

## Chiba University – Ajou University symposium 2014

December 11-12th, 2014

Main Meeting Room (1 floor),

Graduate School of Science and Technology building 1 in Chiba University



# Chiba-Ajou Symposium program

## **11th Dec.**

### **Opening remark**

17:00-17:15 Takashige Omatsu & Kihong Kim

### **Optica & Nano/Bio Science      Chair   Y. K. Kim**

17:15-17:30    11P-1   Kenichi Oto

"Imaging of Spin Polarized Quantum Hall Current by Scanning Kerr Microscope"  
oto@physics.s.chiba-u.ac.jp

17:30-17:45    11P-2   Sang Woon Lee

"Utilization of atomic layer deposition for energy/nano devices"  
slee@ajou.ac.kr

17:45-18:00    11P-3   Hwan Myung Kim

"Molecular two-photon probes for bio-imaging applications"  
kimhm@ajou.ac.kr

18:00-18:15    11P-4   Peter Kruger

"New insights into thin film magnetism by hard x-ray and resonant photoemission"  
pkruger@chiba-u.jp

18:15-18:30    11P-5   Ji-Yong Park

"Scanning probe microscopy for the local electrical characterizations of nanomaterials and nanodevices"  
jiyong@ajou.ac.kr

18:30-18:45    11P-6   Toyo Kazu Yamada

"STM opens up single molecular spintronics"  
toyoyamada@faculty.chiba-u.jp

19:00-        << Welcome party >>

# Chiba-Ajou Symposium program

## **12th Dec.**

### **Organic materials**      **Chair**    **S. Takahara**

- 9:00-9:15      12A-1    Fumiyuki Shiba  
"Aqueous phase syntheses of monodisperse inorganic particulate materials"  
shiba@faculty.chiba-u.jp
- 9:15-9:30      12A-2    Yeong Hwan Ahn  
"Real-time scanning photocurrent microscopy on nanoscale devices"  
ahny@ajou.ac.kr
- 9:30-9:45      12A-3    Yu Kwon Kim  
"Tuning reaction pathways over controlled defects on TiO<sub>2</sub>"  
yukwonkim@ajou.ac.kr
- 9:45-10:00      12A-4    Norihisa Kobayashi  
"Color e-Paper Technology with Electrochemistry"  
koban@faculty.chiba-u.jp
- 10:00-10:30      << Coffee break >>

### **Processing**      **Chair**    **J. Y. Park**

- 10:30-10:45      12A-5    Shigeru Takahara  
"Photo-induced precipitation of single-walled carbon nanotubes from dispersion using photochromic solubilizers"  
takahara@faculty.chiba-u.jp
- 10:45-11:00      12A-6    Chang-Koo Kim  
"Multi-directional slanted plasma etching"  
changkoo@ajou.ac.kr
- 11:00-11:15      12A-7    In Sun Cho  
"Design and Synthesis of 3-D Hybrid Nanomaterials System  
For efficient energy conversion/storage devices"  
insuncho@ajou.ac.kr

### **Poster Session & Lunch**

- 11:15-12:15      Poster
- 12:15-13:15      << Lunch >>
- 13:15-14:15      Poster

### **Photonics**      **Chair**    **N. Aoki**

- 14:15-14:30      12P-1    Katsuhiko Miyamoto  
"Widely tunable picosecond THz source and its applications"  
k-miyamoto@faculty.chiba-u.jp
- 14:30-14:45      12P-2    Fabian Rotermund  
"Low-dimensional carbon nanostructures for nonlinear photonics"  
rotermun@ajou.ac.kr

## Chiba-Ajou Symposium program

- 14:45-15:00      12P-3   Dong-Il Yeom  
"Towards high energy ultrafast fiber lasers using a graphene saturable absorber"  
diyeom@ajou.ac.kr
- 15:00-15:15      12P-4   Takashige Omatsu  
"Topological Nonlinear Optics pumped by Optical Vortices"
- 15:15-15:30      12P-5   Kwang Jun Ahn  
" Surface plasmon enhanced light-matter interaction in NIR and THz regime"  
khahn@ajou.ac.kr
- 15:30-16:00      << Coffee break >>

### **Nano materials Chair   K. Kim**

- 16:00-16:15      12P-6   Nobuyuki Aoki  
"Scanning gate imaging of conductance fluctuations in CVD grown monolayer graphene"  
n-aoki@faculty.chiba-u.jp
- 16:15-16:30      12P-7   Hye-Young Jang  
"Synthesis of optically active organic compounds via green catalysis "  
hyjang2@ajou.ac.kr
- 16:30-16:45      12P-8   Hisao Ishii  
"Impact of Orientation Polarization in OLED on Carrier Injection Property"
- 16:45-17:00      12P-9   Sunghwan Kim  
"Silk as biocompatible optical material"  
sunghwankim@ajou.ac.kr

### **Closing remark**

- 17:00-17:15      Takashige Omatsu & Kihong Kim

### **Lab Tour**

- 17:15-              Lab tour

### **Banquet**

- 18:30-              Banquet (Cafeteria)

# Chiba-Ajou Symposium program

## **12th Dec. 11:15-14:15      Poster Session**

- P-1      Misa Hirose, Yuri Tatsuzawa, Saori Toyota, and Norimichi Tsumura  
"Analysis and Synthesis of Facial Color Image to Investigate the Appearance of Age Spot and Freckle"  
tsumura@faculty.chiba-u.jp
- P-2      Kazuya Nakamoto, Kenji Mizutani, Kano Suzuki, Yoshiko Ishizuka-Katsura, Mikako Shirouzu, Shigeyuki Yokoyama, Ichiro Yamato, Takeshi Murata  
"Crystal Structure of ADP-Bound  $A_3B_3$  Complex of Enterococcus hirae V-ATPase"  
t.murata@faculty.chiba-u.jp
- P-3      Hikaru Sasaki, Fabiana Yakushiji, Kenji Mizutani, Kano Suzuki, Yoshiko Ishizuka-Katsura, Mikako Shirouzu, Shigeyuki Yokoyama, Ichiro Yamato, Takeshi Murata  
"Crystal Structure of  $A_1B_1$  Complex of Enterococcus hirae V-ATPase"  
t.murata@faculty.chiba-u.jp
- P-4      T. Shimogata, Y. Okawa, F. Shiba  
"Size control synthesis of monodisperse Au nanoparticles in a citrate reduction system without growth modifiers"  
shiba@faculty.chiba-u.jp
- P-5      Yoshitaka Yagi, Shigeru Takahara  
"Photo-functional dispersants for single-walled carbon nanotubes and graphene"  
takahara@faculty.chiba-u.jp
- P-6      Toma Takebayashi, Masaya Ninoyu, Shigeru Takahara  
"Dispersion and precipitation of single-walled carbon nanotube using dialkyl-heterocyclic dianthrones"  
takahara@faculty.chiba-u.jp
- P-7      Takuma Sawada, Shigeru Takahara  
"Triphenylsulfonium salt-based "Photo Ampholyte compounds Generator" introduced adamantane structure"  
takahara@faculty.chiba-u.jp
- P-8      Ikuma Suda, Mustafa Ciftci, Shigeru Takahara, Yusuf Yagci  
"Photo cationic and radical polymerization sensitized by dihexyl-heterocyclic dianthrone"  
takahara@faculty.chiba-u.jp
- P-9      Takahiro Kojima, Noriyuki Sugiyama, Hirofumi Kanoh, Tsutomu Itoh, Takayoshi Arai  
"Asymmetric Iodolactonization Using Poly Zinc-Aminoiminobinaphthoxide Complex"  
tarai@faculty.chiba-u.jp
- P-10      Takuma Moribatake, Ikiyo Oka, Hyuma Masu, Takayoshi Arai  
"Structural Analysis and Catalyst Activity of Chiral Bis(imidazolidine)-derived NCN-Pd-X Complex"  
tarai@faculty.chiba-u.jp
- P-11      R. Ogawa, F. Shiba, and Y. Okawa  
"Characterization of Au Nanoparticles Immobilized on ITO Electrodes under Various Conditions"  
y\_okawa@faculty.chiba-u.jp
- P-12      Y. Koike, F. Shiba, and Y. Okawa  
"Gelatin-based Gel Electrolyte with an Organic Solvent"  
y\_okawa@faculty.chiba-u.jp



## Chiba-Ajou Symposium program

- P-13 Koji Okudaira, Tomohiro Ishii, Nobuo Ueno  
"Anisotropic Molecular Orientation of Poly(tetrafluoroethylene) Thin Film on Nanostructured Substrate"  
okudaira@faculty.chiba-u.jp
- P-14 Masato Tanaka, Koji Okudaira, Nobuo Ueno  
"Influence of Solvent Treatment on the Electronic structure and Morphology of PEDOT:PSS Films"  
okudaira@faculty.chiba-u.jp
- P-15 Yosuke Suda, Keiichirou Yonezawa, Kazuto Yamada, Hiroyuki Yoshida, Naoki Sato, Susumu Yanagisawa, Koji K Okudaira, Nobuo Ueno, Satoshi Kera  
"Unoccupied electronic states of superlattice monolayer depending on the mixing ratio of donor-accepter molecules"  
okudaira@faculty.chiba-u.jp
- P-16 Y. Ioka, K. Yonezawa, R. Makino, T. Tago, S. Kera, N. Ueno, K.K. Okudaira  
"Molecular-substrate Interaction and Ionization Energies in Organic Thin Film"  
okudaira@faculty.chiba-u.jp
- P-17 M. Funase and K. Oto  
"Magneto-capacitance of graphene in the quantum Hall conditions"  
oto@physics.s.chiba-u.ac.jp
- P-18 Y. Ariumi, J. Irobe, and K. Oto  
"Dynamic nuclear spin polarization in the quantum Hall breakdown observed by magneto-optical Kerr effect"  
oto@physics.s.chiba-u.ac.jp
- P-19 N. Kiryu, R. Kamagata, K. Yagasaki, and K. Oto  
"Electron spin polarization in GaAs HEMT devices in the quantum Hall conditions"  
oto@physics.s.chiba-u.ac.jp
- P-20 R. Suizu, K. Morioka, M. Yamamoto, T. Hayashida, Y. Shuku, T. Uchihashi, T. Nakayama, K.K. Okudaira, K. Awaga, and K. Sakamoto  
"Molecular arrangement and physical properties of heterocyclic thiazyl diradical BDTDA thin films grown on substrates used in devices"  
kazuyuki\_sakamoto@faculty.chiba-u.jp
- P-21 T. Hayashida, H. Ishikawa, Y. Yaoita, and K. Sakamoto  
"Electronic structure of heavy-element alloy TlBi grown on Si(111)"  
kazuyuki\_sakamoto@faculty.chiba-u.jp
- P-22 Y. Zhang, K. Morioka, H. Ishikawa, J. Fujii, Y. Yoshida, Y. Hasegawa, and K. Sakamoto  
"Electronic structure of ultrathin Tl single crystal film on Ag(111)"  
kazuyuki\_sakamoto@faculty.chiba-u.jp
- P-23 Yuki Yoshimoto and Peter Kruger  
"Magnetic anisotropy of iron porphyrin films"  
pkruger@chiba-u.jp
- P-24 Lu Jin, Shota Tsuneyasu, Kazuki Nakamura, Norihisa Kobayashi  
"Electrochemically-Driven Dual Mode Display Device Consisted of Fluorescent Conductive Polymers"  
koban@faculty.chiba-u.jp

## Chiba-Ajou Symposium program

- P-25     Shota Tsuneyasu, Kazuki Nakamura, Norihisa Kobayashi  
"Enhancement of AC-Operated Electrochemically Generated Luminescence by Addition of TiO<sub>2</sub> Nanoparticles"  
koban@faculty.chiba-u.jp
- P-26     Naoki Ura, Kazuki Nakamura, Norihisa Kobayashi  
" Improved Coloration Properties of Electrochromic Device by Connecting Organic Dyes on Electrode"  
koban@faculty.chiba-u.jp
- P-27     Hiroumi Kinjo, Hyunsoo Lim, Yusuke Ozawa, Tomoya Sato, Yutaka Noguchi, Yasuo Nakayama, Hisao Ishii  
"The occupied LUMO of Alq<sub>3</sub> at polarized film surface studied by negative-ion PES"  
ishii130@faculty.chiba-u.jp
- P-28     Y. Sekine, Y. Saito, Y. Okui, K. Takano, M. Hangyo, K. Oto, and M. Nakajima  
" Polarization change induced by two dimensional metal mesh metamaterial with the circular dichroism in the terahertz frequency regime"  
oto@physics.s.chiba-u.ac.jp
- P-29     R. Ishino, H. Kim, Y. Nakayama, Y. Noguchi, H. Ishii  
"An Organic EL Device Using Thermally Activated Delayed Fluorescence Studied by Transient EL and Displacement current measurements"  
ishii130@faculty.chiba-u.jp
- P-30     Tomoya Sato, Kaveenga Rasika Koswattage, Yasuo Nakayama, Hisao Ishii  
"Direct Observation of Electronic Structure of Nylon-6,6 Thin Film to Clarify the Mechanism of Contact Electrification"  
ishii130@faculty.chiba-u.jp
- P-31     Palidan Aierken, Lee Jun Hyung, Manabu Magarisawa, Katsuhiko Miyamoto, Takashige Omatsu  
"Glycine crystallization by structured photon radiation pressure"  
omatsu@faculty.chiba-u.jp
- P-32     Aizitiaili Abulikemu, Taximaiti Yusufu, Katsuhiko Miyamoto, and Takashige Omatsu  
"Optical vortex pumped optical parametric oscillator"  
omatsu@faculty.chiba-u.jp
- P-33     Wataru Akiyama, Naoto Nakamura, Yu Tanaka, Katsuhiko Miyamoto, Takashige Omatsu, Jonathan P. Bird, Yuichi Ochiai, and Nobuyuki Aoki  
"Polymerization of C<sub>60</sub> molecules with optical manipulation by optical vortex irradiation"  
n-aoki@faculty.chiba-u.jp
- P-34     Akram M. Mahjoub, Nobuyuki Aoki, Katsuhiko Miyamoto, Tomohiro Yamaguchi, Takashige Omatsu, Jonathan P. Bird, David K. Ferry, Koji Ishibashi, and Yuichi Ochiai  
"THz bolometric detection by thermal noise in graphene"  
n-aoki@faculty.chiba-u.jp
- P-35     S. Xiang, S. Sato, T. Luan Nguyen, N. Mukasa, N. Aoki, S. Xiao, J.P. Bird and Y. Ochiai  
"Quantum phase transition in fractional quantum Hall regime in the quasi-one dimension structure"  
n-aoki@faculty.chiba-u.jp

## Chiba-Ajou Symposium program

- P-36 Bong Joo Kang, Won Tae Kim, Kwang Jun Ahn, Dong-Il Yeom, and Fabian Rotermund  
"Broadband terahertz coherent sources and their applications for nonlinear and time-resolved spectroscopy"  
rotermun@ajou.ac.kr
- P-37 Daeyong Kim and Chee Burm Shin  
"Modeling of the electrical and thermal behaviors of an ultracapacitor for automotive applications"  
cbshin@ajou.ac.kr
- P-38 Seulong Kim, Kihong Kim  
"Mode conversion of MHD waves in stratified inhomogeneous media with shear flows"  
khkim@ajou.ac.kr
- P-39 Taehyeong Kim, Joonhan Park and Sunghwan Kim  
"Photolithography and dry-etch process on silk biopolymer"  
sunghwankim@ajou.ac.kr
- P-40 S. J. Park, and Y. H. Ahn  
"Highly sensitive detection of fungi and bacteria using terahertz metamaterial and plasmonic sensor"  
ahny@ajou.ac.kr
- P-41 Minseok Oh and Byungmin Ahn  
"Effect of sintering condition on Zn vaporization in Al-6Cu-5Zn P/M alloy"  
byungmin@ajou.ac.kr
- P-42 Shinyoung Ryu, Jonghyuk Yim and Soonil Lee  
"Fabrication of Si/CNT hybrid solar cell by spray method"  
soonil.ajou@gmail.com
- P-43 Il-Han Yoo, Shankara S. Kalanur, Sun A Park, and Hyungtak Seo  
"Water splitting system of 2D SnS<sub>2</sub> on FTO"  
hseo@ajou.ac.kr
- P-44 Chan Lee and Hye-Young Jang  
"Synthesis of Valuable Organic Building Blocks using O<sub>2</sub> and CO<sub>2</sub>"  
hyjang2@ajou.ac.kr
- P-45 Hae-Min Lee, Gyoung Hwa Jeong, Sang-Wook Kim, and Chang-Koo Kim  
"Pseudocapacitive performance of porous ZrO<sub>2</sub>-SiO<sub>2</sub> sheets doped with WO<sub>3</sub> nanoparticles"  
changkoo@ajou.ac.kr
- P-46 Hyo Won Lee and Hwan Myung Kim  
"A Ratiometric Two-Photon Fluorescent Probe for Quantitative Detection of  $\beta$ -Galactosidase"  
kimhm@ajou.ac.kr
- P-47 Woong-bin Yim, Huiseong Jeong, S.J. Park, Y.H.Ahn, Soonil Lee, and Ji-Yong Park  
"Nanostructure formation using carbon nanotubes as a sputtering mask"  
jiyong@ajou.ac.kr
- P-48 Han Jin Lim and Seung-Joo Kim  
"Synthesis and structure analysis of lithium conducting material, Lithium aluminum sulfide"  
sjookim@ajou.ac.kr



## Chiba-Ajou Symposium program

- P-49 Byungwook Jeon and Yu Kwon Kim  
"Changes in the photoactivity and thermal reactivity of V-doped anatase TiO<sub>2</sub>: The effect of vanadium loading"  
yukwonkim@ajou.ac.kr
- P-50 Sung-yoon Joe, Jong Hyuk Yim, Shin Young Ryu, N. Y. Ha, Y. HA. Ahn, Ji-Yong Park, and Soonil LEE  
"Fabrication of organic solar cell of based on P3HT and ICBA with the addition of donor nanowires"  
soonil.ajou@gmail.com
- P-51 Deokhyun Han and Byungmin Ahn  
"Formability evaluation on hydroforming of Al tubes for heat exchanger"  
byungmin@ajou.ac.kr
- P-52 Sang Yeon Lee, Yu-min Park and Hyungtak Seo  
"Depth Resolved Band alignments of TiN/ZrO<sub>2</sub> and TiN/ZAZ DRAM Capacitors"  
hseo@ajou.ac.kr
- P-53 Hwanseong Jeong, Sun Young Choi, Fabian Rotermund, and Dong-II Yeom  
"Passively mode-locked dissipative soliton laser with high pulse energy of 34 nJ using SWCNT saturable absorber"  
diyeom@ajou.ac.kr
- P-54 J. K. Park, B. H. Son, J. Y. Park, S. Lee, and Y. H. Ahn  
"Ultrafast carrier transport in semiconducting nanowire and carbon nanotube field-effect transistors"  
ahny@ajou.ac.kr

# Chiba-Ajou Symposium program

**11th Dec.**

**Opening remark**

**17:00-17:15 Takashige Omatsu & Kihong Kim**

**Optica & Nano/Bio Science Chair Y. K. Kim**

**17:15-17:30 11P-1 Kenichi Oto**

**"Imaging of Spin Polarized Quantum Hall Current  
by Scanning Kerr Microscope"**

**oto@physlcs.s.chiba-u.ac.jp**

An optical fiber-based Kerr rotation microscope working at low temperatures has been developed to investigate the electron spin polarization in a single layer GaAs/AlGaAs two-dimensional electron system in the QHE regime. Without external current, the observed Kerr image at Landau level filling factor one reveals the local electron density fluctuation only less than 0.1% in the quantum well. In the current flowing QHE state, the spin polarized incompressible strip appears at the center region of the Hall-bar channel. With increasing current, the incompressible strip becomes narrow and the extent of the spin polarized area decreases. The images of quantum Hall current distribution and the highly current dependent electron spin polarization are demonstrated.

**17:30-17:45 11P-2 Sang Woon Lee**

**"Utilization of atomic layer deposition for energy/nano devices"**

**slee@ajou.ac.kr**

Atomic layer deposition (ALD) technique has attracted great attentions for the growth of functional materials in a wide range of applications recently. The unique selflimiting mechanism of ALD technique enables us to get functional materials with high quality, atomic-level controllability, excellent uniformity and conformality on complex structures. Thus, this ALD technique has been applied to the deposition of high-k dielectrics for memory and transistors (MOSFET) in the semiconductor field. Besides the application of ALD in the conventional semiconductor field, recent application of ALD to a new area will be introduced, such as energy materials and nano materials, which can provide promising opportunities in those fields. The detailed application of ALD to the thin film solar cell and 2-dimensional electron gas (2-DEG) will be addressed in this presentation.

**17:45-18:00 11P-3 Hwan Myung Kim**

**"Molecular two-photon probes for bio-imaging applications"**

**kimhm@ajou.ac.kr**

Small molecule fluorescent probes are powerful tools for imaging specific biological events in cells. In recent years, two-photon microscopy (TPM), which uses two near-infrared photons as excitation source, has become an important tool to the study of biology and medicine due to its capability for molecular imaging in deep inside intact tissues. TPM offers a number of advantages over conventional microscopy including greater penetration depth ( $> 500 \mu\text{m}$ ), localization of excitation, and longer observation times. For maximum utilization of TPM, there is a strong need to develop various two-photon (TP) probes for direct, real-time imaging of target analyze. Recently, we have developed small molecule TP probes that can selectively detect cellular metals,<sup>1</sup> H<sub>2</sub>O<sub>2</sub>,<sup>2</sup> H<sub>2</sub>S,<sup>3</sup> beta amyloid plaques<sup>4</sup> and pH<sup>5</sup> in live cells, live tissue slices and living mouse brain. The design and evaluation of a selection of our recent studies, and their use in quantitative imaging studies will be presented.

## Chiba-Ajou Symposium program

18:00-18:15

**11P-4 Peter Kruger**

**"New insights into thin film magnetism by hard x-ray and resonant photoemission"**

**pkruiger@chiba-u.jp**

First the interplay between circular dichroism and spin-polarization in resonant photoemission from magnetic surfaces is investigated with a newly developed ab initio computational method. It is shown that the observed spin-polarization in antiferromagnets is due to an angular momentum transfer from the photon to the electron spin rather than a measurement of local moments as claimed previously. Second the electronic structure of FeRh across the meta-magnetic transition is studied with hard x-ray photoemission and ab initio calculations. We find a substantial increase of the density of states at the Fermi level, which indicates that the electronic entropy partly drives the transition.

18:15-18:30

**11P-5 Ji-Yong Park**

**"Scanning probe microscopy for the local electrical characterizations of nanomaterials and nanodevices"**

**jiyong@ajou.ac.kr**

Scanning probe microscopy (SPM) has been an invaluable tool in the investigation of local characteristics of nanomaterials and devices. SPM can be used to probe not only the surface topography but also the local electrical properties of nanomaterials and devices with such techniques as electrostatic force microscopy (EFM) and scanning gate microscopy (SGM). In this talk, I will present how we can probe local electrical properties of nanomaterials such as carbon nanotubes (CNTs) and graphene. I will present a few examples where SPM is utilized to provide information about local electrical characteristics such as voltage profiles and potential landscapes of CNT-based nanoelectronic devices. Variations and evolution of local conductance in graphene oxide films as they are reduced are also studied with SPM. These local electrical measurements can provide complementary information to traditional transport measurements. Our results mostly indicate significant inhomogeneities and variations of electrical properties in nanomaterials and devices which cannot be generally observed with bulk measurements.

18:30-18:45

**11P-6 Toyo Kazu Yamada**

**"STM opens up single molecular spintronics"**

**toyoyamada@faculty.chiba-u.jp**

Scanning tunneling microscopy (STM) has been used to visualize material topology with an atomic scale for last decades, while recently STM, with a combination of scanning tunneling spectroscopy and spin-polarized techniques, was found to be a strong tool to investigate electronic as well as (magnetic or quantum) spin properties of 1-nm-size nanomaterials, such as nano-magnets, single atoms, single molecules, and graphene nanoribbons, which are attractive candidates for realizing new nano-electronic devices with low cost, low power consumption, and high performance. In this study, we will show our recent studies of single molecules as well as nano-magnets.

19:00-

**<< Welcome party >>**

# Chiba-Ajou Symposium program

**12th Dec.**

**Organic materials      Chair   S. Takahara**

**9:00-9:15**

**12A-1 Fumiyuki Shiba**

**"Aqueous phase syntheses of monodisperse inorganic particulate materials"**

**shiba@faculty.chiba-u.jp**

This talk will introduce recent topics on synthesis of inorganic monodisperse particles in our laboratory. Though controlling both nucleation and growth periods is essential, we have focused especially on the former to design the chemical reaction process. Some strategies have been applied to actual systems of Prussian blue analogues particles, Au nanoparticles, or one-dimensional yttrium hydroxide particles, indicating the importance of nucleation process on synthesis of particulate materials.

**9:15-9:30**

**12A-2 Yeong Hwan Ahn**

**"Real-time scanning photocurrent microscopy on nanoscale devices"**

**ahnhy@ajou.ac.kr**

Scanning photocurrent microscopy (SPCM) is useful for investigating the localized information such as metal contacts, defects, and junctions in nanoscale field-effect transistors. In particular, a high-speed SPCM technique with a scanning speed of 1 frame/s enables us to obtain in-situ photocurrent images of individual carbon nanotube and nanowire devices. This helps us to remove the hysteresis effects that frequently obscure the field configurations applied by the gate bias voltage. Not only in ambient condition, we can also address the devices in various environments; for instance, we could visualize and quantify the ionic distributions near nanotube devices in electrolyte solutions, including their dynamical behaviors.

**9:30-9:45**

**12A-3 Yu Kwon Kim**

**"Tuning reaction pathways over controlled defects on TiO<sub>2</sub>"**

**yukwonkim@ajou.ac.kr**

The (110) facet of TiO<sub>2</sub> surface provides a well-ordered surface with well-characterized defects such as oxygen vacancies, surface hydroxyls and oxygen adatoms. This provides a chance of investigating the role of each surface defect in catalytic reactions taking place on the surface. Oxygen vacancies can be prepared by repeated cycles of Ar<sup>+</sup>-sputtering and a subsequent annealing at 900 K in vacuum. On the surface, surface hydroxyls can be made selectively by dissociative adsorption of water (H<sub>2</sub>O) over the oxygen vacancies. The surface can be further treated with molecular oxygen at around room temperature for the removal of surface hydroxyls while maintaining the ordered TiO<sub>2</sub>(110) structure. The oxygen vacancies can also accommodate molecular oxygen by breaking its O-O bond leaving oxygen adatoms on the surface. Under a controlled condition in a UHV chamber, various surfaces with different kind of defects can be prepared on rutile TiO<sub>2</sub>(110) surface in a systematic manner and catalytic reactions associated with such species can be probed for understanding detailed mechanism. In this study, we show that NO reactions over TiO<sub>2</sub>(110) are strongly influenced by such surface defects and the reaction pathways are tuned by the type of surface defects. NO reduction into N<sub>2</sub>O and N<sub>2</sub> is enhanced when oxygen vacancies are present, while surface hydroxyls induce NH<sub>3</sub> formation. When oxygen adatoms may form NO<sub>2</sub> or NO<sub>3</sub> species, which can further dissociate into N<sub>2</sub>O at > 200 K. Competition between different reaction channels are tuned by the type of defects in a way to favor a certain reaction channel, thus, determines the overall TPD spectral shape under a given condition.

## Chiba-Ajou Symposium program

9:45-10:00

**12A-4 Norihisa Kobayashi**

**"Color e-Paper Technology with Electrochemistry"**

**koban@faculty.chiba-u.jp**

We are focusing on novel e-paper technology with electrochemical reaction. First, we will show our recent results on electrochromic (EC) materials and devices which show three primary colors (CMY) in subtractive color mixture system. Electrodeposition is also attractive method to create colors. We will discuss the mechanism of electrodeposition and a wide range of its applications.

We also demonstrated novel display device with dual reflective and emissive modes. This is called dual mode display (DMD). DMD enables both reflective and emissive mode of representation which can be chosen as a situation demand. We fabricated DMD by combining both EC and electrochemiluminescence (ECL) materials in a single cell. The device functions as an EC cell in the reflective mode, and as an ECL cell in the emissive mode.

10:00-10:30

**<< Coffee break >>**

**Processing**

**Chair J. Y. Park**

10:30-10:45

**12A-5 Shigeru Takahara**

**"Photo-induced precipitation of single-walled carbon nanotubes from dispersion using photochromic solubilizers"**

**takahara@faculty.chiba-u.jp**

Dialkyl-heterocodanthrones (dialkyl-HCDs) and dialkyl-benzodioxanthene (dialkyl-BDX) are well soluble in organic solvents, depending on the respective length of alkyl group. We found these compounds to be photo-reactive solubilizers of nano-carbon materials, using their photochromic reactions. They acted as the solubilizer of single-walled carbon nanotubes (SWNTs) in chloroform or other organic solvents. The SWNTs were precipitated from the dispersion liquid through irradiation with visible light. Such photo-induced precipitation was also observed in the SWNT/solubilizer complex films.

10:45-11:00

**12A-6 Chang-Koo Kim**

**"Multi-directional slanted plasma etching"**

**changkoo@ajou.ac.kr**

Etch profiles with slanted microstructure are building blocks of three-dimensional microstructures. These three-dimensional microstructures with high aspect ratio slanted profiles can be used not only in microelectronics but also in photonic crystals, nanopillar arrays, grating couplers, dry adhesives, and so on. Precise control over the angle and aspect ratio of slanted structures is imperative for obtaining three-dimensional microstructures with various slanted patterns.

In this study, the use of a novel plasma etching technique was demonstrated to yield single- and multi-directional slanted etch profiles of silicon. A Faraday cage system was used to control the angle of ions incident on the substrate. Single-, double-, and quadruple-directional slanted plasma etchings could be fabricated using various types of Faraday cages.

11:00-11:15

**12A-7 In Sun Cho**

**"Design and Synthesis of 3-D Hybrid Nanomaterials System  
For efficient energy conversion/storage devices"**

**insuncho@ajou.ac.kr**

The development of highly efficient, cost-effective and environmental friendly material is a crucial element for sustainable and renewable energy implementation. Especially, for electrochemical energy conversion/storage devices such as solar-fuels, dye-sensitized solar

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cells, catalysts, fuel cells, and metal-air batteries, design and synthesis of semiconductors and/or electrocatalysts is central to the performance. Here, we seek to study on design and synthesis of 3-D hybrid nanomaterials system (nanowires hetero-structured with different materials and morphologies) for enhanced devices performance. By controlling the chemical composition and morphology of each component, the electrical, optical and chemical properties of the hybrid nanomaterials can be engineered, thus offer new opportunities to achieve multi-functionality, and enable to design/develop more efficient devices. To synthesize these hybrid nanomaterials, we will utilize newly developed 'Sol-flame' method which is based on the combination of solution chemistry and high-temperature flame process, enabling to fabricate various types of hybrid nanomaterials with a great functionality. We believe that advances in the design and synthesis of these hybrid nanomaterials will lead to more efficient energy utilization and hence highly efficient electrochemical energy conversion/storage devices.

### **Poster Session & Lunch**

**11:15-12:15**    **Poster**  
**12:15-13:15**    **<< Lunch >>**  
**13:15-14:15**    **Poster**

### **Photonics**      **Chair N. Aoki**

**14:15-14:30**    **12P-1 Katsuhiko Miyamoto**  
**"Widely tunable picosecond THz source and its applications"**  
**k-miyamoto@faculty.chiba-u.jp**

We present a widely tunable picosecond terahertz source, formed of a picosecond Nd:YVO<sub>4</sub> laser pumped periodically poled stoichiometric lithium tantalate (PPSLT) optical parametric amplifier and a 4'-dimethylamino-N-methyl-4-stilbazolium tosylate (DAST) difference frequency generator. With this system, the THz output exhibited an average power of 18  $\mu$ W and a linewidth of ~120GHz at 4.3 THz, and its frequency was tuned in the range of 1-15 THz. We also address the THz vortex generation by using a polymeric (Tsurupica) spiral phase plate.

**14:30-14:45**    **12P-2 Fabian Rotermund**  
**"Low-dimensional carbon nanostructures for nonlinear photonics"**  
**rotermun@ajou.ac.kr**

In recent years, low-dimensional carbon nanostructures such as single-walled carbon nanotubes (SWCNTs) and graphene have been intensively investigated for a number of nonlinear photonic applications. In this talk, our research activities regarding developments of nanocarbon-based saturable absorbers for ultrafast solid-state lasers and ultrafast & nonlinear THz spectroscopy in graphene-based materials will be presented.

**14:45-15:00**    **12P-3 Dong-II Yeom**  
**"Towards high energy ultrafast fiber lasers using a graphene saturable absorber"**  
**diyeom@ajou.ac.kr**

Realizing high energy pulses in ultrafast fiber laser systems has been intensively studied with their merits including alignment-free structure, excellent beam profile, and compactness, finding important applications both in scientific and practical fields. While optical soliton operation has been regarded as dominant means to generate ultrashort pulses in fiber lasers, it is still hard to scale the pulse energy due to the limit of fundamental soliton condition and lack of suitable saturable absorber operating at high power. In this talk, we briefly review recent our research on development of passively mode-locked all-

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fiber laser oscillators with high pulse energy based on novel in-line saturable absorbers using a CNT and graphene.

**15:00-15:15    12P-4 Takashige Omatsu**  
**"Optical vortex lasers pioneer chiral nano-structures"**  
**omatsu@faculty.chiba-u.jp**

Optical vortex lasers with a helical wavefront carry an orbital angular momentum owing to a phase singularity. In recent years, we and our-coworkers have discovered that their orbital angular momentum enables us to twist materials to form chiral structures on a nano-scale. Such chiral nano-structures will provide us a new physical insight in laser-oriented materials science, including chiral plasmonics, chiral metamaterials and novel nanoscale imaging technologies for selective identification of the chirality of molecules and chemical composites. In this presentation, we review a state-of the art of the chiral materials science based on optical vortex laser technologies.

**15:15-15:30    12P-5 Kwang Jun Ahn**  
**"Surface plasmon enhanced light-matter interaction in NIR and THz regime"**  
**khahn@ajou.ac.kr**

Surface plasmon (SP) is a collective electric charge density oscillation at dielectric-metal interfaces. In the vicinity of metal surfaces, enhanced surface Raman spectrum and quenched or enhanced photoemission of atomic light emitters are caused by the enhanced electric field of SP. In this talk, the substantially enhanced light-matter interaction enabled by the SP resonance in terahertz (THz) frequency regime will be discussed. It will be demonstrated that several orders of the absorption enhancements can be obtained when vanadium dioxides (VO<sub>2</sub>) and RDX molecules are hybridized with THz plasmonic nanoresonators, which can eventually be utilized to highly sensitive nanodetection.

**15:30-16:00    << Coffee break >>**

**Nano materials                      Chair   K. Klm**

**16:00-16:15    12P-6 Nobuyuki Aoki**  
**"Scanning gate Imaging of conductance fluctuations in CVD grown monolayer graphene"**  
**n-aoki@faculty.chiba-u.jp**

We have observed a wide constriction of graphene grown by chemical vapor deposition (CVD) via a low temperature scanning gate microscopy (LT-SGM). Conductance fluctuations in the constriction have successfully visualized in the image. Moreover, evolutions of the SGM response have been confirmed with changing the back gate voltage and the applied current. Transition of transport properties from quantum to classical due to a hot carrier effect can be discussed from the series of the SGM images. For the SGM observation, the sample was mounted in the LT-SPM head installed under 3He pot. A piezoresistive cantilever coated by Ti thin film was used to allow metallization of the tip. For SGM imaging, the tip was lifted 200 nm away from the graphene layer and biased at 2V.

**16:15-16:30    12P-7 Hye-Young Jang**  
**"Synthesis of optically active organic compounds via green catalysis "**  
**hyjang2@ajou.ac.kr**

Development of synthetic methods for optically active compounds has been received a great attention. Most biologically active compounds are chiral; therefore, optically active organic building blocks always considered as a potential drug. In addition, chiral organic



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compounds are also used as organic materials in electronic devices. The chirality of organic compounds modulates physical and optical properties.

In this presentation, environmental-friendly and efficient catalytic methods to generate new chiral organic compounds are shown. The combination of cheap metal complexes (Cu and Fe) and chiral amine catalysts converted achiral aldehydes to various chiral building blocks with excellent enantioselectivity.

**16:30-16:45    12P-8   Hlsao Ishii**  
**"Impact of Orientation Polarization in OLED on Carrier Injection Property"**  
**ishii130@faculty.chiba-u.jp**

Materials for organic light-emitting diodes (OLEDs) often show spontaneous orientation polarization in evaporated films with giant surface potential (GSP). This polarization induces positive and negative fixed charges on both ends of the polarized layer, leading to interface charges at organic/organic and organic/electrode interfaces in organic light-emitting devices. These interface charges often attract and repel carriers, and significantly affects the device performance. In this study, the impact of orientation polarization in OLEDs was investigated from the viewpoints of carrier behavior and electronic structures: The former was measured by displacement current measurement (DCM), and the latter by high-sensitivity photoemission measurement.

**16:45-17:00    12P-9   Sunghwan Kim**  
**"Silk as biocompatible optical material"**  
**sunghwankim@ajou.ac.kr**

Silk, a natural protein extracted from cocoons, has been attractive for biomedical and biooptical applications due to its biocompatibility, optical transparency, and robust mechanical properties. Here I introduce high technological reinvents of silk. Silk can be used as a base material for the demonstration of fully biocompatible optical devices and give functionalities by doping biofunctional molecules. This approach offers much fascinating potential applications such as in vivo monitoring and a super-sensitive biosensor.

### Closing remark

**17:00-17:15    Takashige Omatsu & Kihong Kim**

### Lab Tour

**17:15-            Lab tour**

### Banquet

**18:30-            Banquet (Cafeteria)**

**12th Dec. 11:15-14:15 Poster Session**

- P-1 Misa Hirose, Yuri Tatsuzawa, Saori Toyota, and Norimichi Tsumura**  
**"Analysis and Synthesis of Facial Color Image to Investigate the Appearance of Age Spot and Freckle"**

**tsumura@faculty.chiba-u.jp**

In this research, we evaluate the visibility of age spot and freckle with changing the blood volume based on the actual facial color images and compare the result with that of pigmentation patterns generated by simulated spectral reflectance. We acquire the concentration distribution of melanin, hemoglobin and shading components by applying the independent component analysis on a facial color image. We reconstruct images by using the obtained melanin and shading concentration and the changed hemoglobin concentration to generate facial images with changing the blood volume. Finally, we evaluate the visibility of pigmentations using these images and compare with the result of pigmentation patterns based on simulated reflectance.

- P-2 Kazuya Nakamoto, Kenji Mizutani, Kano Suzuki, Yoshiko Ishizuka-Katsura, Mikako Shirouzu, Shigeyuki Yokoyama, Ichiro Yamato, Takeshi Murata**  
**"Crystal Structure of ADP-Bound  $A_3B_3$  Complex of Enterococcus hirae V-ATPase"**

**t.murata@faculty.chiba-u.jp**

V-ATPase functions as ATP-dependent proton pump. The  $A_3B_3$ , which is the catalytic domain of V-ATPase, forms a hexagonal ring by the three catalytic A subunits and the three non-catalytic B subunits. We previously reported the asymmetric structures of the nucleotide-free (2.8 Å) and AMP-PNP-bound (3.4 Å)  $A_3B_3$  complex from *Enterococcus hirae*. Two AMP-PNP molecules were found at the nucleotide-binding pockets in two AB pairs. Here we report the crystal structure of ADP-bound  $A_3B_3$  complex at 2.7 Å resolution. Three ADP molecules are found at the nucleotide-binding pockets in all AB pairs. In my poster, I would like to discuss the intermediate structure of  $A_3B_3$  complex.

- P-3 Hikaru Sasaki, Fabiana Yakushiji, Kenji Mizutani, Kano Suzuki, Yoshiko Ishizuka-Katsura, Mikako Shirouzu, Shigeyuki Yokoyama, Ichiro Yamato, Takeshi Murata**  
**"Crystal Structure of  $A_1B_1$  Complex of Enterococcus hirae V-ATPase"**

**t.murata@faculty.chiba-u.jp**

V-ATPases function as  $H^+$  pumps in eukaryotic acidic organelles and certain bacterial membranes. V-ATPases are composed of a hydrophilic domain ( $V_1$ ) and a hydrophobic domain ( $V_0$ ).  $A_3B_3$  complex in  $V_1$  catalyzes the ATP hydrolysis reaction. Three A subunits and three B subunits are alternatively arranged and form a hexagonal ring by the N terminal  $\beta$  barrel domain. We observed that nucleotide binding induced dissociation of  $A_3B_3$  complex into  $A_1B_1$  complex. To obtain the crystal structure of  $A_1B_1$  complex, we designed mutations at the contacting interfaces of three AB pairs in the barrel region. Here we report the crystal structure of  $A_1B_1$  complex with nucleotide and will discuss the structural differences between  $A_3B_3$  complex and  $A_1B_1$  complex.

- P-4 T. Shimogata, Y. Okawa, F. Shiba**  
**"Size control synthesis of monodisperse Au nanoparticles in a citrate reduction system without growth modifiers"**

**shiba@faculty.chiba-u.jp**

Size of monodisperse Au nanoparticles have been altered by shifting pH of the reacting solution after a certain time from addition of citric acid in to a boiling  $HAuCl_4$  aqueous solution without adding any growth modifiers. Different from the common citrate reduction method, which uses trisodium citrate, the  $Au^{3+}$  species is reduced slowly to  $Au^+$  species that acts as the precursor for nucleation. Size of monodisperse Au nanoparticles is successfully changed in the range of 5 – 15 nm, by controlling degree of the precursor accumulation by varying the interval time between additions of citric acid and NaOH.

- P-5 Yoshitaka Yagi, Shigeru Takahara**  
**"Photo-functional dispersants for single-walled carbon nanotubes and graphene"**

**takahara@faculty.chiba-u.jp**

Benzo [1,2,3-*kl*:4,5,6-*kl'*] dioxanthene (BDX) is known as a photochromic compound. When mixed with single-walled carbon nanotube (SWNT), dialkyl-BDXs dispersed SWNT in organic solvents, such as chloroform, toluene and THF. Upon visible light irradiation of dialkyl-BDX-SWNT dispersions under oxygen atmosphere resulted in the structural change of BDX, leading to BDXPO (endoperoxide), and the

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appearance of SWNT aggregation. This shows that SWNT was easily released from the dialkyl-BDX reacted photochemically. Heating the solution to recover BDX, it was again able to disperse SWNT. From the analysis of FT-IR spectra and TGA measurement, the released SWNTs were not only free of BDX but also removed impurities contained in the raw SWNT.

- P-6 Toma Takebayashi, Masaya Ninoyu, Shigeru Takahara**  
**"Dispersion and precipitation of single-walled carbon nanotube using dialkyl-heterocoeirdianthrones"**  
**takahara@faculty.chiba-u.jp**

Single-walled carbon nanotube (SWNT) is a promising material having excellent properties. However, its poor solubility to organic solvents is a big obstacle to apply it. Some heterocoerdianthrone (HCD) derivatives have exhibited potential as "Photoreactive solubilizer" for SWNT. In this study, we focused on the reusability of HCD and the change in characteristics of SWNT caused by dispersion procedure. HCDPO, which is the endoperoxide generated from HCD, can recover to HCD by the UV light irradiation or heating. Since the re-rise of absorbance of SWNT had been observed after those reproduction and sonication procedure, it was found that HCD can re-disperse SWNT. Furthermore, some selectivity to semiconducting SWNT was shown by resonance Raman spectroscopy.

- P-7 Takuma Sawada, Shigeru Takahara**  
**"Triphenylsulfonium salt-based "Photo Ampholyte compounds Generator" introduced adamantane structure"**  
**takahara@faculty.chiba-u.jp**

We have attempted to expand both the application area and the concept due to newly define "photo-X-generator" (PXG) from "photo initiator". We developed a novel functional material which is called "photo ampholyte generator" (PAmG) as one of PXGs. PAmG has the unique properties to change pH from base to acid by irradiation. It has been studied ionic type and non-ionic type of PAmG. We have designed and prepared a new PAmG introduced an adamantane structure and evaluated the properties of it. Upon irradiation by low-pressure mercury lamp ( $\lambda=254\text{nm}$ ), it was observed the pH changing from 9.6 to 4.6, and generation of ampholyte materials.

- P-8 Ikuma Suda, Mustafa Ciftci, Shigeru Takahara, Yusuf Yagci**  
**"Photo cationic and radical polymerization sensitized by dihexyl-heterocoerdianthrone"**  
**takahara@faculty.chiba-u.jp**

Photo radical polymerization and cationic polymerization are mainly used in the ink, adhesive and coating technologies. New initiating system for polymerization is expected to overcome their drawbacks, such as the oxygen inhibition or low reactivity. We applied dihexyl-heterocoerdianthrone (DHHCD) in the photo-initiating system of polymerization. DHHCD worked as efficient sensitizer with an onium salt initiating a cationic polymerization, and the system was also able to initiate a radical polymerization.

- P-9 Takahiro Kojima, Noriyuki Sugiyama, Hirofumi Kanoh, Tsutomu Itoh, Takayoshi Arai**  
**"Asymmetric Iodolactonization Using Poly Zinc-Aminoiminobinaphthoxide Complex"**  
**tarai@faculty.chiba-u.jp**

Due to the importance of chiral iodinated compounds in pharmaceutical science, catalytic asymmetric iodolactonization has been received much attention in recent years. Recently, we have succeeded in an asymmetric iodolactonization using a trinuclear zinc-aminoiminobinaphthoxide complex. Herein, we report an environmentally friendly enantioselective iodolactonization using the poly zinc-aminoiminobinaphthoxide complex. The poly zinc-aminoiminobinaphthoxide complex was prepared by a self-condensation of 3,3'-diformyl binaphthol and tetramine in the presence of zinc acetate. This complex catalyzed iodolactonization smoothly to give the products with good yields and high enantioselectivities. The poly zinc-aminoiminobinaphthoxide complex was easily reused in iodolactonization with keeping the high catalyst activity.

- P-10 Takuma Moribatake, Ikiyo Oka, Hyuma Masu, Takayoshi Arai**  
**"Structural Analysis and Catalyst Activity of Chiral Bis(imidazolidine)-derived NCN-Pd-X Complex"**  
**tarai@faculty.chiba-u.jp**

The pincer type complexes have received considerable attention in catalysis due to the compatibility of the stability and the activity, and the recent research advances have focused on the application in asymmetric

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catalysis. In this fascinating area, we have succeeded in the development of a chiral bis(imidazolidine)-derived NCN-Pd pincer complex, and made its chemical structure clear by X-ray crystal structural analysis. The newly developed bis(imidazolidine)-derived NCN-Pd pincer complex showed remarkable catalyst activity in the asymmetric catalysis for a 1,4-addition reaction of malononitrile to nitroalkenes to give the products with high yield and excellent enantioselectivity.

**P-11 R. Ogawa, F. Shiba, and Y. Okawa**  
**"Characterization of Au Nanoparticles Immobilized on ITO Electrodes under Various Conditions"**

**y\_okawa@faculty.chiba-u.jp**

Modification of electrode surfaces with nanomaterials, e.g. nanoparticles, is an attractive way to the development of new functional electrochemical systems. In view of this, we systematically investigated the characteristics of ITO electrodes carrying gold nanoparticles, which were immobilized with various methods onto the surface pretreated with a series of silane coupling agents. The modified electrode surfaces were observed with scanning electron microscopy. It has been demonstrated that the surface pretreatments and thus introduced moieties strongly affect the immobilized state and stability of the nanoparticles on the electrode. The electrochemical characteristics of the modified electrodes were studied by cyclic voltammetry.

**P-12 Y. Koike, F. Shiba, and Y. Okawa**  
**"Gelatin-based Gel Electrolyte with an Organic Solvent"**

**y\_okawa@faculty.chiba-u.jp**

Although gelatin is well-known as a protein gelling agent in aqueous systems, it can be used for some organic solvent systems. We studied the gelling characteristics and the electrical and mechanical characteristics of gels composed of gelatin and dimethyl sulfoxide (DMSO) including lithium perchlorate ( $\text{LiClO}_4$ ) as an electrolyte. The gelatin was dried at 100 °C prior to use. It was found that the gelatin-DMSO/ $\text{LiClO}_4$  gel electrolyte is flexible and transparent, and its electrical conductivity is in the range of  $10^{-4}$ ~ $10^{-3} \text{ Scm}^{-1}$  at the temperatures ranging from 30 to 70 °C, with the activation energy of ca. 20 kJmol<sup>-1</sup>.

**P-13 Koji Okudaira, Tomohiro Ishii, Nobuo Ueno**  
**"Anisotropic Molecular Orientation of Poly(tetrafluoroethylene) Thin Film on Nanostructured Substrate"**

**okudaira@faculty.chiba-u.jp**

The uniaxially oriented PTFE film are obtained by evaporation onto the microstructured Cu plate, which is prepared by polishing uniaxially by polishing paste. This process does not need high temperature and the contamination is hard to occur at the film surface due to its vacuum process in comparison with the friction transfer method. In order to determine the molecular orientation we observe incidence angle ( $\alpha$ ) dependence of near-edge x-ray absorption fine structure spectra (NEXAFS) of PTFE(5nm)/Cu where the electrical vector of incidence photon is parallel (parallel condition) and perpendicular (perpendicular condition) to the polishing direction of Cu plate. From the comparison between observed and calculated  $\alpha$  dependence of C1s NEXAFS spectra with two different conditions, it is concluded that PTFE molecules uniaxially align, where the C-C main chains are parallel to the polishing direction of Cu substrate.

**P-14 Masato Tanaka, Koji Okudaira, Nobuo Ueno**  
**"Influence of Solvent Treatment on the Electronic structure and Morphology of PEDOT:PSS Film"**

**okudaira@faculty.chiba-u.jp**

In this work the electrical properties and film structure of organic polymer, poly(3,4-ethylenedioxythiophene) : poly(4-styrenesulfonate) (PEDOT:PSS) are investigated. Post-treatment of PEDOT:PSS films by dipping into ethylene glycol solution with a various concentration improve the electrical conductivity by two to three orders of magnitude. Surface sensitive x - ray photoemission spectroscopy shows that (i) as the films show higher conductivity, stronger charge transfer from PEDOT to PSS occurs, where PSS acts as an acceptor to PEDOT, (ii) PEDOT regions appears around film surface at higher conductive films. In the photoelectron emission microscopy images of highly conductive PEDOT:PSS films the domains with different contrast appear (typical domain size is in the range of several  $\mu\text{m}$ ). It is expected that the electrical properties of PEDOT:PSS depend strongly on the film structure.

- P-15 Yosuke Suda, Keiichirou Yonezawa, Kazuto Yamada, Hiroyuki Yoshida, Naoki Sato, Susumu Yanagisawa, Koji K Okudaira, Nobuo Ueno, Satoshi Kera**  
**"Unoccupied electronic states of superlattice monolayer depending on the mixing ratio of donor-accepter molecules"**

**okudaira@faculty.chiba-u.jp**

It is essential for developing device performance to understand how to control the carrier injection barrier at organic/organic interface. We have used low-energy inverse-photoemission spectroscopy to investigate the unoccupied electronic structure of the superlattice monolayer derived from diindenoperylene (DIP) and perfluoropentacene (PFP). By adding the results of ultraviolet photoemission spectroscopy, it is found that the both unoccupied states and the occupied states of DIP in the binary monolayer shift to the low-binding energy side with increasing the PFP molecular ratio. By arranging the mixing ratio of donor-accepter molecules, the energy level alignment at organic/organic interface can be controlled intentionally.

- P-16 Y. Ioka, K. Yonezawa, R. Makino, T. Tago, S. Kera, N. Ueno, K.K. Okudaira**  
**"Molecular-substrate Interaction and Ionization Energies in Organic Thin Film"**

**okudaira@faculty.chiba-u.jp**

In organic electronics, the ionization energy is important factor to understand the charge injection mechanism of organic devices. To obtain the ionization energies we observed the ultraviolet photoelectron spectra of diindenoperylene (DIP), perylene, dichlorotin phthalocyanine (SnCl<sub>2</sub>Pc) and dichlorotin naphthalocyanine (SnCl<sub>2</sub>Nc) with monolayer on graphite and Au(111) substrates. The ionization energies of DIP and perylene on Au(111) are smaller than those of DIP and perylene on graphite, respectively. Furthermore, the ionization energy of SnCl<sub>2</sub>Nc, which has widely extended  $\pi$ -electron system, on graphite is smaller than that of SnCl<sub>2</sub>Pc on graphite. It is found that the ionization energies of organic thin films strongly depend on the molecular-substrate interaction.

- P-17 M. Funase and K. Oto**  
**"Magneto-capacitance of graphene in the quantum Hall conditions"**

**oto@physics.s.chiba-u.ac.jp**

The capacitance spectroscopy is one of the useful techniques to study the electronic state in the new materials. We have fabricated the graphene FETs to measure the capacitance between the graphene sheet and the gate electrode separated by the SiO<sub>x</sub> insulating layer, but the observed magneto-capacitance shows complicated feature owing to the stray capacitance which is much larger than the value of graphene capacitance. We report the experimental results of magnetic field and the gate bias voltage dependences of the measured capacitance at 4.2 K to explain the observed magneto-capacitance up to 8.5 T.

- P-18 Y. Ariumi, J. Irobe, and K. Oto**  
**"Dynamic nuclear spin polarization in the quantum Hall breakdown observed by magneto-optical Kerr effect"**

**oto@physics.s.chiba-u.ac.jp**

At the quantum Hall breakdown phenomenon, the relaxation of spin polarized excited electrons causes the dynamic nuclear spin polarization (DNP) in the semiconductor crystal. We have tried to detect the DNP through the electron spin polarization measured by the magneto-optical Kerr effect at very low temperatures below 1 K. The relaxation profile of the time-dependent Kerr signal reveals the existence of DNP. The detailed experimental setup and the typical results of the time-dependent Kerr signal due to the DNP measured at the quantum Hall condition are presented.

- P-19 N. Kiryu, R. Kamagata, K. Yagasaki, and K. Oto**  
**"Electron spin polarization in GaAs HEMT devices in the quantum Hall conditions"**

**oto@physics.s.chiba-u.ac.jp**

We have measured the spin polarization in the two-dimensional electron system (2DES) in the GaAs high electron mobility transistor (HEMT) structures at quantum Hall regime by using magneto-optical Kerr effect. Since the Kerr rotation angle from the single layer 2DES magnetization is very small (typically less than 10<sup>-5</sup> rad), we developed high sensitive Kerr rotation microscope by using the Sagnac interferometer operating at 1.5 K and 9 T. We have successfully detected the Kerr signal at the quantum Hall plateau of Landau level filling factor is three. We demonstrate the possibility of spin polarization imaging observed in the HEMT devices at quantum Hall regime.

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- P-20 R. Suizu, K. Morioka, M. Yamamoto, T. Hayashida, Y. Shuku, T. Uchihashi, T. Nakayama, K.K. Okudaira, K. Awaga, and K. Sakamoto**  
**"Molecular arrangement and physical properties of heterocyclic thiazyl diradical BDTDA thin films grown on substrates used in devices"**

**kazuyuki\_sakamoto@faculty.chiba-u.jp**

In recent years, organic semiconductors have received much attention in the field of organic electronics/spintronics. In order to develop new working principle of devices, we choose heterocyclic thiazyl radicals, are stable and possess strong intermolecular interactions in crystal structures, as targets. In a former study, we have fabricated highly oriented thin films of 4,4'-bis(1,2,3,5-dithiadiazolyl) (BDTDA) and revealed photovoltaic behavior with a giant transient photocurrent at zero bias voltage of ITO/BDTDA/Al photocells. In this poster, we report that the molecular arrangement and electronic structures of BDTDA thin films grown on ITO and SiO<sub>2</sub>, which are widely used as substrate in devices.

- P-21 T. Hayashida, H. Ishikawa, Y. Yaoita, and K. Sakamoto**  
**"Electronic structure of heavy-element alloy TlBi grown on Si(111)"**

**kazuyuki\_sakamoto@faculty.chiba-u.jp**

The electronic structures of heavy metal element adsorbed surfaces exhibit Rashba split bands due to the strong spin-orbit interaction. These systems have attracted large interest in order to realize spintronics devices. In our former studies, we have revealed that Tl/Si(111) and Bi/Si(111) show peculiar Rashba effects originating from the symmetry of the surface. In this talk, we report the electronic structure of a TlBi alloy formed on Si(111) measured by angle-resolved photoelectron spectroscopy. A metallic linear valley structure was observed around the  $\bar{K}$  point together with a Rashba-like splitting band at the  $\bar{M}$  point.

- P-22 Y. Zhang, K. Morioka, H. Ishikawa, J. Fujii, Y. Yoshida, Y. Hasegawa, and K. Sakamoto**  
**"Electronic structure of ultrathin Tl single crystal film on Ag(111)"**

**kazuyuki\_sakamoto@faculty.chiba-u.jp**

The surface electronic bands of heavy elements with strong spin-orbit interaction show spin-split in the momentum space at the surface due to the structural inversion asymmetry. This is called the Rashba effect. Previously, we have observed a peculiar Rashba spin showing an abrupt rotation from the surface parallel direction to perpendicular on a silicon surface with a Tl monolayer on top of it. In this talk, we report the electronic and geometrical structures of Tl single crystal films grown on Ag(111) and Ag/Si(111) measured by ARPES and STM.

- P-23 Yuki Yoshimoto and Peter Kruger**  
**"Magnetic anisotropy of iron porphyrin films"**

**pkruiger@chiba-u.jp**

Paramagnetic complexes such as phthalocyanine and porphyrin molecules with transition metal atoms have strong magnetic anisotropy. Therefore they are interesting for fundamental research in spintronics and it is expected that they can be used for magnetic switching devices. In this study we have analyzed the magnetic anisotropy of iron porphyrin on Cu(001). A previous XMCD study has reported that iron in FeP takes S=1 intermediate spin state and has in-plane anisotropy. We have performed the simulation of XMCD by DFT+U calculation and Ligand-field-Multiplet calculations, then we have revealed that the ground state of this system is a mixture of two states which is caused by Spin-Orbit Coupling. Moreover, we show that in this state the spin and angular momentum are quenched.

- P-24 Lu Jin, Shota Tsuneyasu, Kazuki Nakamura, Norihisa Kobayashi**  
**"Electrochemically-Driven Dual Mode Display Device Consisted of Fluorescent Conductive Polymers"**

**koban@faculty.chiba-u.jp**

Display devices can be classified into two major categories as reflective display (non-emissive display) and emissive display. We propose novel display cell (DMD cell) which has both the reflective display and the emissive display mechanism, and we can choose either as the situation demands. DMD cell is a device which enables both the coloration by electrochromism (EC) and the light emission by electrochemiluminescence (ECL) respectively with electrochemical reaction. In this paper, we reported the reflective and emissive effect of DMD cell with EC and ECL reactions using conducting polymer Poly(2-methoxy-5-(2-ethylhexyloxy)-p-phenylenevinylene) (MEH-PPV) driven by direct current.

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- P-25 Shota Tsuneyasu, Kazuki Nakamura, Norihisa Kobayashi**  
**"Enhancement of AC-Operated Electrochemically Generated Luminescence by Addition of TiO<sub>2</sub> Nanoparticles"**

**koban@faculty.chiba-u.jp**

Electrochemically Generated Luminescence(ECL) is emission phenomenon from the excited state of the material generated electrochemically. We previously reported that the high brightness and quick response were achieved by AC-driven ECL device, compared with conventional DC-system. However, the ECL intensity and long term stability of the system was not sufficient.

In this study, we introduced TiO<sub>2</sub> nanoparticle in Ruthenium(II) complex-based ECL solution in order to improve emission properties of AC-operated ECL device. As a result, the ECL intensity and long term stability of the device were improved by adding TiO<sub>2</sub> nanoparticle in ECL solution.

- P-26 Naoki Ura, Kazuki Nakamura, Norihisa Kobayashi**  
**" Improved Coloration Properties of Electrochromic Device by Connecting Organic Dyes on Electrode"**

**koban@faculty.chiba-u.jp**

Electrochromism (EC) is known as reversible color change induced by an electrochemical reaction. Organic EC materials are expected to have potential applications in full-color electronic paper-like imaging devices. However, these cells could not retain the colored state enough to use as electronic paper devices because the bleaching of coloration due to collision between reduced species and oxidized species. In order to head off the collisions, the EC materials should be connected on the electrode and be suppressed diffusion in the electrolyte. In order to improve the coloration properties, we fabricated functional electrodes that the EC molecules were covalently-connected on the surface of the electrodes.

- P-27 Hiroumi Kinjo, Hyunsoo Lim, Yusuke Ozawad, Tomoya Sato, Yutaka Noguchi, Yasuo Nakayama, Hisao Ishii**  
**"The occupied LUMO of Alq<sub>3</sub> at polarized film surface studied by negative-ion PES"**

**ishii130@faculty.chiba-u.jp**

Organic EL materials often show spontaneous orientation polarization in evaporated films with giant surface potential (GSP). In this study, by using low energy photoemission spectroscopy (LE-PES) and photoelectron yield spectroscopy (PYS), we have found unusual photoemission from films of Alq<sub>3</sub> with GSP. Even if the photon energy is smaller than their ionization energy, photoelectrons are clearly observed. This can be ascribed to photoemission from anions which are captured by the orientation polarization. Our finding can be extended to develop as negative-ion PES (NI-PES) to determine electron affinity of various organic EL materials with high resolution and less damage.

- P-28 Y. Sekine, Y. Saito, Y. Okui, K. Takano, M. Hangyo, K. Oto, and M. Nakajima**  
**" Polarization change induced by two dimensional metal mesh metamaterial with the circular dichroism in the terahertz frequency regime"**

**oto@physics.s.chiba-u.ac.jp**

We have investigated the polarization properties of terahertz (THz) wave after transmission of the two-dimensional metal mesh metamaterial with cut-structures. The mesh structure was partially cut under the microscope. The polarization rotation of THz pulses induced by passing through the metamaterial was measured. We have found the large rotation- angle and ellipticity around 0.12 THz in the double-cut sample that has two cuts of one side and next side in a mesh. Furthermore, we have succeeded in expanding spectral range of polarization change by increasing cut density. The observed polarization change is well explained by the circular dichroism due to the chirality of cut- structure.

- P-29 R. Ishino, H. Kim, Y. Nakayama, Y. Noguchi, H. Ishii**  
**"An Organic EL Device Using Thermally Activated Delayed Fluorescence Studied by Transient EL and Displacement current measurements"**

**ishii130@faculty.chiba-u.jp**

Recently, organic EL devices using thermally activated delayed fluorescence (TADF) have attracted much attention due to their high efficiency without necessity of rare metals like Ir. In this study, an organic EL device using a typical TADF material, 4CzIPN, was investigated by using displacement current measurement (DCM) and transient EL measurement. We compared pristine with aged device (The device structure was ITO/□-NPD/CBP:4CzIPN(5wt%)/TPBi/LiF/Al.) We have found time to cancel the interface



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charge at TPBi interface is delayed as the device degraded. We concluded degradation of this device is attributed to reduction of hole mobility in CBP layer.

- P-30 Tomoya Sato, Kaveenga Rasika Koswattage, Yasuo Nakayama, Hisao Ishii**  
**"Direct Observation of Electronic Structure of Nylon-6,6 Thin Film to Clarify the Mechanism of Contact Electrification"**  
**ishii130@faculty.chiba-u.jp**  
Contact electrification of insulating polymers has been widely used in several technologies. But the fundamental mechanism of electrification is still controversial, and several models have been discussed. In most models, the existence of gap states is often assumed between highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO). The direct observation of these states was, however, examined only for limited insulating polymers. In this study, the electronic structure of Nylon-6,6, which is a typical insulating polymer, was observed by high sensitivity ultraviolet photoemission and photoelectron yield spectroscopy (HS-UPS/PYS). We will discuss the relationship between the observed gap state density and charging property of Nylon-6,6.
- P-31 Palidan Aierken, Lee Jun Hyung, Manabu Magarisawa, Katsuhiko Miyamoto, Takashige Omatsu**  
**"Glycine crystallization by structured photon radiation pressure"**  
**omatsu@faculty.chiba-u.jp**  
The laser trapping technique by utilizing a photon radiation pressure based on a focused optical vortex beam optical vortex was performed to crystallize an amino acid, glycine. The circularly polarized optical vortex, carrying orbital and spin angular momenta, was tightly focused onto the glycine deuterium oxide solution, so as to gather the glycine molecules at high density. We discovered that the optical vortex trapping enabled us to uniform the density of the glycine solution and to create a mono-crystalline glycine at high efficiency.
- P-32 Aizitiaili Abulikemu, Taximaiti Yusufu, Katsuhiko Miyamoto, and Takashige Omatsu**  
**"Optical vortex pumped optical parametric oscillator"**  
**omatsu@faculty.chiba-u.jp**  
We demonstrated a 0.5- $\mu\text{m}$  first-order optical vortex pumped optical parametric oscillator formed of non-critical phase-matching  $\text{LiB}_3\text{O}_5$  (NCPM-LBO) crystals in combination with a folding cavity configuration. With this system, the topological charge of the pump beam was selectively transferred to the signal output, which exhibited a topological charge of 1 in a wavelength range of 950-990nm. A maximum signal output energy of 0.9 mJ was achieved at a pump energy of 9mJ.
- P-33 Wataru Akiyama, Naoto Nakamura, Yu Tanaka, Katsuhiko Miyamoto, Takashige Omatsu, Jonathan P. Bird, Yuichi Ochiai, and Nobuyuki Aoki**  
**"Polymerization of C60 molecules with optical manipulation by optical vortex irradiation"**  
**n-aoki@faculty.chiba-u.jp**  
Recently, a state of the art photo-polymerization of a C60 thin film has been realized by irradiation of topological laser beam namely optical vortex (OV).  
In our study, thermally evaporated C<sub>60</sub> thin film was deposited 10 nm on Si<sub>3</sub>N<sub>4</sub> membrane grids for a transmission electron microscope (TEM) observation. A continuous-wave laser beam ( $\lambda = 532 \text{ nm}$ ) was used for the optical source, and then the OV was produced by using a spiral phase plate and irradiated onto the sample through an objective lens. In the observation of the surface of the C<sub>60</sub> thin film by atomic force microscope and TEM, very thin layers having a thickness of  $\sim 5 \text{ nm}$  and covering the surface of C<sub>60</sub> grains were confirmed after the OV irradiation. In this presentation, the characteristics of the films will be discussed.
- P-34 Akram M. Mahjoub, Nobuyuki Aoki, Katsuhiko Miyamoto, Tomohiro Yamaguchi, Takashige Omatsu, Jonathan P. Bird, David K. Ferry, Koji Ishibashi, and Yuichi Ochiai**  
**"THz bolometric detection by thermal noise in graphene"**  
**n-aoki@faculty.chiba-u.jp**  
The motive behind this study, is to utilizing the basic electrical, mechanical, and thermal properties of the graphene nano-carbon material to develop a new generation of Terahertz (THz) sensing devices. In this study, the electrical properties of the graphene device has been investigated by analyzing the 1/f noise spectrum. The analysis highlights the interplay of two dominate thermal effects as a measure of detection

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responses. The observation of those effects at room temperature as a detection mechanism should provide a solid approach for THz detection due to bolometric local heating effect.

The understanding of the response differences between monolayer and bilayer graphene should provide an insight to the THz sensing devices which will open new prospects for communication, security, medical and even scientific imaging applications.

- P-35 S. Xiang, S. Sato, T. Luan Nguyen, N. Mukasa, N. Aoki, S. Xiao, J.P. Bird and Y. Ochiai**  
**"Quantum phase transition in fractional quantum Hall regime in the quasi-one dimension structure"**

**n-aoki@faculty.chiba-u.jp**

Except the integer quantized conductance, a quasi-plateau near  $0.7 G_0$  ( $G_0 = 2e^2/h$ ) in quantum wires (QW) has been also reported recent decades, which is attributed to many-body effect. In this study, we have investigated the magnet-resistance in QW devices. Some fractional plateaus have been observed in linear conductance at high magnetic field. At 4.5 T, the temperature dependence of the fractional plateau indicates that the metal-insulator transition can be observed in QWs. The fractional plateau seems evolve from 0.7 structure as magnetic field is increased, and it can also survive at high temperature ( $\sim 10$  K). Therefore, we suggest that the 0.7 structure must be related to phase transition.

- P-36 Bong Joo Kang, Won Tae Kim, Kwang Jun Ahn, Dong-Il Yeom, and Fabian Rotermund**  
**"Broadband terahertz coherent sources and their applications for nonlinear and time-resolved spectroscopy"**

**rotermun@ajou.ac.kr**

Terahertz (THz) waves have attracted a great attention as a new coherent light source for a wide range of scientific and industrial applications due to its unique transparency in most dielectric materials without damage and the finger printing capability of specific molecular motions. Although the special properties in THz regime are getting more important for optics and electronics, there are limited research activities focused on THz ultrafast and nonlinear phenomena in materials because of lack of ultrafast and high-field THz systems.

Here, we introduce different THz pulse generation systems covering wide power ranges for various THz research activities. We construct three different systems, i.e., fs Ti:sapphire regenerative amplifier-based high-power and mid-power broadband THz pulse generation systems and fs oscillator-based high-signal-to-noise broadband THz pulse generation system based on photoconductive switch. Our THz systems can generate THz output powers from 100 nW to 3.5 mW with electric field strengths high as 400 kV/cm<sup>1,2</sup> and are further applied for precise THz nonlinear and time-domain spectroscopy.

- P-37 Daeyong Kim and Chee Burm Shin**  
**"Modeling of the electrical and thermal behaviors of an ultracapacitor for automotive applications"**

**cbshin@ajou.ac.kr**

Ultracapacitors, also known as supercapacitors, have the potential to meet the high pulse power capability related to the automotive applications. As compared to batteries, ultracapacitors offer a higher power density, higher efficiency, and longer shelf and cycle life. The primary disadvantage of ultracapacitors is their low energy density relative to that of batteries. It is important to calculate accurately the electrical and thermal behaviors of an ultracapacitor for the efficient and reliable systems integration from an application perspective. In this work, modeling is performed to study the electrical and thermal behaviors of a 2.7V/650F ultracapacitor from LS Mtron Ltd. A three-branch circuit model is employed to calculate the electrical behavior of the ultracapacitor. To predict the thermal behavior of the ultracapacitor, Joule-heat and reversible heat at the electrodes are considered. The validation of the modeling approach is provided through the comparison of the modeling results with the experimental measurements.

- P-38 Seulong Kim, Kihong Kim**  
**"Mode conversion of MHD waves in stratified inhomogeneous media with shear flows"**

**khkim@ajou.ac.kr**

The propagation, resonant absorption, over-reflection, and mode conversion phenomena of magnetohydrodynamic (MHD) waves in stratified media with shear flows are theoretically studied. We derive an MHD wave equation for the situation where the shear flow velocity, the external magnetic field strength and the plasma density depend on one spatial coordinate  $z$ , while the directions of the shear flow

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and the external magnetic field are perpendicular to that of inhomogeneity. The MHD wave equation is solved in a numerically precise manner using a generalized version of the invariant imbedding method. In general, resonant conditions can be satisfied at several values of  $z$ , which are close to each other, therefore different kinds of resonant absorption and over-reflection phenomena may interfere and result in substantial enhancement of resonances. A detailed investigation of the enhanced mode conversion including its dependences on the frequency, the incident angle and the inhomogeneity profile is presented.

**P-39 Taehyeong Kim, Joonhan Park and Sunghwan Kim**  
**"Photolithography and dry-etch process on silk biopolymer"**  
**sunghwankim@ajou.ac.kr**

Here we introduce a new photoresist which can replace the conventional materials in semiconductor industry. Silk, extracted from the cocoons, possess the biocompatibility and optical transparency, so has proven its potential as a remarkable optical material. Along with those, the excitation by the electron beam and UV light can change the molecular structure of silk and therefore silk can be applied in the lithography process.

Our approach provides the entirely water-based process, eco-friendly, and competitive etching selectivity.

**P-40 S. J. Park, and Y. H. Ahn**  
**"Highly sensitive detection of fungi and bacteria using terahertz metamaterial and plasmonic sensor"**  
**ahny@ajou.ac.kr**

We demonstrate that THz metamaterials and plasmonic devices can work as efficient sensors for detecting microorganisms such as fungi and bacteria. A clear shift in the resonant frequency is observed following the deposition of microorganisms, and arises due to the change in the effective dielectric constant in a gap area. The resonant frequency shift is higher for the larger dielectric constants, which was confirmed by the dielectric constant measurements of individual microorganisms. In addition, THz metamaterials and plasmonic sensors can be used in aqueous environment, because it is highly sensitive to the substances located near the surface. Although our technique is based on the dielectric sensing, a selective detection is also possible by functionalizing the substrates with antibodies specific to the target substances.

**P-41 Minseok Oh and Byungmin Ahn**  
**"Effect of sintering condition on Zn vaporization in Al-6Cu-5Zn P/M alloy"**  
**byungmin@ajou.ac.kr**

Conventional power metallurgy process via cold compaction and sintering is hardly applicable to the powder mixture of Al-Cu-Zn alloy system due to the vaporization loss of Zn. The Zn atoms are readily vaporized during sintering because of high vapor pressure compared with other metallic elements, resulting in inhomogeneity of microstructure and decrease in mechanical properties of the resultant sintered material. In the present study, each alloying elements were mixed to form a composition of Al-6Cu-5Zn, and then sintered at 615°C for 1 hour. In the sintering process, three different heating rates were applied, 5, 10, and 15°C/min. To investigate the vaporization behavior of Zn element, the microstructural and chemical analyses were performed using scanning electron microscope (SEM), energy dispersive X-ray spectroscopy (EDS), X-ray fluorescence (XRF), and inductively coupled plasma (ICP). The experimental results were correlated with a thermodynamic calculation of Zn vaporization. The minimum vaporization loss of Zn was observed at the greater heating rate during sintering.

**P-42 Shinyoung Ryu, Jonghyuk Yim and Soonil Lee**  
**"Fabrication of Si/CNT hybrid solar cell by spray method"**  
**soonil.ajou@gmail.com**

We fabricated SWCNT-Si hybrid solar cells by using a spraying process to form a network film of SWCNTs that were in intimate contact with a Si wafer. Preparation of stable aqueous SWCNT dispersion solutions, thorough removal of surfactants after SWCNT film deposition, balancing transparency and sheet resistance of SWCNT films, and controlling passivation layers using insulating medium such as SiO<sub>2</sub> were essential to fabricate hybrid solar cells showing good power conversion efficiency (PCE). In addition, SWCNT-Si hybrid solar cells showed large variations in their performance in response to changes in fabrication and measurement processes. We are going to discuss how PCEs of such devices can be enhanced.

**P-43 Il-Han Yoo, Shankara S. Kalanur, Sun A Park, and Hyungtak Seo**  
**"Water splitting system of 2D SnS<sub>2</sub> on FTO"**  
**hseo@ajou.ac.kr**

Hydrogen energy is a clean energy and can be used as an energy source in many field such as hydrogen vehicle(fuel cell) and industry. Water splitting is one of the most promising and cleaner method to produce hydrogen. In water splitting reaction, water and solar energy are used as source which are unlimited and environmentally cleaner.

For solar water splitting, the most important factor is band gap of the material. In addition, conduction band edge should be located higher potential than H<sup>+</sup>/H<sub>2</sub> reaction and the valence band edge should be located lower potential than O<sub>2</sub>/H<sub>2</sub>O reaction. Above all, for better efficiency material should absorb the visible light that accounts for most of the sun light wavelength.

In this study, SnS<sub>2</sub> ultra-thin film are used for solar water splitting. With the band gap of 2.5eV, SnS<sub>2</sub> can absorb much of the visible light and can be efficiently used for water splitting. SnS<sub>2</sub> is corrosion resistant, and can be used for a long time in water splitting device. As water splitting reaction occurs mainly on the surface, we used 2D SnS<sub>2</sub> to increase the efficiency. SnS<sub>2</sub> thin films are fabricated using hydrothermal method on fluorine-doped tin oxide (FTO). Thus fabricated SnS<sub>2</sub> thin films characterized using XRD, SEM, TEM, UV-vis. The SnS<sub>2</sub> thin films photo electrochemically characterized by measuring photocurrent density. Specifically we have studied the relationship between specific surface area dependent photo electrochemical properties.

**P-44 Chan Lee and Hye-Young Jang**  
**"Synthesis of Valuable Organic Building Blocks using O<sub>2</sub> and CO<sub>2</sub>"**  
**hyjang2@ajou.ac.kr**

Considering environmental pollution and limited amounts of fossil fuel, one of important issues in synthetic chemistry is to design the reaction conditions using less amounts of toxic chemicals and generating less amounts of byproducts. Accordingly, our research group has studied the environmental-friendly and economical catalytic reactions to synthesize industrially and pharmaceutically valuable organic compounds. In this presentation, two different types of chemical conversions using oxygen as an oxidant as well as a reactant, and using carbon dioxide as a C1 source. In the oxidation, efficient conversion of thiols to thioamides, esters, and olefins was shown. Carbon dioxide was also participated in the formation of carboxylic acids and carbonates.

**P-45 Hae-Min Lee, Gyoung Hwa Jeong, Sang-Wook Kim, and Chang-Koo Kim**  
**"Pseudocapacitive performance of porous ZrO<sub>2</sub>-SiO<sub>2</sub> sheets doped with WO<sub>3</sub> nanoparticles"**  
**changkoo@ajou.ac.kr**

Recently, with the impending energy crisis and the rising global demand for energy consumption, alternative energy storage devices and materials have attracted tremendous attention. Supercapacitors, an intermediate system between conventional capacitors and batteries, are considered as one of the most promising candidates for energy storage devices and have drawn much attention due to their high power capabilities, fast charge-discharge processes and long cycle life.

Since the introduction of the single layer graphene in 2004, graphene would be an outstanding candidate as an electrode material of solar cells, lithium ion batteries, and supercapacitors due to the theoretical specific surface area of 2,630 m<sup>2</sup>g<sup>-1</sup>, excellent thermal and electrical conductivity. It is well-known that binary composite oxides such as ZrO<sub>2</sub>-SiO<sub>2</sub> are important to fabricate materials with chemical, thermal, and mechanical stabilities. However, these binary composite oxides have relatively low surface areas. To overcome this shortcoming, we synthesized new ternary oxide system of porous ZrO<sub>2</sub>-SiO<sub>2</sub> sheets with ultrasmall WO<sub>3</sub> NPs for the energy-storage device. WO<sub>3</sub> is an attractive electrode material because of its multiple oxidation states. Nevertheless, there are rarely reports on the capacitive performance of WO<sub>3</sub>.

In this work, a direct and simple method to synthesize porous ZrO<sub>2</sub>-SiO<sub>2</sub> sheets with well-defined ultrasmall WO<sub>3</sub> nanoparticles for electrode materials was developed. The synthesized samples were characterized by transmission electron microscopy (TEM), powder X-ray diffraction (XRD), and BET. In addition, the electrochemical properties for supercapacitors were obtained using a computer-controlled potentiostat equipped with a standard three-electrode cell at room temperature.

**P-46 Hyo Won Lee and Hwan Myung Kim**

**"A Ratiometric Two-Photon Fluorescent Probe for Quantitative Detection of  $\beta$ -Galactosidase"**

**kimhm@ajou.ac.kr**

Human  $\beta$ -galactosidase ( $\beta$ -gal) is a lysosomal exoglycosidase that cleaves galactose residues from various substrates, such as gangliosides, glycoproteins, sphingolipids, and keratin sulfate.<sup>1</sup> Interestingly, abnormally accumulated  $\beta$ -gal activity has long been reported in diverse senescent cells and tissues, showing this senescence-associated  $\beta$ -gal (SA- $\beta$ -gal) as an important biomarker for cellular senescence.<sup>2</sup>

To monitor the  $\beta$ -gal enzyme activity in cells and tissues, some fluorescent probes have been reported,<sup>3</sup> but these probes are limited by having a turn-on response within a single detection window, their short excitation wavelengths, and/or pH sensitivity, making the quantitative analysis of  $\beta$ -gal activity challenging.

Herein, we have developed a new ratiometric two-photon fluorescent probe (SG1) for  $\beta$ -galactosidase and its application to quantitative detection of  $\beta$ -gal activity during cellular senescence in live cells and tissues. This probe shows a significant two-photon excited fluorescence, a marked blue-to-yellow emission color change (SG1 to 1, Scheme 1) in response to  $\beta$ -gal, easy loading into cells and tissues, insensitivity to pH and ROS, high photostability and low cytotoxicity. Moreover, ratiometric two-photon microscopy (TPM) imaging using SG1 may be an effective tool for biomedical research, including studies of cellular senescence.

**P-47 Woong-bin Yim, Huiseong Jeong, S.J. Park, Y.H.Ahn, Soonil Lee, and Ji-Yong Park**  
**"Nanostructure formation using carbon nanotubes as a sputtering mask"**

**jiyong@ajou.ac.kr**

In this study, we investigated the formation of nano-structures using carbon nanotubes (CNTs) as a sputtering etch mask. We found that CNTs can be used as a sputtering etch mask since CNT and polymers have significantly different sputtering yield. For this study, we transferred CNTs grown by thermal chemical vapor deposition (CVD) on the SiO<sub>2</sub>/Si substrate to a poly(methyl methacrylate) (PMMA) film by etching SiO<sub>2</sub> layer with the buffered oxide etch (BOE) while spin-coated PMMA layer is holding CNTs on the surface.

When the PMMA film with CNTs is exposed to Ar plasma, CNTs act as an etch mask protecting PMMA region underneath. In this way, nano-structures with the width similar to that of CNTs and heights as high as ~20 nm can be formed on PMMA film. The aspect ratio of nano-structures can be controlled by the diameter of CNTs, power and exposure time of Ar plasma. We investigated the formation of nano-structures by atomic force microscopy, Raman spectroscopy, and I-V measurement.

**P-48 Han Jin Lim and Seung-Joo Kim**

**"Synthesis and structure analysis of lithium conducting material, Lithium aluminum sulfide"**

**sjookim@ajou.ac.kr**

Li<sub>5</sub>AlS<sub>4</sub> was synthesized by solid state reaction of Li<sub>2</sub>S and Al<sub>2</sub>S<sub>3</sub>. Because Li<sub>5</sub>AlS<sub>4</sub> is very unstable and uptakes easily moisture from atmosphere, all the preparation procedure was carried out in an argon-filled glove box. The mixture of starting materials was put into a carbon-coated quartz tube and it was heated at a reaction temperature. The crystal structure of Li<sub>5</sub>AlS<sub>4</sub> was investigated by means of Ab initio structure determination method based on neutron powder diffraction data. The specimen was placed in a vanadium cell ( $\Phi$ 8mm, L40~50mm) which is sealed in the aluminum can. Diffraction pattern of this compound showed a monoclinic symmetry (space group, P2<sub>1</sub>/m). In the structure of Li<sub>5</sub>AlS<sub>4</sub>, aluminum atom is coordinated to four sulfur atoms to form an AlS<sub>4</sub> tetrahedron. Lithium atoms occupy crystallographically different four sites. Among them, Li<sub>1</sub> and Li<sub>2</sub> are coordinated to four sulfur atoms to form LiS<sub>4</sub> tetrahedra, while Li<sub>3</sub> and Li<sub>4</sub> atoms are coordinated to six sulfur atoms to form LiS<sub>6</sub> octahedra. This structure can be considered as a derivative of Li<sub>2</sub>FeS<sub>2</sub>, in which Fe atom is substituted by 0.5Li and 0.5Al. The ionic conductivity of Li<sub>5</sub>AlS<sub>4</sub> was  $8.10 \times 10^{-6}$  at 481 K with an activation energy of 0.61 eV in the temperature range of 324K ~ 481K.

**P-49 Byungwook Jeon and Yu Kwon Kim**

**"Changes in the photoactivity and thermal reactivity of V-doped anatase TiO<sub>2</sub>: The effect of vanadium loading"**

**yukwonkim@ajou.ac.kr**

We have synthesized V-doped anatase TiO<sub>2</sub> nanosheets using a varying amount of ammonium vanadate (0 – 10 wt%) as a vanadium precursor. The resulting V-doped TiO<sub>2</sub> nanocrystals were found to have an increasing amount of vanadium in the bulk while the bulk anatase TiO<sub>2</sub> structure was maintained as

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measured from Raman spectroscopy and X-ray diffraction (XRD) measurements. The band gap of V-doped TiO<sub>2</sub> was found to be reduced gradually down to 2.4 eV with increasing V loading. Electron paramagnetic resonance (EPR) and X-ray photoelectron spectrum (XPS) show that vanadium ions are in ionic states of V<sup>4+</sup> and V<sup>5+</sup> in anatase TiO<sub>2</sub> nanosheets. The photoactivity of the V-doped TiO<sub>2</sub> was compared from photodegradation of methylene blue (MB). The results showed that the V species incorporated into the bulk TiO<sub>2</sub> decreased the photodegradation reaction rate. The thermal reactivity of the V-doped TiO<sub>2</sub> was measured from thermal reactions of ethanol into acetaldehyde (dehydrogenation) and ethylene (dehydration). The temperature dependent reaction rates were systematically measured and plotted against 1/T. The analysis showed that the V species enhanced the reaction rate under the same experimental condition. The activation energy barrier of dehydration was found to be significantly reduced while that of dehydrogenation was little influenced. This observation has an important implication on the reaction mechanisms of the two channels. The V species is speculated to have a direct influence on the rate-limiting step toward dehydration, while it's not the case for dehydrogenation. Instead, the number of active sites for dehydrogenation is speculated to be increased.

**P-50 Sung-yoon Joe, Jong Hyuk Yim, Shin Young Ryu, N. Y. Ha, Y. HA. Ahn, Ji-Yong Park, and Soonil LEE**

**"Fabrication of organic solar cell of based on P3HT and ICBA with the addition of donor nanowires"**

**soonil.ajou@gmail.com**

Bulk heterojunction (BHJ) polymer solar cells are the devices based on a blend of a polymeric electron donor (D) and an electron acceptor (A). In the BHJ device, the active layer consisting of the D and A materials provides sufficient D/A interface for photo-generated exciton dissociations. It is important to control over the interface and nanomorphology of the active layer for acquiring highly efficient the BHJ solar cells. In particular, control of the nanoscale phase separation between the D and A domains, enhancement of molecular ordering of the donor polymers, and an increase in the percolation of acceptor molecules are critical factors that determine BHJ device properties. In this work, to fabricate efficient BHJ solar cells, we introduced self-assembled P3HT nanowires (NWs) into the BHJ solar cell architectures, in which phenyl-C61-butyric acid methyl ester (PCBM) or indene-C60 bisadduct (ICBA) were used as acceptors. The self-assembled P3HT NWs-based BHJ solar cells showed higher power conversion efficiency (PCE) by careful optimization of the active-layer thickness and thermal annealing conditions.

**P-51 Deokhyun Han and Byungmin Ahn**

**"Formability evaluation on hydroforming of Al tubes for heat exchanger"**

**byungmin@ajou.ac.kr**

For the metallic heat exchanger, the major manufacturing processes are brazing of U-shaped tubes and expanding of the tubes using bullets. However, those processes always involve deleterious issues to the heat exchanger. The brazed joints are readily susceptible to corrosion and fracture, and the bullets always smear the internal groove structures inside diameter during expansion resulting in deteriorated efficiency of the heat conduction. In the present study, a novel approach was applied for a process excluding brazing or bullet-expansion of tubes, hydroforming of aluminum tubes to transfix fin-tube of evaporator. The formability during hydroforming of the tubes was numerically simulated using finite element analysis (FEA), and the simulated results were compared with the experimental results through investigating expansion ratio on each internal pressures and thickness of the tubes.

**P-52 Sang Yeon Lee, Yu-min Park and Hyungtak Seo**

**"Depth Resolved Band alignments of TiN/ZrO<sub>2</sub> and TiN/ZAZ DRAM Capacitors"**

**hseo@ajou.ac.kr**

As high dielectric constant (k) dielectrics are implemented to increase charge storage capacity per area of metal-insulator-metal (MIM) capacitor cell in dynamic random access memory (DRAM), it is extremely crucial to ensure the effective controllability on a leakage current through ultrathin high-k dielectrics. In order to ensure the proper level of charge retention in MIM cell, the leakage current suppression and control is mandatory. In this study, we investigated the interfacial electronic band structure of TiN-dielectrics (ZrO<sub>2</sub>/ZrO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub>-ZrO<sub>2</sub> (ZAZ))-TiN capacitors formed by atomic layer deposition (ALD) using X-ray photoelectron spectroscopy (XPS), Ultra-violet photoemission spectroscopy (UPS), and spectroscopy ellipsometry (SE). Based on these various spectroscopic analysis under the depth profiling scheme, the interfacial chemical composition and conduction/valence band offset (CBO/VBO) were determined by combining band gaps of dielectrics from SE analysis and work functions from UPS analysis. I will talk the TiN/ZrO<sub>2</sub>/TiN or TiN/ZAZ/TiN structure band

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alignment by analyzing conduction band offset (CBO) and valence band offset (VBO) at the interfacial part on electrode/dielectric layer using depth resolved spectroscopy techniques. Between electrode and dielectric layer, at the center of interface defined by chemical composition depth profile, CBO was determined at 2.03 eV for ZrO<sub>2</sub> and 2.57 eV for ZAZ. The process induced subcutaneous TiON at the interface was identified and played an important role in creating sub-band states. Based on combined analyses on both intrinsic and sub-band structures, the band alignment model is proposed. It was confirmed that the Al<sub>2</sub>O<sub>3</sub> layer in ZAZ leads to the lowering of Fermi energy level or p-doping effect, increasing CBO and the tunneling barrier in metal-insulator-metal capacitors.

- P-53 Hwanseong Jeong, Sun Young Choi, Fabian Rotermund, and Dong-Il Yeom**  
**"Passively mode-locked dissipative soliton laser with high pulse energy of 34 nJ using SWCNT saturable absorber"**  
**diyeom@ajou.ac.kr**

In recent years, single walled-carbon nanotube (SWCNT) has been intensively studied for the application to nonlinear optic devices such as ultrafast optical switches, optical limiters and saturable absorbers (SAs) due to its huge third-order nonlinearity, fast recovery time and broad absorption properties [1]. Although SWCNTs coated on fiber-end are used as an in-line SA for fiber laser mode-locking, it is liable to the optical damage due to the limited nonlinear interaction length. To increase the damage threshold of the SWCNT-SA, a side-polished fiber (SPF)-based SWCNT-SA has been demonstrated [2]. It can enhance the nonlinear interaction length while reducing the optical damage of the SA because it employs evanescent wave interaction with the SWCNT.

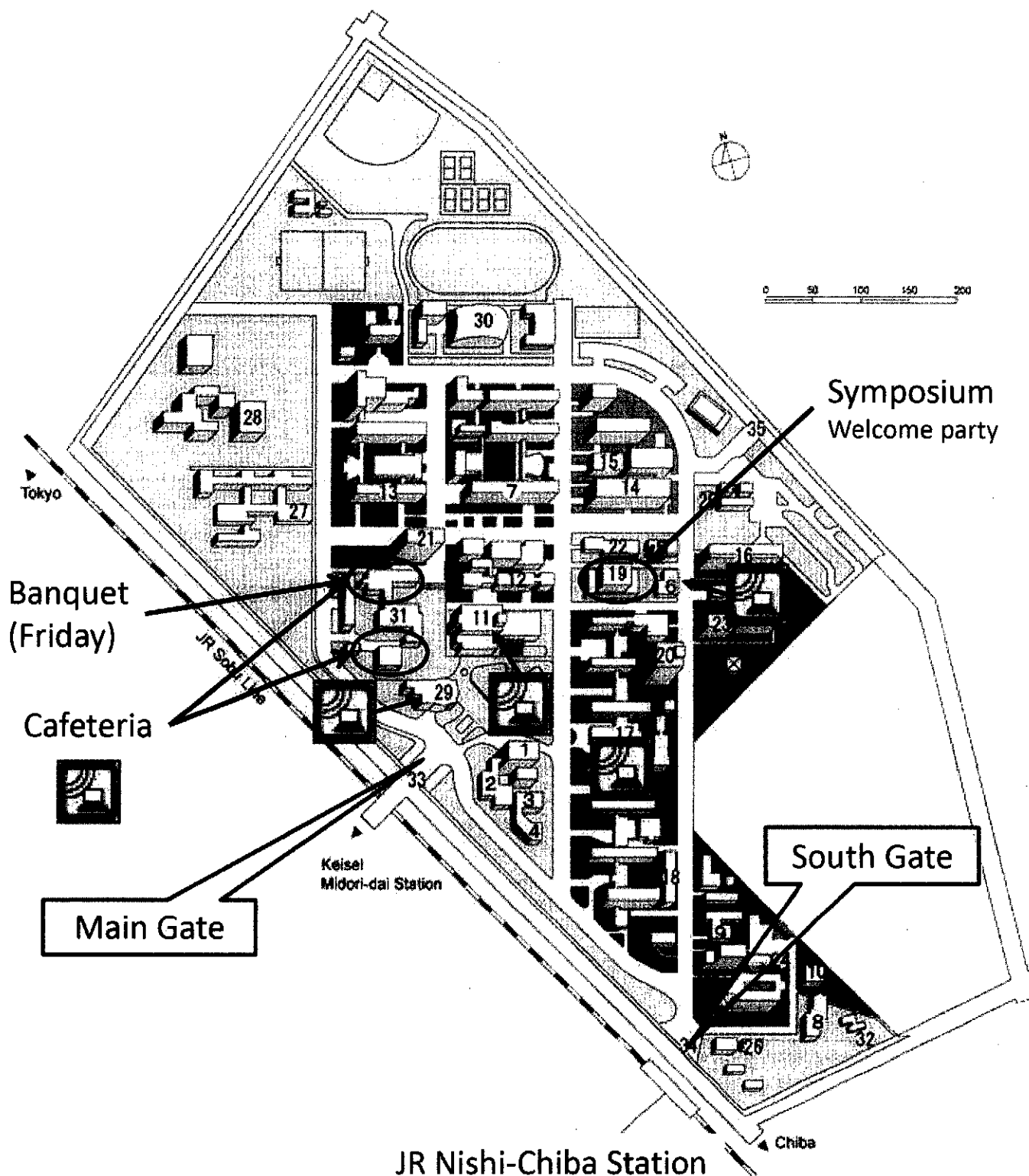
In this work, we report an all-fiber dissipative soliton laser with high pulse energy of 34 nJ based on SWCNT-SA coated on the SPF. The SWCNT SPF SA is fabricated by optimized condition. An Erbium-doped dissipative soliton fiber laser including a segment of dispersion managed fiber was built using our SA. The all-fiber laser oscillator delivers highly chirped pulse with the pulse duration of 12.7 ps. The average output power up to 335 mW was measured. Corresponding pulse energy was estimated to be 34 nJ at the fundamental repetition rate of 9.8 MHz.

- P-54 J. K. Park, B. H. Son, J. Y. Park, S. Lee, and Y. H. Ahn**  
**"Ultrafast carrier transport in semiconducting nanowire and carbon nanotube field-effect transistors"**  
**ahny@ajou.ac.kr**

Femtosecond photocurrent microscopy enables a direct visualization of ultrafast carrier motions in nanoscale devices, such as Si nanowire (NW) and carbon nanotube (CNT) field-effect transistors. We measured transit times of ultrashort carriers that are generated near one metal electrode and subsequently transported toward the opposite electrode based on drift and diffusion motions. We observed drift-like motion in Si NWs, in which the average velocity did not change noticeably with changes in the channel length. More importantly, the carrier dynamics have been measured for various working conditions that strongly modify the electronic band structures of NWs. In particular, gate-dependent measurements reveal that the carrier velocity changes linearly with the applied gate bias in accordance with changes in the electric field strength in the Schottky barrier.



# Chiba University (Nishi-Chiba)



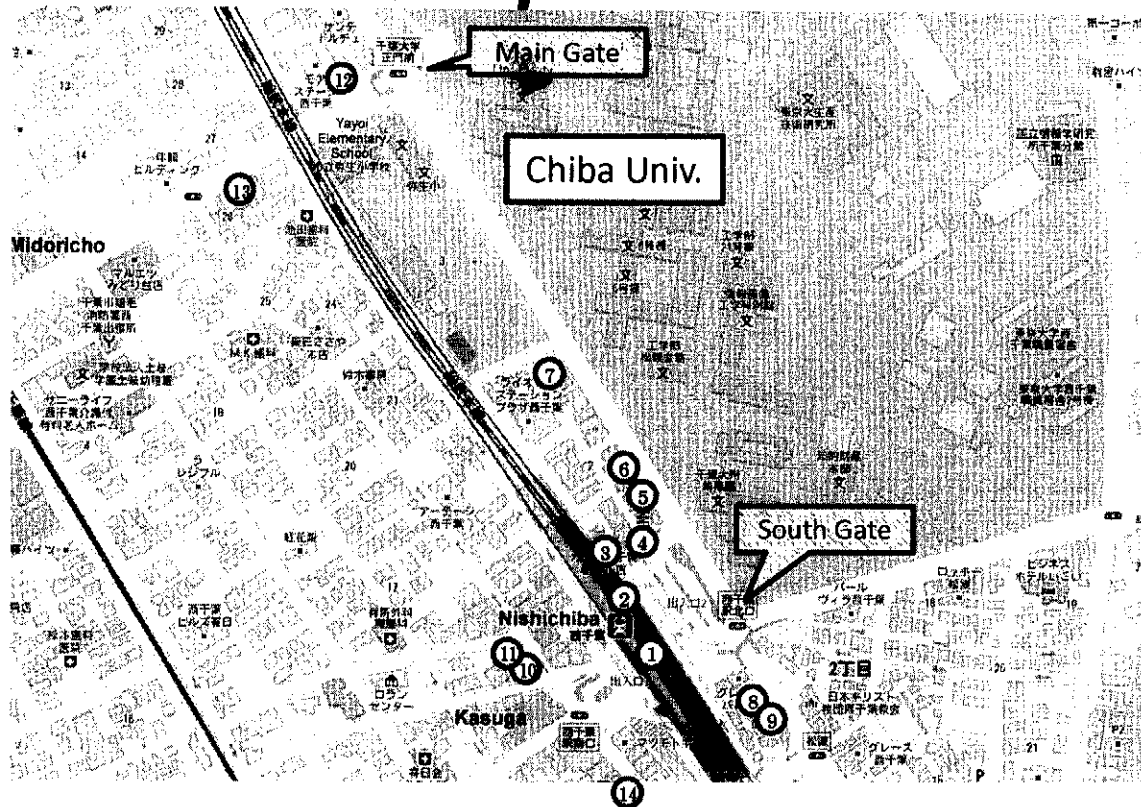
WiFi spots

# Access to free WiFi spots

SSID	eduroam
Security type	WPA2-Enterprise
Encryption type	AES

id	password
cuguest01-1@chiba-u.eduroam.jp	BOg7InyV
cuguest01-2@chiba-u.eduroam.jp	ziXZ-5AP
cuguest01-3@chiba-u.eduroam.jp	OLeCQMwQ
cuguest01-4@chiba-u.eduroam.jp	LOs89wR3
cuguest01-5@chiba-u.eduroam.jp	cBA65rR6
cuguest01-6@chiba-u.eduroam.jp	9_AfmthU
cuguest01-7@chiba-u.eduroam.jp	daKn36Dc
cuguest01-8@chiba-u.eduroam.jp	jZAzJWgc
cuguest01-9@chiba-u.eduroam.jp	TG2C33J7
cuguest01-10@chiba-u.eduroam.jp	n2wd9Y6l
cuguest01-11@chiba-u.eduroam.jp	WUHURvIm
cuguest01-12@chiba-u.eduroam.jp	jo2jCpmc
cuguest01-13@chiba-u.eduroam.jp	0t69w1S0
cuguest01-14@chiba-u.eduroam.jp	1bPjrCoA
cuguest01-15@chiba-u.eduroam.jp	Wg9gNDUg
cuguest01-16@chiba-u.eduroam.jp	7P2WB3La
cuguest01-17@chiba-u.eduroam.jp	B0KCmcSb
cuguest01-18@chiba-u.eduroam.jp	ytzAZKXr
cuguest01-19@chiba-u.eduroam.jp	WasZAsJw
cuguest01-20@chiba-u.eduroam.jp	9Vq9W_TB
cuguest01-21@chiba-u.eduroam.jp	h26A5QLh
cuguest01-22@chiba-u.eduroam.jp	K9_QQiM
cuguest01-23@chiba-u.eduroam.jp	Ow-uAv0z
cuguest01-24@chiba-u.eduroam.jp	Ppo7aJMb
cuguest01-25@chiba-u.eduroam.jp	0-Gn3GbE
cuguest01-26@chiba-u.eduroam.jp	ti0g3wvl
cuguest01-27@chiba-u.eduroam.jp	fQmnribW
cuguest01-28@chiba-u.eduroam.jp	7nRc3Yi2
cuguest01-29@chiba-u.eduroam.jp	39ddjPFn
cuguest01-30@chiba-u.eduroam.jp	Bx86e4wE
cuguest01-31@chiba-u.eduroam.jp	FEizBth3
cuguest01-32@chiba-u.eduroam.jp	fuR6tRrg
cuguest01-33@chiba-u.eduroam.jp	Hg6lrkp_
cuguest01-34@chiba-u.eduroam.jp	aDmY4WW5
cuguest01-35@chiba-u.eduroam.jp	lPwU86g7
cuguest01-36@chiba-u.eduroam.jp	Xn2eWZYg
cuguest01-37@chiba-u.eduroam.jp	fZ2OXhsr
cuguest01-38@chiba-u.eduroam.jp	pLeEH1lR
cuguest01-39@chiba-u.eduroam.jp	0EJZjzfJ
cuguest01-40@chiba-u.eduroam.jp	3KMV08-h

# Restaurant map



- 1, Nishichiba Station:  
Café, UDON, doughnut, Market
- 2, KONNICHIWA(今日和), Italian
- 3, Gust(ガスト), Restaurant
- 4, SUBWAY, Sandwich
- 5, TANDOORI(タンドリー), Curry
- 6, PLUMERIA(プルメリア), Sandwich
- 7, Bambina(バンビーナ), Italian
- 8, MUGENDAI(無限大), Noodles
- 9, POPOKI(ポポキ), Restaurant
- 10, HIDAKAYA(日高屋), Chinese
- 11, MUSASHIYA(武蔵屋), Noodles
- 12, GAZAL(ガザル), Curry
- 13, MOS BURGER(モスバーガー), Fast food
- 14, Sugiya(杉屋), Japanese

