Greeting;

Already 5 years have passed, since KANEKA/SKKU Incubation Center has been established on July 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 businesses 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 Japan and Korea.

KANEKA/SKKU International Symposium were held so far four times at Sungkyunkwan university with very outstanding professors and scholars; Prof. H. Shirakawa; Novel laurate 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 from Japan and Korea as shown in this program. They are usually so busy and it is hard to hear their seminars. I would very much appreciate them to come to SKKU and give us wonderful lectures.

Finally, I hope all of you to enjoy their seminars and discussions, as before.

Thanks.

夫 龍淳 (Professor LyongSun Pu)
Director, KANEKA/SKKU Incubation Center
Office 81419 RIC, Sungkyunkwan University
300 Cheoncheon-dong, Jangan-gu, Suwon, 440-746 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

09:45 Chihaya Adachi (Kyushu Univ.)
"High Efficiency OLED Based on Delayed Fluorescence"

10:25 Kil Won Cho (Pohang Univ. of Sci. and Tech.)
"Molecular Assembly for High-Performance Organic Electronics"

11:05 Break

11:20 Shizuo Tokito (Yamagata Univ.)
"Flexible Printed Organic Transistors and Their Applications"

12:00 Lunch

Chair person :

13:20 Jang Doo Lee (Samsung Display Co., Ltd.)
"Display Technology Prospect Based on OLED"

14:00 Kazunari Domen (Tokyo Univ.)
"Development of Visible Light Responsive Photocatalysts for Water Splitting"

14:40 Doo Sung Lee (Sungkyunkwan Univ.)
"Injectable Block Copolymer Hydrogels for Biomedical Applications"

15:20 Break

Chair person :

15:40 Mitsuru Akashi (Osaka Univ.)
"Development of Dimensionally Controlled Polymer Materials from Polymers Living Cells by Use of Self-assembly Based on Weak Interactions"

16:20 Ho Seok Park (Sungkyunkwan Univ.)
"Bendable and Compressible Graphene Materials for Ultracapacitive Energy Storage under Mechanical Stresses"

17:00 Closing

17:15 Reception

High Efficiency OLED Based on Delayed Fluorescence

Prof. Chihaya Adachi

Center for Organic Photonics and
Electronics Research (OPERA),
Kyushu University

E-mail : adachi@cstf.kyushu-u.ac.jp

Organic light emitting diodes (OLEDs) have been anticipated to exhibit highly efficient, stable emission aimed for displays and lighting applications. Here, we report the design rules for increasing the electroluminescence efficiency based on thermally activated delayed fluorescence (TADF). We show that a large delocalization of the highest occupied molecular orbital and lowest unoccupied molecular orbital in these charge transfer compounds enhances the rate of radiative decay considerably by inducing a large oscillator strength even when there is a small overlap between the two wavefunctions. Further, through computational simulation, we identified intramolecular charge-transfer (CT) molecules with small singlet-triplet CT state splitting but different energy relationships between ^{3}CT and locally-excited triplet (^{3}LE) states. Systematic comparison of excited-state dynamics revealed that CT molecules can emit efficient and short-lifetime (a few μs) TADF when the emission peak energy is high enough and the ^{3}LE state is higher than the ^{3}CT state. The OLEDs with TADF emitters offer an external quantum efficiency over 20% and reduced efficiency roll-off characteristics at high luminance. Also, we mention the importance of molecular orientation for enhancing light outcoupling efficiency. Some critical molecular design and processing condition will be discussed.

Further, we report fluorescence-based OLEDs that realize external quantum efficiencies as high as 20% for blue, green, yellow, and red emission, indicating that the exciton production efficiency reached nearly 100%. The high performance was enabled by utilization of TADF molecules as assistant dopants that permit efficient transfer of all electrically generated singlet and triplet excitons from the assistant dopants to the fluorescent emitters. OLEDs employing this novel exciton harvesting process provide freedom for the selection of emitters from a wide variety of conventional fluorescent molecules.

Prof. Chihaya Adachi

Education

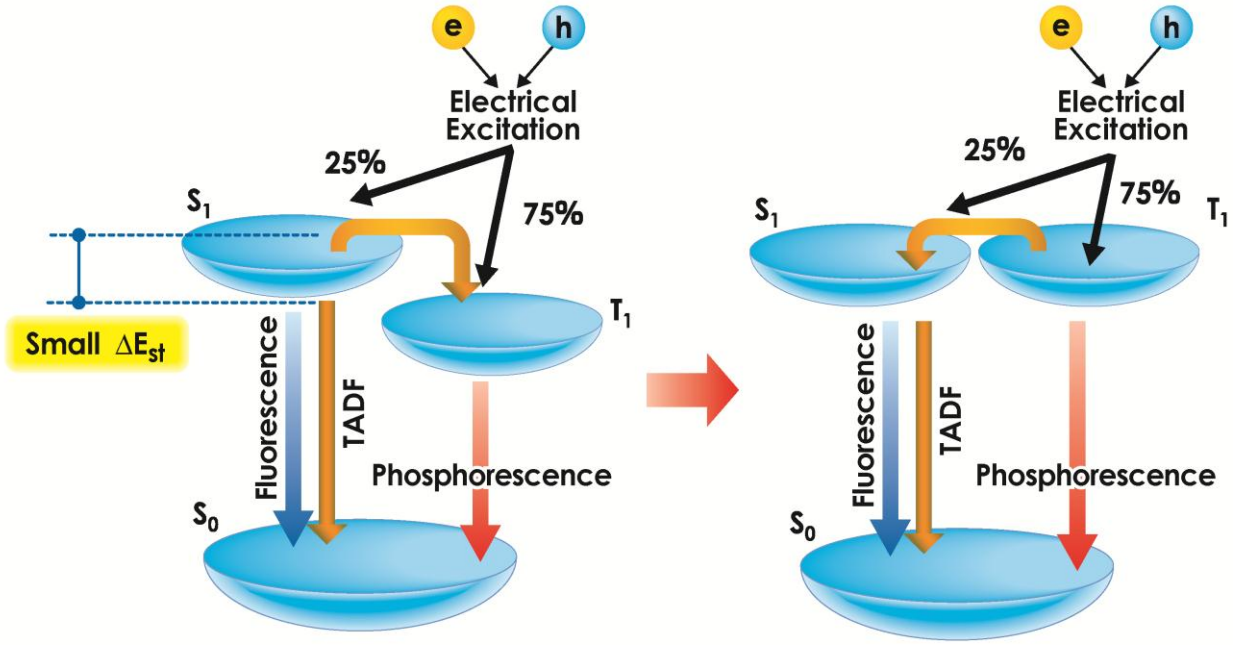
1988 : M. Eng. Materials Science and Technology, Kyushu University
1991 : D. Eng. Materials Science and Technology, Kyushu University

Professional Appointments (Research)

1999-2001 : Princeton University, Department of Electrical Engineering, Research Staff
2004-2006 : Chitose Institute of Science and Technology, Professor
2010- : Kyushu University, Center for Organic Photonics and Electronics Research (OPERA), Director
2013- : Kyushu University, Education Center for Global Leaders in Molecular Systems for Devices, Program Coordinator
2013- : Fukuoka i3 Center for Organic Photonics and Electronics Research, Director

Recipient of an International Award(s)

2004: Nano-tech 2004, International Nanotechnology Exhibition and Conference, Nano-tech award, IT&Electronics division
2005: The Commendation for Science and Technology by the Minister of Education
2014: SID Fellow Awards



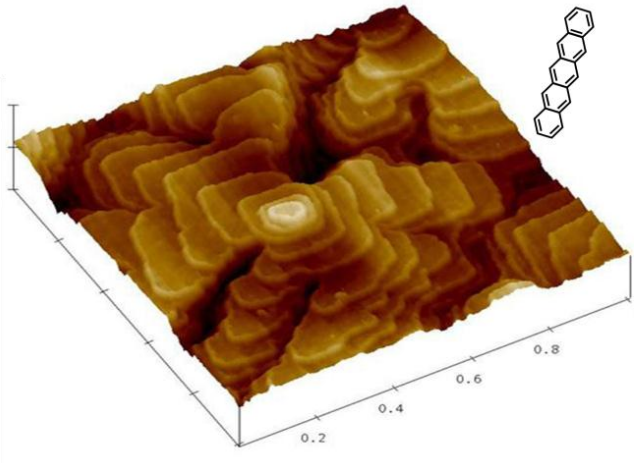
Molecular Assembly for High-Performance Organic Electronics

Prof. Kil Won Cho

Department of Chemical Engineering,
Pohang University of Science and Technology,
Pohang 790-784 Korea

E-mail : kwcho@postech.ac.kr

Microstructure in organic semiconductor thin films has been regarded as the key factor determining the performance of the organic electronics. In case of bottom-contact organic field effect transistors (OFETs) and organic photovoltaics (OPVs), the control of the surface characteristics of the underlying substrates can govern the mesoscale and/or nanoscale ordering of the semiconductor assembled on them. Here, we present various approaches for controlling the growth of organic semiconductors on the gate dielectrics and electrodes to achieve high performance OFETs and OPVs.



Prof. Kil Won Cho

Professor, Department of Chemical Engineering,
Pohang University of Science and Technology (POSTECH), Pohang, 790-784, Korea.
E-mail) kwcho@postech.ac.kr Web URL) http://crg.postech.ac.kr

Education

BS Applied Chemistry, Seoul National University (1980)
MS Applied Chemistry, Seoul National University (1982)
Ph.D. Polymer Science, The University of Akron (1986)

Professional Appointments

1986-1987 Postdoctoral Fellow, University of Akron
1987-1988 Visiting Scientist, IBM Research Center
1988- Professor, POSTECH
1993-1993 Visiting Professor, Tokyo Institute of Technology
2005- Director, Polymer Research Institute, POSTECH
2011- Director, Global Frontier Research Center for Advanced Soft Electronics
2015 Senior Vice President (President-Elect), The Polymer Society of Korea

Honors and Awards

-Fellow, The Korean Academy of Science and Technology
-Best Paper Award, The Korean Federation of Science and Technology Societies(1999)
-Outstanding Research Award, The Polymer Society of Korea (2004)
-NanoKorea Award, Ministry of Science and Technology, Korea (2008)
-Proud Postechian Award (POSTECH, 2009)
-Lee, D. Y. Award (Pohang Accelerator Laboratory , 2009)
-Scientist of the Month Award (The Ministry of Edu. Sci. Tech., 2010)
-Lee, J. Y. Chair Professor (2011)

Flexible Printed Organic Transistors and Their Applications

Prof. Shizuo Tokito

Distinguished Research Professor, Vice Director,
Research Center for Organic Electronics (ROEL)
Yamagata University, Yamagata 992-8510, Japan

E-mail : tokito@yz.yamagata-u.ac.jp

Fully printed OTFT devices were successfully fabricated on a flexible plastic substrate using solution-processable organic semiconductors (OSC) and silver nanoparticle inks. The printed OTFT devices using the new OSC showed excellent p-type electrical performance with a maximum mobility of 2 cm2/Vs. The subthreshold swings were small and current on/off ratios were over 107. The uniformity of the device performance within the panel was excellent. In particular, the deviations in threshold voltage were very small, which is ideal for display applications. We also attempted to fabricate pseudo-CMOS inverters by using only p-type printed OTFT devices. The fabricated inverter with a channel length of 20 μm showed a typical transfer curve with a high gain of 35 at 20 V. Logic circuits such as NAND and NOR circuits based on the pseudo-CMOS were also successfully fabricated and exhibited ideal characteristics. Furthermore, a more complicate circuit (1-bit flip-flop) using the pseudo-CMOS logic was fabricated. The logic circuit exhibited ideal output response according to the truth table. In addition, the applications for RFID Tag, flexible display and memory will be presented briefly.

[1] K. Fukuda *et al*. Nat. Commun. **5**, 4147 (2014).
[2] K. Fukuda *et al*. ACS Appl. Mater. Interfaces **5**, 3916 (2013).
[3] K. Fukuda, *et al*. Sci. Rep. **4**, 3947 (2014).
[4] Y. Takeda *et al*. Org. Electron. **14**, 3362 (2013).

Prof. Shizuo Tokito

Education:

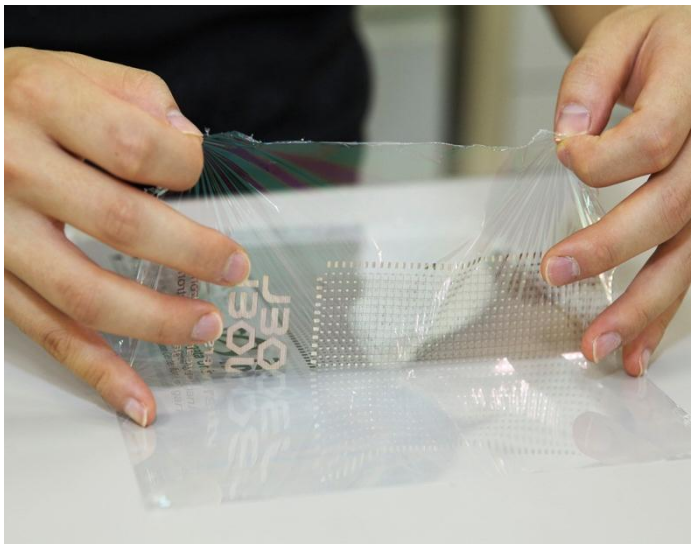
1987 : D. Eng. Graduate School of Engineering Sciences, Kyushu University
1982 : B. A. Tokyo University of Agriculture and Technology

Professional Experience:

1988 : University of California, Santa Barbara, Postdoctoral Fellow
1990 : Toyota Central R&D Labs., Inc., Researcher
2003 : Tokyo Institute of Technology, Graduate School of Science of Engineering, Adjunct professor (joint responsibility)
2009 : Japan Broadcasting Corporation (NHK), Research Director
2010 : Yamagata University, Distinguished Research Professor, Vice Director of Research Center for Organic Electronics

Research Interests:

• Organic semiconductors
• Metallic nanoparticle inks
• Printed and flexible organic electronics
• Biosensors, etc.



Display Technology Prospect Based on OLED

Dr. Jang Doo Lee

Vice President, Platform Research Team
Samsung Display Co., Ltd.

E-mail : jangdoo.lee@samsung.com

Triggered by the recent developments in display technologies, our everyday lifestyle is changing faster than ever before. As a result, the focal point of the display market is rapidly shifting from a large display to a mobile display and from LCD to OLED. Particularly, OLED display with outstanding performance traits (e.g. flexibility, wide color gamut, rapid response, excellent contrast ratio, and etc) will further transform our lifestyle through the developments of flexible display, transparent display, and bio display. This session introduces the future trend and technologies in OLED display.

Dr. Jang Doo Lee

#95 Samsung 2-ro, Giheung-gu,
Yongin-City, Gyeonggi-Do, 446-711 Korea
+82-10-3761-1652
jangdoo.lee@samsung.com

Summary

Vice President in Display Research Center at Samsung Display Co., Ltd.
AMOLED Device & Flexible Display Development

Professional Experience

Samsung Display Co., Ltd. (1993-Now)

Platform Research Team (2013-Now)

- Next Generation OLED Device Development
  Development of Flexible display, Transparent display, and High Resolution OLED.

- Global standardization on several emerging displays including flexible display and transparent display.

Product Development Team (2006-2013)

- Large Size OLED Development
- Small Size OLED Development
  Launched the World's first 2.4" QVGA AMOLED (2007)

Education

Ph. D. in Physics, Korea Advanced Institute of Science and Technology, Korea, 1993.

Development of Visible Light Responsive Photocatalysts for Water Splitting

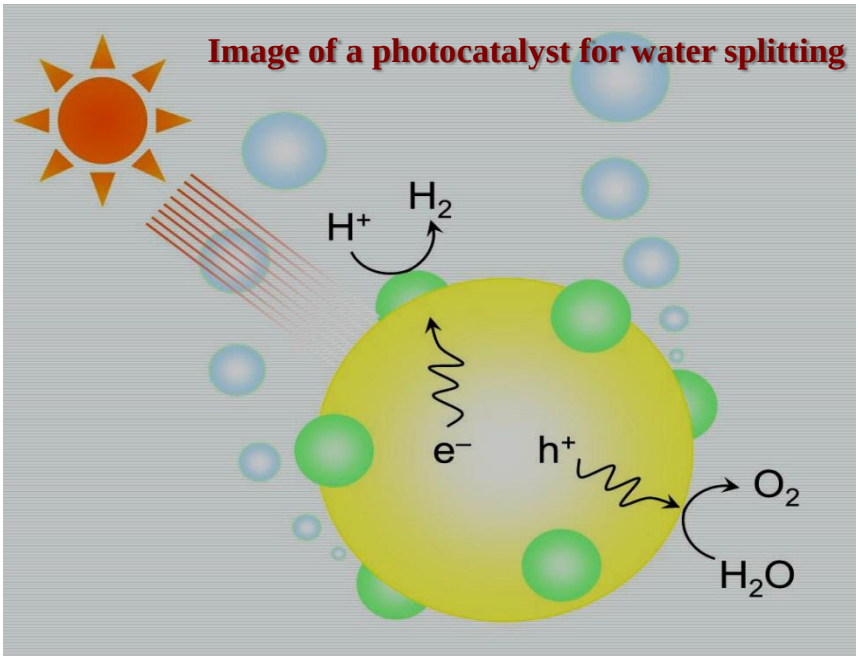
Prof. Kazunari Domen

Department of Chemical System Engineering,
School of Engineering,
The University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan

E-mail : domen@chemsys.t.u-tokyo.ac.jp

Solar water splitting using semiconductor photocatalysts and photoelectrodes has received much attention as a means of production of renewable hydrogen on a large scale. A semiconducting material can generate both hydrogen and oxygen on the surface during the band gap excitation when the band gap straddles the reduction and the oxidation potentials of water. Two semiconductor materials can be combined so that hydrogen and oxygen are generated on the different photocatalysts as in Z-scheme water splitting based on two-step excitation.

Some (oxy)nitrides and (oxy)chalcogenides work as promising photocatalysts and photoelectrodes for water splitting under visible light irradiation. Some oxynitrides are active for photocatalytic overall water splitting under visible light irradiation up to 600 nm. In this presentation, promising photocatalytic materials for visible-light-driven water splitting will be introduced.



Prof. Kazunari Domen

Professor, Department of Chemical System Engineering,
School of Engineering, the University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan
(room 715, 7th floor, Factory of Engineering building 5, Hongo campus)
Tel: +81-3-5841-1148/ Fax: +81-3-5841-8838
E-mail: domen@chemsys.t.u-tokyo.ac.jp

Major Fields: Physical Chemistry, Heterogeneous Catalysis, Photocatalysis, Surface Chemistry, Functional Materials

Biography:

Graduated from the University of Tokyo in 1976 .
Received a Ph.D. in Science from the University of Tokyo in 1982.
Became Associate Researcher at Tokyo Institute of Technology in 1982 . Promoted to Associate Professor in 1990 .
Professor in 1996 .
Became Professor at The University of Tokyo in 2004 .
(Visiting Scientist at IBM Almaden Research Center from 1985 to 1986.)
Present

Awards:

Encouragement Prize, Catalysis Society of Japan, 1990;
Catalyst Preparation Awards, 1991
Catalysis Society of Japan Awards 2007
The Chemical Society of Japan Awards 2011

Injectable Block Copolymer Hydrogels for Biomedical Applications

Prof. Doo Sung Lee

Theranostic Macromolecules Research Center,
School of Chemical Engineering,
Sungkyunkwan University,
Suwon, Gyeonggi-do 440-746, South Korea

E-mail : dslee@skku.edu

Over the last decade, injectable stimuli-sensitive polymeric hydrogels have attracted considerable attention, because of their potential biomedical and pharmaceutical applications, such as in drug/protein delivery and tissue engineering. In this presentation, I will talk about the recent progress in injectable block copolymer hydrogels responding to pH and temperature, which were developed in my group, and their potential biomedical applications. These copolymers usually contain tertiary amine groups as pH-sensitive moieties and many different chemical groups, such as ester, amide, urethane, urea… to control the hydrogel properties, including biodegradable, mechanical, in vitro and in vivo stability, cytotoxicity and release behavior. These copolymer aqueous solutions exists in the sol states at low pH and low temperature with low viscosity, which is suitable for formulation with proteins or bioactive molecules, and exhibited a sol-gel transition to be the gel states with high viscosity by changing to physiological conditions (37 ℃, pH 7.4) or after being injected into the body, which can let them serve as proteins/bioactive molecules depots for long term sustained release. The potential applications of these hydrogels as drugs/proteins carriers will also be reported

Keywords Injectable hydrogel; pH/temperature sensitive; Block copolymer; Protein delivery

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1. Huynh, C.T., Nguyen, M.K. Lee, D.S., Macromolecules, 2011, 44, 6629-6636.
2. Huynh, C.T., Nguyen, M.K. Lee, D.S., Chem. Comm., 2012, 48(89), 10951-10953.
3. Huynh, C.T., Nguyen, M.K. Lee, D.S., Soft Matter, 2011, 7(19), 8984-8990.
4. Manokruang, K., Lee, D.S., Macro. Biosci., 2014, 13(9), 1195-1203.

Prof. Doo Sung Lee

Education and Appointments

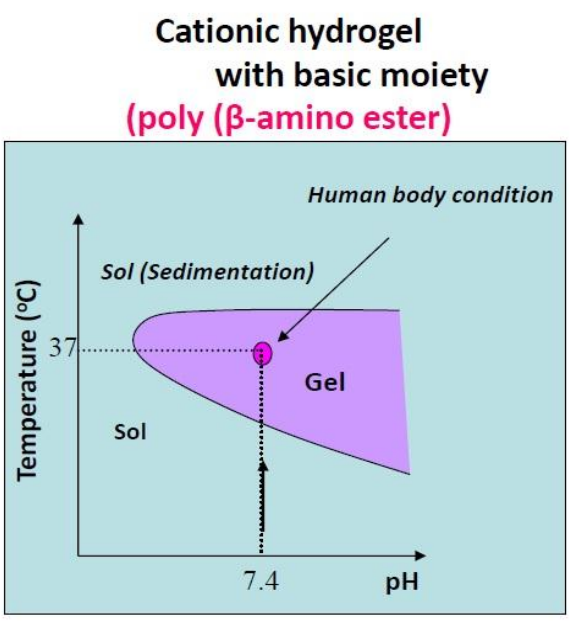
B.S., Chemical Engineering, Seoul National University, 1978
Ph.D., Chemical Engineering, KAIST, 1984
1978 -1979 Research Scientist, Korea Institute of Science and Technology
1984 -present Professor of School of Chemical Engineering, Sungkyunkwan University
2005 -2007 Dean of College of Engineering, Sungkyunkwan University

Professional Activities

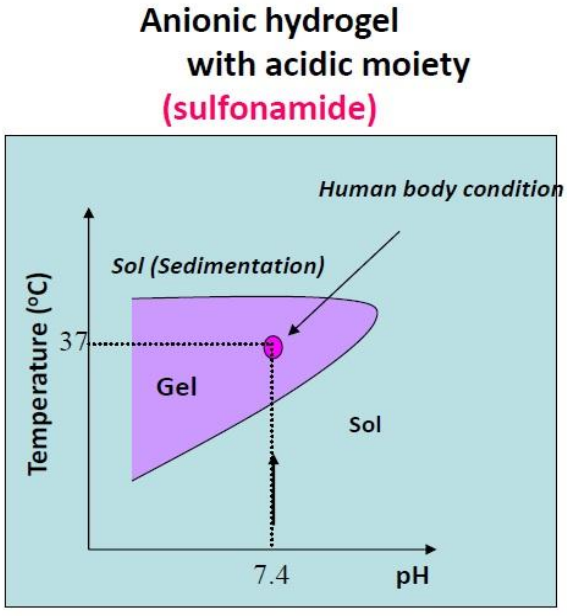
President of the Polymer Society of Korea (2013)
Member of Korean Academy of Science and Technology (2011-)
Member of National Academy of Engineering of Korea (2007-)
Director of Theranostic Macromolecules Research Center (NRF)
Council member of Pacific Polymer Federation (2009-)
Fellow of ISU of Biomaterials Science and Engineering (2008-)
Editorial board of Advanced Healthcare Materials
Editorial board of Nanomedicine NBM

Research Area

Biomaterials and Biomedical Engineering
165 papers, total citation 6175 , *h*-index = 39



Drug solution at pH 6.5 can be injected to form a gel



Drug solution at pH 8.0 can be injected to form a gel

Development of Dimensionally Controlled Polymer Materials from Polymers to Living Cells by Use of Self-assembly Based on Weak Interactions

Prof. Mitsuru Akashi

Graduate School of Engineering,
Osaka University, Suita 565-0871, Japan

E-mail : akashi@chem.eng.osaka-u.ac.jp

Generally interactions such as hydrogen bonding, electrostatic, hydrophobic interactions and others play important roles for structure and mechanical properties in both synthetic and naturally occurring polymers. Since week interactions such as van der Waals and hydrophobic interactions reveal their character strongly in polymer system comparing with low molecular weight compounds, we can use them for design and creation of functional polymer materials. In my lecture, 1) I talk on complex formation of i-PMMA with s-PMMA and poy-L-lactide with poly-D-lactide by van der Waals interaction with using Layer-by-Layer technique, and their application to stereoregular free radical template polymerization of MMA. And, 2) the formation of nano-particles derived from poly-γ-glutamic acid bearing phenyl alanine ethylester by use of hydrophobic interaction occurred in an aqueous system have been established and applied for antigen proteins DDS (vaccine). Finally, 3) 3D living tissues with manipulated cells have been accomplished by use of affinity interaction between so-called ECM proteins for regenerative medicine and human tissue models instead of animal experiments.

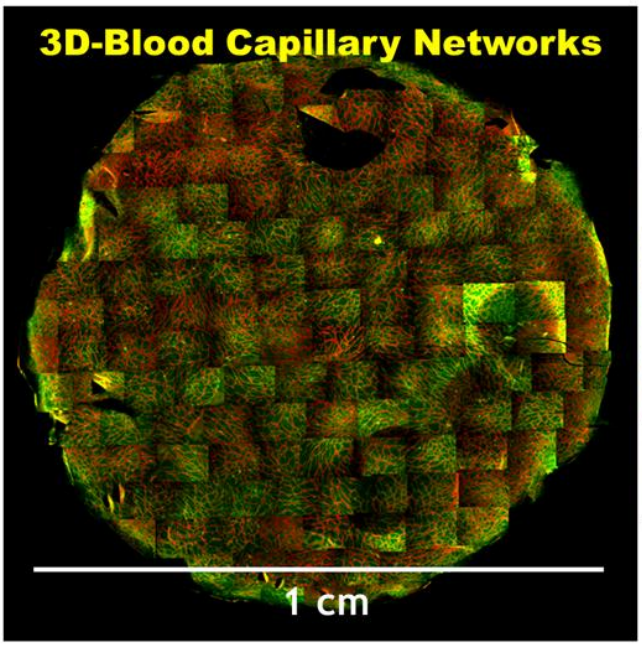
Prof. Mitsuru Akashi

Education : BS from Osaka University, March 1972
Ph.D. in Engineering, from Osaka University, March 1978

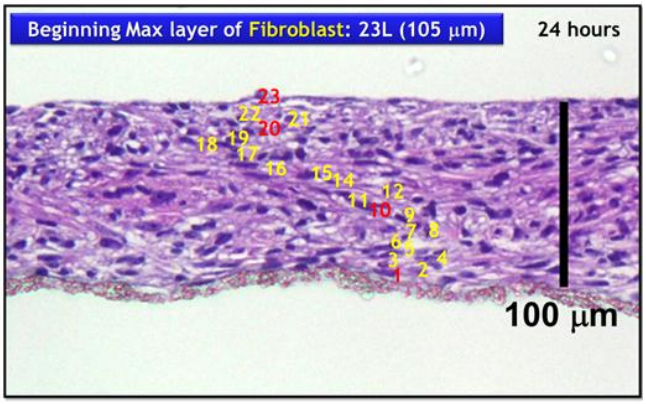
Previous Appointment : Postdoctoral Fellow, National Institute of Health, Gerontology Research Center (USA), 1978-1979
Visiting Lecturer, Lund University (Sweden), 1982
Faculty of Engineering, Kagoshima University
1981-1884, Assistant Professor
Graduate School of Engineering, Osaka University
2003-now, Professor

Academic Activities : Associate Editor of *Chemistry Letters* (2000-2003),
Editorial Board Member of *"Biomacromolecules"*
President of the Society of Polymer Science, Japan(2012-2014)

Award : The Award of the Society of Polymer Science, Japan, in 1999
The Award of the Japanese Society for Biomaterials, in 2004
The Award of the Chemical Society of Japan, in 2015



Adv. *Mater.* 23, 3506 (2011).
Biomaterials 35, 4739 (2014).



Adv. *Drug Deliv. Rev.* 74, 95 (2014).

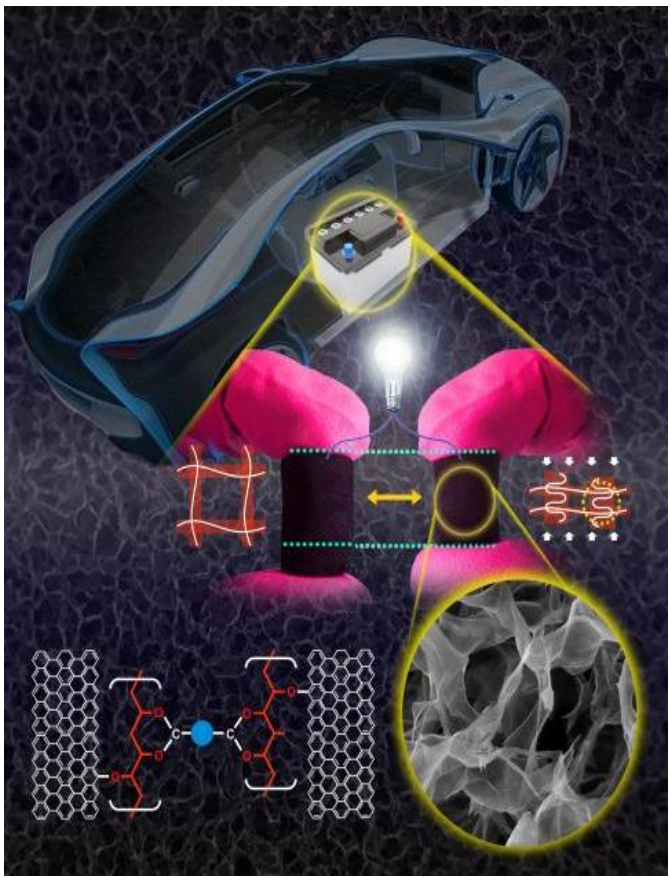
Bendable and Compressible Graphene Materials for Ultracapacitive Energy Storage under Mechanical Stresses

Prof. Ho Seok Park

School of Chemical Engineering,
Sungkyunkwan University (SKKU),
Suwon 440-746, Korea

E-mail : phs0727@skku.edu

With increasing demand for more lightweight, compact future electronic devices, the feasibility of energy storage under even more limited space and mass is of prime importance for special applications of electrical vehicle, aerospace, solar/wind energy, portable mobile electronics, and integrated on-chip systems. The highly bendable and compressible energy storage devices that operate well under mechanical stress and limited space are expected to be adopted in these applicative fields as long as they can deliver a substantial amount of gravimetric capacity (based on unit mass). In this talk, I will introduce bendable and compressible supercapacitors that can deliver electrical energy under various mechanical stresses. In order to achieve high performance supercapacitor devices under various mechanical stresses, the micro- and macroscopic structures and chemical compositions of graphenes are delicately controlled by chemical modification. The solution chemistry described herein would pave the way to obtain high performances of energy storage materials/devices that are otherwise difficult to realize with current, conventional technologies, leading to breakthroughs for important emerging applications.



Prof. Ho Seok Park

Education and Experience

2014.09.01-present : Assistant Professor, School of Chemical Engineering, Sungkyunkwan University

2010.03.01-2014.08.31 : Assistant Professor, Department of Chemical Engineering, Kyung Hee University

2008.12.01-2010.02.28 : Postdoctoral Researcher, MIT

2005.03.01-2008.08.14 : Ph.D in Chemical & Biomolecular Engineering, KAIST, Korea

1996.03.02-2002.02.24 : BS in Polymer Science & Engineering, Kyungpook National Univ., Korea

Research Interests

[1]Energy conversion & storage : carbon nanomaterials (CNTs, Graphenes, and conducting polymers) and their nanocomposites for electrode, organic/inorganic nanohybrid and ionic gel electrolytes, flexible energy storage devices

[2] Nanotechnology for environmental applications : CO2 capture, water purification

Scientific & Educational Activities

[1] Editorial board in 'Journal of Photonic Science and Technology' (2011-Present), 'ISRN Nanomaterials' (2012- Present), and 'Graphene' (2012- Present)

Representative Publications (~80 papers)

[1] Ho Seok Park* et al., J. Am. Chem. Soc., 2008, 130, 845-852.

[2] Ho Seok Park* et al., J. Am. Chem. Soc., 2011, 133, 14765-14770.

[3] Ho Seok Park* et al., Energy Environ. Sci., 2011, 4, 4284-4289.

[4] Ho Seok Park* et al., ChemSusChem, 2014, 7, 1094-1101. Cover

[5] Ho Seok Park* et al., Adv. Funct. Mater., 2015, In press. Cover