (1) Currently at Institute for Biological and Medical Imaging

Welding processes are widely used in most industrial sectors, but the issue of on-line quality monitoring to detect or avoid the occurrence of defects is still a subject of intense research. In this paper an optical spectroscopic technique is presented. Optimizations and field trials in the automotive, aeronautical and nuclear sectors are reported.

B-2 11:45

Oct. 31(Mon.)

ABSOLUTELY OPTICAL-FREQUENCY-STABILIZED CESIUM OPTICAL ATOMIC CLOCK

M. Yoshida (1), F. Suzuki (1), T. Morisaki (1), M. Nakazawa (1), (1) Research Institute of Electrical Communication, Tohoku University

We have successfully realized an optical-frequency-stabilized Cs optical atomic clock using a mode-hop-free mode-locked fiber laser and an acetylene optical frequency standard. An optical frequency stability of 2×10^{-11} was achieved for an averaging time of 1-100 s.

B-3 12:00

FOUR-CHANNEL SPECTRAL IMAGING IN VISIBLE WAVELENGTH UTILIZING PHOTONIC CRYSTAL PATTERNED WAVELENGTH FILTERS

Shuhei YAMAGUCHI (1), Yasuo OHTERA (1), Hirohito YAMADA (1), (1) Graduate School of Engineering, Tohoku University

A four-channel spectral imaging system utilizing multilayer-type photonic crystal (PhC) is demonstrated. In order to check the feasibility of the system for the application to biomedical measurement in the future, we took hemoglobin as a test target. PhC long wavelength pass filters (LPFs) were designed to function as a set of LPFs covering a part of the visible wavelength range where absorption peaks of hemoglobin exist.

B-4 12:15

BACKGROUND NOISE SUPPRESSION IN BRILLOUIN OPTICAL CORRELATION DOMAIN REFLECTOMETRY BASED ON OPTIMIZED INTENSITY MODULATION

Sitthipong Manotham, Masato Kishi, Zuyuan He, Kazuo Hotate, Department of Electrical Engineering and Information Systems, The University of Tokyo

The optimized intensity modulation is applied to Brillouin Optical Correlation Domain Reflectometry in order to modify optical power spectrum of the light source for suppressing the noise floor in Brillouin Gain Spectrum. The noise level suppression is experimentally demonstrated, and the performance of distributed strain measurement is much improved.

Lunch Break 12:30-13:45

C. Slow light Oct. 31(Mon.) 13:45-15:30

Tachibana Conference Hall

Chairs: M. Qiu, KTH Royal Inst. Tech.

M. Watanabe, AIST

C-1 13:45 Invited

SLOW LIGHT DEVICES IN III-V PHOTONIC CRYSTALS: STATE OF THE ART AND OPEN ISSUES

S. Combr e, P. Colman, G. Lehoucq, S. Xavier and A. De Rossi, Thales Research and Technology

We review the properties of photonic crystals in III-V materials from the prospective of light-matter interaction enhanced by "slow-light". We discuss some key functions, namely the generation of a time delay and the nonlinear conversion. Compared to optical fibers, the typical scales, dispersion and nonlinear lengths are reduced to the mm range, thereby opening the possibility of on-chip all optical processing. That has been enabled by the minimisation of linear and nonlinear losses.

C-2 14:15

ULTRAHIGH-RESOLUTION TUNABLE DELAY OF SLOW LIGHT AND ITS APPLICATION TO FAST OPTICAL CORRELATOR

Norihiro Ishikura (1, 2), Toshihiko Baba (1, 2), Eiichi Kuramochi (2, 3), Masaya Notomi (2, 3), (1) Department of Electrical and Computer Engineering, Yokohama National University, (2) JST CREST, (3) NTT Basic Research Laboratories

We fabricated photonic crystal slow-light waveguide using high-resolution e-beam lithography, and demonstrated a high tunable resolution of 36 by local heating. This value is further improved to 110 by compressing output pulse. We applied it to optical correlator, and observed sub-picosecond pulse at a scanning frequency of 1 kHz.

C-3 14:30

EXPERIMENTAL DEMONSTRATION OF BEAM-STEERING BASED ON SLOW-LIGHT WAVEGUIDE AMPLIFIER

Xiaodong Gu, Toshikazu Shimada, Ayumi Fuchida, Akihiro Imamura, Akihiro Matsutani, Fumio Koyama, Photonics Integration System Research Center, Precision and Intelligence Lab., Tokyo Institute of Technology

We present the first experimental demonstration of beam steering based on a slow light waveguide amplifier. Continuous and clear beam steering of over 30 degrees is observed by tuning the wavelength of input light. The result is in good agreement with simulation, exhibiting a potential of large number of resolution points.

C-4 14:45

SLOW LIGHT ENHANCED WAVEGUIDE NONLINEARITY IN ULTRAHIGH-Q PHOTONIC CRYSTAL COUPLED RESONATOR CHAIN

Nobuyuki Matsuda (1), Takumi Kato (1,2), Ken-ichi Harada (1), Hiroki Takesue (1), Eiichi Kuramochi (1), Masaya Notomi (1), (1) NTT Basic Research Laboratories, NTT Corporation, (2) Research Institute of Electrical Communication, Tohoku University

We demonstrate highly enhanced optical nonlinearity in a coupled-resonator optical waveguide (CROW) in a four-wave mixing

Oct. 31(Mon.)

experiment. Using a CROW consisting of two-hundred coupled resonators of width-modulated photonic crystal nanocavities in a line defect, we obtained an effective nonlinear constant exceeding 10,000 W/m.

C-5 15:00

LATERAL INTEGRATION OF MEMS VCSEL AND SLOW LIGHT AMPLIFIER

Masanori Nakahama, Toshikazu Shimada, Fumio Koyama, Precision & Intelligence Lab., Tokyo Institute of Technology

We propose the lateral integration scheme of MEMS tunable VCSEL and slow light amplifier for increasing single-mode power. The modeling result shows the efficient excitation of slow light in the integrated amplifier. The coupling efficiency and the radiation angle from the amplifier are almost constant during wavelength tuning.

C-6 15:15

SLOW LIGHT AMPLIFIER LATERALLY INTEGRATED WITH VCSEL

Toshikazu Shimada, Fumio Koyama, P & I Lab., Tokyo Tech

We demonstrate the lateral integration of a VCSEL and a slow light amplifier. We realized the loss compensation and amplification for a compact slow light amplifier laterally integrated with a VCSEL. The integration enables us to increase the singlemode output power of VCSELS.

Break 15:30-15:45

D. Terahertz Oct. 31(Mon.) 15:45-17:15

Tachibana Conference Hall

Chairs: R. Baets, Ghent Univ.

H. Ito, Tohoku Univ.

D-1 15:45 Invited

PHOTOTHERMAL EFFECTS IN A PLASMONIC METAMATERIAL STRUCTURE

Min Qiu (1, 2), Yiting Chen (2), Xi Chen (2), Jing Wang (2), Jiaming Hao (2), and Min Yan (2), (1) State Key Laboratory of Modern Optical Instrumentation and Inst. of Advanced Nanophotonics, Dept. of Optical Engineering, Zhejiang University, (2) Laboratory of Photonics and Microwave Engineering, Royal Institute of Technology (KTH)

Heat generation due to photothermal effects in plasmonic nanostructures have generated many important applications, due to the strong enhancement of light absorption through plasmonic resonance at visible and near-infrared region. In this talk, we review our recent experimental efforts on photothermal effects in a metamaterial nanostructure, which has an ultrasensitive heating response owing to plasmonic resonance. We observed close-to-instantaneous fusion and re-shaping of the nanoparticles with a nanosecond pulse train. The generated heat profile has a subwavelength resolution, and the resonance wavelength can be in principle tailored to arbitrary wavelength region by choosing an appropriate geometry for the resonator structure.

D-2 16:15

TERAHERTZ INJECTION LOCKED OSCILLATION IN PLASMON-RESONANT TRANSISTORS

T. Watanabe (1), Yudai Tanimoto (1), Akira Satou (1), Taiichi Otsuji (1), RIEC: Research Institute of Electrical Communication, Tohoku University

We experimentally and analytically investigated the possibility of injection locked oscillation in a plasmon-resonant dualgrating-gate high-electron mobility transistor to the difference terahertz frequency component of photomixed dual CW laser irradiation. Although the perfect injection locking has not yet been obtained the device model we newly formulate will lead to find practical solutions of successful operation.

D-3 16:30

GENERATION OF TERAHERTZ WAVE BY LTG-GaAs ANTENNAS EXCITED AT 1550nm BAND

Tokutaka Hara (1), Masahito Mure (1), Jun-ichiro Ichikawa(1), Yasuhiro Takemura(1), Yutaka Kadoya(2), (1) Sumitomo Osaka Cement Co., Ltd., New Technology Research Laboratories, (2) Graduate School of Advanced Sciences of Matter, Hiroshima University

The terahertz wave was generated by photoconductive antenna (PCA) based on low-temperature grown (LTG)GaAs with 1550nm pulse excitation. We constructed terahertz time domain spectroscopy (THz-TDS) system by all 1550nm band excitation and obtained the spectrum of terahertz wave in the range to 2THz.

D-4 16:45

DEMONSTRATION OF INTEGRATED AlGaAs QUANTUM-WELL RIDGE-STRUCTURE TWO-WAVELENGTH DBR LASER FOR THZ WAVE GENERATION

M. Uemukai (1), A. Ito (1), T. Suhara (1), H. Kitajima (2), A. Watanabe (2), H. Kan (2), (1) Department of Electrical, Electronic and Information Engineering, Graduate School of Engineering, Osaka University, (2) Central Research Laboratory, Hamamatsu Photonics K. K.

Oct. 31(Mon.)

An integrated two-wavelength semiconductor laser consisting of two DBR lasers and a Y-branch waveguide amplifier was designed and fabricated. Two-wavelength oscillation with same output level of ~10 mW and wavelength difference of 1.0 ~ 3.7 nm was obtained. Coherent THz wave generation was also demonstrated by photomixing of the integrated two-wavelength laser output.

D-5 17:00

FABRICATION OF TERAHERTZ WIRE-GRID POLARIZER BY DIRECT MACHINING

A. Partanen (1), J. Väyrynen (2), S. Hassinen (2), H. Tuovinen (1), J. Mutanen (1), T. Itkonen (1), P. Sillfsten (1), P. Pääkkönen (1), M. Kuittinen (1), K. Mönkkönen (2), (1) Department of Physics and Mathematics, University of Eastern Finland, (2) North Karelia University of Applied Sciences

In this study a terahertz wire-grid polarizer was manufactured using ruling based ultra precision diamond machining process and replicated to TPX (Polymethylpentene) using hot embossing. Imprinted structures were evaporated with aluminum in a slanted angle so that an aluminum grid was formed. Polarizers were tested with THz-spectrometer.

Break 17:15-17:45

E. Special Session Oct. 31(Mon.) 17:45-20:30

Tachibana Conference Hall

Organizer: S. Yamashita, Univ. Tokyo

INTRODUCTION 17:45

Shinji Yamashita, University of Tokyo

*Presentation order of special session has been changed.

E-5 18:00

NOVEL EXCITONIC PROPERTIES OF CARBON NANOTUBES TOWARD NANO-CARBON OPTICS

Kazunari Matsuda (1), (1) Institute of Advanced Energy, Kyoto University

We report the novel excitonic properties of carbon nanotubes. The first observation of room temperature charged exciton was successfully demonstrated. We also demonstrated photoluminescence enhancement of single carbon nanotubes using plasmonics techniques. These novel excitonic properties of carbon nanotube open pathways for applying to various optoelectronic devices and applications.

E-1 18:30

FIELD EMISSION PROPERTY OF CARBON NANOTUBES AND THEIR APPLICATION TO DISPLAY DEVICES

Yahachi Saito, Department of Quantum Engineering, Nagoya University

Carbon nanotubes (CNTs) possess various unique properties such as a needle-like shape with nanometer-size diameter, high mechanical strength, chemical stability and high electrical conductivity, which are advantages as field electron emitters. Dynamic behavior of CNT emitters revealed by field emission microscopy (FEM) and in-situ transmission electron microscopy (TEM) are first presented, and then development of various types of CNT-based field emission devices is reviewed.

E-2 19:00

CNT-BASED MODE-LOCKED LASERS

Masataka Nakazawa, Research Institute of Electrical Communication, Tohoku University

We present our recent demonstrations of SWNT-based passively mode-locked fiber lasers. By using the SWNT/polymer bulk- and film-type saturable absorbers that we fabricated, 110~130 fs pulses were successfully generated in the 1.5 and 1.07 μm regions by optimizing the fiber cavity as a soliton laser.

E-3 19:30

GRAPHENE COMPOSITES FOR ULTRAFAST PHOTONICS

Francesco Bonaccorso, Zhipei Sun, Tawfique Hasan, Andrea C. Ferrari, Department of Engineering, University of Cambridge

Ultrafast lasers play a key role in a variety of devices, from basic research to materials processing and medicine. Graphene has great potential as saturable absorber for ultrafast lasers. Here we present an overview of graphene-based ultrafast lasers, from solution processing of the raw materials, to their incorporation into polymers, device fabrication and testing.

E-4 20:00

COMMERCIAL APPLICATIONS OF CARBON-NANOTUBE PHOTONIC TECHNOLOGIES

Sze Y. Set, Alnair Labs Corporation

We introduce current commercial applications of carbon-nanotube (CNT) photonic technologies. In particular, two key applications of CNT mode-locked lasers will be described: high-speed optical sampling using a long-wavelength, low-repetition rate femtosecond CNT laser and 3D high-precision profile measurement using a high-repetition rate CNT laser.

Nov. 1 (Tue.)

F. Display & Lighting Nov. 1(Tue.) 9:00-10:45

Tachibana Conference Hall

Chairs: S. L. Chuang, Univ. Illinois

N. Arai, Konica Minolta Opto, Inc.

F-1 9:00 Invited

NANOIMPRINTED PHOTONIC CRYSTAL COLOR FILTERS FOR SOLAR-POWERED REFLECTIVE DISPLAYS

Eun-Hyoung Cho (1), Hae-Sung Kim (1), Jin-Seung Sohn (1), Chang-Youl Moon (1), No-Cheol Park (2), Young-Pil Park (2), (1) Nano Fabrication Group, Material & Device Center, Samsung Advanced Institute of Technology, (2) Center for Information Storage Device (CISD) Yonsei University

A novel concept for reflective displays that uses two-dimensional photonic crystals with subwavelength gratings is introduced. A solar-powered reflective display with photonic crystal color filters was analyzed by a theoretical approach. We fabricated the photonic crystal color filters on a glass substrate by using low-cost nanoimprint lithography and multi-scan excimer laser annealing to produce RGB color filters through a single patterning process. The theoretical and experimental results show that the color filters have high reflectance and angular tolerance, which was qualitatively confirmed by chromaticity coordination analysis.

F-2 9:30

HIGH RESOLUTION MULTICHANNEL IMAGING SYSTEMS

A. Bräuer, A. Brückner, F. Wippermann, P. Dannberg, R. Leitel, Fraunhofer Institute IOF

Bio-inspired multichannel imaging systems bear the inherent advantage of shorter total track lengths compared to mono-channel imaging system. On the other hand, the attained resolution was rather poor up to now. In this paper we describe the realisation of a multichannel VGA camera. Sub-images are stitched together electronically in the so-called "electronic cluster eye" camera. Secondly, a close-up imaging system is shown, the "ultraflat microscope" achieving a resolution as high as 250 LP/mm.

F-3 9:45

A POLARIZED LASER BACKLIGHT OF ZERO-ZERO-BIREFRINGENCE POLYMER FOR LIQUID CRYSTAL DISPLAYS

Takahiro Kurashima (1), Takayuki Arai (2), Akihiro Tagaya (1), Yasuhiro Koike (1), (1) Keio Photonics Research Institute, Keio University, (2) Enplas Corporation

We proposed a polarized laser backlight to improve light use efficiency of liquid crystal displays, and evaluated its basic polarization properties. In order not to degrade the polarization state, light guide plates were fabricated of polymer free of orientational and photoelastic birefringence, which is called zero-zero-birefringence polymer.

F-4 10:00

LASING BEHAVIOR ANALYSIS IN GAN-BASED 2D PHOTONIC CRYSTAL SURFACE EMITTING LASERS WITH LOCALIZED DEFECT

Tzeng-Tsong Wu¹, Peng-Shiang Weng¹, Yen-Ju Hou¹, You-Ching Lin², Chi-Cheng Chen¹, Tien-Chang Lu^{1,2}, Hao-Chung Kuo¹ and Shing-Chung Wang¹, 1. Department of Photonic & Institute of Electro-Optical Engineering, National Chiao Tung University, 2. Institute of Lighting and Energy Photonic, National Chiao Tung University

The GaN-based two-dimensional (2D) Photonic Crystal Surface Emitting Lasers (PCSELS) with different type of localized defect have been fabricated and investigated. According to the different cavity sizes, the threshold energy density and lasing wavelength of PCSELS could be investigated by micro-Photoluminescence (μ -PL) system. Besides, by using the Multiple Scattering Method, the threshold gain of different defect cavities of PCSELS could be calculated precisely and well matched to the experimental results.

F-5 10:15 Invited

DESIGN AND REALIZATION OF AN ULTRA-SLIM ARRAY PROJECTOR

Marcel Sieler, Peter Schreiber, Peter Dannberg, Andreas Bräuer, Fraunhofer Institute for Applied Optics and Precision Engineering IOF

State of the art projectors with a single aperture optical layout always require a trade-off between system volume and projected flux caused by étendue limitation. The presented 'array projection' technology overcomes this constraint of traditional concepts by an optical multi-aperture setup using arrayed microlenses as projection objectives. Furthermore, the presented multi-channel approach enables for a unique extension of depth of focus, which ensures a brilliant image contrast even for extreme screen geometries without decreasing the system transmission. We present the design and realization of a first prototype for fixed projection patterns and show results of simulations regarding to depth of focus extension.

Break 10:45-11:00

G Active Devices Nov. 1(Tue.) 11:00-12:30

Tachibana Conference Hall

Chairs: Y. K. Yeo, A*STAR

S. Tsuji, Hitachi Ltd.

G-1 11:00 Invited**DEMONSTRATION OF A 4λ x 12.5 Gb/s FULLY INTEGRATED SILICON PHOTONIC LINK***Hai-Feng Liu, Intel Corporation*

We demonstrate a fully integrated Si photonics based 4λ x 12.5 Gb/s CWDM link, where hybrid silicon lasers are integrated, for the first time, with an modulator array and an optical multiplexer on the same Si substrate.

G-2 11:30**A SINGLE-STRIPE TUNABLE LASER OPERATED AT CONSTANT TEMPERATURE USING THERMO-OPTIC EFFECT***T. Kaneko, Y. Yamauchi, K. Uesaka, H. Shoji, Sumitomo Electric Industries, Ltd*

We studied a modified structure of high power and low noise full-band tunable CSG-DR laser operating at a constant chip temperature. The examined laser, TDA-CSG-DR-LD, has structure with the phase control region controlled by heaters. The fabricated device shows a capability to emit more than 60 mW output power at chip temperature of 50 °C and a wavelength tuning range of nearly 40 nm. These results promise the downsizing of package and widen application field of the device.

G-3 11:45**25-Gbit/s TRANSCEIVER USING MICRO-LENS INTEGRATED 1.3-μm LASER DIODE AND PHOTODIODE FOR OPTICAL INTERCONNECTS**

D. Kawamura (1), T. Takai (2), Y. Lee (1, 4), K. Kogo (1), K. Adachi (1, 4), Y. Matsuoka (1), N. Chujo (2, 4), R. Mita (1), S. Hamamura (2), S. Kaneko (3), T. Takemoto (1, 4), F. Yuki (1, 4), H. Yamashita (1, 4), T. Sugawara (1), S. Tsuji (1,4), (1) Central Research Laboratory, Hitachi, Ltd., (2) Yokohama Research Laboratory, Hitachi, Ltd., (3) MONOZUKURI Engineering Division, Hitachi, Ltd., (4) Photonics Electronics Technology Research Association

We developed an external lens-free transceiver with a high optical coupling efficiency and a large alignment tolerance using a 1.3-μm lens-integrated surface-emitting laser diode and a lens-integrated Photo diode. 25 Gbit/s error-free 3-m multi-mode fiber (MMF) transmission was successfully demonstrated.

G-4 12:00**ABSOLUTE FREQUENCY STABILIZATION OF A LASER DIODE BASED ON TRIPLE RING RESONATORS TO AN C2H2 ABSORPTION LINE**

Keisuke Kasai (1), Masataka Nakazawa (1), Hiroyuki Yamazaki (2), (1) Research Institute of Electrical Communication, Tohoku University, (2) Fiber Optic Devices Division, NEC Yamanashi, Ltd.

We demonstrate the frequency stabilization of a laser diode based on waveguide triple external ring resonators to an 13C2H2 absorption line. The frequency stability reached 6.8×10^{-11} for $\tau=1$ s and 1.0×10^{-11} for $\tau=100$ s. Furthermore, a RIN of -140 dB/Hz and a linewidth of 100 kHz were simultaneously achieved.

G-5 12:15**QUANTUM WELL MACH-ZEHNDER MODULATOR WITH SINGLE MICRORING RESONATOR AND OPTIMIZED ARM LENGTH**

Hiroki Kaneshige, Yuta Ueyama, Hitoshi Yamada, Taro Arakawa, Yasuo Kokubun, Graduate School of Engineering, Yokohama National Univ.

We propose and demonstrate a low-voltage InGaAs/InAlAs multiple quantum well Mach-Zehnder (MZ) modulator with a single microring resonator and an arm with an optimized length. The quantum well wafer was grown by molecular beam epitaxy and the device structure was fabricated by photolithography and dry etching processes. The half-wave voltage was successfully reduced to one-fourth compared to a conventional MZ modulator.

Lunch Break 12:30-13:45

H. Poster Session Nov. 1(Tue.) 13:45-16:30

Sakura Hall 1

H-1 13:45**NUMERICAL ANALYSIS OF GAIN SATURATION CHARACTERISTICS OF SEMICONDUCTOR OPTICAL AMPLIFIER USING TUNNEL INJECTION STRUCTURE**

Mikio Sorimachi, Yasutaka Higa, Takuya Nishinome, Hajime Iwasaki, Tomoyuki Miyamoto, Photonics Integration System Research Center, P&I Lab., Tokyo Institute of Technology

We provide the numerical analysis result of the gain saturation characteristics of a semiconductor optical amplifier (SOA) using the

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tunnel injection structure that we proposed. The tunnel injection SOA has the features of the carrier reservoir and the control of the carrier relaxation speed. The analysis suggested that the tunnel injection SOA improves the output power by 4.9 dB at 100 Gbps PRBS without signal distortion.

H-2 13:45

PROPOSAL OF POLARIZATION-INDEPENDENT SILICON WIRE-WAVEGUIDE DIRECTIONAL COUPLER OPTICAL SWITCH

T. Ushio, K. Tsukamoto, K. Utaka, Faculty of Science and Engineering, Waseda University

We propose a polarization-independent silicon wire-waveguide directional coupler optical switch (DC-OS) by adjusting the propagation constant difference between the guided modes. The thermo-optic (TO) switching power consumption is as low as 18.5mW. This polarization-independent DC-OS is expected to be valuable for optical interconnection in silicon photonics.

H-3 13:45

IMPROVED BOUNDARY INTEGRAL EQUATION NEUMANN-TO-DIRICHLET MAP METHOD FOR DIFFRACTION GRATINGS

Wangtao Lu^{1,2}, Ya Yan Lu², 1Department of Mathematics, University of Science and Technology of China, Hefei, Anhui, China, 2Department of Mathematics, City University of Hong Kong, Kowloon, Hong Kong

The boundary integral equation (BIE) method is one of the most effective numerical methods for analyzing diffraction gratings. The recently developed BIE-Neumann-to-Dirichlet (BIE-NtD) method is particularly simple to use, since it avoids the quasi-periodic Green's functions. In this paper, we present an improved BIE-NtD method. Numerical results indicate that our new BIE-NtD method achieves a high order of accuracy.

H-4 13:45

GROWTH AND OPTICAL PROPERTY OF NANO CARBON THIN FILMS BY WET PROCESS

Shoichi Chihara, Shin-ichiro Yanagiya, Nobuo Goto, Department of Optical Science and Technology, Faculty of Engineering, The University of Tokushima

Nano-carbon such as carbon nanotube (CNT) and graphene has been widely studied in this decade. We investigated the fabrication of nano-carbon dispersed film by wet process in this study. The CNT dispersed thin films were coated using spinner. Graphene films were made by dipping the CNT coated glass plate in KMnO₄. The films were observed by an atomic force microscopy and a transmission electron microscopy. The UV-VIS-IR optical absorption of nano-carbon solution was also studied.

H-5 13:45

HIGH FINESSE FIBER RING CAVITY FOR FREQUENCY STABILIZATION OF Nd:YAG LASER WITH POUND-DREVER-HALL METHOD

Eun-Hwa Her, Duseong Yoon, Gwang Hoon Jang, Minsoo Song, Tai Hyun Yoon, Department of Physics, Korea University

We have fabricated a high finesse fiber ring cavity with a record high finesse of 938, free-spectral range of 413 MHz, and line-width of 440 kHz, respectively. The fiber ring cavity has been successfully used for the frequency stabilization and line-width reduction of a highly-stable Nd:YAG laser at 1064 nm by employing the Pound-Drever-Hall frequency locking method. The measured short-term frequency stability of the Nd:YAG laser was on the level of 10 kHz and remained locked for long time.

H-6 13:45

PROPOSAL OF CROSSED CAVITY-RESONATOR-INTEGRATED GUIDED-MODE RESONANCE FILTER

Tatsuya Majima (1), Junichi Inoue (1), Koji Hatanaka (1), Kenji Kintaka (2), Kenzo Nishio (1), Yasuhiro Awatsuji (1), Shogo Ura (1), (1) Department of Electronics, Kyoto Institute of Technology, (2) National Institute of Advanced Industrial Science and Technology

Cavity-resonator-integrated guided-mode resonance filter (CRIGF) is expected to provide high reflectance and narrowband spectrum response. Crossed-CRIGF consisting of two CRIGFs orthogonal to each other was proposed as polarization-independent CRIGF and designed. Reflectance at resonance wavelength was predicted to be almost 100 % regardless of incident wave's polarization by coupled-mode analysis.

H-7 13:45

MULTIMODE INTERFERENCE COUPLER WITH TE MODE REJECTION CHARACTERISTICS IN A SILICON WAVEGUIDE

Yuya Shirato, Ryohei Takei, Yuya Shoji, Tetsuya Mizumoto, Tokyo Institute of Technology

The multimode interference (MMI) coupler which prohibits TE mode transmission and provides 1:1 dividing characteristics to TM mode is discussed. TE/TM mode extinction ration of 10 dB was obtained in a fabricated MMI coupler.

H-8 13:45

STUDY OF FUSION SPLICE FOR SINGLE-MODE MULTICORE FIBER

Kengo Watanabe(1), Tsunetoshi Saito(1), Katsunori Imamura(1), Yoshihide Nakayama(2), Masato Shiino(1), (1) FITEL Photonics laboratory, Furukawa Electric Co., Ltd, (2) FITEL Products Division, Furukawa Electric Co., Ltd.

We studied the fusion splice for multicore fiber (MCF), with seven cores arranged in a hexagonal array. The passive alignment based on the side observation of MCFs demonstrated the equivalent splice loss value compared to the active alignment. It is shown that cleave angle may affect fusion splice loss.

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H-9 13:45

IMPROVEMENT IN COUPLING EFFICIENCY BETWEEN A SILICON WAVEGUIDE AND A SURFACE MOUNTED PHOTO DETECTOR USING AN APODIZED GRATING COUPLER

A. Fujimoto, K. Uchiho, Y. Shoji, T. Mizumoto, Department of Electrical and Electronic Engineering, Tokyo Institute of Technology

The design of an apodized grating coupler is discussed for coupling lightwave between a silicon waveguide to a surface mounted photo detector. A coupling efficiency higher than 85% is available for a random polarization at a wavelength of 1.55 μm .

H-10 13:45

IMPROVEMENT OF EXTINCTION RATIO IN CROSS STATE OF MACH-ZEHNDER INTERFEROMETER SWITCHES WITH FERROELECTRIC LIQUID CRYSTAL CLADDING

T. Nonaka, Y. Ban, K. Tadokoro, A. Kato, K. Nakatsuhara, T. Nakagami, Department of Electrical and Electronic Engineering, Kanagawa Institute of Technology

We demonstrated a switching operation with high extinction ratio in cross state of a fabricated optical switch using Si waveguide with a ferro-electric liquid crystal cladding. The refractive index matching between ferro-electric liquid crystal and SiO₂-Ta₂O₅ glass was successfully obtained in Si waveguide Mach-Zehnder interferometer.

H-11 13:45

FIBER FABRY-PEROT OPTICAL CAVITIES USING EXPANDED-CORE FIBERS WITH CONCAVE FORM

C.Fujikawa(1), T.Shintaku(2), K.Tateyama(1), E..Watanabe(3), (1)Tokai University, (2)Tokyo Polytechnic University, (3)The University of Electro-Communications

A new type of fiber Fabry-Perot interferometer with expanded cores was proposed. The form of the fiber ends was concave curve. It has simple structure and wide wavelength range, and the free spectral range of the device was suitably controllable. We have obtained the high performance of the fiber Fabry-Perot cavity by concave processing of an expanded core fiber end.

H-12 13:45

IMPROVEMENT OF CONTRAST RATIO FOR RECOGNITION OF OPTICAL QPSK LABELS WITH WAVEGUIDE CIRCUITS

Yoshihiro Makimoto, Nobuo Goto, Shin-ichiro Yanagiya, Department of Optical Science and Technology, The University of Tokushima

In photonic label routing networks, optical recognition of optical labels is one of the key functions. Label recognition circuits for optical QPSK labels with improved contrast ratio are proposed and verified by FD-BPM.

H-13 13:45

FULL C-BAND SPATIAL MULTI-MODE COMBINER BASED ON MULTI-MODE INTERFERENCE

Yutaka Chaen, Zhao Zhao, Haisong Jiang, Kiichi Hamamoto, I-Eggs, Kyushu University

We propose multi-mode interference (MMI) based multi-mode combiner for future spatial multi-mode multiplexing transmission. The designed MMI multi-mode combiner showed superior multiplexing (0th and 1st order modes) characteristics of below 0.5 dB excess loss for full C-Band theoretically.

H-14 13:45

MEMS TUNABLE SILICON NANO-WIRE AIR-GAP COUPLING FOR COUPLER SWITCH AND INTERFEROMETER

Y. Akihama, T. Ikeda, Y. Kanamori, K. Hane, Department of Nanomechanics, Tohoku University

Air-gap silicon waveguide couplers are studied for tunable optical telecommunication devices. Air-gap of coupler can be modulated by a MEMS actuator to vary the coupling efficiency, and the position of coupler can also be shifted by the actuator for varying the optical path length. We study the characteristics of the air-gap coupler theoretically and experimentally. Fabricated MEMS actuators are so small to be embedded in the vicinity of silicon nano-wire waveguides.

H-15 13:45

MgO:LiNbO₃ WAVEGUIDE SHG DEVICE WITH DOMAIN-INVERTED GRATING FORMED BY 2-STEP VOLTAGE APPLICATION UNDER UV LIGHT

Masatoshi Fujimura, Eri Kitado, Toshiyuki Inoue, Toshiaki Suhara, Graduate School of Engineering, Osaka University

A new simple method for formation of domain-inverted gratings in MgO:LiNbO₃, i.e., 2-step voltage application under ultraviolet light, was proposed. A high quality grating of 19 μm period was formed and applied to a waveguide quasi-phase-matched second-harmonic generation (QPM-SHG) device for pumping at 1.55 μm wavelength. A SH power as high as 220 mW was obtained for a pump power of 587 mW. High applicability of the method to QPM device fabrication was demonstrated.

H-16 13:45

FOUR-WAVE-MIXING BASED WAVELENGTH CONVERSION IN A TAPERED FIBER COATED WITH CARBON NANOTUBES/POLYMER COMPOSITE

Bo Xu(1), Mika Omura(2), Masato Takiguchi(3), Amos Martinez(1), Takaaki Ishigure(2), Shinji Yamashita(1), Takahiro Kuga(3), 1 Department of Electrical Engineering and Information Systems, University of Tokyo, 2 Faculty of Science and Technology, Keio University, 3 Institute of Physics, Graduate School of Arts and Sciences, University of Tokyo

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We demonstrate a nonlinear optical device based on a fiber taper coated with a carbon nanotube/polymer composite. Four wave mixing-based wavelength conversion of 10 Gb/s Non-return-to-zero signal with the coated fiber-taper nonlinear device is achieved. Wavelength tuning is also investigated.

H-17 13:45

INPUT WAVELENGTH DEPENDENCY OF ALL-OPTICAL XOR GATE USING SOA-MZI WAVELENGTH CONVERTER FOR ALL-OPTICAL NETWORK CODING

Tomonori Kono, Akihiro Maruta, Ken-ichi Kitayama, Graduate School of Engineering, Osaka University

We experimentally investigate the input wavelength dependency of all-optical XOR gate using SOA-MZI wavelength converter for all-optical network coding. More than 20 nm wavelength tunability has been demonstrated with less than 1.5 dB power penalty.

H-18 13:45

1070 nm PASSIVELY MODE-LOCKED YTTERBIUM-DOPED FIBER SOLITON LASER WITH SWNT/PMMA SATURABLE ABSORBER

Yuichiro Hori, Zuxing Zhang, Masataka Nakazawa, Research Institute of Electrical Communication, Tohoku University

We report an Yb-doped fiber soliton laser emitting a femtosecond pulse train at 1.07 μm using an SWNT-incorporated PMMA saturable absorber. Stable passive mode locking was obtained at a pump power of 179 mW, and a 543-fs, 15.1-MHz pulse train was generated.

H-19 13:45

LAYERED POLY(ALKYLFLUORENE) LIGHT EMITTING DIODES FOR OPTICAL SIGNAL TRANSMISSION

Toshinari Kojima (1), Hirotake Kajii (1), Yutaka Ohmori (1), (1) Graduate School of Engineering, Osaka University

Polymeric materials are one of promising materials for organic electronics devices fabricated by printing technology. Among polymeric materials, poly(9,9-dialkylfluorene) (PFO) is one of soluble conducting polymers for polymeric light-emitting diodes (PLEDs), which exhibits high fluorescence quantum yield, high electron and hole mobility and good thermal stability. Layered polymeric light emitting diodes were fabricated by solution process in order to enhance the emission characteristics, especially, emission intensity and emission efficiency.

H-20 13:45

VCSEL-BASED GAIN-SWITCHING SHORT OPTICAL PULSE SOURCE WITH TIME-JITTER SUPPRESSION BY SELF-SEEDING METHOD

Hayato Uematsu (1), Monir Hossen (1), Kazuki Hashiguchi (1), Koji Nonaka (2), Masanori Hanawa (1), (1) University of Yamanashi, (2) Kochi University of Technology

A gain-switching short optical pulse source using vertical-cavity surface-emitting laser (VCSEL) as a gain medium is experimentally investigated. Modulated driving current is supplied to the VCSEL and short optical pulse train is generated by gain-switching. Partial reflector connected with VCSEL is used to suppress timing fluctuation of pulse generation by feeding back a part of the lased pulses just before of the following pulse.

H-21 13:45

RELIABLE FULL BAND TUNABLE LASER MODULE REALIZED BY ADHESIVE BONDING TECHNOLOGY

Toshio Sugaya (1), Maiko Ariga (1), Toshio Kimura (1), Kazunori Akizuki (2), Yasuo Nakajima (2), Yoshihiro Arashitani (2), (1) Optical Device Dept, Fitel Photonics Laboratory, Furukawa Electric Co.,Ltd, (2) Electronic & Telecommunication Materials Dept, Fitel Photonics Laboratory, Furukawa Electric Co.,Ltd

We developed the highly reliable FBT (Full Band Tunable) DFB laser module by applying adhesive bonding technology to internal micro optical components, which enabled the flexible module design to realize higher optical output power with lower power consumption. The reliability necessary for telecommunication WDM(Wavelength Division Multiplexing) application has been tested and confirmed through detailed analysis on outgas from the cured adhesive as well as the reliability test on the assembled modules.

H-22 13:45

10 GHz, 1.1 ps PULSE GENERATION FROM A HARMONICALLY AND REGENERATIVELY MODE-LOCKED Yb FIBER LASER AT 1.1 μm

Kengo Koizumi, Masato Yoshida, Toshihiko Hirooka, Masataka Nakazawa, Research Institute of Electrical Communication, Tohoku University

We describe 10 GHz, 1.1 ps pulse generation at 1.1 μm directly from a harmonically and regeneratively mode-locked Yb fiber laser with timing jitter as low as 140 fs. Stable mode locking was achieved by optimizing the laser cavity as a soliton laser.

H-23 13:45

POWER-EFFICIENCY DEPENDENCE ON TRANSIENT RESPONSE SPEED OF OPTICAL TRANSCEIVER WITH HGW-DETERMINED ONU SLEEP PATTERN

Hiroko Nomura, Susumu Nishihara, Hirota Ujikawa, Masashi Tadokoro, Takeshi Sakamoto, Naoto Yoshimoto, NTT Access Network Service Systems Laboratories, NTT Corporation

We reduce the power consumption of the optical network unit (ONU) by using the home gateway to set the ONU's sleep pattern. We

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confirm the improvements possible with our proposal. Numerical simulations quantitatively reveal the relationship between the transient response speed of the optical transceiver (start-up and shut-down) and the power savings possible. It is also shown that one of the key points for 10-Gbit/s class transceivers is raising the response speed to achieve high power efficiency.

H-24 13:45

TRANSVERSE MODE CONTROL OF VCSELS USING HIGHLY ANGULAR DEPENDENT HIGH CONTRAST SUB-WAVELENGTH GRATING

Jyunichi Kashino, Akihiro Imamura, Fumio Koyama, Photonics Integration System Research Center, Precision and Intelligence Lab., Tokyo Institute of Technology

We propose the transverse mode control of VCSELS using high contrast sub-wavelength grating (HCG). We found that the angle-dependence of reflectivity of HCG can be controlled by optimizing grating parameters. The active region can be expanded by the highly angular dependent reflectivity.

H-25 13:45

SLOW LIGHT AMPLIFIER WITH HIGHLY ANGULAR DEPENDENT HCG MIRROR

Yasumitsu Miyake, Ayumi Fuchida, Fumio Koyama, Photonics Integration System Research Center, Precision and Intelligence Lab., Tokyo Institute of Technology

The modeling of slow light SOA with highly angular dependent high-contrast grating (HCG) mirror is presented. HCG is useful to realize slow light SOA with avoiding vertical resonance. We investigated HCG structure for slow light SOA using RCWA. The result shows a possibility of compact and low power consumption SOAs.

H-26 13:45

THEORETICAL ANALYSIS OF SEMICONDUCTOR DOUBLE MICRORING MACH-ZEHNDER MODULATOR

Hitoshi Yamada, Yuta Ueyama, Taro Arakawa, Yasuo Kokubun, Graduate School of Engineering, Yokohama National University

A semiconductor double microring Mach-Zehnder (DM-MZ) modulator is proposed. Its operation principle and DC modulation characteristics are theoretically discussed. The DM-MZ enables a push-pull operation and the driving voltage can be significantly reduced compared to a conventional MZ modulator due to the phase-shift enhancement effect in a microring resonator.

H-27 13:45

ACTIVELY MODE-LOCKED FIBER LASER USING A BISMUTH-BASED ERBIUM-DOPED FIBER AND A BISMUTH-BASED HIGHLY NONLINEAR FIBER

Naohiro Takahashi, Tomoyuki Tsuchida, Yutaka Fukuchi, Department of Electrical Engineering, Faculty of Engineering, Tokyo University of Science

We demonstrate stable bit-error-free operation of an actively mode-locked fiber laser using a 151-cm-long bismuth-based erbium-doped fiber and a 414-cm-long bismuth-based highly nonlinear fiber.

H-28 13:45

HARMONICALLY MODE-LOCKED FIBER RING LASER EMPLOYING A SHORT LENGTH BISMUTH-OXIDE-BASED NONLINEAR ERBIUM-DOPED FIBER

Yutaro Shimada, Hideaki Ikeda, Yutaka Fukuchi, Department of Electrical Engineering, Faculty of Engineering, Tokyo University of Science

We report a harmonically mode-locked short-cavity laser employing a 151-cm-long bismuth-oxide-based nonlinear erbium-doped fiber. A back-to-back bit-error-rate test shows stable bit-error-free mode-locking operation.

H-29 13:45

INTEGRATED 4-BIT ACTIVE-MMI HIGH-MESA BI-STABLE LASER DIODES COUPLED WITH HEMISPHERICAL LENS FIBRE ARRAY

Makoto Jizodo (1), Haisong Jiang (1), Kazuisao Tsuruda (1), Takuma Hagio (1), Yutaka Chaen (1), Shinji Matsuo (2), Kiichi Hamamoto (1), (1) I-Eggs, Kyushu University, (2) NTT Photonics Laboratories

Integrated 4-bit Active-MMI High-Mesa Bi-Stable Laser Diodes, which resulted in wide hysteresis of 20mA with single wavelength emission (non-grating), showed coupling efficiency of 24.5% with hemispherical lens fibre array for the first time.

H-30 13:45

HOLE-SIZE DEPENDENCE OF FIBER FUSE PROPAGATION IN HOLE-ASSISTED FIBER (HAF)

Kenji Kurokawa, Nobutomo Hanzawa, Kyozo Tsujikawa, Shigeru Tomita, NTT Access Network Service Systems Laboratories, NTT Corporation

We clarified the mechanism of fiber fuse termination in hole-assisted fiber (HAF) by observing its dynamics at a splice point between HAF and SMF. We examined fiber fuse propagation in HAF and confirmed that it depends strongly on the hole diameter.

H-31 13:45

ULTRA COMPACT O/E MODULE FOR OPTICAL INTERCONNECTION

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Masaki Ooyagi, Takayuki Shimazu, Tomoki Sekiguchi, Tomomi Sano, Optical Communications R&D Laboratories, Sumitomo Electric Industries, LTD.

We are going to propose an optoelectronic ferrule called the LFI (Lead Frame Inserted) ferrule for application to optical interconnection modules. In this time, we have developed the LFI-Stab ferrule that is improved to become ultra compactly. This ferrule can be achieved high optical coupling efficiency by the optical fiber insertion and flip chip bonding the optical device. We have evaluated the fabricated LFI-Stab ferrule by measurement optical characteristics. Consequently, the LFI-Stab ferrule is able to apply for optical interconnection.

H-32 13:45

LIGHT PROPAGATION WITHIN MICROSPHERES CONNECTED WITH MICRO-JOINTS

T. Onodera (1), T. Mitsui (2), T. Hayashi (1), Y. Wakayama (2), N. Ikeda (2), Y. Sugimoto (2), T. Takamasu (2), H. Oikawa (1), (1) Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, (2) National Institute for Materials Science

Light propagation was simulated through coupled-resonator optical waveguides (CROWs) of polystyrene microspheres connected with micro-joints. Through micro-joints, nanojet-induced mode (NIM) light propagation was enhanced even across a bending point. In addition, NIM light propagation was significantly dependent on the micro-joint diameter.

H-33 13:45

CONTROL OF MODE EVOLUTION IN THE MULTIMODE OPTICAL FIBER FOR RELIABLE EVALUATION OF THE MULTIMODE POLYMER OPTICAL WAVEGUIDE

Freddy Susanto Tan, Okihito Sugihara, Toshiyuki Kaino, Institute of Multidisciplinary Research for Advanced Materials, Tohoku University

A standard evaluation method for the multimode polymer optical waveguides is necessary to obtain reliable experimental results. There are several categories of evaluation techniques proposed by the International Electro-technical Commission (IEC). We have developed a simple input launch configuration to control mode evolution in the multimode optical fiber by means of the Encircled Flux (EF) category.

H-34 13:45

THREE-DIMENSIONAL BRANCH WAVEGUIDE FABRICATED BY MASK-TRANSFER SELF-WRITTEN METHOD

Nobuhiko Ishizawa, Kenichi Nakama, Osamu Mikami, Graduate School of Engineering, Tokai University

Novel three-dimensional (3D) branch waveguide fabricated by mask-transfer self-written (MTSW) method was proposed and the optical characteristics of the fabricated V-branch waveguide are demonstrated. By controlling the irradiating angle of UVlight through the mask aperture, it is possible to fabricate V-branch waveguide having a certain branch angle.

H-35 13:45

FABRICATION OF A BAND-PASS FILTER IN A LIGHT-INDUCED SELF-WRITTEN WAVEGUIDE

M. Tomiki (1), H. Watanabe (1), H. Sakata (1), T. Yamashita (2), A. Kawasaki (2), M. Kagami (2), (1) Shizuoka University, (2) Toyota Central R&D Labs., Inc.

Light-induced self-written waveguides for optical fiber connections are an attractive prospect, as the technology for highly efficient connections. In this report we fabricated a band-pass filter in the waveguide by irradiating it with a violet laser diode through a phase mask. The extinction ratio of fabricated filter is about 30dB.

H-36 13:45

INTEGRATION OF 45° MICROMIRROR IN SINGLE-MODE WAVEGUIDE

Junichi Inoue (1), Tomonori Ogura (1), Kenji Kintaka (2), Kenzo Nishio (1), Yasuhiro Awatsuji (1), Shogo Ura (1), (1) Kyoto Institute of Technology, (2) National Institute of Advanced Industrial Science and Technology

Micromirrors for high-density coupling between guided waves and free-space waves were integrated in dielectric-glass planar waveguides by using dry etching of trenches and tilt exposure for 45-degree tapers in the water. Input and output coupling efficiencies were experimentally estimated to be 75 % and 60 %, respectively.

H-37 13:45

FABRICATION OF SELF-WRITTEN POLYMERIC WAVEGUIDES USING NEAR-INFRARED LIGHT FROM SINGLE-MODE DEVICES

Tatsuya Yamashita, Akari Kawasaki, Osamu Watanabe, Manabu Kagami, Toyota Central R&D Labs., Inc

We show the feasibility of optical interconnection waveguides formed by self-trapping effect with 0.85 μm light irradiation into photopolymer. Self-written waveguides as extensions of both a single-mode fiber and a VCSEL chip were demonstrated.

H-38 13:45

OPTICAL RESPONSE OF PHOTODISSOCIATION-TYPE POLARIZATION HOLOGRAMS

Kazuo Kuroda, Institute of Industrial Science, University of Tokyo

Optical response of polarization holographic material is investigated theoretically base on a simple model that the material is composed of anisotropic rod molecules which are photodissociated into isotropic molecules. The change of dielectric tensor is derived by the exposure of optical field. Two extreme examples, random and fully-aligned orientation, are studied.

H-39 13:45

HOLOGRAPHIC MEMORY FORMED BY MULTI-CONTEXT RECORDING FOR OPTICALLY RECONFIGURABLE GATE ARRAY

Akifumi Ogiwara (1), Minoru Watanabe (2), Fuminori Kobayashi (3), (1) Department of Electronic Engineering, Kobe City College of Technology, (2) Faculty of Engineering, Department of Electrical and Electronic Engineering, Shizuoka University, (3) Department of Systems Design and Informatics, Kyushu Institute of Technology

A holographic polymer-dispersed liquid crystal (HPDLC) memory formed by volume gratings is fabricated to record multi-context information based on the various circuit contexts. The contexts are recorded at various separated regions in the HPDLC memory by connecting a rotating pinhole set on a glass cell filled with LC composites and a metal photo mask written by the multi-context patterns placed on the motorized X-stage under the control of a personal computer.

H-40 13:45

OPTICAL FIBER LOOP MEMORY BASED ON SEMICONDUCTOR OPTICAL AMPLIFIER USING ISOLATOR AND FILTER

Yuma Fujikawa (1), Hirokazu Tanimoto (1), Yoshinobu Maeda (1), (1) Graduate School of Science and Engineering Research, Kinki University

We have configured optical fiber loop memory based on semiconductor optical amplifier using an isolator and a tunable filter. Optical characteristics of the memory were examined by varying conditions of the fiber loop. The output signals can be memorized for 40 circulations or longer.

H-41 13:45

DESIGN AND OPTIMIZED OF THE AlGaInP-BASED TWO-DIMENSIONAL PHOTONIC CRYSTAL SURFACE EMITTING LASERS

Chih-Tsang Hung¹, Yu-Cheng Syu², Tzeng-Tsong Wu¹, Tien-Chang Lu¹, ¹ Department of Photonics and Institute of Electro-Optical Engineering, National Chiao-Tung University, ² Department of Display Institute, National Chiao-Tung University

In this article, we have discussed the influence of various thicknesses on different layers in AlGaInP-based Photonic Crystal Surface Emitting Lasers (PCSELS) by transfer matrix method to obtain the highest vertically optical confinement factor. Furthermore, we simulated the threshold gain of the optimized structure by coupled-wave theory. The important relation between the threshold gain and filling factor of photonic crystal has also been calculated.

H-42 Withdrawn

H-43 13:45

3D MODELING OF ACTIVE PIXEL SENSOR WITH MICROLENS

Y. G. Xiao, Z. M. Simon Li, K. Uehara, M. Lestrade, Z. Q. Li, Crosslight Software Inc

Three dimensional modeling of active pixel sensor with microlens is reported by using an advanced drift-diffusion simulator together with finite difference time domain method for optical effect in this work. The opto-electronic responses are presented versus various power intensity and illumination wavelength. The aperture size of the isolated metal layer is also discussed. Whereas microlens is shown to improve the sensitivity, the aperture size of the isolated metal layer should be optimized to avoid sensitivity loss.

H-44 13:45

A SIMPLE TECHNIQUE FOR STUDYING MIE SCATTERING BEHAVIOR OF NANOHYBRID POLYMER MATERIAL

Hendry I. Elim (1), Bin Cai (1), Okihito Sugihara (1), Toshikuni Kaino (1), Tadafumi Adschiri (1), Institute of Multidisciplinary Research for Advanced Materials, Tohoku University

Here we propose a simple technique for studying Mie scattering behavior of nanohybrid polymer material by incorporating bright-field imaging method and detecting photon counts of the images. Therefore, by examining the imaging of nanohybrid polymer and measuring its photon counts, we can demonstrate how big the different of photon counts due to Mie scattering of each images of nanohybrid polymer materials.

H-45 13:45

EXAMINATION OF IMAGE-STICKING-FREE FEASIBILITY IN MULTI-LEVEL/HIGH-SPEED SPATIAL LIGHT MODULATORS UTILIZING ANTI-FERROELECTRIC LIQUID CRYSTALS

Kayo OGAWA (1), Yasushi SUZUKI (2), (1) Faculty of Science, Japan Women's University, (2) LCA

Liquid crystal devices are electrically-controllable photonic devices and used in a wide range of ends such as filters, switches and spatial light modulators. So far, we developed smectic liquid crystal material as a liquid crystal device and realized multivalued amplitude/phase modulation and high-speed operation at 2kHz by proposing a high-speed driving scheme. However, because smectic material with spontaneous polarization is activated by a sequential writing system, it is affected by the polarity of applied voltage.

H-46 13:45

MULTI-CONTEXT OPTICALLY RECONFIGURABLE GATE ARRAY USING A POLYMER-DISPERSED LIQUID CRYSTAL HOLOGRAPHIC MEMORY

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Retsu Moriwaki(1), Minoru Watanabe(1), Akifumi Ogiwara(2), Fuminori Kobayashi(3), (1) Shizuoka University, (2) Kobe City College of Technology, (3) Kyushu Institute of Technology

Optically reconfigurable gate arrays (ORGAs) have been developed as a type of multi-context field programmable gate array. Although many configuration contexts can be stored on an ORGA device and although its gate array can be reconfigured dynamically in an extremely short time, many laser sources are necessary to address the configuration contexts. Therefore, up to now, a laser reduction method on ORGAs using a polymer-dispersed liquid crystal holographic memory has been proposed.

H-47 13:45

FULL LIQUID CRYSTAL SPATIAL LIGHT MODULATOR WRITER SYSTEM FOR A PROGRAMMABLE OPTICALLY RECONFIGURABLE GATE ARRAY

Shinya Kubota, Minoru Watanabe, Shizuoka University

This paper presents results of a demonstration of a full liquid crystal writer system used for a programmable optically reconfigurable gate array (PORGA) with a reflective silver-halide holographic memory. The recorded PORGA demonstrates the capability of 0.95–1.05 ms configuration context switching among four configuration contexts.

H-48 13:45

EFFECT OF DIELECTRIC SUBSTRATE ON THE OPTICAL PROPERTIES OF PLASMONIC WAVEGUIDE

Taeseob Kim, Won-Sup Lee, No-Cheol Park, Kyoung-Su Park, Young-Pil Park, Department of Mechanical Engineering, Yonsei University

We computationally investigated the optical properties of a thin metallic aperture, emphasizing the effects of the dielectric substrate on the plasmonic waveguide. We demonstrate that the red-shifted wavelength and the dielectric properties (i.e., effective relative permittivity and dielectric thickness) can compensate for the optical loss due to plasmon red shift.

H-49 13:45

LIGHT PULSE DELAY IN A MULTI-LAYERED PHOTONIC CRYSTAL

Rihei Endo, Riichiro Saito, Department of Physics, Tohoku University

The transient time of an optical pulse in multi-layered photonic crystal is discussed as a function of the length L of the crystal and the wave vector of the incident light. In a periodic photonic crystal, the transient time τ for the wave vector close to photonic band gap is proportional to L^3 while τ for the wave vector at the center of photonic band is proportional to L . In a nonperiodic Fibonacci lattice, τ becomes proportional to $L^{3.127}$ and $L^{1.287}$ for the wave vector close to photonic band gap and at the center of photonic band, respectively.

H-50 13:45

RESONANCE CHARACTERISTICS OF CYLINDRICAL CAVITIES UTILIZING CURVED RESONANT GRATINGS AS A MIRROR

Shohei IJIMA, Yasuo OHTERA, Hirohito YAMADA, Department of Electrical and Communication Engineering, Graduate School of Engineering, Tohoku University

Cylindrical resonant cavities with micro-structured cavity walls are proposed. The cavity was surrounded by a circular dielectric boundary with periodic rectangular corrugation. The corrugation is a kind of a curved resonant grating and functions as a highly reflective mirror for a diverging cylindrical wave inside the cavity. Basic characteristics of the resonant grating mirror and the cavity were investigated through numerical simulation.

H-51 13:45

LITHIUM NIOBATE MEMBRANE ON SILICON PLATFORM FOR WAVEGUIDE SENSOR

Eiki Mochizuki (1, 2), Yusuke Muranaka (1, 2), Sunao Kurimura (1), Kiyofumi Kikuchi (1, 2), Akihiro Terasaki (1, 2)**, Hirochika Nakajima (2), (1) National Institute for Materials Science (NIMS), (2) Waseda University, *Currently at NTT Photonics Laboratories, **Currently at Toyama Murata Manufacturing Co.*

Cladless nonlinear optical waveguide is fascinating for high-sensitivity light-fluid interaction. Membrane composed of 4 μ m-thick Mg:LN is fabricated by an etching process on a silicon platform. Novel fabrication process will be introduced for various sensing applications.

H-52 13:45

PLASMON ENHANCED PHOTOLUMINESCENCE OF CONJUGATED POLYMERS USING ALL-SOLUTION-PROCESS METHOD

Tsong-Shin Lim(1), Kang-Chuang Lee(2), (1) Department of Physics, Tunghai University, (2) Institute of Atomic and Molecular Sciences, Academia Sinica

We used the liquid-buffer method to overcome the dissolution problem of spacer layers by organic solvents and the Tollens reaction method to produce silver nanostructures. We obtained a 10-fold enhancement of photoluminescence of MEH-PPV film. The all-solution-process method provides an easier way to manufacture plasmon enhanced conjugated polymer devices.

H-53 13:45

MEASUREMENT OF SCATTERING COEFFICIENT IN PMMA WITH SiO₂ PARTICLES BY OPTICAL COHERENCE TOMOGRAPHY

Nov. 1(Tue.)

Kazuo Fujiwara (1, 2), Tatsuya Maruyama (2), Satoshi Nakamura (2), Kouichi Nitta (2), Osamu Matoba (2), (1) Research and Development Center, GLORY Ltd, (2) Dept. Systems Science, Grad. Sch. of System Informatics, Kobe University

An experimental evaluation of reduced scattering coefficient in a homogeneous scattering medium is presented. For deriving the reduced scattering coefficient, a scattering coefficient in a weak scattered region is measured by optical coherence tomography and an anisotropic parameter is derived from the measurement of output beam width. The experimental results showed that the proposed method gave the acceptable values by comparing the results from Mie theory.

H-54 13:45

SURFACE PLASMON ABSORPTION TOPOGRAPHY IN A MULTI-LAYER Ti/Ag THIN FILM BY AN OPTICAL BEAM SCANNING

Noriaki Saiga, Yoshihiro Okamoto, Haruka Matsumoto, Department of Electronic Control Engineering, Yonago National College of Technology

Surface plasmon polariton absorption was visualized over a large area of Ti/Ag thin film to observe the distribution of electron density. A converging light was incident on the surface at the angle of maximum absorption or some angles a little apart from it. The reflectance of the light showed up such an image as only the electron density distribution was in high contrast or the thickness variation of the film was enhanced. The calculation gave the qualitative verification of such imaging characteristics.

H-55 13:45

QUANTITATIVE ANALYSIS OF REFRACTIVE INDEX OF LIQUIDS USING COMBINED LASER CONFOCAL AND ATOMIC FORCE MICROSCOPE

Shin-ichiro Yanagiya (1), Hiroshi Katayama (2), Nobuo Goto (1), (1) Institute of Technology and Science, (2) Department of Optical Science and Technology, The University of Tokushima

We investigated the refractive index analysis theoretically and experimentally. The theoretical study indicates that the angle can be illuminated by the existence of a step whose height is measured by AFM. And steps of colloid crystal were successfully prepared as a reference for interference.

H-56 13:45

INVESTIGATION ON NUMERICAL SIMULATION OF VOLUME DIGITAL HOLOGRAPHIC MICROSCOPY

Tomoyoshi Shimobaba¹, Takahiro Sakurai¹, Takashi Nishitsuji¹, Atanas Gotchev², Vladislav Uzunov², Juho Jokelainen², Nobuyuki Masuda¹, Tomoyoshi Ito¹, ¹Chiba University, ²Tampere University of Technology

We investigate a volume digital holographic microscopy (VDHM) on numerical simulation, in terms of the calculation time for volume reconstruction and the amount of memory required during the calculation. The resolution power of volume reconstruction needs to be increased in order to obtain a large numerical aperture; hence we need to use a large hologram. However, this increases the calculation time and the amount of required memory.

H-57 13:45

REFLECTIVITY CHARACTERISTICS OF HIGH REFRACTIVE INDEX CONTRAST SUB-WAVELENGTH GRATING MIRROR WITHOUT LOW INDEX SPACER LAYER

Daisuke Nakagawa, Yusuke Mikoshiba, Tomoyuki Miyamoto, Photonic Integration System Research Center, P&I Lab., Tokyo Institute of Technology

High refractive index contrast sub-wavelength grating (HCG) without a low-index spacer layer between a grating layer and semiconductor was investigated. By the 2D-FDTD analysis of reflection spectrum of the proposed HCG, an interesting characteristic was found out that was input direction dependence of the reflectivity. When a plane wave input from air and semiconductor, the reflectivity spectra were different at specific wavelength range.

H-58 13:45

OPTICAL RING RESONATOR USING SIDE WALL GRATING WAVEGUIDE ARRAY

Hideaki Okayama (1,2), Hiroki Yaegashi (1), (1) Oki Electric Industry Co., Ltd., (2) RISE, Waseda University

We report a ring resonator using arrayed waveguides and side wall grating to couple the input/output light beam from the surface to the waveguide. The weak grating can be fabricated simultaneously with the waveguide structure. The grating and resonator principle was verified by finite difference time domain method.

H-59 13:45

DAMPING RATIO IN A GLASS-BASED GUIDED-WAVE OPTICAL MICROPHONE WITHOUT A DAMPING STRUCTURE

Kazuya Murata(1), Kazuaki Yoshida(1), Masashi Ohkawa(2), Takashi Sato(2), (1) Graduate School of Science and Technology, Niigata University, (2) Faculty of Engineering, Niigata University

In a guided-wave optical microphone with a diaphragm as the vibration plate, damping diaphragm vibration is very significant. In this study, a glass-based guided-wave optical microphone without a damping structure was experimentally examined to evaluate the damping ratio as the first phase in the optimization of damping. The damping ratio and resonance frequency were evaluated to be 0.009 and 3.5kHz, respectively, for a fabricated microphone with a diaphragm of 20 mm × 20 mm × 0.15 mm.

H-60 13:45

PROPOSAL OF NOVEL STRIP HIGH-MESA WAVEGUIDE FOR INFRARED ABSORPTION SENSING

Nov. 1(Tue.)

Daisuke Nakashima, Kiichi Hamamoto, I-EggS, Kyushu Univ.

Here we propose novel waveguide of strip high-mesa waveguide for infrared absorption sensing for the first time. The higher optical portion out of the waveguide (we define this portion as "Gair") is the key feature for the infrared absorption, and the novel waveguide realize extremely high Gair of 76% at the wavelength $\lambda=1550\text{nm}$ theoretically.

H-61 13:45

POLARIZATION SELECTIVE TERAHERTZ WAVE GENERATION FROM GAP WAVEGUIDES VIA COLLINEARLY PHASE-MATCHED DIFFERENCE FREQUENCY MIXING

Kyosuke Saito (1), Tadao Tanabe (2), Yutaka Oyama (1), (1) Department of Material Science ,Graduate School of Engineering, Tohoku University, (2) Institute of Multidisciplinary Research for Advanced Materials, Tohoku University

Terahertz (THz) radiation from GaP waveguides via collinearly phase-matched difference frequency mixing (DFM) of two near-infrared (NIR) laser lights was demonstrated. We obtained TE- and TM-mode THz radiation from the waveguide selectively by adjusting each polarization of NIR lasers. We have confirmed elliptically polarized THz radiation from GaP waveguides.

H-62 13:45

ARRAY OF VERTICAL CAVITY MICROLASER USING DYE-DOPED PHOTOPOLYMER

K. Yamashita (1), H. Yanagi (2), K. Oe (3), (1) Department of Electronics, Graduated School of Science and Technology, Kyoto Institute of Technology, (2) Graduate School of Materials Science, Nara Institute of Science and Technology, (3) Department of Electronics, Graduated School of Science and Technology, Kyoto Institute of Technology

A plastic-based microlaser array was fabricated by a lithographic technique using an organic dye-doped photopolymer. Each laser element in this device array has an optical cavity along the vertical direction. Under optical pumping, very fine emission spectra showing a Fabry-Pérot type lasing were observed. The microlasers with desired operation wavebands could be conveniently integrated by using this technique.

H-63 13:45

MONITORING-CAMERA NETWORK BASED ON FIBER OPTIC POWER SUPPLY

Naoto Tsuchida, Yosuke Tanaka, Takashi Kurokawa, Graduate School of Engineering, Tokyo University of Agriculture and Technology

We proposed a monitoring-camera network consisting of camera nodes driven by laser power. An experimentally developed camera node produced 240 Mbps optical signal of image information by modulating a part of the light sent through an optical fiber. The optical power for driving the node was only 20 mW.

H-64 13:45

EXPERIMENTAL VERIFICATION OF PHOTON COUNTING FOURIER TRANSFORM

Kouichi Nitta, Kenichiro Sakiori, Osamu Matoba, Department of Systems Science, Graduate of System Informatics, Kobe University

Photon counting Fourier transform is experimentally verified. In the verification, a single photon counter is utilized. From the experimental results, it is shown that the proposed Fourier transform is effective for spatially parallel processing with single photon. These results show that spatially optical parallel processing can be applied to quantum processing.

H-65 13:45

IDENTIFICATION OF TUMOR CELL IMAGES BY USING AN OPTICAL CORRELATOR

K. Moriyama¹, H. Kuboyama¹, S. Arai¹, M. Fukuda¹, M. Kato², T. Kawaguchi², S. Yamamoto³, M. Inoue¹, ¹Department of Electrical and Electric Information Engineering, Toyohashi University of Technology, ²PaPaLaB Ltd., ³Hamamatsu University School of Medicine

A technique for identifying tumor cell images was developed that uses a joint transform correlator (JTC). Cell images taken with a digital camera are converted into luminance-intensity histograms and x-y chromaticity diagrams in the correlator system. These two-dimensional patterns are displayed on a spatial light modulator and retrieved on the JTC system. The patterns extracted from normal cell images were very different from those extracted from tumor cell images, and the two cases could be clearly distinguished on the correlator.

H-66 13:45

JOINT TRANSFORM CORRELATOR USING FRINGE ADJUSTMENT TECHNIQUE

H. Kuboyama, K. Moriyama, S. Arai, M. Fukuda, Department of Electrical and Electronic Information Engineering, Toyohashi University of Technology

This paper proposes a new technique for enhancing the performance of a joint transform correlator. A joint power spectrum corresponding to the input joint images was recorded as an optical intensity distribution using a correlator, and this recording technique was theoretically and experimentally evaluated for retrieval precision. The key method for increasing the precision is to prevent any power saturation on the CMOS sensor.

H-67 13:45

AN APPROACH OF HIGH REFRACTIVE INDEX AND HIGHLY TRANSPARENT POLYMER NANOCOMPOSITE FABRICATION

Bin Cai (1), Okihito Sugihara (1), Hendry I. Elim (1), Tadafumi Adschiri(2), Toshikuni Kaino (1), (1) Institute of Multidisciplinary

Nov. 1(Tue.)

Research for Advanced Materials, Tohoku Univ., (2) WPI Advanced Institute for Materials Research, Tohoku Univ.

In order to prepare a high refractive index as well as a highly transparent polymer nanohybrid composite, a high refractive index per-naphthalene polymer was designed and synthesized successfully. We developed an effective and versatile wet-annealing process for further increasing the RI of the nanohybrid composites. By the indispensable steps, we achieved the highest RI of $n(594\text{ nm}) \approx 2$ and highly transparent (transmittance $\approx 93\%$ at 460nm) polymer nanohybrid composite.

H-68 13:45

ZERO-BIREFRINGENCE PRESSURE SENSITIVE ADHESIVES FOR PREVENTING THE LIGHT LEAKAGE OF LCDS

Hiroto Ito (1), Satoshi Yanai (1), Sumihisa Oda (2), Akihiro Tagaya (1), Yasuhiro Koike (1), (1) Keio Photonics Research Institute, Keio University, (2) Saiten Chemical Industry Co., Ltd.

To reduce the light leakage of liquid crystal displays (LCDs), pressure sensitive adhesives (PSAs) that exhibit no birefringence at any orientation were fabricated by the novel evaluation method of the birefringence of PSAs. This PSA successfully prevented the light leakage through the crossed polarizers after the accelerated aging test.

H-69 13:45

COMPACT RED-GREEN-BLUE MULTIPLEXER WITH A WAVEGUIDE STRUCTURE

Ryuji Morimoto, Yoshiaki Kakinoki, Yuya Kato, Toshio Katsuyama, Graduate School of Engineering, University of Fukui

We proposed the red-green-blue multiplexer with optical waveguides to achieve a miniaturization of the next generation small-sized projection-type displays. The designed multiplexer has three directional couplers. The average efficiency for each RGB output light is as high as 96%, and the size is as small as 0.06x6 mm.

H-70 13:45

GRADIENT REFRACTIVE INDEX LAYER FOR IMPROVING THE OPTICAL EXTRACTION EFFICIENCY OF LED PACKAGE WITH QUANTUM DOT PHOSPHOR

Min-Ho Shin, Hyun-Guk Hong, Young-Joo Kim, School of Mechanical Engineering, Yonsei University

The layer structure of gradient refractive index was proposed to improve the extraction efficiency of white LEDs based on quantum dot phosphor. Ray-tracing simulation shows that the extraction efficiency increases by 7~14% with new layer structure of refractive index difference of 0.15 compared to the remote phosphor structure.

H-71 13:45

A COMPACT WAVELENGTH DIVISION MULTIPLEXER BASED ON PHOTONIC CRYSTALS

Zhen Hu1, Ya Yan Lu2, 1Department of Mathematics, Hohai University, 2Department of Mathematics, City University of Hong Kong

We present an extremely compact three-frequency wavelength division multiplexer in a square-lattice photonic crystal. The structure is obtained by optimizing the radii of rods in the crossing region of two perpendicular photonic crystal waveguides. The optimization is performed with the recently developed Dirichlet-to-Neumann (DtN) map method.

H-72 13:45

MULTIPLE SCATTERING BY CIRCULAR CYLINDERS ON A SQUARE LATTICE

Shichang She, Ya Yan Lu, Department of Mathematics, City University of Hong Kong

A simple model for two-dimensional photonic crystal devices is a finite set of circular cylinders centered on a square or triangular lattice and surrounded by a homogeneous medium. The Dirichlet-to-Neumann (DtN) map method (Yuan and Lu, Communications in Computational Physics 9, 113-128, 2011) is an efficient numerical method for scattering problems associated of such structures.

H-73 13:45

A STUDY ON THE IMPROVEMENT OF MOLD LIFE-TIME IN UV NANOIMPRINT

Satoru Ozawa, Yuusuke Nakai, Tetsuya Jigami, Shigeo Wakabayashi, Tadayuki Fujiwara, Mitsubishi Rayon Co.,Ltd

Long mold-life time is great important for roll-to-roll process in UV nanoimprint. We investigated the cause of the decay of the releasing performance by various surface characterization methods. We optimized the coating condition of the releasing agent, and we have achieved the elongation of the mold life-time.

H-74 13:45

OPTICALLY INDUCED ROTATION OF MICRO-WHEEL GEARS FABRICATED FROM PHOTOPOLYMERIZABLE LIQUID CRYSTAL

Kiminori ITO, Hiroshi FRUSAWA, Masahiro KIMURA, Kochi University of Technology

Liquid crystal (LC) molecules that carry photopolymerizable end groups absorb photon energy via a two-photon process and can thus be photofabricated. Some of the present authors reported that circularly polarized laser beams induced rotational motions of the photopolymerized LC micro-objects that had cylindrical shapes (K. Ito and M. Kimura, Jpn. J. App. Phys. 49 (2010) 040208). Here we first investigated the fabrication accuracy of the present LC molecules, and fabricated micro-wheel gears with different sizes.

H-75 13:45

FORMATION OF TEMPERATURE DEPENDENT HOLOGRAPHIC POLYMER-DISPERSED LIQUID CRYSTAL GRATING

Nov. 1(Tue.)

USING SPATIAL LIGHT MODULATOR

Akifumi Ogiwara, Department of Electronic Engineering, Kobe City College of Technology

A holographic polymer dispersed liquid crystal (HPDLC) based microperiodic structure is fabricated by a photo-induced phase separation technique using LC composites with different physical properties, such as refractive indices and clearing points. The holographic image is recorded in the HPDLC grating by a spatial light modulator (SLM).

H-76 13:45

PRECISE MEASUREMENT OF SPECTRAL PEAK BY OPTICAL FREQUENCY SHIFT

Yo Washizaki(1), Ken Kashiwagi(1), Jun Nishikawa(2), Hiroshi Suto(2), Motohide Tamura(2), Takashi Kurokawa(1), (1)Graduate School of Engineering, Tokyo University of Agriculture and Technology, (2)National Astronomical Observatory of Japan

We need to detect the periodic Doppler shift with very high accuracy to discover Earth-like extrasolar planets. We propose an accurate spectral peak measurement using an optical frequency shifter, and achieved accuracy as high as 1/100 of spectrometer resolution.

H-77 13:45

ANISOTROPIC NONLINEAR PHOTOLUMINESCENCE IN A GaAs QUANTUM-WELL WAVEGUIDE

T. Nakahora, A. Nizamuddin, Y. Kuwamura, Y. Nagao, N. Katsuki, T. Hotani, T. Katsuyama, Graduate School of Engineering, University of Fukui

The polarization dependence of the nonlinear photoluminescence in a GaAs quantum-well wavelength was studied. Although the saturation onset light intensity is the same for different polarizations, the peak shift and half width of the luminescence are influenced by the output polarizations. These results indicate the importance of the light-hole-related transition.

H-78 13:45

DEGRADATION OF SPECTRAL LINEWIDTH AND SIGNAL-TO-NOISE RATIO IN SUPERCONTINUUM GENERATION PROCESS

Sadahiro Inoue, Yosuke Mizuno, Ken Kashiwagi, Takashi Kurokawa, Graduate School of Engineering, Tokyo University of Agriculture and Technology

We investigated degradation of the spectral linewidth of each frequency component and the SNR in supercontinuum generation process. The spectral linewidth measured by a self-delayed heterodyne method was enlarged along with a separation from the center frequency of the SC, and the SNR was reduced as the pulse peak power was increased.

H-79 13:45

FABRICATION OF Si WIRE WAVEGUIDES COMPOSED OF AMORPHOUS Si

Y. Kitamura (1), T. Yamaguchi (1), K. Saiki (1), K. Hiidome (1), K. Kirimura (1), T. Katsuyama (1), M. Tokuda (2), H. Takagi (2), M. Morita (2), Y. Ito (2), K. Tsutsui (2), Y. Wada (2), (1) Graduate School of Engineering, University of Fukui, (2)Bio-nano Electronics Research Center, Toyo University

We have successfully fabricated high-quality Si wire waveguides composed of amorphous Si. The surface bend of the waveguide was fairly reduced by annealing. The loss is 11.7 dB/mm before annealing and the loss is changed to 6.4 dB/mm after annealing, which indicates the importance of the waveguide-surface- imperfection loss.

H-80 13:45

IMPROVEMENT OF MODULATION PATTERNS IN A METHOD FOR PARALLEL MODULO EXPONENTIATION WITH OPTICAL AMPLITUDE MODULATION

T.Kamigiku, K.Nitta, O.Matoba, Department of System Science, Graduate of System Informatics, Kobe University

An optical method to improve the system for modulo exponentiation is proposed. In this method, modulation patterns are modified in comparison with that of our original system. The proposed method is numerically analyzed and effectiveness of the method is verified.

PD Section

PD-4 13:45

PEAK POWER EVALUATION OF PICO SECOND OPTICAL PULSE USING TWO-PHOTON ABSORPTION

Isao Morohashi(1), Takahide Sakamoto(1), Iwao Hosako(1) Tetsuya Kawanishi, (1)Yasuaki Tamura(2), Masahiro Oikawa(2), Shusei Aoki(2), (1) National Institute of Information and Communications Technology, (2) Optohub Co., Ltd

It is necessary to evaluate peak power of the Pico-second and femto-second optical pulse to make the pulse in ideal. This paper demonstrates peak power evaluation system using two-photon absorption detector. InGaAs/GaAs based detector which has band gap of 980nm is used for two photon detector. We have observed peak power of the pulse becomes maximum value when the chirping is compensated in optimum. The pulse is generated by LN Mach-Zehnder modulator (MZM).

PD-5 13:45

DESIGN OF WIDE-ANGLE PHOTONIC CRYSTAL WAVEPLATES

Ryuichi Katayama, Department of Information Electronics, Faculty of Engineering, Fukuoka Institute of Technology

Nov. 1(Tue.)

Incident angle dependence of retardation of waveplates using photonic crystals was numerically simulated. The simulation revealed that which photonic band the angular frequency of the incident light belongs to determines the incident angle dependence. Based on this fact, waveplates whose retardation shows low dependence on the incident angle were designed.

PD-6 13:45

NEGATIVE EFFECT OF CRYSTALLIZATION ON THE MECHANISM OF LASER DAMAGE IN HfO₂/SiO₂ MULTILAYER

Ryo TATENO(1), Hajime OKADA(2), Atsushi KOSUGE(2), Kunihiro KASHIWAGI(3), (1) Shimadzu Corporation, (2) Kansai Photon Science Institute, (3) Department of Electrical & Communication Engineering, Faculty of Engineering, Toyo University

Elucidation for the mechanism of laser damage is indispensable to realize a high resistance mirror for the ultra-short pulse high intense lasers of the next generation. In this study, the surface and a section of a laser-damaged area of a laser mirror were observed with a laser microscope and a transmission electron microscope (cross-sectional TEM), respectively. A grain boundary of HfO₂ microcrystal was observed in the damaged area. This observation, and an evaluation of the mirror's damage resistance showed that the formation of crystals in the multilayer mirror is one of the major determinants of damage resistance.

Break 16:30-17:00

Micro Concert Nov. 1(Tue.) 17:00-18:00

Hagi Conference Hall

Conference Party Nov. 1(Tue.) 18:00-20:30

Sakura Hall 2

Nov. 2 (Wed.)

J. Green Photonics Nov. 2(Wed.) 9:00-10:30

Tachibana Conference Hall

Chairs: E. H. Cho, Samsung

A. Arimoto, PrimeOptics Co., Ltd.

J-1 9:00 Invited

NANO-STRUCTURED MATERIALS AND DEVICES FOR GREEN PHOTONICS

Ching-Fuh Lin, IEEE Fellow, Graduate Institute of Photonics and Optoelectronics, National Taiwan University

In this work, we present the fabrication of silicon nanowires and its application on inorganic/organic hybrid solar cells. The n-type SiNWs combine with conducting polymer, PEDOT:PSS. The interface of the SiNW and PEDOT:PSS forms heterojunction for separation of photo-generated carriers. Strong light trapping effect in the SiNWs significantly suppresses optical reflection. The n-SiNW/PEDOT:PSS solar cells have a current density (J_{sc}) of 24.24 mA/cm² and an open circuit voltage (V_{oc}) of 0.532 V, leading to a power conversion efficiency of 8.40%.

J-2 9:30

DOUBLE-BRANCHED 1×29 SILICA-BASED PLC SWITCH WITH LOW LOSS AND LOW POWER CONSUMPTION

Toshio Watanabe, Yasuaki Hashizume, Hiroshi Takahashi, NTT Photonics Laboratories, NTT Corporation

We propose a novel double-branched circuit configuration for a 1×N optical switch. This compact configuration offers a high port count without greatly increasing power consumption. The fabricated 4-arrayed 1×29 silica-based PLC switch exhibits an insertion loss as low as 2.6 dB.

J-3 9:45

DEMONSTRATION OF AN ALL-OPTICAL T-TYPE FLIP-FLOP USING COUNTER-FACED SOA-MZIS

Satoshi Shimizu, Hiroyuki Uenohara, Photonics Integration System Research Center, Precision & Intelligence Lab., Tokyo Institute of Technology

We experimentally realized an all-optical T-type Flip-Flop using counter-faced SOA-MZIs that can be available for DPSK encoder for the first time. The possibility of achieving stable T-FF operation conditions with asymmetric MZIs is confirmed.

J-4 10:00

STRETCH-PULSE MODE-LOCKING EMPLOYING A CARBON NANOTUBE SATURABLE ABSORBER

Amos Martinez, Shinji Yamashita, Department of Electrical Engineering and Information Systems, University of Tokyo

Stretch pulse mode-locking offers several advantages over the standard soliton-like mode-locking regime. Here, we demonstrate stretch pulse mode-locking in a ring cavity fiber laser using a carbon nanotube saturable absorber.

J-5 10:15

FLEXIBLE OPTICAL LABEL GENERATION AND PROCESSING BY LiNbO₃ MODULATORS AND A SPECTRUM CONTROLLER

Mitsuko Mieno(1), Hiroki Watanabe(1), Satoshi Shinada(2), Naoya Wada(2), Hirochika Nakajima(1), (1) Waseda University, (2) National Institute of Information and Communications Technology

We proposed optical label generation and processing based on LiNbO₃ (LN) modulators and variable bandwidth spectrum shaper (VBS), respectively. This method is capable of flexible optical encoding and decoding (en/decoding) and high precision control in spectrum domain. We confirmed correct discrimination between matched and unmatched code by threshold processing in simulation and experiment using 8 chip, 20 Gchip/s binary phase shift keying (BPSK) codes.

Break 10:30-10:45

K. Fiber Based Devices Nov. 2(Wed.) 10:45-12:15

Tachibana Conference Hall

Chairs: A. Cobo, Univ. Cantabria

Y. Koike, Keio Univ.

K-1 10:45 Invited

ALL-POLYMER PHOTONIC BANDGAP BRAGG FIBERS FOR BIO-CHEMICAL SENSORS AND SPECTROMETERS

Hang Qu, Maksim Skorobogatiy, Genie physique, Ecole Polytechnique de Montreal

Nov. 2 (Wed.)

In this talk, we demonstrate bio-chemical fiber-optic sensors and fiber bundle spectrometers based on the hollow- and solid- core all-polymer Bragg fibers fabricated in our group. The hollow-core Bragg fiber sensor operates on a resonant sensing mechanism in which variations in refractive indices of liquid analytes filling the fiber core can be detected by interrogating the resonant wavelength shift in fiber transmission. Experimental sensitivity of the sensor is found to be ~1400nm/RIU which is comparable to that of a SPR sensor. The Bragg fiber bundle spectrometer fabricated with solid-core Bragg fibers can be used to replace traditional spectrometers based on movable gratings, leading to significant cost-saving and increased acquisition speed. As an example of the application of the Bragg fiber bundle spectrometer, we integrate it into the hollow-core Bragg fiber sensing system for spectral acquisition.

K-2 11:15

DISPERSION DEPENDENCE OF LINEWIDTH IN ACTIVELY MODE-LOCKED RING LASERS

Akira Takada, Makoto Fujino, Shigenori Nagano, Corporate R & D Center, General Engineering and Development Division, Topcon Corporation

We numerically and experimentally study the effect of cavity dispersion in actively mode-locked ring lasers. The wavelength-swept laser with quite narrow linewidth is achieved by the combination of anomalous dispersion in a linearly chirped fiber Bragg grating and self-phase modulation-induced spectral broadening in semiconductor optical amplifier. By using this technique, a wavelength sweeping with rate of 120 kHz and range of 40 nm have been successfully demonstrated.

K-3 11:30

GAIN EQUALIZER DESIGN METHOD FOR CASCADED S-BAND THULIUM DOPED FIBER AMPLIFIER

Shinichi Aozasa(1), Hiroji Masuda (2), (1) NTT Photonics Laboratories, NTT Corporation, (2) Shimane University

We propose a new method for designing a gain equalizer for a cascaded S-band thulium doped fiber amplifier (TDFA). The precisely designed gain equalizer provided high performance with a gain excursion of less than 0.6 dB in the 1482-1508 nm wavelength region.

K-4 11:45

COMPACT, LOW-DISPERSION COUPLING BETWEEN SILICAGRIN LENSED FIBER AND NONLINEAR OPTICAL WAVEGUIDE

Taro Suzuki (1), Tohru Kitagawa (1), Toshiaki Fukuda (1), Naofumi Maruyama (1), Naoki Misu (1), Sunao Kurimura (2, 3), Kiyofumi Kikuchi (2, 3), Hirochika Nakajima (3), (1) TOYO GLASS Co.,Ltd, (2) National Institute for Materials Science (NIMS), (3) Waseda University

We report compact graded refractive index lens which can be fusion-spliced to optical fibers by using sol-gel method. We developed optical fiber condenser which can make beam-waist diameter smaller than mode field diameter of single-mode fiber, and the condenser has low chromatic dispersion, difference of focal distance is only 6.5 microns between 785nm and 1550nm. We also manufactured a wavelength conversion module and SHG normalized conversion efficiency was 478%/W.

K-5 12:00

DENSE HETEROGENEOUS UNCOUPLED MULTI-CORE FIBER USING 9 TYPES OF CORES WITH DOUBLE CLADDING STRUCTURE

Yasuo Kokubun (1), Tatsuhiko Watanabe (2), (1) Yokohama National University, Graduate School of Eng, (2) Yokohama National University, Faculty of Eng., Dept. of Electrical and Computer Engineering

A novel high-density arrangement of heterogeneous multi-core fibers using nine different types of cores with double cladding structure was developed, increasing packing density by threefold and decreasing cross-talk between cores. A reference design that example use low index contrast is shown and is compared with a conventional design.

Lunch Break 12:15-13:30

L. O/E Applications Nov. 2(Wed.) 13:30-15:30

Tachibana Conference Hall

Chairs: H. F. Liu, Intel Corp.

H. Sasaki, Oki Electric Industry Co., Ltd.

L-1 13:30 Invited

INTEGRATED LASERS FOR BIOPHOTONIC LAB-ON-A-CHIP SYSTEMS IN POLYMER

Timo Mappes (1), Christoph Vannahme (1, 2, 3), Tobias Großmann (4), Sönke Klinkhammer (1, 3), Mario Hauser (4), Torsten Beck (4), Tobias Wienhold (1), Mads Brækner Christiansen (2), Anders Kristensen (2), Heinz Kalt (4), Uli Lemmer (3), (1) Institute of Microstructure Technology, Karlsruhe Institute of Technology (KIT), (2) DTU Nanotech, Technical University of Denmark (DTU), (3) Light Technology Institute, Karlsruhe Institute of Technology (KIT), (4) Institute of Applied Physics, Karlsruhe Institute of Technology (KIT)

Lab-on-a-Chip (LoC) systems enable biomedical or chemical testing for point-of-care analysis at the patient's bedside or in the field. Our work is focused on developing optical LoCs based on polymers by integrating microfluidic channels, optical waveguides, and miniaturized lasers on different platforms. The chips introduced in our work are using optical and fluidic interconnects only. While some of our photonic structures require features with lateral dimensions in the range of 100 nm, the microfluidic channels are more than one order of magnitude above this regime. In order to allow for mass production, the processes for multiscale replication of the chips are

Nov. 2 (Wed.)

optimized for a minimal number of parallel production steps.

L-2 14:00

LOW THERMAL RESISTANCE 780nm GaInPAs/GaInP 40CH VCSEL ARRAY FOR LASER PRINTERS

Kazuhiro Harasaka, Hiroshi Motomura, Kei Hara, Akihiro Ito, Naoto Jikutani, Shunichi Sato, RICOH Co., LTD. Tohoku R&D Center

We have developed a 780nm 40ch VCSEL array for laser printers. Low thermal resistance has been achieved by improving the layer construction, with the result that laser power changing due to self-heating and thermal interference in the array have been stabilized. Moreover, single-mode high power and stable polarization have been achieved by GaInPAs strained quantum wells grown on 15° off GaAs substrate and anisotropically-shaped transverse mode filter on the output surface.

L-3 14:15

ENHANCEMENT OF SOLAR CELL EFFICIENCY USING SPECTRAL CONVERTER OF QUANTUM DOTS AND LIGHT TRAPPING STRUCTURE

Hyun-Guk Hong (1), Tae-Young Kim (2), Young-Joo Kim (1), (1) Department of Mechanical Engineering, Yonsei University, (2) Corporate R&D Institute, Samsung Electro-Mechanics

Both layers of the spectral converter with quantum dots and the light trapping structure with microlens and micro-hole arrays were prepared and evaluated experimentally to improve the efficiency of single crystal Si solar cell, resulting in the enhancement of short circuit current by more than 9.64%.

L-4 14:30

ELECTRO-OPTIC BRAGG DEFLECTION MODULATOR USING PERIODICALLY POLED MgO:LiNbO₃

Toshiyuki Inoue (1), Toshiaki Suhara (1), Masahide Okazaki (2), (1) Graduate School of Engineering, Osaka University, (2) Dainippon Screen MFG.

We propose and demonstrate an electro-optic Bragg deflection modulator using periodically poled MgO:LiNbO₃ for the first time. It was found that annealing the device after the poling process was effective for reducing the relaxation. The maximum deflection efficiency as high as 97% was obtained for the violet-blue light. Also, the modulation of the UV light was accomplished.

L-5 14:45

ELECTRO-OPTIC BRAGG DEFLECTION MODULATOR FOR UV LASER LIGHT USING PERIODICALLY POLED MgO:s-LiTaO₃

Masahide Okazaki (1), Takao Chichibu (1), Syuhei Yoshimoto (1), Toshiyuki Inoue (2), Toshiaki Suhara (2), (1) Dainippon Screen Mfg. Co., Ltd., (2) Graduate School of Engineering, Osaka University

We propose and demonstrate an electro-optic Bragg deflection spatial light modulator using a periodically poled MgO:s-LiTaO₃ thin crystal for UV laser light. Good performances which include a diffraction efficiency as high as 97.8% and a high extinction ratio were accomplished at 355nm wavelength. In addition, we demonstrate the spatial light modulation.

L-6 15:00 Invited

GROWTH AND CONFINEMENT EFFECTS IN III-V SEMICONDUCTOR NANOSTRUCTURES

G. Jolley, Lan Fu, H. H. Tan, C. Jagadish, Department of Electronic Materials Engineering, Research School of Physics and Engineering, The Australian National University,

Semiconductor nanostructures have the potential to enhance the performance of numerous opto-electronic devices. Experimental results of quantum dot infrared photodetectors and quantum dot solar cells are presented and the effects of the carrier confinement on the device performance are discussed. Due to the limitation of current quantum dot growth techniques it is concluded that a level of control over the thermal interactions with electrons in nanostructures that would allow these devices to reach their full theoretical potential has not yet been achieved.

Break 15:30-15:45

PD. Post Deadline Papers Nov. 2(Wed.) 15:45-16:15

Tachibana Conference Hall

Chairs: C.-F. Lin, National Taiwan Univ.

S. Ozawa, Furukawa Electric Co., Ltd.

PD-1 15:45

SYMBOL-RATE-VARIABLE DQPSK RECEIVER FABRICATED USING CMOS-COMPATIBLE PROCESS

Keijiro Suzuki (1), Hong C. Nguyen (1,2), Takemasa Tamanuki (1), Fumihiro Shinobu (1,2), Yuji Saito (1,2), Yuya Sakai (1,2), Toshihiko Baba (1,2), (1) Department of Electrical and Computer Engineering, Yokohama National University, (2) Core Research for Evolutional Science and Technology, Japan Science and Technology Agency

We demonstrate a silicon DQPSK receiver, that is symbol-rate variable, fabricated by using CMOS compatible process. It consists of Si-wire waveguides, splitters/couplers, heater-controlled Mach-Zehnder attenuators, phase shifters, 90° hybrid including low-loss

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crossing and balanced Ge photodetectors. In addition, micro-ring-based slow-light device is introduced to demodulate various bit-rate signals. The demodulation was observed at bit-rates of 14.8 – 18.0 Gb/s.

PD-2 15:55

40 Gb/s WAVELENGTH DIVISION DEMULTIPLEXING WITH A PhC FILTER

S. Combr , G. Lehoucq, S. Xavier, A. De Rossi (1), K. Lengle, L. Bramerie, M. Gay, J.C. Simon (2, 3), G. Bellanca, S. Malaguti, S. Trillo (4), (1) Thales Research and Technology, (2) Universit  europ enne de Bretagne, (3) CNRS Foton (UMR 6082), (4) University of Ferrara

We have designed and fabricated a photonic crystal filter intended for demultiplexing in wavelength division domain. This device is single-mode, the total insertion losses are about 12dB and the channel isolation can exceed 25dB. Non return to zero signal at 40Gb/s have been successfully filtered with no penalty in the bit error rate analysis. The device is cascable to form a multichannel demultiplexer and can be tuned through an integrated, low power temperature controller.

PD-3 16:05

IMPROVING LIGHT OUTPUT OF BLUE LIGHT-EMITTING DIODES BY PHOTONIC CRYSTAL OF EPITAXIALLY-GROWN ZINC OXIDE

Kenji Orita, Takahiro Hamada, Akihiro Itou, Nobuaki Nagao, Ayumu Tsujimura, Advanced Technology Research Laboratories, Panasonic Corporation

To improve light output in blue light-emitting diode, photonic crystal (PhC) is fabricated by a wet epitaxial growth of zinc oxide (ZnO) rods. The fabricated PhC enhances light output by 1.4 times as designed, indicating that the wet-grown ZnO exhibits the excellent optical and structural quality for PhC.

Award & Closing Nov. 2(Wed.) 16:15-16:45

Tachibana Conference Hall

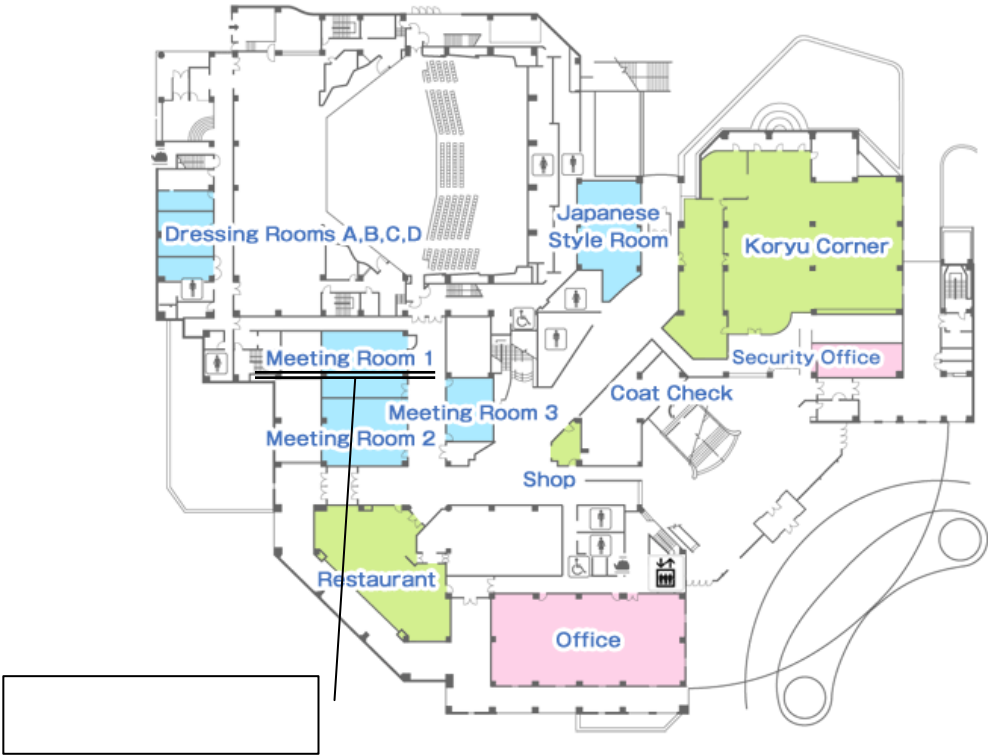
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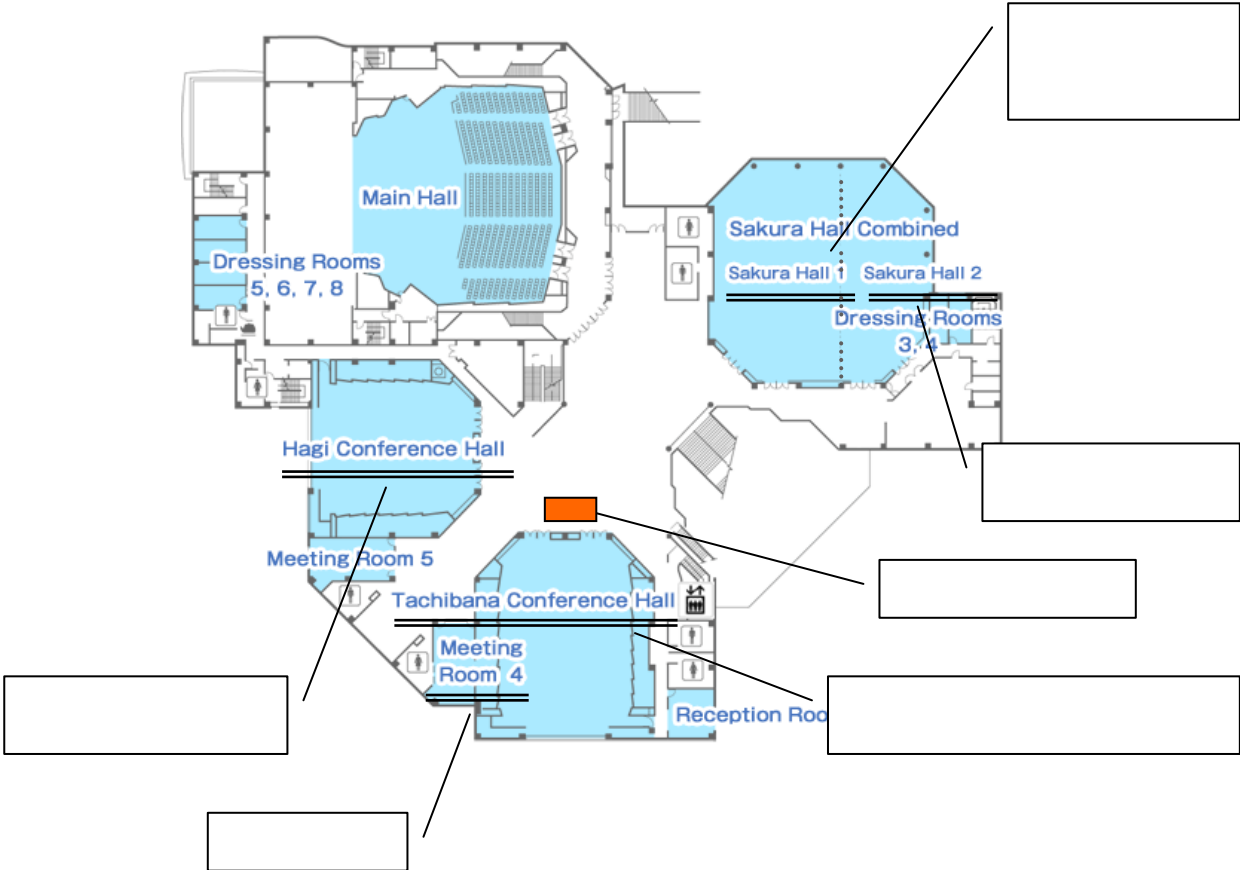
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