



2022 SKKU-PNU BK21 Four

Joint Symposium

Program & Abstract

February 9, 2022



Online Link : <https://pusan.zoom.us/j/84328195365?pwd=bHgxSzUrcGpzbg5CNUxiK3haNlpJUT09>

2022 SKKU-PNU BK21 Four Joint Symposium

Organized by

- Department of Chemistry and Institution for Functional Materials, Pusan National University
- Department of Chemistry, Sungkyunkwan University
Institute of Basic Science, Sungkyunkwan University
- Chemical Science HRD Center for Student Success (BK21 Four), Sungkyunkwan University
- Education and Research Center for Molecular Materials (BK21 Four), Pusan National University

Sponsored by

- National Research Foundation of Korea
- Department of Chemistry and Institution for Functional Materials, Pusan National University
- Institute of Basic Science, Sungkyunkwan University

2022 SKKU-PNU BK21 Four Joint Symposium



Program at Glance



2022. 02. 09. Wed

10:00 – 10:10	Opening Remarks (Ms.Meeree Kim, SKKU)
10:10 – 11:30	Oral Presentation (Session A) (Chair : Nallal Muthuchamy, PNU)
11:30 – 11:40	Break Time
11:40 – 13:00	Oral Presentation (Session B) (Chair : Jeongwon Kim, SKKU)
13:00 – 13:10	Closing Address (Prof. Kang Hyun Park, PNU)
13:10 –	Lunch

Oral Presentations – Abstract

Session A (Chair: Nalla Muthuchamy, PNU)

OR_A1 Sanha Jang PNU

OR_A2 Jeongwon Kim SKKU

OR_A3 Jihun Han PNU

OR_A4 So-yeon Park SKKU

Session B (Chair: Jeongwon Kim, SKKU)

OR_B1 Jong Doo Lee SKKU

OR_B2 Dongwon Kim PNU

OR_B3 Meeree Kim SKKU

OR_B4 Mohamed Yusuf PNU

Preparation and characterization of multifunctional nanofibers containing metal-organic frameworks and Cu₂O nanoparticles: particulate matter capture and antibacterial activity

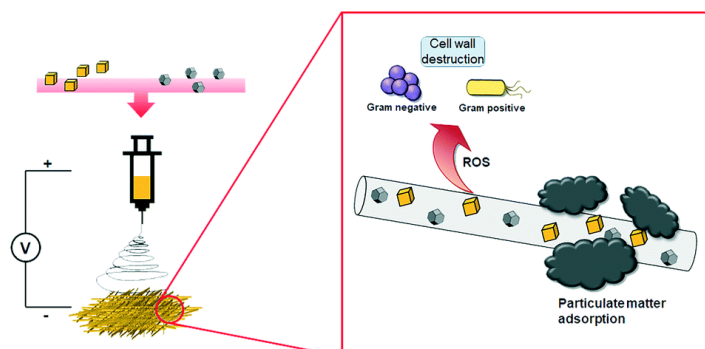
Sanha Jang and Kang Hyun Park*

Department of chemistry, Pusan National University, Busandaehak-ro 63beon-gil, Geumgeong-gu, Busan 46241, Republic of Korea

*Corresponding Authors. E-mail address: chemistry@pusan.ac.kr

Protection from particulate matter (PM₁₀ and PM_{2.5}) and microorganisms using MOFs (metal–organic frameworks) and nanoparticles used in filtration has been a major challenge. In this study, poly(vinylidene fluoride) (PVDF) nanofibers embedded with MOF-801 and Cu₂O nanoparticles were prepared using electrospinning. The modified nanofibers adsorb particulate matter (PM₁₀ and PM_{2.5}) and reduce microorganism populations, thereby improving filtration and antibacterial processes. The multifunctional nanomaterials, which are suitable for use in the presence of hazardous concentrations of particulate matter and *E. coli* because of the well-dispersed MOF-801 and Cu₂O on the nanofibers, show very efficient particulate matter adsorption (PM_{2.5}: 64.46%, PM₁₀: 63.19% after 5 min and PM_{2.5}: 88.26%, PM₁₀: 85.22% after 10 min, respectively).

Keywords: Electrospinning, Filtration, Nanoparticles, Metal-Organic Frameworks (MOFs), Nanofiber, Nanocomposites



Plasmonic tripod nanoframes with three embedded spheres

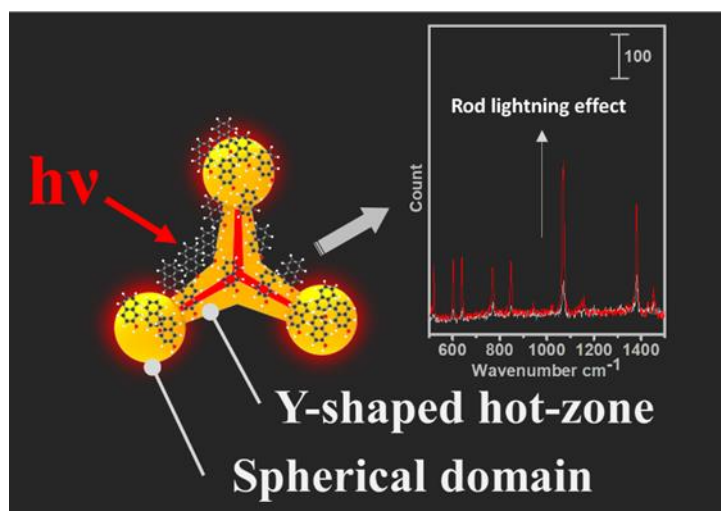
Jeongwon Kim and Sungho Park*

Department of Chemistry, Sungkyunkwan University, Suwon 16419, Republic of Korea

*Corresponding Authors. E-mail address: spark72@skku.edu.

Designing complex plasmonic nanoparticles has attracted interest in developing hot-spot to detect vibrational modes of the analyte. Nanoparticles with intrinsic narrow nanogaps can induce highly sensitive, reproducible Raman signal. In this work, we applied ‘protection-deprotection concept’ to the nanoparticle synthesis to realize light focusing on the single nanoparticle. Starting from Au triangular nanoplate, multi-step reaction was delicately controlled by surfactant concentration, temperature, and Au precursor. In our synthetic model system, Pt atoms were preferentially deposited on the spherical domains and successfully protected the three spheres in the mild Au etching reaction. Plasmonic tripod nanoframes with three embedded spheres were prepared after Au regrowth, which possess hybrid plasmonic properties of nanospheres and nanoframes. Notably, SERS intensity was highly increased by spherical domain and intraframe in the single particle level. This study will provide understanding of engineering nanostructure to increase near-field focusing.

Keywords: Nanoframe, Surface-enhanced Raman Scattering (SERS), Hot-spot, Nanogap, Localized Surface Plasmon Resonance (LSPR)



Formation of anionic acetonate as synthons: self-assembly of mercury(II) with pyridyl donor ligands in Acetone

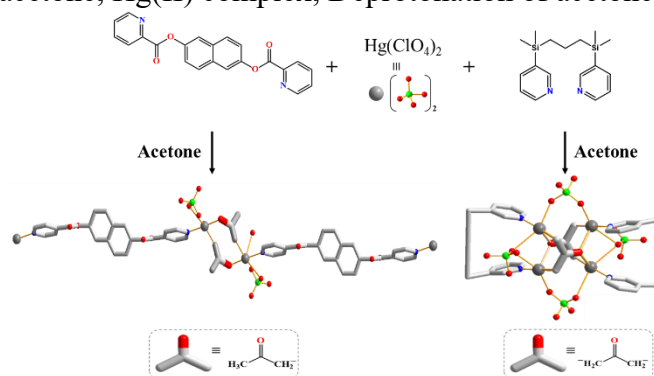
Jihun Han¹ and Ok-Sang Jung^{1,*}

¹ Department of chemistry, Pusan National University, Busan 46241, Republic of Korea

*Corresponding Authors. E-mail address: oksjung@pusan.ac.kr.

Acetone has known to exhibit the keto–enol tautomerism in which the nominal keto form $(\text{CH}_3)_2\text{C}=\text{O}$ of acetone itself is in equilibrium with its enol isomer $(\text{CH}_3)\text{C}(\text{OH})=\text{CH}_2$. Thus, enolates derived from the deprotonation of carbonyl compounds are widely used as reagents in the synthesis of organic compounds. Enolate anions has known to be delocalized over the oxygen and the two carbon sites, and have the character of both an alkoxide and a carbanion. Deprotonation of such enolizable ketones, aldehydes, and esters gives enolates under vigorous condition such as strong bases, lithium diisopropylamide (LDA). Some organic reactions of platinum metal complexes in acetone are accompanied by proton elimination and rearrangement of acetone molecule, which leads to the formation of various acetonyl complexes. Various M–ketonyl species have been isolated by using late-transition metals, such as Rh, Ni, Pt, Pd, and Au. According to Johnson’s group, mercuration occurs spontaneously, if slowly, in acidic aqueous solutions of acetone and free mercuric ion to produce at least nine organomercury species including acetonyl dianion, all of which can exist in equilibrium simultaneously. To the best of our knowledge, no examples of the X-ray structure on acetonyl coordination for mercury(II) complexes has been described at all.

Keywords: Anionic acetone, Hg(II) complex, Deprotonation of acetone



Highly Sensitive Detection of BKV DNA Based on Sandwich Assay Using Integrated Nanogap Sensor

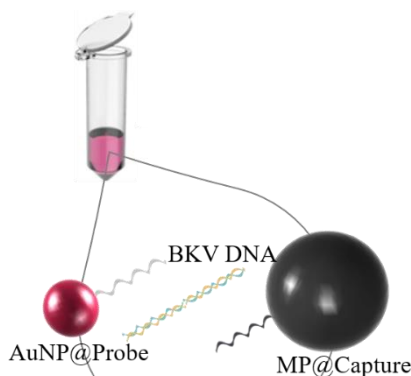
So-yeon Park¹, Seok Cheol Kim¹, SeHui Oh¹, Cho Yeon Lee¹, Gyeong Yeon Byeon¹ and Wan Soo Yun^{1*}

¹ Department of chemistry, Sungkyunkwan University, Suwon 16419, Republic of Korea

*Corresponding Authors. E-mail address: wsyun97@skku.edu.

Recently, the importance of virus detection in hospital settings has been emphasized. Since BK virus causes a serious problem upon kidney transplant, devising a simple detection method of its gene is one of the important diagnostic issues. In this work, detection of extremely low concentration of BK virus DNA was demonstrated using an integrated nanogap sensor without relying on DNA amplifying techniques such as PCR. As a result, it could be a limit of detection of about 100 aM that was readily attainable, which is well below the cut-off value of BK virus diagnosis (~16 fM). In addition, 100% specificity and 92% sensitivity achieve by performing a blind test to detect real patient samples.

Keywords: BK virus, PCR-Free, Integrated Nanogap Sensor, Sandwich Assay, On-Device Percentage



Nanoparticulate Lewis acidic microporous catalysts for the synthesis of biodegradable polymers

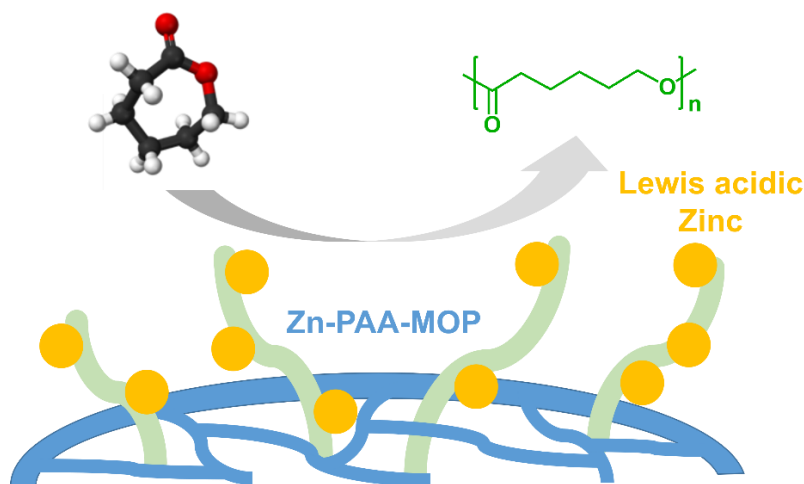
Jong Doo Lee and Seung Uk Son*

Department of Chemistry, Sungkyunkwan University, Suwon 16419, Republic of Korea

*Corresponding Authors. E-mail address: sson@skku.edu.

This work shows the synthesis of size-controlled microporous organic polymers (MOPs) using poly(acrylic acid) (PAA) as a surfactant. The nanoparticulate MOPs were prepared by the Sonogashira coupling of tetra(4-ethynylphenyl)methane with 1,4-diiodobenzene in the presence of PAA, denoted as PAA-MOPs. Zn-ions were introduced into carboxylate moieties in PAA-MOPs. The resultant Zn-PAA-MOPs showed microporosity and a high surface area of 523 m²/g. The Zn-PAA-MOPs were applied as heterogeneous Lewis acid catalysts for the synthesis of bio-degradable polycaprolactone (PCL). The Zn-PAA-MOPs showed excellent catalytic performance in the ring-opening polymerization, due to unique microporosity and a high surface area. The chain lengths of PCL were controlled in the range of 1800 to 11100 g/mol, screening the reaction conditions. The catalytic activities were maintained in the five successive recycling tests.

Keywords: a microporous organic polymer (MOP), Sonogashira coupling, a surfactant, poly(acrylic acid) (PAA), zinc, Lewis acid, biodegradable, polycaprolactone (PCL), ring opening, a heterogeneous catalyst, recycling



Chiral recognition of *l*- and *d*-histidine using chiral 2D silver(I) enantiomers

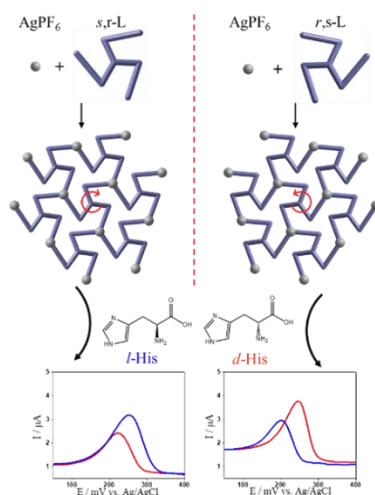
Dongwon Kim¹ and Ok-Sang Jung^{1,*}

¹ Department of chemistry, Pusan National University, Busan 46241, Republic of Korea

*Corresponding Authors. E-mail address: oksjung@pusan.ac.kr.

Self-assembly of AgPF₆ with a pair of chiral tridentate ligands (1*S*,1'*S*,1''*S*,2*R*,2'*R*,2''*R*) and (1*R*,1'*R*,1''*R*,2*S*,2'*S*,2''*S*)-(benzenetricarbonyltris(azanediyl))tris(2,3-dihydro-1*H*-indene-2,1-diy)triisonicotinate (*s,r*-L) and (*r,s*-L) in a mixture of methanol and dioxane yields 2D sheets consisting of [Ag(*s,r*-L)](PF₆)·3C₄H₈O₂ and [Ag(*r,s*-L)](PF₆)·3C₄H₈O₂, respectively. The differential pulse voltammetric (DPV) technique using the pair of chiral 2D-sheet enantiomers was employed for chiral discrimination of amino acid enantiomers, and was found to be an effective tool for enantio-recognition of *l*- and *d*-histidines. Both the size and the binding site of amino acids were strongly dependent on electrochemical enantio-recognition via the chiral 2D sheets.

Keywords: Chiral recognition, Ag(I) complexes, Differential pulse voltammetric (DPV) technique, Chiral 2D-sheet enantiomers



Uncovering the role of counter-cations in ligand exchange of WSe₂: Tuning d-band center toward improved hydrogen desorption

Meeree Kim^{1,2}, G. Hwan Park^{1,2}, Sohyeon Seo², Viet Quoc Bui^{1,2}, Yunhee Cho^{1,2}, Yeseul Hong^{1,2}, Yoshiyuki Kawazoe⁴, Hyoyoung Lee^{1,2,3*}

¹Center for Integrated Nanostructure Physics (CINAP), Institute for Basic Science (IBS), Suwon 16419, Republic of Korea

²Department of Chemistry, Sungkyunkwan University (SKKU), Suwon 16419, Republic of Korea

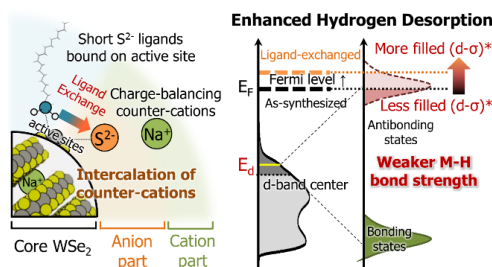
³Department of Biophysics, Sungkyunkwan University (SKKU), Suwon 16419, Republic of Korea

⁴New Industry Creation Hatchery Center, Tohoku University, Sendai, 980-8579, Japan

*Corresponding Authors. E-mail address: hyoyoung@skku.edu.

The role of counter-cations that do not bind to core nanocrystals (NCs) but rather ensure charge balance on ligand-exchanged NC surfaces has been rarely studied and even neglected. Such a scenario is unfortunate, as an understanding of surface chemistry has emerged as a key factor in overcoming colloidal NC limitations as catalysts. In this work, we report on the unprecedented role of counter-cations in ligand exchange for a colloidal transition metal dichalcogenide (TMD), WSe₂, to tune d-band center toward Fermi level for enhanced hydrogen desorption. Conventional long-chain organic ligands, oleylamine, of WSe₂ NCs are exchanged with short atomic S²⁻ ligands having counter-cations to preserve charge balance (WSe₂/S²⁻/M⁺, M = Li, Na, K). Upon exchange with S²⁻ ligands, the charge-balancing counter-cations are intercalated between WSe₂ layers, thereby serving a unique function as an electrochemical hydrogen evolution reaction (HER) catalyst. The HER activity of ligand-exchanged colloidal WSe₂ NCs shows a decrease in overpotential by down-shift of d-band center to induce more electron-filling in antibonding orbital and an increase in the electrochemical active surface area (ECSA). The obtained results suggest that both anionic ligands and counter-cationic species in ligand exchange must be considered to enhance the overall catalytic activity of colloidal TMDs.

Keywords: Colloidal synthesis, Ligand exchange, Intercalation, Catalysis, Transition metal dichalcogenides (TMDs)

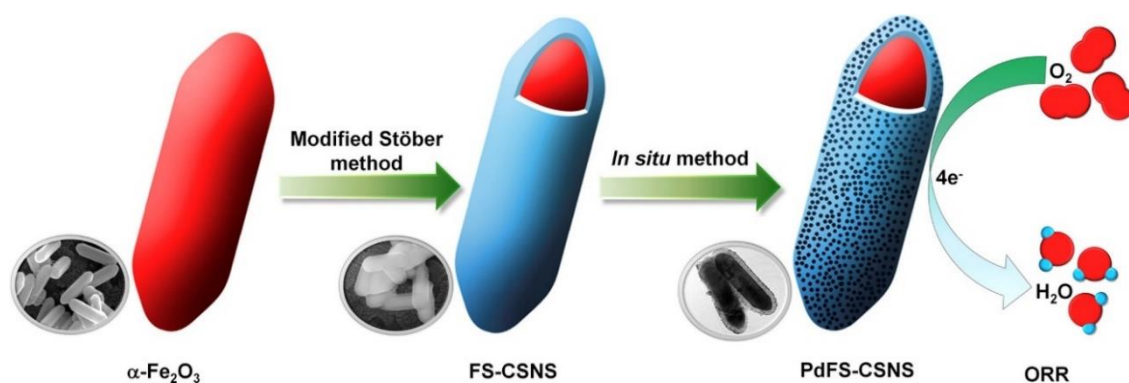


Fabrication of Pd nanoparticles on iron oxide@silica core-shell nanospindle for oxygen reduction reaction

Mohammad Yusuf¹, Muthuchamy Nallal¹, and Kang Hyun Park^{1*}

¹Department of Chemistry, Pusan National University, Busan 46241, Korea

An $\alpha\text{-Fe}_2\text{O}_3@\text{SiO}_2$ core-shell nanospindle composite with a well-dispersed palladium nanoparticle (PdFS-CSNS) is employed as a potential electrocatalyst for the oxygen reduction reaction (ORR). PdFS-CSNS comprised a uniform core-shell ($\alpha\text{-Fe}_2\text{O}_3@\text{SiO}_2$) nanospindle structure with a core diameter of 80 nm and shell thickness of 15 nm. The nano-sized Pd NPs (2 nm) were loaded by the in situ reduction method. The structural properties and elemental composition of the as-prepared PdFS-CSNS catalyst is characterized by scanning electron microscopy, transmission electron microscopy, X-ray powder diffraction, Fourier-transform infrared spectroscopy, N_2 sorption isotherms, and X-ray photoelectron spectroscopy. Compared to commercial $\text{Pt}_{20}\%@\text{C}$, the PdFS-CSNS electrocatalyst demonstrated effective ORR electrocatalytic activity via the 4-electron pathway, high stability, and durability, as well as great methanol tolerance. Such intriguing electrocatalytic performance is ascribed to the highly active Pd NP component and effective production of the silica layer in the novel PdFS-CSNS electrocatalyst. The remarkable electrocatalytic activity of PdFS-CSNS will promote further interest in the development of core-shell nanomaterials for other energy and environmental applications.



2022 SKKU-PNU BK21 Four Joint Symposium

2022 SKKU-PNU BK21 Four
Joint Symposium

Department of Physical Chemistry