2017 한국공업화학회
추계 총회 및 학술대회

2017 KSIEC Fall Meeting

November 8~10, 2017
BEXCO, BUSAN, KOREA

Korea-Thailand Symposium
November 10, 2017

2017 한국공업화학회
추계 총회 및 학술대회

2017 KSIEC Fall Meeting

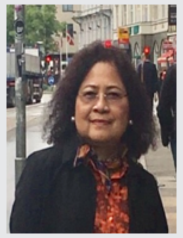
November 8~10, 2017
BEXCO, BUSAN, KOREA

Korea-Thailand Symposium

Organizer

Jongwook Park
(Kyung Hee University, Korea)

- 1994 Ph.D. KAIST, Korea
- 1995 – 1998 Samsung SDI, Korea
- 2002 – 2016 Catholic Univ., Korea
- 2016 – Kyung Hee Univ. Korea



Ladda Meesuk
(Kasetsart University, Thailand)

- 1985 Ph.D. University of East Anglia, England
- 1979 – 2014 Kasetsart Univ., Thailand
- 2011 – Present Member of Executive Committee, Chemical Society of Thailand

Chair of Session A

Felix Sunjoo Kim
(Chung-Ang University, Korea)

- 2003 B.S. Seoul National Univ., Korea
- 2012 Ph.D. Washington Univ., Korea
- 2014 Outstanding Graduate Research Award
- 2013 – Present Chung-Ang Univ., Korea

Chair of Session B

Sung Chul Hong
(Sejong University, Korea)

- 1996 Ph.D., Seoul National University
- 1998 – 1999 BASF, Germany
- 2000 Carnegie Mellon Univ., USA
- 2004 – Present Sejong Univ. Korea

2017 한국공업화학회
추계 총회 및 학술대회
2017 KSIEC
Fall Meeting

Session A

(Chair : Felix Sunjoo Kim)

2SK-1	12:30~12:50	Materials and Devices for High-Efficiency Organic Solar Cells Hang Ken Lee (KRICT, Korea)
2SK-2	12:50~13:10	Molecular Tuning of D-π-A Organic Dyes for High Efficiency Dye-Sensitized Solar Cells Vinich Promarak (VISTEC, Thailand)
2SK-3	13:10~13:30	Carbon counter electrode and gel electrolyte of dye-sensitized solar cells for improved stability Sung Chul Hong (Sejong University, Korea)
2SK-4	13:30~13:50	Development of Electrocatalysts Based on Porous Carbons as the Counter Electrodes for Dye-Sensitized Solar Cells Panitat Hasin (Kasetsart University, Thailand)
2SK-5	13:50~14:10	Synthesis and Electroluminescence of New Blue Dual-Core Emitters Using Spirofluorene and Phenylcarbazole Jongwook Park (Kyung Hee University, Korea)

Session B

(Chair : Sung Chul Hong)

2SK-6	14:40~15:00	Conducting polymers: Applications in Electronic Devices and Sensors Walaiporn Prissanaroon Ouajai (KMUTNB, Thailand)
2SK-7	15:00~15:20	Electron transport in imide-containing polymer semiconductors transistors and memory devices Felix Sunjoo Kim (Chung-Ang University, Korea)
2SK-8	15:20~15:40	Role of Conductive Fillers on Properties of Composites for PEMFC Bipolar plates Rungsima Yeetsorn (KMUTNB, Thailand)
2SK-9	15:40~16:00	Porous polymeric templates for sensor and composite applications Jonghwi Lee (Chung-Ang University, Korea)
2SK-10	16:00~16:20	Photocatalysis fundamentals and surface modification of magnetic core-shell $Fe_3O_4/SiO_2/CeO_2$ Duangdao Channei (Naresuan University, Thailand)

Session A (Chair : Felix Sunjoo Kim)

2SK-1

Materials and Devices for High-Efficiency Organic Solar Cells

Hang Ken Lee, Chang Eun Song, Sang Kyu Lee,
Won Suk Shin, Jong-Cheol Lee, Sang-Jin Moon

Center for Solar Energy Materials
Korea Research Institute of Chemical Technology (KRICT)

hangken@krict.re.kr

Organic photovoltaic cell (OPV) have been researched as a potential next generation power generator due to its low light, flexible, low cost fabrication possibilities. At this stage, one of the major technical huddle for commercialization is high-enough efficiency of OPV. Here, we are going to show some of our effort to increase OPV efficiency by developing new active material and device engineering including molecular modification of polymer and small molecule based donor, non-fullerene acceptor and interface modifier.

· Keywords : Organic solar cell, Donor, Non-fullerene acceptor, surface modifier

Hang Ken Lee is senior researcher in the Korea Research Institute of Chemical Technology (KRICT). He obrained Ph.D. degree in 2010 at KAIST(Republic of Korea). After then he joined in LG Chem. (Repuplic of Korea) as a senior manager from 2010 to 2017 and Prof. G. Bazan's group from 2014 to 2015 to work on commercialization of organic solar cell. He is currently interested in organic based opto-electonic devices especially solar cell, photodiode.

2017 한국공업화학회
추계 총회 및 학술대회
2017 KSIEC
Fall Meeting

2SK-2

Molecular Tuning of D-π-A Organic Dyes for High Efficiency Dye-Sensitized Solar Cells

Vinich Promarak

School of Molecular Science and Engineering, Vidyasirimedhi Institute of Science and Technology (VISTEC), Payupnai, Wangchan, Rayong, 21210 Thailand

vinich.p@vistec.ac.th

Dye-sensitized solar cell (DSSC) has emerged as one of the most attractive photovoltaic devices because it offers the possibility of low-cost conversion of photoenergy. Ruthenium complex and porphyrin dyes are currently the most efficient dyes. These dyes, however, are costly and hard to prepare in high yields, which have led to the evolution of metal-free organic dyes. Organic dyes exhibit not only higher extinction coefficient, but simple preparation, structure modification and purification procedure with a low cost. In this talk, an improvement of the performance of the organic dyes as sensitizers for DSSC by fine tuning the dye chemical structures will be presented. A series of organic dipolar compounds with different molecular configurations of D-D-π-A, D(dendron)-π-A, D-π-A-π-A, D-π(D)-A, D-π-A-π(D)-A bearing triarylamine, carbazole and carbazole dendrons as donor moiety were designed, synthesized and investigated. The relationships between structure of these dyes and properties and cell performances will be drawn and discussed. The choice of -linker, auxiliary acceptor and terminal acceptor are found to be crucial in designing of the dye. Some of these dyes show power conversion efficiencies surpass that of the Ru-based device measured under similar conditions, indicating a high potential candidate for a commercial use.

· Keywords : Dye-sensitized solar cell; Organic dyes; D-π-A; Carbazole

Vinich Promarak is currently professor in Chemistry at School of Molecular Science and Engineering, Vidyasirimedhi Institute of Science and Technology (VISTEC). He obtained his D.Phil. degree in 2002 from Shool of Chemistry, University of Oxford, under a supervision of Prof. Paul L Burn. His current research interests involve "High-Tech" Organic materials that can be used in optoelectronic devices i.e. organic light-emitting diode; perovskite/dye-sensitized solar cell, bulk heterojunction solar cell, sensor, optical switch, organic field-effect transistor. To date, he has co-authored more than 115 peer-reviewed papers, and his publications have been cited over 2300 times with current H-index of 30 based on Google Scholar.

2SK-3

Carbon counter electrode and gel electrolyte of dye-sensitized solar cells for improved stability

Sung Chul Hong

Department of Nanotechnology and Advanced Materials Engineering, Sejong University, Seoul 05006, Republic of Korea

sunghong@sejong.ac.kr

Dye-sensitized solar cells (DSSCs) have potential for success owing to their high solar energy conversion efficiency, low production cost and easy fabrication process. A classical DSSC is generally composed of a transparent conductive glass with nanostructured TiO2, photoactive dye, redox electrolyte and platinum (Pt)-coated conductive glass as a counter electrode (CE). However, Pt is a high-priced metal and tends to be corroded by electrolytes through long-term exposure. In addition, leakage and volatilization of the liquid electrolyte may also limit the long-term stability of DSSCs. In our group, various carbonaceous nanomaterials, such as carbon nanotubes, reduced graphene oxide and carbon nanofibers, were investigated as alternatives to replace Pt CE. Hybridization of the carbonaceous materials with minor amounts of catalytic Pt significantly improved the electro-catalytic performances of the carbon CEs. An initiator- and monomer-free UV-cross-linkable block copolymer was designed and synthesized for controlled in-situ gelation of electrolytes in DSSC. A composite separator membrane with an A/B/A type layered structure was also inserted in electrolyte, demonstrating desirable combination of short- and long-term performances of DSSC. The combination of the carefully designed CE and gel electrolyte are believed to be beneficial for the success of DSSC especially for flexible energy generation devices.

· Keywords : dye-sensitized solar cell, counter electrode, carbon, gel electrolyte, membrane

Sung Chul Hong is Professor of Polymer Chemistry at the Department of Nanotechnology and Advanced Materials Engineering of Sejong University. He received his Ph.D. from Seoul National University in 1996. During 1997-1998, he worked as a post-doc. research fellow under Prof. Kazuo Soga of JAIST in Japan. During 1998-1999, he also worked at the central polymer research center of BASF in Ludwigshafen, Germany. In both institute, he worked on the immobilized metallocene catalysts for olefin polymerizations. In 2000, he joined K. Matyjaszewski's group in Carnegie Mellon University, working on the immobilized ATRP catalyst and the related radical polymer synthesis. In 2002, he joined R&D team of Crompton Corporation in USA to develop novel specialty polymers through controlled radical polymerization techniques. In 2004, he joined Sejong University. His research interests are mainly focused on the synthesis and application of well-defined polymers through controlled polymerization techniques, including functional polyolefin, polyurethanes and carbon materials. He is the author of more than 80 papers and holds over 40 patents in the field of Polymer Chemistry. He is currently an Editor of Macromolecular Research (SCI journal, impact factor of 2016 = 1.405) and has actively joined the Polymer Society of Korea and Korean Society of Industrial and Engineering Chemistry as finance director, general director, organizer, etc.. He was awarded the Mid-career Researcher Academy Award of the Polymer Society of Korea in 2014.

2017 한국공업화학회
추계 총회 및 학술대회
2017 KSIEC
Fall Meeting

2SK-4

Development of Electrocatalysts Based on Porous Carbons as the Counter Electrodes for Dye-Sensitized Solar Cells

Panitat Hasin[1,*], Vittaya Amornkitbamrung[2], Narong Chanlek[3]

[1]Department of Chemistry, Faculty of Science, Kasetsart University, Bangkok 10900, Thailand
[2]Department of Physics, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand
[3]Synchrotron Light Research Institute, Nakhon Ratchasima 30000, Thailand

fscipths@ac.th

Nanocomposites of cobalt or nickel species and N-doped mesoporous carbon as well as tungsten carbide imbedded in N-doped hierarchical hollow mesoporous carbon were prepared for replacing Pt as the electrocatalysts on the counter electrodes (CEs) of dye-sensitized solar cells (DSCs). It is shown that the obtained nanocomposite carbon materials significantly improve the electrocatalytic activity toward the reduction of I_3^- compared to bared porous carbons. The prepared nanocomposite carbon materials with enhanced electrochemical stability are the benefit to combining high electrical conductivity and electrocatalytic activity into one material in which Co or Ni species as well as WC serve as the electrocatalysts and N-doped mesoporous carbon as well as N-doped hierarchical hollow mesoporous carbon serves as the electrical conductors. The fabricated nanocomposite carbon materials based DSCs show the best light-to-electricity conversion efficiency (η) which are higher than those of the cells with bared porous carbons CEs and are comparable to that of the cell with a platinized CE.

· Keywords : Nanocomposite, Porous carbon, Dye-sensitized solar cell, Counter electrode, Electrocaralyst

Dr. Panitat Hasin received his BS (2003) and MS (2007) degrees in Department of Chemistry from Thammasat University and Kasetsart University, Thailand, respectively. He received his Ph.D. in Department of Chemistry and Biochemistry at the Ohio State University, USA in 2012. Currently, he is a Faculty in Department of Chemistry at Kasetsart University. His research interests mainly surround applications of chemically modified carbon electrodes to photovoltaic and taste sensing devices, including dye-sensitized solar cells and electronic tongue sensors.

2SK-5

Synthesis and Electroluminescence of New Blue Dual-Core Emitters Using Spirofluorene and Phenylcarbazole

Beomjin Kim[1], Suji Lee[2], Hyocheol Jung[1], Hayoon Lee[1], Seokwoo Kang[1], and Jongwook Park[1*]

[1]Department of Chemical Engineering, Kyung Hee University, Yongin, 17104, Republic of Korea
[2]Department of Chemistry, Catholic Univerisity of Korea, Bucheon, 14662, Republic of Korea

jongpark@khu.ac.kr

Intensive studies have been conducted on organic light-emitting diodes (OLEDs), as they have a great potential to be applied to large full-color displays. Most π-conjugated organic molecules have been reported to display red, green and blue electroluminescence (EL). Red and green emitters have already achieved high efficiency and long life. However, it has been very difficult to develop materials that emit pure blue light with high efficiency since a wide band gap, with a large difference between the energy levels of adjacent holes and electron transporting layers, is an intrinsic property of blue emitters. Thus, the development of stable blue emitters is still required. We used fluorene and carbazole as the side groups, which have high luminescence efficiency and excellent thermal stability values, and substituted them into a 1-anthracen-9-yl-pyrene (AP) dual core. DSF-AP and SCP-AP were synthesized through borylation and the Suzuki aryl-aryl coupling reaction. Synthesized materials exhibited PLmax values at 443 nm and 448 nm in solution state (CHCl3), and at 458 nm and 463 nm in a thin-film state. Electroluminescence (EL) devices with the synthesized materials were fabricated. Compared with the EL device of AP core, EL device of DCP-AP showed 31% higher luminance efficiency (resulting in a value of 4.37 cd/A) and 32% higher power efficiency (to yield 1.93 lm/W), as well as a high external quantum efficiency (3.64%).

· Keywords: blue OLED, dual core, spirofluorene, phenylcarbazole

Jongwook Park is Professor of Organic Chemistry at the Chemical Engineering Department of Kyung Hee University. He received his Ph.D. from KAIST (Korea Advanced Institute of Science and Technology) in 1994. During 1995-1996, he worked as a research fellow under Prof. Alan MacDiarmid of University of Pennsylvania, Nobel Laureates of Chemistry in 2000. In 1995, he joined Samsung SDI, received Ph.D. Project Award of Samsung SDI in 1996, and established his OLED team in 1997. His research interests are mainly focused on synthesis and properties of π- conjugated materials for electronics as well as OLED. For his contributions in the development of new synthetic compounds for OLED, he was awarded the Excellent Paper of the Korean Electronic Materials Society in 2001. He is the author of 214 SCI papers and holds 43 patents in the field of organic semiconducting materials. He was a general director of Korean Polymer Society, Korean Union of Chemical Science and Technology Societies, and Korean Society of Industrial and Engineering Chemistry for 7 years. He is an OLED committee member of SPIE in US, the Korean Display Society, and the polymer division chairman of Korean Society of Industrial and Engineering Chemistry. He was also chairman of 8 large-scale projects of Korean industry in relation with electronic materials. He received the Prime Minister Award from Korean government in 2012.

Session B (Chair : Sung Chul Hong)

2SK-6

Conducting polymers : Applications in Electronic Devices and Sensors

Walaiporn Prissanaroon Ouajai[1*], Anuvat Sirivat[2], Paul Pigram[3]

[1]Department of Industrial Chemistry, Faculty of Applied Science, King Mongkut's University of Technology North Bangkok (KMUTNB), Bangkok, Thailand

[2]Conductive and Electroactive Polymers Research Unit, Petroleum and Petrochemical College (PPC), Chulalongkorn University, Bangkok, Thailand

[3]Department of Physics, Centre for Materials and Surface Science (CMSS), La Trobe University, VIC, Australia

walaiporn.o@sci.kmutnb.ac.th

Electrically conducting polymers (ECPs) are an advanced new class of electronic materials, which have attracted an increasing interest since their discovery in 1977. They have many advantages, as compared to the conventionally non-conducting polymers, which is primarily due to their remarkable electronic properties such as electrical conductivity, low energy optical transitions, low ionization potential, and high electron affinity while maintaining mechanical flexibility and high thermal stability. Extensively studied ECPs include polypyrrole (PPy), polyaniline (PANI), polythiophene (PTh), Poly(3,4-ethylenedioxythiophene) (PEDOT), etc. During the last decade, the applications of ECPs in electronic devices and sensors have been extensively explored by our research team which is collaborating of Department of Industrial Chemistry KMUTNB, PPC Chulalongkorn University and CMSS La Trobe University. Some important contributions will be highlighted in the presentation including electrostatic discharge materials, fuel cell bipolar plate, electrically controlled drug delivery, potentiometric sensors and biosensors.

· Keywords : Conducting polymers, Sensors, Fuel cell bipolar plate, Drug delivery, EMI shielding, ESD protection.

Walaiporn Prissanaroon Ouajai completed her B.Sc. with first class honours in Industrial Chemistry from KMUTNB, Thailand in 1996, her M.S. in Polymer Science from Petroleum and Petrochemical College, Chulalongkorn University in 1998 and her Ph.D. from La Trobe University, Australia in 2004. In 2008 she has received Endeavour Research Fellowship from The Department of Education, Science and Training, Australian Government. In 2015 she has been selected to participate Australia-Thailand Young University Researchers Exchange Program to do the collaborting research at Centre for Materials and Surface Science (CMSS), La Trobe University. She is currently Assistant Professor and Deputy Head of Department of Industrial Chemistry (Academic Affairs). Her research interests include conducting polymers and their applications in sensors, fuel cell bipolar plate, drug delivery, EMI shielding and ESD protection.

2SK-7

Electron transport in imide-containing polymer semiconductors for transistors and memory devices

Felix Sunjoo Kim

Chemical Engineering and Materials Science, Chung-Ang University, Seoul, Korea

fskim@cau.ac.kr

Non-conventional electronics are emerging in a form of wearable electronics. In this talk, we present electron-transporting properties of imide-containing polymer semiconductors and their applications in organic n-channel transistors and nonvolatile memory devices. Highly pi-conjugated and fused aromatic units with diimide groups are able to be easily reduced from neutral state. This capability results in efficient transport of negative charge carriers through the polymers. Various thiophene derivatives were used as the comonomers. In an alternating arrangement of electron-donors and acceptors in the backbone, we were able to tune the molecular bandgap in a range of 1–2 eV. We have engineered the molecular structures to tune the electron-transporting and trapping properties, and show that the properties are sensitive to the core structures and side-chains. We have applied the series of polymers to organic transistors, complementary circuits, and transistor-based memory devices.

· Keywords : electron transport, donor-acceptor polymer, polyarylenediimide, transistor, memory device

Felix Sunjoo Kim is an Assistant Professor at the School of Chemical Engineering and Materials Science of Chung-Ang University since 2013. He earned a B.S. degree in Chemical Engineering from the Seoul National University (Seoul, Korea) in 2003. He then received his Ph.D. degree in Chemical Engineering from the University of Washington (Seattle, Washington, USA) in 2012, under the guidance of Prof. Samson A. Jenekhe. For his graduate research studies, he became a recipient of the Outstanding Graduate Research Award in Polymer Chemistry (American Chemical Society) in 2014 and one of the finalists for the Padden Award for Graduate Student Research in Polymer Physics (American Physical Society) in 2012. He has authored 50 research articles and filed 11 international and domestic patent applications, as of 2017. His research interest focuses on structure-processing-property relationships of polymers and organic conjugated molecules and their applications in electronics and energy conversion.

2SK-8

Role of Conductive Fillers on Properties of Polypropylene Composites for PEMFC Bipolar plates

Rungsima Yeetsorn[1*], Michael W. Fowler[2], Costas Tzoganakis[2], Chaiwat Prapainainar[3], Walaiporn Prissanaroon Ouajai[1],

[1]Department of Industrial Chemistry, Faculty of Applied Science, King Mongkut's University of Technology North Bangkok, Bangkok, Thailand

[2]Department of Chemical Engineering, Faculty of Engineering, University of Waterloo, Ontario, Canada 3Department of Chemical Engineering, Faculty of Engineering, King Mongkut's University of Technology North Bangkok, Bangkok, Thailand

rungsima.y@sci.kmutnb.ac.th

Due to increasing environmental concerns and escalating oil prices, increasing attention is being paid to fuel cell technologies. One of the current barriers to their commercialization is the cost of the components and manufacturing, specifically bipolar plates. Conductive thermoplastic composites are thought to be one of the most promising candidate materials to substitute for metallic and graphite materials in bipolar plates for low temperature fuel cells, such as Proton Exchange Membrane Fuel Cell (PEMFC) or Direct Methanol Fuel Cell (DMFC). Bipolar plates made from thermoplastic carbon composites are light in weight and can be shaped in mold. Research work on bipolar plate materials will bring about the next significant improvement in fuel cell performance by lowering the size, weight and cost of stacks. Our research group focuses on using polypropylene/conductive filler composites with low filler loading as materials for bipolar plate production. The selected conductive fillers used in our work are graphite, carbon fiber, carbon black, and graphene. These composites have a major advantage in that they can be produced by a conventional low-cost injection or compression molding techniques. However, it is difficult to meet desirable conductivity when using the composite plates while maintaining processability. Surface, contact, and volume resistance occurring in fuel cells causes low efficiency fuel cells containing the composite bipolar plates compared to fuel cells containing metallic or graphite bipolar plates. In this regard, several approaches, such as introducing small amounts of polypyrrole to the composites, coating polypyrrole via chemical polymerization or coating copper via electroless deposition on a bipolar plate surface, and inserting metal sheet into the composite plates, were created for reducing the resistance.

· Keywords : Bipolar plates, Electrically conductive composites, Fuel cells, Electrical conductivity, PEMFC, DMFC

Rungsima Yeetsorn completed her M.S. in Industrial Chemistry from King Mongkut's University of Technology North Bangkok (KMUTNB), Thailand in 2000. She graduated Ph.D in Chemical Engineering from University of Waterloo, Canada in 2010 with The Thai Royal Government Scholarship. In 2004 she received research fellowship from University Hamburg-Harburg, Hamburg, Germany to do the collaborative research on the topic of HDPE/MWCNT composites. In 2013 she joined the collaborative research about The Hydrodesulfurization of Coprocessing Bio-oil under a JICA project. In 2016 she won Junior Research Fellowship Program Funding from Government of France to work in Fuel Cell Lab, Belfort, France on Experimental Studies on Degradation Mechanisms in Polymer Electrolyte Membrane Fuel Cells. She is currently an Assistant Professor at the Department of Industrial Chemistry as well as Associate Dean for research affairs and strategic industry relations of the Faculty of Science Energy and Environment, KMUTNB. Her research interests include material improvement for low temperature fuel cells, fuel cell hydridization system, productions of electrically and thermally conductive composites, and degradation mechanisms in fuel cells.

2SK-9

Porous polymeric templates for sensor and composite applications

Cheongcheon Lee, Yunho Cho, Soyun Kim, Kyuhyung Choi, Soomin Bae, Hyeongju Kim, Byoung Soo Kim, Kantappa Halake, Junseok Kim, Suyeong An, and Jonghwi Lee*

Department of Chemical Engineering and Materials Science, Chung-Ang University 221 Heukseok-dong, Dongjak-gu, Seoul 156-756, Korea (South)

jong@cau.ac.kr

Porous polymers have been developed and utilized as the key engineering materials in many industries. However, their pore morphology has been limited by the restricted number of choices of preparation methods. Recently, pores of novel morphologies can be prepared by crystallization of solvent and subsequent sublimation. This relatively new technique offers us to prepare porous polymeric templates having unique aligned pore structures, which could serve as substrates for sensors and prepregs for composites. Porous polyurethanes enabled simple surface adsorption of graphene, resulting in conductive composites of relatively low graphene content. This composite was successfully manufactured into glucose sensors with flexibility. The 3D continuous structures of pores generated by this preparation technique allowed easy infiltration into the prepreg, resulting in 3D co-continuous composites. Novel temperature-sensitive composites with controlled structures of poly(N-isopropylacrylamide) (PNIPAm) hydrogel and polydimethylsiloxane were fabricated. Volume transition between its swelling-deswelling states became faster than that of PNIPAm. This class of materials could be an interesting bridge between the hydrophobic and the hydrophilic materials.

· Keywords : porous materials, polydimethylsiloxane, directional melt crystallization, composites

Jonghwi Lee got his Ph.D. degree in University of Michigan, Ann Arbor and worked for Merck Research Laboratories as a senior researcher after his postdoctoral training at the University of Minnesota. He won prizes from The Polymer Society of Korea (Best Paper Award), Korean Society of Industrial Engineering Chemistry (Best Paper Award, Best Industry Collaboration Award), and Chung-Ang University (Excellence in Achievement Award, Bae Young Soo Award). He has published more than 150 research papers, and currently a vice editor of 'Journal of Industrial and Engineering Chemistry' and 'Macromolecular Research'.

2017 한국공업화학회
추계 총회 및 학술대회
2017 KSIEC
Fall Meeting

2SK-10

Photocatalysis fundamentals and surface modification of magnetic core-shell $Fe_3O_4/SiO_2/CeO_2$

Duangdao Channei[1,2,*], Sukon Phanichphant[3], Auppatham Nakaruk[4], Pramod Koshy[5], and Charles C. Sorrell[5]

[1]Department of Chemistry, Faculty of Science, Naresuan University, Phitsanulok 65000, Thailand

[2]Research Center for Academic Excellence in Petroleum, Petrochemicals and Advanced Materials, Naresuan University, Phitsanulok 65000, Thailand

[3]Materials Science Research Center, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand

[4]Department of Industrial Engineering, Faculty of Engineering, Naresuan University, Phitsanulok 65000, Thailand

5School of Materials Science and Engineering, Faculty of Science, UNSW Australia, Sydney, NSW 2052, Australia

duangdaoc@nu.ac.th

Photocatalysis as a green and sustainable technology has received increasing attention during the past decades. Based on the fundamentals of photocatalysis and surface chemistry of CeO_2 materials, we herein discuss a very facile and novel method for the synthesis of $Fe_3O_4/SiO_2/CeO_2$ with a control of core-shell structure. The first attempt in producing Fe_3O_4/CeO_2 magnetic photocatalyst involved the direct deposition of CeO_2 onto the surface of magnetic Fe_3O_4 particles. However a direct contact of CeO_2 onto the surface of magnetic Fe_3O_4 particles presented unfavorable heterojunction, thus the SiO_2 barrier layer between magnetic Fe_3O_4 and CeO_2 was prepared as a core-shell structure to reduce the negative effect. $Fe_3O_4/SiO_2/CeO_2$ core-shell magnetic nanoparticles was recovered in the consecutive cycles of use by external magnetic field. The material showed good stability with regards to photocatalytic performance for three cycles of use.

· Keywords : CeO_2, Photocatalyst, Core-shell structure, Magnetic photocatalyst

Duangdao Channei graduated with a Ph.D. in Chemistry from Chiang Mai University, Thailand in 2015. From 2010 to 2012 she worked as International visiting research student at School of Materials Science and Engineering, The University of New South Wales, Australia, under the supervision of Prof.C.C. Sorrell. At present, she is a lecturer at the Department of Chemistry, Naresuan University, Thailand. Her research interest focuses on the synthesis of metal oxide catalysts, ceramic processing, photocatalytic process, and physico-chemical properties of materials.