

Greeting;

Already 7 years have passed, since KANEKA/SKKU Incubation Center has been established on June 1st 2010 on the base of Japanese chemical company; Kaneka Corporation's full financial support.

As you may know, Japan has long history in industry and tradition to develop excellent basic and material technologies, as Kaneka has represented until now. And in Korea, there are dynamism and good technologies for electronics with excellent global companies such as Samsung, LG etc. Fusion of these two powers must be great influence to the market in the world. Our Incubation Center plays an important role to make a bridge between Korea and Japan.

KANEKA/SKKU International Symposium were held so far six times at Sungkyunkwan university with very outstanding professors and scholars; Prof. H. Shirakawa; Nobel laureate invited in 2011 and Prof. H. Hosono; outstanding research on oxide semiconductor materials in 2014, etc. This year, we have also invited very famous scholars and engineers as shown in this program. They are usually so busy and it is hard to hear their talks. I would very much appreciate them to come to SKKU and give us wonderful lectures.

Finally, I hope all of you to enjoy this international symposium as before.

Thanks.

夫 龍淳 (Professor LyongSun Pu)

Director, KANEKA/SKKU Incubation Center

Office 81419 RIC, Sungkyunkwan University

2066, Seobu-ro, Jangan-gu, Suwon-si, Gyeonggi-do 16419, Korea

E-mail; lspu@skku.edu(univ.), lpu@fsinet.or.jp(home)

Phone; +82-31-299-6705(office), +82-10-9247-3074(mobile)

Program

Chair person :

09:30 Opening

09:50 Seong Hyeon Yun (Samsung Medical Center, Sungkyunkwan Univ.)

“Small Journey Toward the Future “No scar” Surgery”

10:35 Kazunori Kataoka (The Univ. of Tokyo, Director of BICS, SKKU)

“Self-Assembled Supramolecular Nanosystems for Smart Diagnosis and Therapy of Intractable Diseases”

11:15 Break

11:30 Masateru Ishiguro (Seoul National Univ.)

“The Japanese Asteroid Missions : Hayabusa and Hayabusa-2”

12:10 Lunch

Chair person :

13:20 Tsutomu Miyasaka (Toin Univ. of Yokohama)

“Creation of Organic Inorganic Hybrid Perovskite Solar Cell and Its High Efficiency Development”

14:00 Nam-Gyu Park (Sungkyunkwan Univ.)

“Halide Perovskite : Magic Material Covering From Photovoltaics to ReRAM”

14:40 Katsuhiko Takagi (Kanagawa Academy of Sci. and Tech.)

“Evaluation and Standardization of Organic Solar Cells”

15:20 Break

Chair person :

15:40 Tae-Woo Lee (Seoul National Univ.)

“Next LEDs : Organometal Perovskite Light-Emitting Diodes”

16:20 Toshikazu Yamada (National Inst. of Adv. Ind. Sci. and Tech.)

“Printing Ultrafine Conductive Pattern through Ligand Conversion of Metal Nanoparticles on Photoactivated Surface”

17:00 Closing

17:15 Reception

“Small Journey Toward the Future “No scar” Surgery”

Prof. Seong Hyeon Yun

Department of Surgery
Samsung Medical Center
Sungkyunkwan University School of Medicine

E-mail: shyunmd@skku.edu



It is almost more than 20 years since the laparoscopic surgery has been introduced for colorectal disease. During the past a quarter century, minimally invasive surgery (MIS) is going to be continuously developed into various technologies such as robotic, single or reduced port, and natural orifice surgery. In early 2000s, the dramatic concept of the natural orifice transluminal endoscopic surgery (NOTES) was introduced in the surgical practice. Despite many efforts of pioneers and researchers, it can be applied for limited areas such as transgastric appendectomy or cholecystectomy due to lack of specialized platform.

However, the concept of NOTES has influenced to the preexisting MIS, the basic techniques of the natural orifice specimen extraction (NOSE) and single port surgery (SPS) were developed. Now single port surgery is widely applied to not only benign but also malignant disease of the colon and rectum. The major advantages of the SPS is the superior cosmetic outcome with similar safety and oncologic outcome when applied to the colon cancer, in spite of lack of evidences supported by large scale randomized trials.

Recently transanal total mesorectal excision(taTME) developed for facilitating the preexisting rectal surgery with the concept of NOTES. Combination of SPS and taTME is one more step to practical NOTES.

Technical advancement in many fields including robotics, sensing, artificial intelligences can enable complex surgery easier in the very near future.

Prof. Seong Hyeon Yun

Education

Mar. 1985 - Feb. 1989 College of Medicine, Yonsei University, Seoul, Korea
Mar. 1992 - Feb. 1998 Postgraduate course for Master Degree Graduate School
Yonsei University, Seoul, Korea
Mar. 1999 - Feb. 2007 Postgraduate Course for Doctor Degree Graduate School
Yonsei University, Seoul, Korea

Continuing Medical Education

Sep. 2007 - Aug. 2008 Reserch Scholar, Section of Colon and Rectal Surgery
Weill Medical College, Cornell University, New York
Presbyterian Hospital, N.Y., U.S.A

Academic Appointments

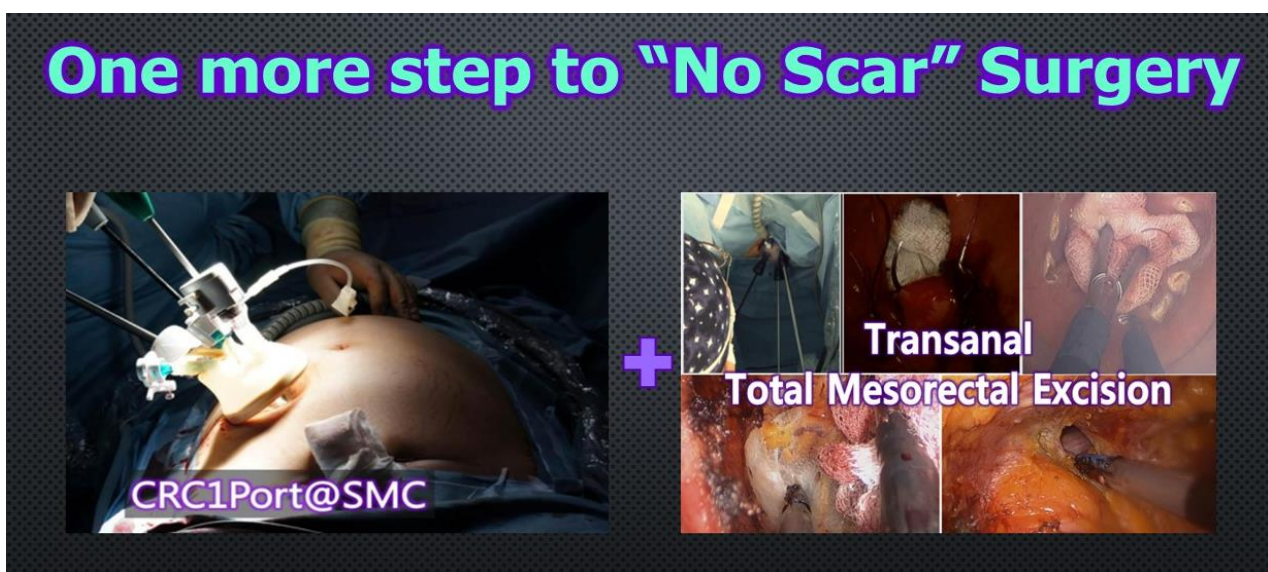
Oct. 2008 - Sep. 2014 Associate Professor, Department of Surgery
Sungkyunkwan University School of Medicine
Oct. 2014 - Present Professor, Department of Surgery
Sungkyunkwan University School of Medicine

Social Activities

Head, New Technology, Korean Society of Endoscopic and Laparoscopic Surgeons

Awards

Karl-Storz EAES Award (2015), European Academy of Endoscopic Surgeons



“Self-Assembled Supramolecular Nanosystems for Smart Diagnosis and Therapy of Intractable Diseases”

Prof. Kazunori Kataoka

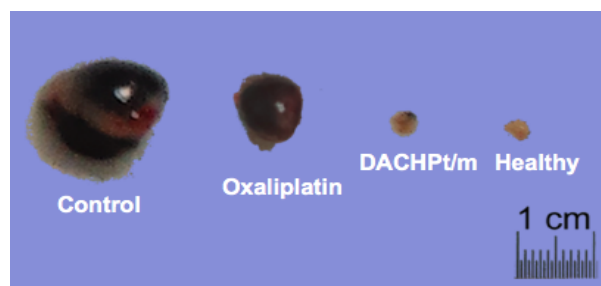
Innovation Center of NanoMedicine,
Kawasaki Institute of Industrial Promotion
Policy Alternatives Research Institute,
The University of Tokyo

E-mail: Kataoka@pari.u-tokyo.ac.jp



Nanotechnology-based medicine (Nanomedicine) has received progressive interest for the treatment of intractable diseases, such as cancer, as well as for the non-invasive diagnosis through various imaging modalities. Engineered polymeric nanosystems with smart functions play a key role in nanomedicine as drug carriers, gene vectors, and imaging probes. This presentation focuses present status and future trends of self-assembled nanosystems from block copolymers for the therapy and the non-invasive diagnosis of intractable cancer. Nanosystems with 10 to 100 nm in size can be prepared by programmed self-assembly of block copolymers in aqueous entity. Most typical example is polymeric micelles with distinctive core-shell architecture. Several micellar formulations of antitumor drugs have been intensively studied in preclinical and clinical trials, and their utility has been demonstrated¹, particularly, as shown in the panel below, for the treatment of metastatic cancer² and cancer stem cells³. Versatility in drug incorporation is another feasibility of polymeric micelles. Loading of imaging reagents makes polymeric micelles with theranostic functions⁴. These results demonstrate the promising features of polymeric micelles as platform nanosystems for molecular therapy of various intractable diseases.

1. Y. Matsumoto, et al, *Nature Nanotech.* **11**, 533 (2016).
2. H. Cabral, et al, *ACS Nano* **9**, 4957 (2015).
3. H. Kinoh, et al, *ACS Nano* **10**, 5643 (2016).
4. P. Mi, et al, *Nature Nanotech.* **11**, 724 (2016).



Ex vivo microscopy of metastatic lymph nodes with melanoma

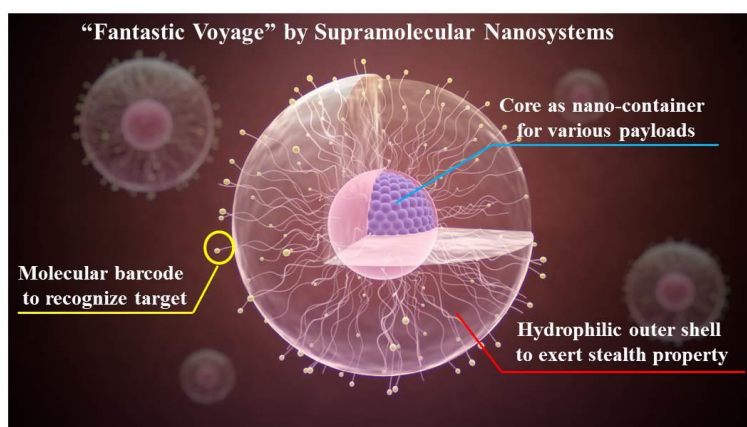
Prof. Kazunori Kataoka

Dr. Kazunori Kataoka is a Director General of Innovation Center of NanoMedicine (iCONM), Kawasaki Institute of Industry Promotion. He is also a Professor at Policy Alternatives Research Institute, The University of Tokyo.

He received his B.Eng. (1974) in Organic Chemistry, M.Eng. (1976) and Ph.D. (1979) in Polymer Chemistry from The University of Tokyo. He started his academic career at Institute of Biomedical Engineering, Tokyo Women's Medical College as Assistant Professor (1979) and was promoted to Associate Professor in 1988. He moved to Department of Materials Engineering, Tokyo University of Science in 1989 as Associate Professor and was promoted to full Professor in 1994. He joined Department of Materials Engineering, The University of Tokyo in 1998 as full Professor. He was appointed joint-position of full Professor at Center for Disease Biology and Integrative Medicine, The University of Toyo Medical School in 2004. In 2016, he took mandatory retirement from Graduate School of Engineering/Graduate School of Medicine, The University of Tokyo, and moved to the current position. He has joint appointments at Eshelman School of Pharmacy, University of North Carolina Chapel Hill as Adjunct Professor (2015~), and at Biomedical Institute for Convergence at SKKU (BICS), Sungkyunkwan University as Director (2016~).

He has received several scientific awards, including the Clemson Award from the Society for Biomaterials, USA (2005), the Founder's Award from the Controlled Release Society (2008), NIMS Award from National Institute of Materials Science, Japan (2009), The Prize for Science and Technology from the Minister of Education, Culture, Sports, Science, and Tecnology (MEXT), Japan (2010), Humboldt Research Award from Alexander von Humboldt Foundation (2012), Leo Esaki Prize (2012), SPSJ Award for Outstanding Achievements in Polymer Science and Technology from Society of Polymer Science, Japan (2014), and Gutenberg Research Award (2015). He has been a member of the Science Council of Japan since 2006.

He has more than 500 publications with *h-index* as high as 125, and is on the editorial board of 15 international journals. His current major research interests include supramolecular materials for nanobiotechnology, focusing on drug and gene delivery systems.



“The Japanese Asteroid Missions : Hayabusa and Hayabusa-2”

Prof. Masateru Ishiguro

Department of Physics and Astronomy,
Seoul National University

E-mail : ishiguro@astro.snu.ac.kr



In 2010, the Japanese space project, Hayabusa, accomplished the world-first sample return from an asteroid, Itokawa, bringing the surface samples to Earth after overcoming a variety of difficulties. There is no mission other than Hayabusa and Apollo projects that landed on a celestial body and brought the extraterrestrial materials onto Earth. The speaker was involved in the onboard camera team, working for the development, operation and calibration of the camera, and eventually conducted scientific activities using the remote-sensing data as a planetary scientist.

In this presentation, I plan to introduce the miraculous but real story based on my experience. I also introduce the scientific results we learned from Itokawa, including a rubble-pile structure and space weathering of the asteroid. Finally, I mention an ongoing second project to look for the origins of life and the formation of the solar system.



Image of Asteroid Itokawa taken the onboard camera AMICA ((C) Japan Aerospace Exploration Agency (JAXA))



The ongoing asteroid sample return mission, Hayabusa 2. Image Credit : A. Ikeshita / JAXA

Prof. Masateru Ishiguro

Education

1992 April 1 - 1996 March 31

Department of Science, Kobe University (B.S.)

1996 April 1 - 2000 March 31

Graduate School of Science and Technology, Kobe University (M.S., Ph.D.)

Professional Experience

2000 January 1 - 2001 March 31

Japan Society for the Promotion of Science (JSPS) Research fellow,
Kobe University, Japan

2001 April 1 - 2003 March 31

Center of Excellence Research fellow of MUSES-C (Hayabusa) project,
Institute of Space and Astronautical Science (ISAS), JAXA, Japan

2003 April 1 - 2006 January 31

Japan Society for the Promotion of Science (JSPS) Research fellow,
ASTRO-F(AKARI) project and MUSES-C (Hayabusa) project,
Institute of Space and Astronautical Science (ISAS), JAXA, Japan

2005 January 1 - 2006 May 31

Visiting researcher, Institute for Astronomy, University of Hawaii, USA

2006 February 1 - 2007 August 31

Japan Society for the Promotion of Science (JSPS) Research fellow for
Research Abroad, Seoul National University, South Korea

2007 September 1 - 2008 August 31

Contract assistant professor (Brain Korea 21), Department of Physics
and Astronomy, Seoul National University, South Korea

2008 September 1 - 2009 August 31

Researcher, National Astronomical Observatory of Japan, Japan

2009 September 1 - 2013 August 31

Assistant Professor, Department of Physics and Astronomy,
Seoul National University, South Korea

2013 September 1 - present

Associate Professor, Department of Physics and Astronomy,
Seoul National University, South Korea

“Creation of Organic Inorganic Hybrid Perovskite Solar Cell and Its High Efficiency Development”

Prof. Tsutomu Miyasaka

Graduate School of Engineering,
Toin University of Yokohama

E-mail : miyasaka@toin.ac.jp

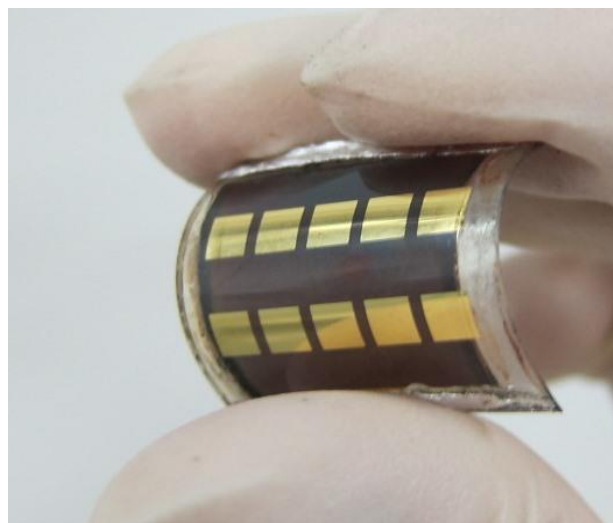
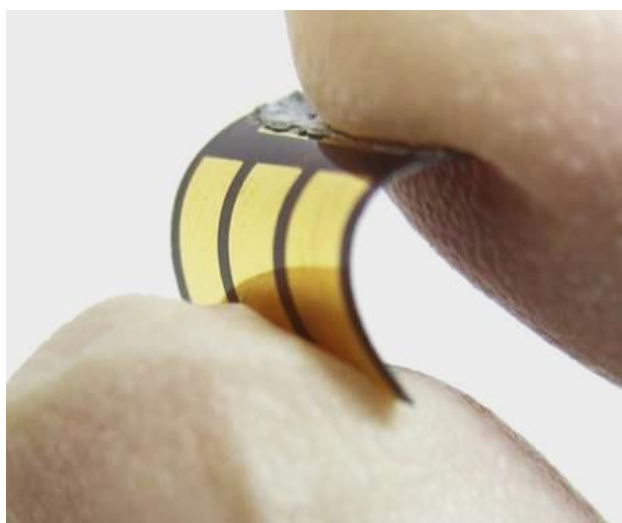


Discovered in 2007-2009 as a light absorber of semiconductor photoelectrochemical cells, organo lead halide perovskite materials have evolved to achieve high power conversion efficiency in fabrication of solid-state photovoltaic devices and have established the new field of solar cell development using solution-processable perovskite materials. With top certified efficiency of 22.1%, research of perovskite solar cell is being directed to ensure high efficiency and high stability (durability) for practical applications. Our study has been focused on material engineering of preparing high quality hetero-junction interfaces of perovskite crystals where efficient charge transfer (suppression of recombination) is key to enhance the efficiency. High performance of perovskite solar cell strongly depends on output of photovoltage. High open-circuit voltage (V_{oc}) of $\text{CH}_3\text{NH}_3\text{PbI}_3$ -based perovskite cells (1.1-1.2V vs band gap energy of 1.6 eV) is rare advantage over existing solar cells. We could achieve efficiency up to 21.6% with high V_{oc} of 1.18V by improving the interfacial structure between TiO_2 and perovskite. Such high performance of metal oxide-based device can be realized by low temperature solution process (<150°C). Stability and durability of the device can also be improved by “chemical” engineering of interfaces. Presentation will review our research background of the perovskite photovoltaics and latest progress in efficiency development based on the design of metal oxide materials and their interfaces.

- 1) T. Miyasaka, *Chem. Lett.* **2015**, 44, 720-729.
- 2) M. M. Lee, J. Teuscher, T. Miyasaka, T. N. Murakami, H. J. Snaith, *Science*, **2012**, 338, 643-647.
- 3) N.-G. Park, M. Gratzel, T. Miyasaka, K. Zhu, K. Emery, *Nature Energy*, **2016**, 16152.

Prof. Tsutomu Miyasaka

Tsutomu Miyasaka received his Doctor of Engineering from The University of Tokyo in 1981. Afterwards, he joined Fuji Photo Film, Co. and worked as a chief researcher at Ashigara Laboratories. He conducted R&Ds on high sensitivity photographic materials, lithium-ion secondary batteries, and design of an artificial photoreceptor (retina). All of his researches relate to photochemistry and energy science based on electrochemistry, in which the artificial photoreceptor was devised by Langmuir-Blodgett method. In 2001, he joined Toin University of Yokohama (TUY), Japan, as a professor of Graduate School of Engineering. In 2006 to 2009 he was the dean of the Graduate School. He also served as a guest professor in Graduate School of Arts and Sciences, The University of Tokyo in 2005 to 2010. His research has been focused on creation of solution-printable and lightweight flexible photovoltaic cells, especially based on low temperature-processed metal oxide semiconductor electrodes. In 2004 he has established a university-based company Peccell Technologies, Inc. in charge of CEO. Peccell has been active to date as a sole maker in Japan specializing in flexible dye-sensitized solar cell (DSSC) and its modules. Notable achievement in printable photovoltaics is creation of organo lead halide hybrid perovskite solar cell, which he started in 2006. He presented the first solid-state perovskite solar cell in 2008 and published the first peer-reviewed paper in 2009. He has directed NEDO-funded solar power generation projects on DSSC development for 6 years. In 2009 he was awarded a Ministry-of-Education (MEXT) prize on his achievements of green sustainable solar cell technology. In 2008-2010 he was a director of Electrochemical Society of Japan, managing the division of photoelectrochemistry. From 2010, he joined a new national research program, FIRST, on the hybrid solar cell. From 2013 onward, he is a project leader in R&D of organic inorganic hybrid photovoltaic cell funded by Japan Science and Technology Agency (JST). Currently he is organizing international conferences and symposia focused on perovskite photovoltaics.



“Halide Perovskite: Magic Material Covering From Photovoltaics to ReRAM”

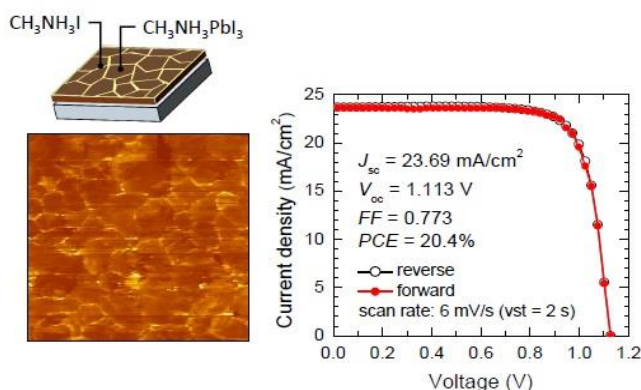
Prof. Nam-Gyu Park

School of Chemical Engineering,
Sungkyunkwan University

E-mail : npark@skku.edu



Since the first report on solid-state perovskite solar cell with power conversion efficiency (PCE) of 9.7% in 2012, intensive researches led to its PCE up to 22%. It is believed that perovskite solar cell is promising next-generation photovoltaics (PVs) thanks to superb performance and very low cost. Besides photovoltaics, halide perovskite exhibits multifunctional properties suitable for light emitting diode, resistive memory etc. In this talk, methodologies for high PCE perovskite solar cell will be given in terms of grain size control and grain boundary engineering. Grain boundary is found to play important role in charge transporting, where charge conduction is pronounced for the perovskite film prepared from grain boundary healing process. Stability and I-V hysteresis are now critical issues in perovskite solar cell. Light-soaking and temperature-dependent test results will be discussed to understand photo- and thermal-stability of perovskite solar cells. Nonstoichiometric approaches extend to light emitting diode application, where we discovered highly efficient green light emitting materials and devices. Extremely sensitive X-ray imaging system was developed based on halide perovskite, which is highly beneficial for low radiation doses for medical examinations such as mammography and even computed tomography. Halide perovskite enables nonvolatile resistive random access memory (ReRAM) device with extremely high on-off ratio and millivolt switching, which will be discussed in detail.



Prof. Nam-Gyu Park

Nam-Gyu Park is professor and SKKU-Fellow at School of Chemical Engineering and adjunct professor at Department of Energy Science, Sungkyunkwan University. He received his B.S., M.S. and Ph.D. from Seoul National University in 1988, 1992 and 1995, respectively. He worked at ICMCB-CNRS, France, from 1996 to 1997 and at National Renewable Energy Laboratory, USA, from 1997 to 1999 as postdoctoral researchers. He worked as Director of Solar Cell Research Center at Korea Institute of Science and Technology from 2005 to 2009 and as a principal scientist at Electronics and Telecommunications Research Institute from 2000 to 2005 before joining Sungkyunkwan University in 2009. He has been doing researches on high efficiency mesoscopic solar cells including perovskite solar cell and dye-sensitized solar cell since 1997. *He is pioneer in solid state perovskite solar cell, which was first developed in 2012.* He received awards, including Scientist Award of the Month (MEST, Korea), KyungHyang Electricity and Energy Award (KEPCO, Korea), KIST Award of the Year (KIST, Korea) and Dupont Science and Technology Award (Dupont Korea), SKKU fellowship, and MRS Outstanding Research Award (MRS, Boston), WCPEC Paper Award (Kyoto, Japan), Hamakawa Award of PVSEC (Busan, Korea) and KAST Engineering Award (KAST, Korea). He published over 220 scientific papers, including Science, Nature Materials, Nature Nanotechnology, Nature Energy and Nature Communications, 80 patent applications, 1 book editor, 7 book chapters. He received H-index of 66 as of January, 2017.

Education

1981 - 1988 Seoul National University, Chemical Education, BS

1989 - 1992 Seoul National University, Chemistry, MS

1992 - 1995 Seoul National University, Chemistry, PhD

Professional Experience

1996.3 - 1997.5 : France ICMCB-CNRS, post-doc

1997.6 - 1999.12 : National Renewable Energy Laboratory (NREL), post-doc

2000.1 - 2005.11 : ETRI, Korea, Principal scientist

2005.12 - 2009.6 : KIST, Korea, Director of Solar Cell Research Center

2009.7 - present : Sungkyunkwan University (SKKU), School of Chemical Engineering,
Professor/SKKU Fellow

“Evaluation and Standardization of Organic Solar Cells”

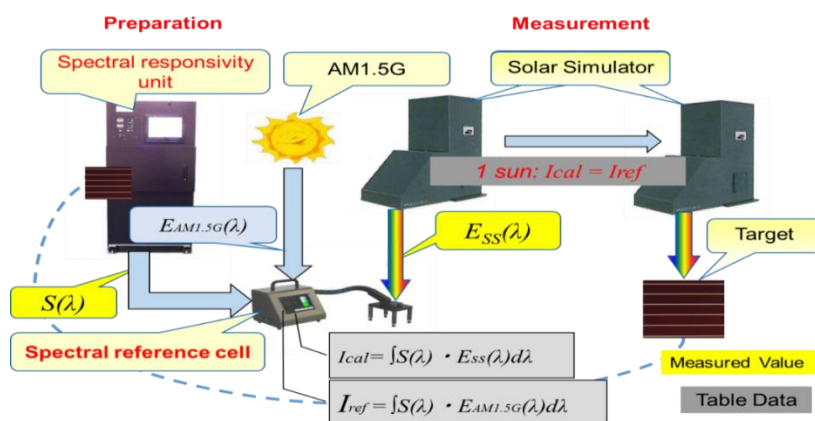
Prof. Katsuhiko Takagi

Kanagawa Academy of Science and Technology
Emeritus Professor of Nagoya University

E-mail : kouboku21bty@gmail.com



Standardized methods to evaluate the performance of organic solar cells, including organic thin films (OPV), dye-sensitized (DSC) and recently emerging Perovskite solar cells (PSCs), have yet to be established. Part of the problem is due to the fact that their electric generation mechanisms are significantly different from conventional and commercially widespread silicon, copper indium gallium selenide (CIGS), and other inorganic solar cells. In addition to the intrinsic instability of the organic materials constituting the cells, their photon-to-electricity transformation pathways, which differ from robust Si photovoltaics, make it difficult to establish performance and stability protocols. However, in the case of DSC as an example, the practical use of primary reference solar cell calibration techniques such as the Differential Spectral Responsivity (DSR) method to measure the incident photon-to-current conversion efficiencies (IPCE) and I-V profiles or organic solar cells can provide a valid evaluation method. In the present talk, the advantageous features of organic solar cells including newly promising PSCs will be overviewed and appropriate measuring methodologies now being investigated to specifically verify their validity and reliability through internationally recognized normalization standards will be proposed.



Irradiance Adjustment System for Various Illumination Conditions

Prof. Katsuhiko Takagi

Education

Nagoya University, Department of Applied Chemistry, Faculty of Engineering,

Undergraduate course : April, 1961 - March, 1965

Graduate course (Master course) : April, 1965 - March, 1967

Graduate course (Doctor course) : April, 1968 - March, 1971

Doctor of Engineering (Nagoya University) : March, 1971

Career

Researcher, The Central research center of Chisso Corporation, (Yokohama, Japan)

: April, 1967 - March, 1968

Assistant Professor of Nagoya University, Department of Applied Chemistry, Faculty of Engineering : October, 1971 - March, 1987

Associate Professor of Nagoya University, Department of Applied Chemistry, Faculty of Engineering : April, 1987 - March, 1997

Professor of Nagoya University, Department of Crystalline Materials Science, Faculty of Engineering : April, 1998 - March, 2007

Emeritus Professor of Nagoya University, April, 2007 - present

Research Associate of Michigan State University (Prof. Harold Hart), September, 1978 - August, 1979.

Visiting Researcher, University of Rochester, Rochester, NY (Prof. David Whitten), September 1984 - November, 1984

Visiting Researcher, University of Notre Dame, South Bend(IN) (Prof. David Whitten), September 1984 - November, 1984

Executive Director of Kanagawa Academy of Science & Technology (KAST) (Yokohama, Japan), April, 2009 - March, 2012

Research Leader of The Evaluation & Standardization of Organic Solar Cells, KAST, April 2012 - present

“Next LEDs : Organometal Perovskite Light-Emitting Diodes”

Prof. Tae-Woo Lee

Department of Materials Science and Engineering,
Seoul National University, Republic of Korea

E-mail : twlees@snu.ac.kr, taewlees@gmail.com



Organometal halide perovskites are emerging high color-purity emitters with low material cost. However, the low electroluminescence (EL) efficiency at room temperature is a challenge that should be overcome. Here, we present efficient perovskite light-emitting diodes (PeLEDs) using various strategies to overcome the EL efficiency limitations. First, we introduced a self-organized buffer hole injection layer to reduce the hole injection barrier and block the exciton quenching at the interface. Furthermore, we found that the formation of metallic lead atoms causes strong exciton quenching, and it was prevented by finely increasing the molar proportion of methylammonium bromide (MABr) in MAPbBr_3 solution. Also, we suggest that the efficiency in PeLEDs can be increased by decreasing MAPbBr_3 grain sizes and consequently improving uniformity and coverage of MAPbBr_3 layers. Using these strategies, a high-efficiency PeLEDs was realized (current efficiency = 42.9 cd/A). Furthermore, quasi-2D perovskites were studied because of the advantages of quasi-2D perovskites such as the enhancement of film quality, exciton confinement and reduced trap density, and quasi-2D PeLEDs with high efficiency and brightness were demonstrated.

- [1] Y.-H. Kim, H. Cho, J. H. Heo, T.-S. Kim, N. Myoung, C.-L. Lee, S. H. Im, T.-W. Lee, Multicolored organic/inorganic hybrid perovskite light-emitting diodes. *Adv. Mater.* **2015**, 27, 1248.
- [2] H. Cho, S.-H. Jeong, M.-H. Park, Y.-H. Kim, C. Wolf, C.-L. Lee, J. H. Heo, A. Sadhanala, N. Myoung, S. Yoo, S. H. Im, R. H. Friend, and T.-W. Lee, *Science* **2015**, 350, 1222.
- [3] J. Byun, H. Cho, C. Wolf, M. Jang, A. Sadhanala, R. H. Friend, H. Yang, T.-W. Lee, *Adv. Mater.* **2016**, 28, 7515.

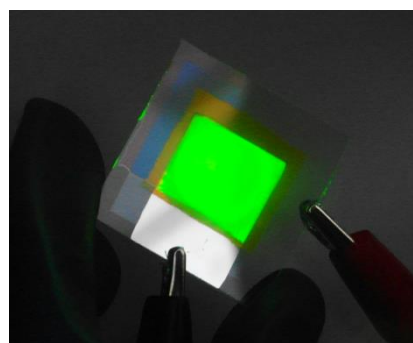
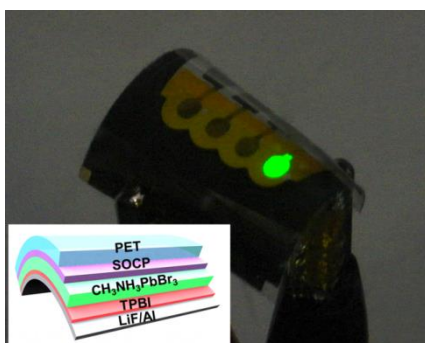
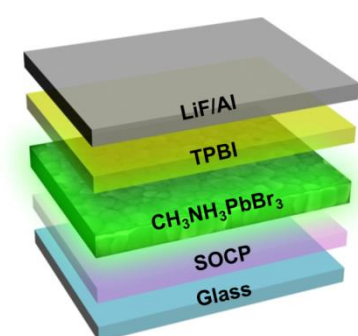
Prof. Tae-Woo Lee

Education

- 1999.3 - 2002.2 : Ph.D. in Chemical and Biomolecular Engineering,
Korea Advanced Institute of Science and Technology (KAIST), Korea
- 1993.3 - 1999.2 : B.S., and M.S. in Chemical Engineering,
Korea Advanced Institute of Science and Technology (KAIST), Korea

Professional Appointments

- 2016.09 - Present : Associate Professor.
Department of Materials Science and Engineering, Seoul National University, Korea
- 2015.07 - Present : Visiting Professor..
Department of Chemical Engineering, Stanford University, USA
- 2012.03 - 2016.08.31: Tenured Associate Professor.
Department of Materials Science and Engineering, Pohang University of Science and Technology(POSTECH), Korea
- 2008.08 - 2012.02 : Assistant Professor.
Materials Science and Engineering, Pohang University of Science and Technology.
- 2008.06 - 2008.08 : Senior Research Scientist in OLED Lab.
Samsung Electronics LCD Business, Korea
- 2003.09 - 2008.05 : Senior Research Scientist in OLED Program Team, Display Lab.,
Samsung Advanced Institute of Technology, Korea
- 2002.3 - 2003.8 : Post-Doctoral Researcher in Physical Science Research Department,
Bell Laboratories, Lucent Technologies, 600 Mountain Avenue, Murray Hill, NJ 07974,
USA.



“Printing Ultrafine Conductive Pattern through Ligand Conversion of Metal Nanoparticles on Photoactivated Surface”

Dr. Toshikazu Yamada

National Institute of Advanced Industrial Science
and Technology (AIST)

E-mail : toshi.yamada@aist.go.jp



Large-scale production of monodispersed metal nanoparticles has made considerable progress in the last decade with a broad range of applications in nanoscience. For example, direct chemical syntheses of encapsulated metal nanoparticles were reported by utilizing the thermolysis process from the source precursor metal complexes. The technique is quite promising for producing nanometal ink for use in printed electronics, as it allows us to predesign the anchor layer whose coordination strength can be tuned with maintaining the equilibrium stability of nanocolloids. We here utilized stable, concentrated, and low-viscosity silver nanocolloids composed of silver nanoparticles encapsulated by alkylamine layers. Alkylamine coordination is slightly weaker than carboxylate coordination, as demonstrated by the relatively low sintering temperature (less than 150°C). However, the lowering of sintering temperature makes difficult to print with the nanocolloids. It is easy to aggregation during the printing process. Indeed, it is very difficult to print conductive patterns with using of conventional printing methods. We found new printing method for silver patterns through reactive sintering on photoactivated surface at almost room temperature.

We have succeeded in developing an extremely simple method to manufacture ultrafine conductive pattern through reactive sintering of metal nanoparticles on photoactivated surface at almost room temperature. The process consists of masked irradiation of vacuum-ultraviolet light on an amorphous perfluorinated polymer layer to produce photoactivated patterned surface with carboxylate group, and subsequent coating of alkylamine-encapsulated silver nanocolloids, which triggers to form self-fused solid silver layer. The technique can produce submicron-fine silver pattern that strongly adheres to the substrate.

Dr. Toshikazu Yamada

Dr. Toshikazu Yamada: I received the Bachelor and Master of Engineering from the Nagoya Institute of Technology in 1987 and 1989. Then I got the job at national institute of Advanced Industrial Science and Technology. I received my PhD in organic thin film transistor from the University of Saitama. After 15 years at Tsukuba, I have moved from Tsukuba branch to Nagoya branch of AIST. I have worked on the development of the device fabrication process with GaN material since last April.

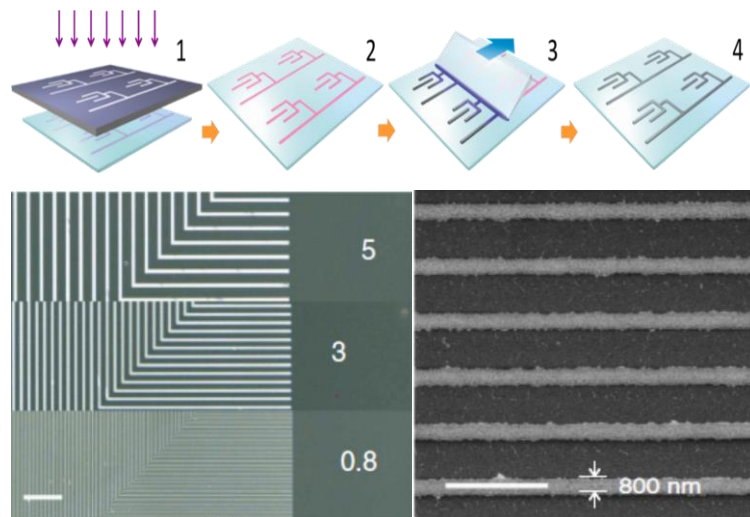


Fig. 1 Schematic images of the printing process (upper).

Optical image of the printed patterns (lower).

Left scale bar, 50μm. Right scale bar, 5μm

