KCS 대한화학회 KOREAN CHEMICAL SOCIETY

2023년 대한화학회 경남지부 춘계학술대회

Program and Abstract

2023년 5월 12일

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2023 년 대한화학회

경남지부 춘계학술대회

순서		
14:50 – 15:00	**등록**	
15:00 – 15:10	**지부장 환영사**	
Session 1		
15:10 – 15:35	**최재원 교수** 경상국립대학교	Controlled Synthesis of Functional Inorganic Nanomaterials for Energy Storage and Conversion
15:35 – 16:00	**박혜정 교수** 창원대학교	Dinuclear Pt(II) Phosphors with Red/NIR Emission by Controlling of the Intramolecular Pt-Pt Distances
16:00 – 16:10	Coffee Break	
Session 2		
16:10 – 16:35	**이영욱 교수** 경상국립대학교	Shape Control and Structure of Metal Nanoparticles and Catalytic Performance
16:35 – 17:00	**윤창석 교수** 창원대학교	Electrochemical Study on Contact Electrification
17:00 – 17:10	Coffee Break 및 기념촬영	
Session 3		
17:10 – 17:30	총회 및 연구성과토론회	
17:30 – 19:00	저녁식사	

[Invited Speaker_1]

Controlled Synthesis of Functional Inorganic Nanomaterials for Energy Storage and Conversion

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As sustainable energy became an important issue, related energy storage devices have attracted special attention from material scientists. The rechargeable battery is one of the most promising energy storage devices for electrical energy. Functional inorganic materials have the potential to replace many electrode materials due to their high reversible capacity and stable cycle life. Synthetic strategies for functional inorganic materials can be classified as follows. First, organometallic compounds have been used to synthesize inorganic nanomaterials with a surfactant. Thus, 1D, 2D, and 3D nanomaterials were easily synthesized with a relatively facile control of widths and thicknesses. Second, microporous organic networks (MONs) have been prepared by cross-coupling various organic building blocks with templates (SiO_2, Polystyrene, PET fibers, Carbon fibers). MONs are versatile materials for various applications. For example, due to their porosity, high surface area, and robust stability against most chemical reagents, MONs have been applied as electrode materials for lithium and sodium-ion batteries. Third, 3D opal structures were fabricated using SiO_2 or Polystyrene spheres. Then, 3D opal structures were turned into 3D inverse opals by infilling the inorganic materials and the etching process. 3D metamaterials as electrodes showed very promising electrochemical performance in rechargeable batteries. In contrast, commercial inorganic materials were easily damaged and rapidly decreased reversible discharge capacity and cyclic stability.

Keywords: Nanomaterials, Inorganic-carbon composite, Microporous polymer, Electrode, Rechargeable batteries

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Recent Selected Publications:

1) Jaewon Choi*, Study on Colloidal Synthesis of ZnS Nanospheres Embedded in Reduced Graphene Oxide Materials for Sodium-ion Batteries and Energy Storage Mechanism, Journal of Alloys and Compounds 2023, 943 169076
2) Jaewon Choi*, Synthesis and Electrochemical Properties of Multi-layered SnO/rGO Composite as Anode Materials for Sodium Ion Batteries, Applied Surface Science, 2023, 612, 155859
3) Jaewon Choi*, Synthesis of Sb_2S_3 NRs@rGO Composite as High-Performance Anode Material for Sodium-Ion Batteries, Materials 2021, 14, 7521.
4) Sanghyeon Kim+, Jaewon Choi+, Reversible Conversion Reactions and Small First Cycle Irreversible Capacity Loss in Metal Sulfide-Based Electrodes Enabled by Solid Electrolytes, Adv. Funct. Mater. 2019, 29, 1901719
5) Jaewon Choi, Enhanced redox activity of a hollow conjugated microporous polymer through the generation of carbonyl groups by carbonylative Sonogashira coupling, J. Mater. Chem. A 2018, 6, 6233.

[Invited Speaker_2]

Dinuclear Pt(II) Phosphors with Red/NIR Emission by Controlling of the Intramolecular Pt-Pt Distances

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Red and near-infrared (NIR) phosphorescent double-decker dinuclear Pt(II) complexes were successfully synthesized and characterized. The synthesized Pt(II) complexes showed different intramolecular Pt-Pt distances according to the electronic characteristics of the C^N ligand. Both experimentally and computationally, the Pt-Pt distance appears to have a very significant influence on the band gaps of the dinuclear Pt(II) complexes. All Pt(II) complexes with achiral ligands existed as racemic mixtures, as confirmed by single-crystal x-ray crystallography. A method to finely control the intramolecular Pt-Pt distance of the dinuclear Pt(II) complex considering the characteristics of the C^N ligand, suggests a guideline for the molecular design of the double-decker dinuclear Pt(II) complexes as red or NIR phosphors in various applications.

Keywords: Platinum, Dinuclear complex, Red/NIR emission, Phosphorescence, OLED

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Recent Selected Publications:

1) Hea Jung Park, Jee-Hun Jang, Jeong-Hwan Lee, and Do-Hoon Hwang.
Highly Efficient Deep-Blue Phosphorescent OLEDs Based on a Trimethylsilyl-Substituted Tetradentate Pt(II) Complex, *ACS Applied Materials & Interfaces,* 2022, *14* (30), 34901-34908.
2) Hea Jung Park, Claire Louise Boelke, Paul Ha-Yeon Cheong, and Do-Hoon Hwang.
Dinuclear Pt(II) Complexes with Red and NIR Emission Governed by Ligand Control of the Intramolecular Pt-Pt Distance, *Inorganic Chemistry*, 2022, *61*(13), 5178-5183.
3) Hea Jung Park, Eun Ah Chae, Hye Won Seo, Jae-Ho Jang, Won Jae Chung, Jun Yeob Lee, Do-Hoon Hwang, and Ung Chan Yoon.
New Blue Phosphorescent Heteroleptic Ir(III) Complexes with Imidazole- and N-Methylimidazole Carboxylates as Ancillary Ligands, *Journal of Materials Chemistry C*, 2020, *8*(39), 13843-13851.
4) Hea Jung Park, Monica C. So, David Gosztola, Gary P. Wiederrecht, Jonathan D. Emery, Alex B. F. Martinson, Süleyman Er, Christopher Wilmer, Nicolaas A. Vermeulen, Alán Aspuru-Guzik, J. Fraser Stoddart, Omar K. Farha, Joseph T. Hupp.
Layer-by-Layer Assembled Films of Perylene Diimide- and Squaraine-Containing Metal-Organic Framework-like Materials: Solar Energy Capture and Directional Energy Transfer, *ACS Applied Materials & Interfaces,* 2016, *8*(38), 24983-24988.

[Invited Speaker_3]

Shape Control and Structure of Metal Nanoparticles and Catalytic Performance

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For the last a few decades, nanotechnology part has been developed to electocatalysis, plasmonics, medical diagnosis. Among them, the catalyst of nanoparticles with fuel cell have been attention because of accelerated exhaustion of fossil fuel and environmental problem. This catalysis depends on high energy surface, high surface with shape and metal composition with enhanced activity. In order to have high activity on surface, it is important to have different surface energy or surface area according to shape control of nanoparticles. The shape controlled nanoparticles are attributed by chemical reduction, physical method, decomposition of organometallic precursors, and surfactant (Figure 1). The shape and size of nanoparticles with high surface energy and area are important factors for the catalytic activity of nanoparticles. As a strategy to enhanced catalytic property, the activity can be increase by changing the surface energy by synthesizing alloy nanostructures. The synthesized nanoparticles were applied to electrochemical properties.

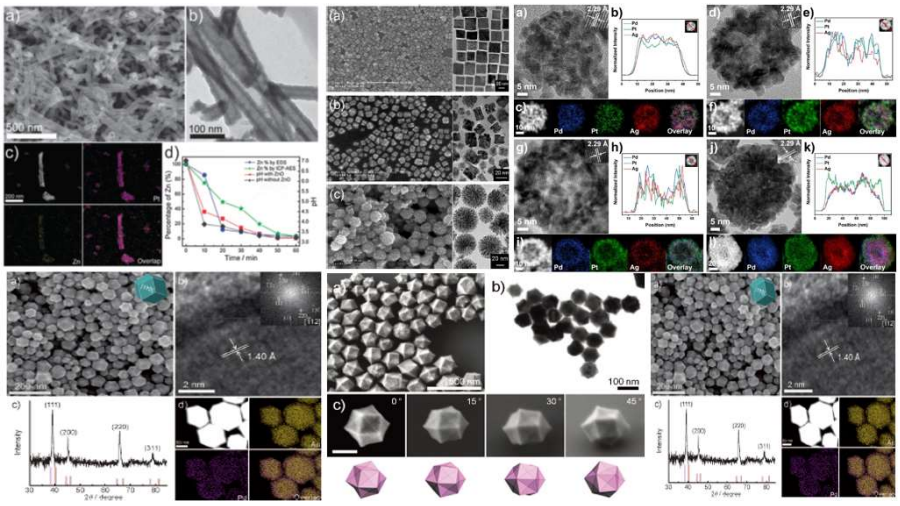

Figure 1. Shape controlled of various nanoparitcles

Keywords: Shape control, Nanoparticles, Metal composition

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Recent Selected Publications:

1) Lee, S. J., Lee, H., Begildayeva, T., Yu, Y., Theerthagiri, J., Kim, Y., Lee, Y. W.* & Choi, M. Y.*(2022). Nanogap-tailored Au nanoparticles fabricated by pulsed laser ablation for surface-enhanced Raman scattering. *Biosensors and Bioelectronics*, *197*, 113766.
2) Woo, S., Chung, K., Bae, J., Shin, T. H., Lee, Y. W.*& Lee, S.* (2021). Microwave-assisted hydrothermal synthesis of a high-voltage microcube $LiMn_{1.5}Ni_{0.5}O_{4-\delta}$ spinel cathode material. *Journal of Electroanalytical Chemistry*, *902*, 115798.
3) Lee, S., Cho, H., Hong, J. W.* & Lee, Y. W.* (2021). Size-controlled palladium dendritic nanocrystals and their electrocatalytic property toward formic acid oxidation and SERS performance. *Materials Letters*, *284*, 128988.
4) Lee, Y. W., Kim, Y., Lee, S., Gong, J., Lee, H. S. & Han, S. W. (2021). One-pot synthesis of ternary alloy hollow nanostructures with controlled morphologies for electrocatalysis. *ACS Appl. Mater. Interfaces*, *13*(38), 45538-45546.
5) Lee, Y. W., Ahn, H., Lee, S. E., Woo, H. & Han, S. W. (2019). Fine control over the compositional structure of trimetallic core–shell nanocrystals for enhanced electrocatalysis. *ACS Appl. Mater. Interfaces*, *11*(29), 25901-25908.

[Invited Speaker_4]

Electrochemical Study on Contact Electrification

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Contact electrification is a common physical phenomenon in our daily lives. Recently, many researches have been tried to investigate this charging mechanism at various interfaces. In this talk, I will present the charging mechanism based on electrochemistry and surface analysis at the PDMS/Au interface. The polarity of static charge on a charged Au is inverted to opposite sign after contact with water and the charged Au have reducing power in aqueous phase. I suggest reduction reaction by the charged Au is driven by mechanochemical radicals instead of inverted static charges.

Other point in this field is energy conversion based on electrification phenomenon, which is a kind of wasted energy. Thus, I will show that chemical electrification at solid/electrolyte interface can be tuned by energy difference between a self-assembled monolayer/electrode and an electrolyte and demonstrate mechanical-to-electrical energy conversion using a harvester.

Keywords: Contact electrification, Energy conversion

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Recent Selected Publications:

1) C Yun, TD Dinh, S Hwang
Chemical electrification at solid/liquid/air interface by surface dipole of self-assembled monolayer and harvesting energy of moving water, *Journal of Colloid and Interface Science*, 2022, 615, 59
2) C Yun, S Hwang
Analysis of the charging current in cyclic voltammetry and supercapacitor's galvanostatic charging profile based on a constant-phase element, *ACS Omega*, 2021, 6, 367
3) C Yun, SH Lee, J Ryu, K Park, JW Jang, J Kwak, S Hwang
Can static electricity on a conductor drive a redox reaction: Contact electrification of Au by polydimethylsiloxane, charge inversion in water, and redox reaction, *Journal of the American Chemical Society*, 2018, 140, 14687

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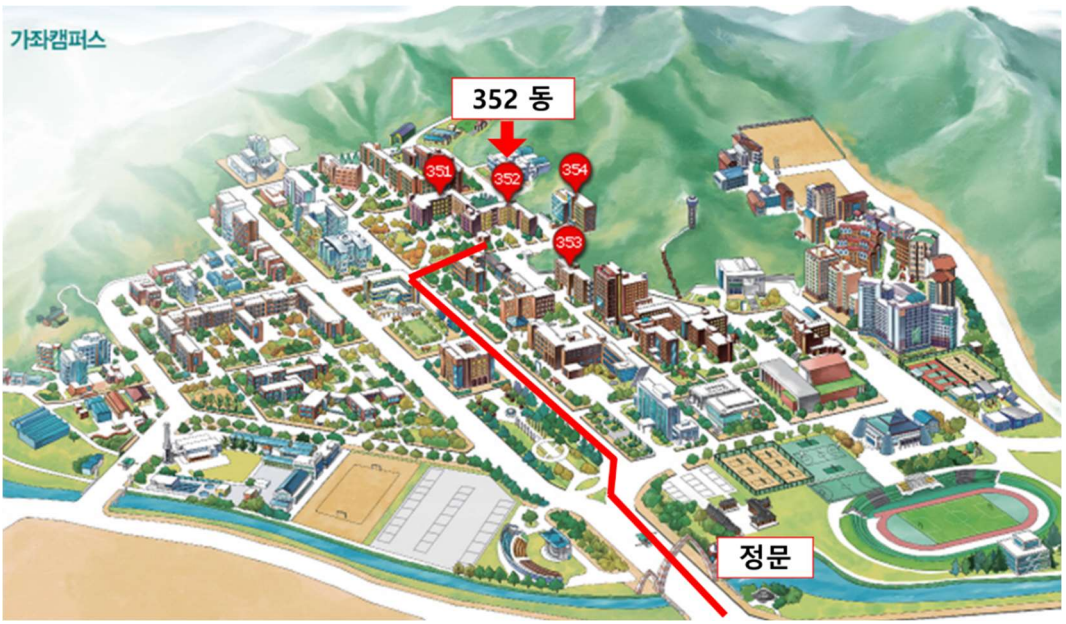

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