The List of 2018 KIST School Partnership Project Awardee

	분야	성명	과제명	국적	소속	직위	졸업학기	지도교수
1	생체분자 과학과	Sarangerel Oidovsambuu	Anti–oxidative constituents in Mongolian medicinal plants and their protective effects against oxidative stress–induced disorders	몽골	National University of Mongolia	Lecturer	2013 전기	노주원
2	에너지환경 융합공학	Chuluun Buyan	Outdoor pilot experiment of bioremediation options for crude oil–contaminated soil	몽골	National University of Mongolia	Assistant Professor	2013 후기	이재성 (퇴직)
3	에너지 변환공학	Dashkhuu Khasbaatar	A novel composite material cryogel and layered double hydroxide	몽골	National University of Mongolia	Head of department, Associate–professor	2008 후기	최웅수
4	에너지환경 융합공학	Nguyen Duc Luong	Multi–site air quality measurement and assessment in Hanoi City	베트남	Institute of Environmental Science and Engineering	Deputy Head	2011 후기	심상규 (퇴직)
5	나노–정보 융합	HO Quoc Dai	Investigation of (photo)electrocatalytic properties of monolayer MoS2 modified by sulfur vacancy and transition metals doping	베트남	Quy Nhon University	Lecturer / Researcher	2017 후기	김승철
6	수질환경 및 복원연구 센터	Pham The Hai	Continued improvements of lithotrophic microbial fuel cells for use as on–site detectors for iron in water sources	베트남	VNU University of Science	Lecturer, Vice–Dean, Principal investigator	2003 후기	김병홍 (퇴직)
7	연료전지	Hary Devianto	Fabrication and Characterization of Intermediate Temperature Solid Oxide Fuel Cell (ITSOFC) Stack with Biogas Feed	베트남	Institut Teknologi Bandung	Assistant Professor	2005 후기	임태훈
8	나노재료공학	Pham Duc Cuong	A study on Ti–based hard coatings on PEEK for prosthetic eye application	베트남	Hanoi University of Industry	Director	2007 전기	윤의성
9	생물화학	Ahmed Mohammed ElKamhawy	Design, synthesis, molecular modelling and biological evaluation of novel heterocycles as potent, safe and selective MAO–B inhibitors for treatment of Parkinson's disease (PD)	이집트	Mansoura University	Assistant Professor (Lecturer)	2015 후기	노은주
10	생체분자 과학과	Ashraf Kareem Awad MohammedEl–Damasy	Design, synthesis, and biological evaluation of novel 2,4–disubstituted thiazoles as unique tyrosine kinase inhibitors with potent antitumor activity	이집트	University of Mansoura	Lecturer of Medicinal–Chemistry	2016 후기	금교창
11	생물화학	Mohamed Mahmoud Ibrahim–AttiaAlSanea	Novel 2–Aryl–4–piperazinylquinazolines: Design, Synthesis and Biological Evaluation as a Novel Class of Hedgehog Signaling Inhibitors for Treatment of Cancer	이집트	Aljouf University	Assistant Professor	2015 전기	이소하
12	생물화학	Ahmed Zakaria	Development of fluorescence probes, based on a curcumin–coumarin hybrid structure, for selective detection of biothiols	이집트	Beni–Suef University	Lecturer	2015 전기	이소하
13	나노–정보 융합	Faisal Shahzad	Density tunable polymer nanocomposites based on magnetic nanoparticles and MXene for electromagnetic interference shielding	파키스탄	Pakistan Institute of Engineering and Applied Sciences (PIEAS)	Assistant Professor	2017 후기	구종민
14	청정연료 화학공학	Gul Rahman	Nitrogen doped Carbon/Metal Oxides Composite as Efficient Electrocatalyst for Water Splitting	파키스탄	University of Peshawar	Assistant Professor	2013 후기	주오심
15	의공학	Muhammad Suhaeri	Application of human fibroblast–derived matrix assisted polyvinyl alcohol hydrogel for osteogenesis and bone regeneration	인도네시아	Universitas Indonesia	Head of Unit	2017 전기	박귀덕
16	에너지환경 융합공학	Chairul Hudaya	Activated Carbon Originated from Water Hyacinth for Lithium Sulfur Batteries	인도네시아	Universitas Indonesia	Assistant Professor	2016 전기	이중기
17	에너지환경 융합공학	Arenst Andreas Arie	Biomass based porous nitrogen–doped carbons as cathode and interlayer component for Lithium Sulfur (LiS) Battery	인도네시아	Parahyangan Catholic University	Head of Chemical Reaction Engineering Laboratory	2011 전기	이중기
18	청정연료 화학공학	Antonius Indarto	Sulfur and Mercaptan Impurities Removal for Indonesian Natural Gas Condensate	인도네시아	Institut Teknologi Bandung (ITB)	Assistant Professor	2012 후기	김재훈
19	청정연료 화학공학	Rika Tri Yunarti	Investigation of metal doped–TiO2 nanowires catalytic activity for 4–nitrophenol reduction	인도네시아	Universitas Indonesia	Assistant professor	2017 전기	하정명
20	에너지환경 융합공학	Muhammad Ridwan	Synthesis graphene–like carbon active from Indonesia Biomass as catalyst support towards Hydrazine Dehydrogenation Reaction	인도네시아	University of Bhayangkara Jakarta Raya	Vice Dean, Faculty of Engineering	2016 전기	남석우
21	HCI 및 로봇공학	Nova Eka Diana	CardioAR: an Augmented Reality Platform for Cardiovascular System Study	인도네시아	Universitas YARSI	Faculty Member of Informatics Department	2012 전기	이득희
22	청정공정 및 시스템	Haznan Abimanyu	Bacterial consolidated bioprocessing of lignocellulosic biomass for lactic acid production	인도네시아	Indonesian Institute of Sciences (LIPI)	Senior Researcher	2008 전기	안병성 (퇴직)
23	청정연료 화학공학	Dasari Harshini	Development of Novel Perovskite based Nano materials for Low Temperature CO Oxidation	인도	Manipal Institute of Technology	Associate Professor	2012 전기	남석우
24	나노재료 공학	Hari Prasad Dasari	Synthesis and characterisation of quaternary ceria–based catalyst for soot oxidation	인도	National Institute of Technology Karnataka	Assistant Professor	2010 후기	이종호

KIST School Partnership Technical Report

General Information Principal Investigator

Sarangerel Oidovsambuu

Affiliation (department)	Laboratory of Genetic Engineering, School of Engineering and Applied Sciences, National University of Mongolia
Position	Lecturer
Project Title	Anti-oxidative constituents in Mongolian medicinal plants and their protective effects against oxidative stress-induced disorders
Project Period	2019.01.01~2019.12.31
Budget	10,000,000 KRW

P.S. The project is still ongoing. In this project the research samples are wild plants in Mongolia,therefore, the sample was collected in August. Untill now we are working on isolation of pure compounds from plant extracts. In addition, the project includes in vivo experiments with rats, therefore the research work consumes time to repeat the animal experiment. In 2020 all the expriments will be completed to publish the data result.

Results of Research Project Summary of the Project

- **Project Title**: Anti-oxidative constituents in Mongolian medicinal plants and their protective effects against oxidative stress-induced disorders
- **Research Field**: Life Science, Biotechnology, Phytochemistry
- **Research Duration**: 2019.01.01 ~ 2019.12.31
- **Research Objectives**: Oxidation of macromolecules has been suggested to be involved in the etiology of several chronic diseases including cancer, liver inflammation and aging. A large body of research has investigated the potential role of antioxidant nutrients in the prevention of these chronic diseases. Mongolian climate is harsh and landscapes are unique. Plants in these severe and unique conditions usually contain protective substances such as anti-oxidants to survive. This project focuses on finding anti-oxidants in Mongolian medicinal plants growing in Gobi desert and studying protective effects of the compounds and extracts against oxidative stress-induced disorders including age-related macular degeneration and liver injury.
- **Research Contents**: This project consists of the following parts:
  ❶ A research team in NUM will work on sample collection of Mongolian plants, especially endemic plants growing in Gobi desert.
  ❷ Plant extracts will be screened by radical scavenging activity.
  ❸ Effective extracts will be subjected to chromatographic separation for their anti-oxidative constituents.
  ❹ Protective effects against liver disorders and age-related macular degeneration will be evaluated on HepG2 and ARPE-19 cell lines.
  ❺ Molecular structures of the isolated compounds will be elucidated by NMR and other spectroscopic methods.
- **Research Outputs**: ❶ The research team in NUM collected totally 17 wild plant samples in Mongolian remote places such as in Gobi desert and in Dornod steppe.
  ❷ All the samples were extracted and their anti-oxidative effects were examined using radical scavenging activity in HepG2 cells.
  ❸ Two extracts among the plant extracts were chosen for the further research and now the extrcats are being isolated for their phytochemical constituents.
- **Collaboration with KIST researcher**: When the isolation is completed pure compounds from the extracts will be sent to KIST Gangneung Natural Product Institute for determination of chemical structure by NMR.

KIST School Partnership Technical Report

General Information Principal Investigator

Chuluun Buyan

Affiliation (department)	Department of Chemistry, School of Arts and Sciences (SAS), National University of Mongolia (NUM)
Position	Associate professor
Project Title	Outdoor pilot experiment of bioremediation options for crude oil-contaminated soil
Project Period	2019.01.01~2019.12.31
Budget	5,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Outdoor pilot experiment of bioremediation options for crude oilcontaminated soil
- **Research Field** Environment
- **Research Duration** 2019.01.01 - 2019.12.31
- **Research Objectives**
  ❶ To carry out outdoor pilot experiment in order to reduce oil contamination of soil using the known oil-degraders
  ❷ To evaluate feasibility, time, cost, and adverse actions of pilot experiment
  ❸ To determine best bioremediation options for cold country such as Mongolia
- **Research Contents** Outdoor pilot experiment using the indigenous effective bacteria and organic amendments has been carried out in Kherlen soum, Dornod province. Soil type and weather condition of Kherlen soum is similar to Tamsagbulag oil field where oil-contaminated soil was accumulated and just buried. Eight bioreactors containing various ingredients were monitored over six months and evaluated in terms of oil reduction.
- **Research Outputs** Outdoor experiment using indigenous oil–degraders for bioremediation of oilcontaminated soil is never carried out. Therefore it is very important to develop cheaper and less destructive clean–up techniques for oil–contaminated soils in Mongolia. Research outputs of the project:
  ·Selected as oral presentations in domestic conferences as well as in international conference;
  ·Published a full paper in domestic journal of scientific society;
  ·One master student completed her thesis.
- **Collaboration with KIST researcher** Dr. Jeong Seong Pil as a partner
  Dr. Lee Seunghak as a field experiment adviser

KIST School Partnership Technical Report

General Information Principal Investigator

Dashkhuu Khasbaatar

Affiliation (department)	Department of Chemical and Biological Engineering
Position	Associate professor
Project Title	A novel composite material cryogel and layered double hydroxide
Project Period	2019.01.01~2019.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** A novel composite material cryogel and layered double hydroxide
- **Research Field** Material science
- **Research Duration** 2019.01.01 ~ 2019.12.31
- **Research Objectives** Layered double hydroxides (LDHs) nanoparticles are effective sorbents for chromium oxoanions, but must be fabricated in a suitable fashion for implementation in water treatment applications using packed columns.
  Synthesis and development of Cryogel-LDH composite material for better penetration of water through the composite than LDH itself. Physical and chemical characterization of Cryogel-LDH composite. Removal of chromium from aqueous solution using the novel Cryogel-LDH composite material
- **Research Contents**
  ❶ The layered double hydroxide was successfully synthesized by coprecipitation method. The characterization of LDH is well confirmed with SEM, XRD, and FTIR analyzes. The thickness of the LDH was around 20-30 nm.
  ❷ Synthesized cryogel as a new material, synthesized by certain catalytic catalysts, and the macrometer crystals capable of penetrating the surface with irregular, porous, and water penetration, and the FT-IR analysis showed that organic compounds formed by reaction mechanisms and the main piles were C = O 1628-1630cm-1, NH 3040- 3070cm wave region.
  ❸ In the cryogel polymerization process, LDH was added in the process. After the polymerization process, LDH was attached on the wall of cryogel. The SEM-EDX analysis was checked the elemental plates on the textured surfaces of Al and Mg, which included a crystalline. the FT-IR the peaks of C = O 1660- 1665cm-1, NH 3150-3160cm-1 were detected to be shifted to another wavenumbers and these are corresponded with LDH that chemically bonded with cryogel.
  ❹ Removal of chromium from aqueous solution was studied at pH 7 and kinetic study, adsorption capacity of the cryogel LDH composite. The capacity of the composite material was 43.44 mg/g.
- **Research Outputs** Final report
  JCR journal: 1 paper.
- **Collaboration with KIST researcher** Principle Researcher, Dr. Ung Su Choi
  Center for Urban Energy research, Green City Technology Institute, KIST

KIST School Partnership Technical Report

General Information Principal Investigator

Nguyen Duc Luong, Ph.D

Affiliation (department)	Department of R&D, Institute of Environmental Science and Engineering (IESE)
Position	Vice Dean
Project Title	Multi-site air quality measurement and assessment in Hanoi City
Project Period	2019.01.01~2019.12.31
Budget	5,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Multi-site air quality measurement and assessment in Hanoi City
- **Research Field** Atmospheric Science
- **Research Duration** 2019.1.01 ~ 2019.12.31
- **Research Objectives** This project aims to perform the multi–site (roadside and residential sites) measurement and assessment of status of air quality (PM10, PM2.5, PM1, NO2, SO2, O3 and CO) in Hanoi City.
- **Research Contents**
  ·Carry out simultaneously field measurements of particulate matter (PM10, PM2.5, PM1) and gaseous pollutants (NO2, SO2, O3 and CO) at both roadside and residential sites in Hanoi City
  ·Evaluate the concentration levels of air pollutants at both roadside and residential sites
  ·Identify and evaluate the potential sources of air pollutants
- **Research Outputs** One manuscript being prepared for submitting to peer-reviewed journal
- **Collaboration with KIST researcher** Collaboration with KIST research groups in preparing the joint manuscript for submitting to peer-reviewed journal

KIST School Partnership Technical Report

General Information Principal Investigator

Ho Quoc Dai

Affiliation (department)	Laboratory of Computational Chemistry and Modeling (LCCM), Department of Chemistry, Quy Nhon University
Position	Lecturer, Researcher
Project Title	Investigation of (photo)electrocatalytic properties of monolayer MoS2 modified by sulfur vacancy and transition metals doping
Project Period	2019.01.01~2019.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Investigation of (photo)electrocatalytic properties of monolayer M0S2 modified by sulfur vacancy and transition metals doping
- **Research Field** Computational Materials Science
- **Research Duration** 01 year (2019.01.01 ~ 2019.12.31)
- **Research Objectives**
  ❶ Structural, electronic, and energetic properties of M0S2 modified by S vacancy and TM (Fc, Co, Ni) doping in comparison with pristine M0S2 and M0S2 with only S vacancy or only TM doping.
  ❷ Photocatalytic performance of modified M0S2 via detailed mechanism of hydrogen evolution reaction (HER) involving on surfaces of modified M0S2 LiS batteries.
- **Research Contents** Hydrogen is an abundant, clean, and renewable source of energy for our future. Environmentally benign hydrogen production via (photo)electrochemical catalysts is usually inefficient due to two limitations: the well-known high overpotential associated with employing electrodes, and the high cost of precious noble metals used. Therefore, to have a more affordable and scalable H2 production, we need to develop an alternative earth-abundant class of electrocatalyst. Recently, transition metal dichalcogenides (TMD) has emerged to be aplausible solution as bifunctional or co-catalytic electrocatalysts. Among them, ultrathin 2D materials, specifically monolayer M0S2 has been regarded as one of the most promising candidates. This material, however, suffering from several intrinsic drawbacks that limits itscatalytic performance. There are some ways to improve catalytic effectof M0S2 such as introducing dopant or making defect. The presence of Svacancy in combination with dopant exotic element, however, has notbeen yet investigated. In this proposal we will use theoretical method to examine the situation which we suspect that would result in an enhancement in performance of the M0S2 materials. Hence, we will also investigate chemical reactions involving reactive species on thematerials' surface. In short, the research content can be summarized as following:
  ·Investigating structural, electronic, and thermodynamic properties of M0S2 modified by S vacancy and TM dopant to evaluate suitability of the materials for HER catalytic reaction.
  ·Investigating the detailed kinetics of chemical reactions involving in surface of modified M0S2 for HER reaction.
- **Research Outputs**
  ·Scientific output: 01 paper published in an international peerreviewed journal (SCI/SCIE)
  ·Educational output: 01 BSc. student graduated with thesis topic falling within the scope ofthe project

KIST School Partnership Technical Report

General Information Principal Investigator

Pham, The Hai

- **Affiliation (department)**: 1. GREENLAB, Center for Life Science Research, Faculty of Biology, VNU University of Science
  2. Department of Microbiology, Faculty of Biology, VNU University of Science
- **Position**: Lecturer, Vice-Dean, Principal investigator

- **Project Title**: Continued improvements of lithotrophic microbial fuel cells for use as on-site detectors for iron in water sources (in Vietnam).
- **Project Period**: 2019.01.01~2019.12.31
- **Budget**: 15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title**: Continued improvements of lithotrophic microbial fuel cells for use as on-site detectors for iron in water sources (in Vietnam).
- **Research Field**: Microbial Biotechnology; Environmental Technology; Bioenergy
- **Research Duration**: Jan 2019 – Dec 2019
- **Research Objectives**:
  ·To improve the lithotrophic MFC (developed in a previous KIST IRDA Alumni project) for practical use in detecting iron in water sources.
  ·To further study the physiology and diversity of iron bacteria enriched in a lithotrophic microbial fuel cell (MFC).
  ·To establish a strategic collaboration with Korean experts on microbial fuel cell technology.
  ·To contribute to improve the sustainability of the life of the rural people.
- **Research Contents**:
  In many villages in Vietnam, not having access to clean water, people have to use water from underground sources, many of which are contaminated with metals such as iron and manganese. Detection of these metals is currently timeconsuming and/or costly. Therefore, in 2012 we proposed a research project aiming at developing an on-site detector for iron and manganese by enriching iron bacteria in a microbial fuel cell (MFC). For a more efficient and accurate performance of the MFC as an on-site detector for iron, further optimizations addressing the MFC configuration and operation are required. Thus this follow-up project was carried out to continue the development of such MFC-based iron sensor.
  In short, the study comprises the following works:
  ·Optimization of the configuration of the lithotrophic MFC for a more efficient detection of iron in terms of (i) the design of the anode chamber, (ii) the volume of the anode chamber, and (iii) the electrode material
  ·Optimization of the operational conditions of the lithotrophic MFC for a more efficient detection of iron in terms of: (i) the feeding scheme, and (ii) the operational mode
  ·Continued research to understand the microbiology of the bacteria enriched in the MFC: In this study, as we faced more difficulties in improving the device for practical application, we adjusted our acivities to put more effort on this objective. Therefore, for microbiological study, we only focused on: (i) isolation of bacteria from well-performing MFC and testing the artificial addition of those isolates into the anodic communities of running MFCs; (ii) analyzing the communities of well-performing MFCs and comparing them with the others (byPCR-DGGE).
  ·Field tests and improvements: Field tests were done in various areas with various ground water conditions. The field tests were to validate the results obtained in the laboratory and foresee possible adjustments
- **Research Outputs**:
  ·We figured out sevetal measures to improve our lithotrophic MFC to become a more practically applicable detector for iron and manganese present in water
  ·We gained some more insights on the iron bacteria in the MFC and their electrochemical activity.
  ·01 research article to be pulised
- **Collaboration with KIST researcher**: Dr. Kim Byung Hong and Dr. Hong Seok Kim from KIST have helped us as scientific consultants.

KIST School Partnership Technical Report

General Information Principal Investigator

Hary Devianto, Ph.D

Affiliation (department)	Lembaga Afiliasi Penelitian dan Industri Institut Teknologi Bandung (LAPIITB)
Position	Project Leader
Project Title	Fabrication and Characterization of Intermediate Temperature Solid Oxide Fuel Cell (IT-SOFC) Stack with Biogas Feed
Project Period	2019.01.01~2019.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title**: Fabrication and Characterization of Intermediate Temperature Solid Oxide Fuel Cell (IT-SOFC) Stack with Biogas Feed
- **Research Duration**: 12 (twelve) months
- **Research Objectives**:
  ❶ To fabricate the anode- and electrolyte-supported IT-SOFC cell using low cost materials.
  ❷ To identify the effect of operating temperature to anode- and electrolytesupported IT-SOFC cell using low cost materials with hydrogen fuel.
- **Research Contents**: Solid Oxide Fuel Cell (SOFC), a fuel cell used solid oxide electrolyte, is one of the promising developments in the fuel cell system. The intermediatetemperature SOFC (IT-SOFC), operated at 500 – 800oC, gives a wide range of material, rapid start-up and shut down, low corrosion rate of metallic component, improved durability and more robust construction. The anode, electrolyte and cathode material of IT-SOFC commonly used is NiO-YSZ, yttria-stabilized zirconia (YSZ) and lanthanum strontium manganite (LSM), respectively. However, these materials such as ytrria, strontium and lanthanum are very expensive due to relatively rare in Indonesia. To replace those rare materials, cheaper and available material in Indonesia such as calcia-stabilized zirconia (CSZ), NiO-CSZ and calcium cobalt zinc oxide (CCZO) can be used as an anode, electrolyte and cathode, respectively.

  Experiments:
  ❶ Various on cell designs (anode- and electrolyte-supported) using low cost materials
  ❷ Variation on operating temperature to observe IT-SOFC cell performance using low cost materials with hydrogen fuel.

  Characterization methods:
  Electrochemical Characterization: Potentiodynamic and Electrochemical Impedance Spectroscopy (EIS). Physical and Chemical Characterization: Scanning Electron Microscope (SEM), X-Ray Diffraction (XRD) and ASTM C373-88, Archimedes Method and Mohs hardness test.
- **Research Outputs**:
  ❶ Electrochemical performance of anode- and electrolyte-supported using low-cost materials
  ❷ The optimum conditions to operate both anode- and electrolyte-supported IT-SOFC single cell using low cost materials with hydrogen fuel
  ❸ Presented in international conference and submitted in international journal
- **Collaboration with KIST researcher**:
  ·Fabrication of anode- and electrolyte-supported IT-SOFC single cells with low-cost materials
  ·Training about how to how to fabricate a good SOFC cell and electrochemical characterization of single cells

KIST School Partnership Technical Report

General Information Principal Investigator

Pham Duc Cuong

Affiliation (department)	HaUI Institute of Technology, Hanoi University of Industry
Position	Director
Project Title	A study on Ti-based hard coatings on PEEK for prosthetic eye application
Project Period	2019.01.01~2019.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** A study on Ti-based hard coatings on PEEK for prosthetic eye application
- **Research Field** Material science; biomedical
- **Research Duration** 1/2019 – 12/2019
- **Research Objectives** PEEK (Poly-ether-ether-ketone) is a semicrystalline organic polymerthermoplastic exhibiting a highly stable chemical structure. PEEK possess excellent mechanical and chemical resistance properties that are retained to high temperatures (up to 260 oC). PEEK is considered an advanced biomaterial used in biomedical due to the fact that it has the same properties as bone tisue, good biocompability as well as easy to shape.
In Vietnam, PEEK have been used to create and replace some parts of the body such as skull patches, spinal disc, and lower jaw, etc. However, there is no any research on application of PEEK in the field of prosthetic eye for implant.

In this work, we fabricated balls (i.e. prosthetic eye) made of polyether- ether-ketone (PEEK); the balls are then coated by TiAgN using sputtering technique and tested for their stable and biocompatible properties.

- **Research Contents**
·Deposition of TiAgN coatings onto the flat samples;
·Investigation into coating's properties: chemical composition, microstructure, etc;
·Determination of coating parameters;
·Fabrication of PEEK balls (i.e. prosthetic eyes);
·Applying TiAgN coatings onto the PEEK balls;
·Implant the TiAgN coated balls into eye socket of animals and evaluate for their stability and biocompatible property;

- **Research Outputs**
·20 balls (prosthetic eyes) of 3 sizes made of PEEK qualfied enough for coating TiAgN;
·TiAgN coatings on flat specimens;
·Analysis results of the TiAgN coatings on flat samples including: chemical composition, microstructures, morphology of the coated samples, SEM images, etc.
·15 TiAgN coated PEEK balls
·Results of testing the balls on animal which exhibit biocompatible property;
·1 abstract of research paper submited to renown domestic conference;
·Data is used for a Master Thesis in material science and engineering;

- **Collaboration with KIST researcher** Discussion with Dr. Yoon Eui Sung (KIST) about project and getting advices in fabrication of thin hard coating, Bio-materials and methodologies

KIST School Partnership Technical Report

General Information Principal Investigator

Ahmed Mohammed ElKamhawy

- **Affiliation (department)** Mansoura University (Pharmaceutical Organic Chemistry)
- **Position** Assistant professor (Lecturer)

- **Project Title** Design, synthesis, molecular modelling and biological evaluation of novel heterocycles as potent, safe and selective MAO-B inhibitors for treatment of Parkinson's disease (PD)
- **Project Period** 2019.01.01~2019.12.31
- **Budget** 15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Design, synthesis, molecular modelling and biological evaluation of novel heterocycles as potent, safe and selective MAO-B inhibitors for treatment of Parkinson's disease (PD)
- **Research Field** Pharmaceutical Organic Chemistry / Medicinal Chemistry
- **Research Duration** January 1st 2019 - December 31st 2019
- **Research Objectives** The increase in average life expectancy has brought about the dramatic increase in prevalence of age-related neurodegenerative diseases such as Alzheimer's, Parkinson's, and Huntington's diseases, which has come to the fore as a social issue. Although no effective disease-modifying treatment has been discovered yet, various drugs for alleviating the symptoms of Parkinson's disease have been developed and prescribed in clinics. Selegiline and rasagiline, selective and irreversible MAO-B inhibitors, have been prescribed to patients with Parkinson's disease. Despite their broad applications, these inhibitors are known to cause undesirable adverse effects such as hallucination and headache. Moreover, neurotoxic or ineffective metabolites are produced through biological actions of these inhibitors, which limit the long-term use of those inhibitors. Motivated by the vigorous need to develop potent, safe and selective potential candidates for treatment of such disease, our objectives are as follow:
  ❶ Development of safe MAO-B inhibitors as promising therapeutic agents.
  ❷ Through this research, we will acquire a unique methodology for development of treatments.
  ❸ Enhancement of the ability of the working team and the collaborative Korean and foreign researchers.
  ❹ Successfully developed molecules would be transferred to pharmaceutical industry for local and international commercialization. At least two high impact international SCI papers will be published.
- **Research Contents** The proposed research plan pursues the design and development of innovative MAO-B selective inhibitors. The chemical structure of the potent compounds will be submitted to extensive structure activity relationship study and optimization through synthesis and evaluation of various libraries of compounds. Comprehensive biological and computational studies will be performed to obtain highly selective and potent compounds which will be subjected to in vitro and in vivo studies.
- **Research Outputs**

  Technological goals:
  Through this research, we will acquire a unique methodology for development of PD treatments via modulation of MAO-B.

  Educational goals:
  Enhancement of the research ability of the working team and the collaborative Korean and foreign researchers involved in this project.

  Economic and industrial goals:
  Successfully developed organic molecules would be transferred to pharmaceutical industry for further development and later domestic and international commercialization.

  Scientific publications and patent application:
  One patent in addition to at least two high impact SCI papers to be published in the top of 10% JCR rank.
- **Collaboration with KIST researcher** I have collaborated with Prof. Eun Joo Roh and Prof. Park Ki Duk to synthesis and evaluate novel agents as MAO-B inhibitors. The results are very promising and we are in progress to get more potent small molecule and publish a high quality article in the field.

KIST School Partnership Technical Report

General Information Principal Investigator

Ashraf Kareem Awad Mohammed El-Damasy

Affiliation (department)	Department of Medicinal Chemistry, Faculty of Pharmacy, University of Mansoura
Position	Assistant Professor of Medicinal Chemistry

Project Title	Design, synthesis, and biological evaluation of novel 2,4-disubstituted thiazoles as potential tyrosine kinase inhibitors with potent antitumor activity
Project Period	2019.01.01~2019.12.31
Budget	15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title**: Design, synthesis, and biological evaluation of novel 2,4-disubstituted thiazoles as potential tyrosine kinase inhibitors with potent antitumor activity
- **Research Field**: Medicinal Chemistry
- **Research Duration**: 2019.01.01 ~ 2019.12.31
- **Research Objectives**: Our main research objectives are the application of ligand based design approach for tailoring of new thiazole derivatives, their synthesis and biological evaluation for identification of novel tyrosine Kinase inhibitors, which can suppress the kinase mediated cellular differentiation and proliferation and hence can be utilized for treatment of clinically important hematological and solid tumors.

- **Research Contents**
  ❶ Literature survey for the relevant chemical scaffolds.
  ❷ Molecular docking study of the proposed compounds.
  ❸ Development of the appropriate synthetic routes of target compounds and synthesis of target compounds.
  ❹ Carrying out the in vitro biochemical assays at reaction biology corporation (RBC, USA).
  ❺ Conducting the in vitro anti-proliferative activity assay against a panel of 4 human cancer cell lines (in house screening).
  ❻ Broad screening of the promising compounds over multiple human cancer cell lines (DTP, USA).
  ❼ Carrying out the in vitro cytotoxic activity assay against L132 normal cell line (in house screening).
  ❽ In vivo determination of pharmacokinetic properties for the most active member(s). Interpretation of results and preparation of patent and/or manuscript for publication.

- **Research Outputs**
  ❶ Identification of new thiazole lead compounds as potent kinase Inhibitors for treatment of hematological and/or solid tumors.
  ❷ Advancing the most active compounds to the toxicity studies and preclinical investigation as potential drug candidates.
  ❸ Patent profile for the examined series of compounds.
  ❹ Potential application of the best compound(s), after being licensed out, in drug industry.
  ❺ Publication of the proposed work and its findings in highly prestigious journals in the field of medicinal chemistry.
  ❻ Establishment of strong collaborative research bond between KIST and Mansoura University.

- **Collaboration with KIST researcher**: KIST School Partnership Project (2019) offered a good opportunity for establishment of strong collaborative research bond between KIST and Mansoura University. The planned work has been performed in both Mansoura University and KIST (in Prof. Gyochang Keum's laboratory).

KIST School Partnership Technical Report

General Information Principal Investigator

Mohammad M. Al-Sanea

Affiliation (department) Pharmaceutical Chemistry Department, College of Pharmacy, Jouf University, Sakaka, Al-Jouf Province, Jouf, Saudi Arabia

Position Assistant Professor

Project Title Novel Ligustrazine-based SLC-0111 Analogues as Selective Carbonic Anhydrase IX Inhibitors Endowed with Antitumor Activity: Design, Synthesis, Biological Evaluation and In Silico Insights

Project Period 2019.01.01~2019.12.31

Budget 15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Novel 2-Aryl- 4-piperazinylquinazolines: Design, Synthesis and Biological Evaluation as a Novel Class of Hedgehog Signaling Inhibitors
- **Research Field** Drug Design and Medicinal Chemistry
- **Research Duration** 21 Months
- **Research Objectives** We propose a project for KIST Institutional Program that uses a multidisciplinary team of scientists from various specialties; Medicinal Chemistry, Organic Chemistry, Pharmacology and Molecular biology, to develop a novel small molecule based on the the 2-aryl- 4-piperazinylquinazoline scaffold with good pharmacokinetics profile, that could fight the solid tumors via targeting the hedgehog signaling pathway.
- **Research Contents** Design, synthesis and purification of the target 2-aryl-4- piperazinylquinazoline derivatives (about 50 novel compounds) using convenient chemical reactions, in addition to, verification of the structure of the synthesized derivatives via spectral and elemental methods of analysis. This will be accompanied by biological evaluations of the target quinazolines as SMO antagonist.
  Furthermore, a molecular docking of the examined quinazolines will be carried out in order to investigate their binding pattern within SMO active site. Moreover, drug metabolism and pharmacokinetics (DMPK) study for the hit will be carried out to assess the druggability of the target compounds.
- **Research Outputs** 20 new compounds were successfully synthesized and their chemical structures were verified using 1HNMR, 13CNMR and HRMS.
  20 compounds were screened for their safety profile and according to the preliminary data, they are safe compounds toward the normal cells.
  20 compounds were subjected for biological evaluation as potential Gli protein inhibitors, and according to the news came from the Biological evaluation team " the results are promising"
  Some compounds were submitted for biological evaluation to NCI for screening over 60 cell lines.
- **Collaboration with KIST researcher** Dr. So Ha Lee supported this project in many different ways.
  Dr. So Ha Lee offered facilitating structural elucidation for all the 20 compounds.
  Dr. So Ha Lee gave complete hospitality of the project PI (Mohammed Mahmoud Alsanea) for 15 days.
  Dr. So Ha Lee gave us the opportunity to perform all structural elucidation using his lab facilities.

KIST School Partnership Technical Report

General Information Principal Investigator

Ahmed Zakaria Abdelazem Selim

Affiliation (department) Biotechnology and Life Sciences Department, Faculty of Postgraduate Studies for Advanced Sciences, Beni-Suef University, Egypt

Position Lecturer

Project Title Development of fluorescence probes, based on a curcumin-coumarin hybrid structure, for selective detection of biothiols

Project Period 2019.01.01~2019.12.31

Budget 10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Development of fluorescence probes, based on a curcumin-coumarin hybrid structure, for selective detection of biothiols
- **Research Field** Biological and Bioorganic chemistry
- **Research Duration** 12 months
- **Research Objectives**
  ❶ Design and synthesis of novel probes of potential activity for selective detection of biothiols.
  ❷ Study the fluorimetric/colorimetric properties of the synthesized probes.
  ❸ Testing the efficiency of the synthesized probes for selective detection of biothiols in vitro.
  ❹ Testing the efficiency of the synthesized probes for imaging biothiols in living cells.
  ❺ Interpretation/understanding the sensing mechanism of the probe with thiols.
- **Research Contents**
  ❶ Synthesis, purification and structure confirmation of the target probes.
  ❷ Using fluorimetric/colorimetric techniques to study the optical properties of the synthesized probes.
  ❸ Using fluorimetric/colorimetric techniques to test the efficiency of the synthesized probes for selective detection of biothiols in vitro.
  ❹ Using fluorescence microscopy to test the efficiency of the synthesized probes for imaging biothiols in living cells.
  ❺ Using 1H-NMR experiment as well as computational methods to understand the sensing mechanism of the probe with thiols.
- **Research Outputs**
  ·So far, there are trials to synthesize the target probes, and there is a modification in the synthetic procedures.
  ·There is so much delay in receiving the chemicals from overseas suppliers due to COVID-19 global conditions.
  ·The chemical that have been ordered in December 2019, just arrived in 13 May 2020.
  ·I would like also to mention that I received the project budget at the end of July 2019, and it took some time until I could use the money (due to some administrative issues).
  ·Therefore, I would like to ask for extension of project time until end of 2020.

KIST School Partnership Technical Report

General Information Principal Investigator

Dr. Faisal Shahzad

Affiliation (department)	Department of Metallurgy and Materials Engineering (DMME), Pakistan Institute of Engineering and Applied Sciences (PIEAS)
Position	Associate Professor
Project Title	Density tunable polymer nanocomposites based on magnetic nanoparticles and MXene for electromagnetic interference shielding
Project Period	2019.01.01~2019.12.31
Budget	15,000,000 KRW

Results of Research Project Summary of the Project

• Project Title

Density tunable polymer nanocomposites based on magnetic nanoparticles and MXene for electromagnetic interference shielding

• Research Field

Electrically conductive and magnetic Nanomaterials for EMI shielding

• Research Duration

2018.12.01 ~ 2019.11.30 (12 months)

• Research Objectives

The major objectives of the proposed research were:

❶ Synthesis and characterization of 2D nanomaterials (transition metal carbides, transition metal nitrides, transition metal carbonitrides) and magnetic nanomaterials (Fe_2O_3, $NiFe_2O_4$, $ZnFe_2O_4$)

❷ Synthesis of polymer composites by using the as-synthesized 2D nanomaterials and magnetic nanoparticles.

❸ Optimizing the synthesis parameters of nanomaterials and their polymer composites for making thin films via solution casting/die pressing.

❹ Synthesis of density-tunable MXene-polymer composites by employing light weight polymeric beads and foam structures.

❺ To enhance the EMI shielding effectiveness of MXene-polymer composites by developing highly electrically conducting nanofillers.

❻ To investigate the morphology, electrical, mechanical, thermal and EMI shielding properties of as-prepared polymeric composites.

• Research Contents

The aim of this project was to develop light weight, highly conducting, flexible EMI shielding materials based on 2D MXenes and magnetic nanoparticles. Following is the brief outline of research contents;

❶ A comprehensive literature survey was conducted and experimental conditions for different types of MXenes/magnetic nanoparticles were optimized.

❷ Synthesis of polymer composites

❸ Density control via use of thermal heat treatment and filler content.

❹ Characterization of nanomaterials by XPS, XRD, SEM, FT-IR, Raman andTEM.

❺ Development of films for EMI shielding measurement on network analyzer, electrical conductivity and mechanical property measurement.

❻ Other high performance EMI shielding materials development using electroless plating of metal shells over polymer beads such as polystyrene and their subsequent characterization and measurements.

❼ Results & Discussion

• Research Outputs

During the on-going research, we developed MXene powder at PIEAS university, which is the first laboratory to do that in Pakistan. The MXene powders were synthesized via selective etching of “A” or “Al” layer from parent MAX phase (Ti3AlC2). The powder was subsequently used for making polymer films with polyvinyl alcohol (PVA) and films of thickness 40-60 µm were made. The films were characterized with SRD, SEM and FT-IR before testing for EMI shielding through in-house build terahertz shielding apparatus. EMI shielding of ~ 30 dB were achieved in the resultant films. Moreover, as a collaborative research with KIST researchers, MXene synthesized in this project were also explore for biosensig applications. High performance EMI shielding materials were also made through coating polymer beads with metallic shells such as Copper and Silver, which exhibited an astonishingly high EMI shielding of ~ 100 dB at low filler contents. These results were published in reputed international journals.

• Collaboration with KIST researcher

Through the KIST School Partnership Project, I developed a strong research collaboration with KIST researchers, in particular with Prof. Chong Min Koo. On an average, we held a meeting once in a month either by skype or via email conversation. I have been involved in discussion with several KIST students in their MS and PhD works and helping them with useful technical discussions. As a result of collaboration, we together published 02 research papers and 02 book chapters whereas several research papers are under review and writing stages.

KIST School Partnership Technical Report

General Information Principal Investigator

Gul Rahman

Affiliation (department) Institute of Chemical Sciences, University of Peshawar, Pakistan

Position Assistant Professor

Project Title Nitrogen doped Carbon/Metal Oxides Composite as Efficient Electrocatalyst for Water Splitting

Project Period 2019.01.01~2019.12.31

Budget 15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Nitrogen doped Carbon/Metal Oxides Composite as Efficient Electrocatalyst for Water Splitting
- **Research Field** Clean Energy
- **Research Duration** Jan. 1 to Dec. 31st 2019
- **Research Objectives**
  ❶ To develop novel electrocatalyts based on N-doped carbon/metal oxide composite for water splitting
  ❷ To use simple and cost-effective solution based methods for the fabrication of the composite material.
  ❸ To optimize the composition of the relative materials to obtain high performance catalyst.
  ❹ To study the effect of various experimental conditions on the structure, morphology and efficiency of the composite material as electrocatalyst.
- **Research Contents** This project aims to develop efficient electrocatalyst based on Nitrogen-doped carbon and transition metal oxide for water splitting activity. N-doped carbon materials have recently got tremendous attention as ORR and OER electrocatalyts due to its intriguing properties and rich electrochemistry. Transition metal oxides, on the other hand, have been found as efficient and low-cost materials with attractive electrocatalytic characteristics. In this project, efforts will be made to develop composites based on N-doped carbon and transition metal oxides for water splitting reaction. The electrocatalyst will be synthesized using low cost solution based routes. The structural and morphological properties as well as water splitting efficiency of the catalyst will be investigated. Various experimental parameters including doping concentration, synthesis and annealing temperature will be optimized. The electrocatalyst synthesized will be tested for electrochemical water splitting activity. It is expected that the electrocatalyst will show high efficiency for the generation of hydrogen fuel.
- **Research Outputs**
  ❶ Articles are published are some are under preparation
  ❷ Basic facilities installed in lab for future projects
  ❸ M.S student get involved in the project work and get some knowledge and skills regarding clean energy related projects
  ❹ Collaboration with kist strengthened by visiting KIST in July to Aug. 2019
- **Collaboration with KIST researcher**
  ❶ Visit to KIST under KIST-School project 2019 and performed collaborative research activities from July 2-Aug. 12, 2019.
  ❷ Discussions on various research related matters with Dr. Oh-Shim Joo and Dr. Sang Youn Chae
  ❸ Trained Ms. Yoo lim in Dr. Joo's lab regarding PEC instrumentations
  ❹ contributed in conducting experiments for minor revision of Dr. Joo's article which is accepted in Angewandte Chemie (I.F = 12.2)

KIST School Partnership Technical Report

General Information Principal Investigator

Muhammad Suhaeri

Affiliation (department)	Unit of Education, Research, and Training, Universitas Indonesia Hospital, Universitas Indonesia
Position	Head of Unit
Project Title	Application of human fibroblast-derived matrix assisted polyvinyl alcohol hydrogel for osteogenesis and bone regeneration
Project Period	2019.01.01~2019.12.31
Budget	15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Application of human fibroblast-derived matrix assisted polyvinyl alcohol hydrogel for osteogenesis and bone regeneration
- **Research Field** Tissue engineering
- **Research Duration** May – December, 2019
- **Research Objectives** The current research is aimed in the preparation and application of hybrid scaffold of human fibroblast–derived matrix (hFDM) and polyvinyl alcohol (PVA) hydrogel (PVA/hFDM) for bone tissue engineering.
- **Research Contents** The contents of this research plan are divided into three categories: material preparation and characterizations, in vitro investigation, and in vivo study.

  ❶ Material preparation and characterizations
  ·Production of PVA/hFDM scaffold.
  ·Scaffold characterizations (gross image, SEM, confocal microscope, and FT-IR).

  ❷ In vitro investigations
  ·Stem cell behaviors (cell viability, proliferation, and morphology).
  ·Stem cell differentiation (osteogenesis and its evaluation).

  ❷ In vivo study
  ·Fabrication of bone defect model (cranial defect model in rat).
  ·Bone regeneration and evaluations (histology and μCT).

- **Research Outputs** From this study we envision that we could have the understanding in the potential of PVA/hFDM scaffold in inducing osteogenesis of human mesenchymal stem cells. In addition, the therapeutic effect of delivering stem cells by employing PVA/hFDM could also be perceived. Once all of this information is gathered, a joint manuscript could be prepared and submitted to a scientific journal. Moreover, the products of this partnership are in conjunction with the Memorandum of Understanding (MoU) for academic cooperation signed in 2016 between Universitas Indonesia and Korea Institute of Science and Technology. Thus, any academic output will be acknowledged as the realization of this MoU. Additionally, the current partnership would initiate the mutual academic and research collaborations between Korea Institute of Science and Technology and Universitas Indonesia Hospital, specifically in tissue engineering research.

KIST School Partnership Technical Report

General Information Principal Investigator

Chairul Hudaya, Ph.D.

Affiliation (department)	Department of Electrical Engineering, Faculty of Engineering, Universitas Indonesia
Position	Assistant Professor
Project Title	Activated Carbon Originated from Water Hyacinth for Lithium Sulfur Batteries
Project Period	2019.01.01~2019.12.31
Budget	15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** — Activated Carbon Originated from Water Hyacinth for Lithium Sulfur Batteries
- **Research Field** — Electrochemical Energy
- **Research Duration** — 12 months (November 2018 – October 2019)
- **Research Objectives** — The aim of this research is to investigate the utilization of activated carbon derived from water hyacinth as the host materials for lithium ion capacitors. The effect of this material design toward the electrochemical performance of lithium ion capacitor will be comprehensively investigated. We will use water hyacinth as the biomass-based activated carbon due to its abundant resources especially in tropical countries like Indonesia.

- **Research Contents** — Research contents are focused on the synthesis materials for activated carbon derived from water hyacinth for lithium ion capacitors. Material characterization (e.g. BET, SEM, EDX, XRD, Raman, etc.) and full cell fabrication where activated carbon played as cathode materials and lithium titanate oxide as the anode materials were assembled as the full cells. Electrochemical characterization (e.g. galvanostatic charge/discharge, cyclic voltammetry, electrochemical impedance spectroscopy, etc.) were carried out to reveal the electrochemical characteristics of materials.
- **Research Outputs**
  - ·20 balls (prosthetic eyes) of 3 sizes made of PEEK qualfied enough for coating TiAgN;
  - ·TiAgN coatings on flat specimens;
  - ·Analysis results of the TiAgN coatings on flat samples including: chemical composition, microstructures, morphology of the coated samples, SEM images, etc.
  - ·15 TiAgN coated PEEK balls
  - ·Results of testing the balls on animal which exhibit biocompatible property;
  - ·1 abstract of research paper submited to renown domestic conference;
  - ·Data is used for a Master Thesis in material science and engineering;
- **Collaboration with KIST researcher** — This study overcome the notorious problems lithium ion capacitors and the use of abundant resources of biomass, originated from precursors of water hyacinth.
  - ❶ The biomass-derived water hyacinth activated carbon has been successfully synthesized and it has been applied as the main active material in the cathode of lithium ion capacitor (LIC).
  - ❷ The most optimal activation temperature is 800oC produced porosity of 3474 m^2/g.
  - ❸ The activated carbon porosity affects the performance of the battery. Meanwhile as the porosity increase not always brings good performance in the battery, it should be an optimum value of porosity.
  - ❹ From electrochemical measurement, LIC full-cell performance can reach specific capacitance 32.1 F/g, specific energy 17.8 W h/kg, and specific power 160.5 W/kg.

KIST School Partnership Technical Report

General Information Principal Investigator

Arenst Andreas Arie

- **Affiliation (department)** Chemical Engineering, Parahyangan Catholic University
- **Position** Head of Advanced Material and Product Design Research Study

- **Project Title** Biomass based porous nitrogen-doped carbons as cathode and interlayer component for Lithium Sulfur (LiS) Battery
- **Project Period** 2019.01.01~2019.12.31
- **Budget** 10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Biomass based porous nitrogen-doped carbons as cathode and interlayer component for Lithium Sulfur (LiS) Battery
- **Research Field** Advanced Energy Materials
- **Research Duration** 1 Year (01.01.2019-31.12.2019)
- **Research Objectives**
  ❶ To synthesize N doped porous carbon (NPC) derived from the solid waste of tofu industry by templating carbonization coupling with subsequent KOH/K_2CO_3 activation.
  ❷ To prepare NPC/S composites by a melt diffusion method.
  ❸ To study the structural and morphology characteristics of the NPC and NPC/S composites.
  ❹ To prepare interlayer film composed of NPC, carbon black conductor and PVDF binder.
  ❺ To evaluate the electrochemical characteristics of the NPC/S composite cathodes with and without NPC based interlayer for LiS batteries.

- **Research Contents** Initially,a series of biomass based nitrogen-doped porous carbon (NPC) will be prepared from nitrogen-rich solid tofu waste by **templating carbonization method coupling with subsequent KOH/ K_2CO_3 activation,** which may be utillized as electrode and interlayer materials for LiS Battery. After that, NPC will be used along with sulfur to form NPC/S composite by **a melt diffusion method.** NPC will be also utilized as an interlayer component. **The structural and morphology characterization** of NPC, NPC/S composite and NPC based interlayer film Si will be studied by various instruments such as XRD, XPS, BET, SEM, TEM, TGA and Raman spectroscopy. The coin cells will be used to study the electrochemical performance of NPC/S composite cathodes for LiS battery with and without the addition of NPC based interlayer. **Various electrochemical measurements** will be used to study the electrochemical characteristics of NPC/S composite such as the galvanostatic charge-discharge (GCD) tests, cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS).
- **Research Outputs** N-doped porous carbons have high conductivity to improve sulfur's insulating characteristics, while the abundant pores address the issues coming from the shuttle effect of polysulfide through sulfur entrapment in the micropores/mesopores as well as accommodating the volume expansion during cycling of LiS battery. The results of this work can be presented in the **international conferences** and **submitted to the reputated SCI/SCIE journal** in the area of electrochemistry or carbon materials related subjects. In addition, there will be probably **one of our master student/junior researcher** working on this research projects, he/she will synthesis the carbon materials at our department in Bandung, Indonesia. The fabrication of LiS battery cells will be conducted at the laboratory of advanced energy material processing under guidance of Dr. Joong Kee Lee at KIST. If possible, patents will be submitted based on our research works.
- **Collaboration with KIST researcher** The research collaboration has been conducted at the Advanced Energy Material Processing Laboratory, Center of Energy Convergence, KIST with Dr. Joong Kee Lee as the research partner at KIST.

KIST School Partnership Technical Report

General Information Principal Investigator

Dr. Antonius Indarto

Affiliation (department)	Department of Chemical Engineering, Institut Teknologi Bandung, Indonesia
Position	Assistant Professor
Project Title	Sulfur and Mercaptan Impurities Removal for Indonesia Natural Gas Condensate
Project Period	2019.01.01~2019.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Sulfur and Mercaptan Impurities Removal for Indonesia Natural Gas Condensate
- **Research Field** Toxic Separation and Purification (Chemical Process Technology)
- **Research Duration** 1 year (12 months)
- **Research Objectives** Study and recommendation of sulfur handling technology for oil condensate to reduce total sulfur content (<1000 ppmwt) and mercaptans (<100 ppmwt)

- **Research Contents**

In the oil and gas production process, in addition to hydrocarbons, a number of impurities are also produced, including CO_2 and sulfur in various concentrations, depending on the conditions and characteristics of underground rock and the location of the oil and gas.
Impurities such as H_2S, carbonyl sulfide (COS), mercaptans (RSH) and sulfur compounds in light hydrocarbons (LPG and natural gas condensates) usually can cause unpleasant odors, corrosion, and also air pollution after burning hydrocarbon fuels. Therefore, the removal of these impurities is very important. Mercaptans and organic sulfur compounds are inseparable in the acid gas removal unit (AGRU) or dehydration unit with molecular sieves. Gas treatment facilities often experience problems when processing feed gas with high concentrations of mercaptans and organic sulfur compounds which will accumulate in condensate and Natural Gas Liquid (NGL).
The removal of sulfur in Indonesian condensates has more complexity because of the variety of sulfur types contained in condensates such as H_2S, mercaptans, COS, and some organic sulfur. The variety of sulfur type variants and the high total value of existing sulfur present their own challenges to the choice of the right technology to be used in processing condensate into condensate products with low sulfur content.

- **Research Outputs**

A summary of the technology comparisons for Indonesian sulfur removal in condensate is shown in the below table

Sulphur comp.	Sulphur removal technology					
	Condensate Stabilizer	Caustic	Methanol +KOH	Peroxide	Adsorbent: Activated Carbon	Adsorbent: Metal oxide
H_2S	V	V	V	V	V	
RSH (mercaptan)		V		V	V	V
COS			V			V
CS_2			V			
RSR (organic Sulphur)				V		
Thiophene					V	

All above conclusion was obtained from lab experimental in the Laboratory of Separation in Chemical Engineering Department of ITB,ndonesia.

KIST School Partnership Technical Report

General Information Principal Investigator

Rika Tri Yunarti, Ph.D

Affiliation (department)	Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Indonesia
Position	Asistant Professor/Head of Undergraduate Program

Project Title	Investigation of metal doped-TiO2 nanowires catalytic activity for 4-nitrophenol reduction
Project Period	2019.01.01~2019.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Investigation of metal doped-TiO2 nanowires catalytic activity for 4-nitrophenol reduction
- **Research Field** Catalysis
- **Research Duration** 2019.01.02 – 2019.12.31
- **Research Objectives** The aim of this research is to investigate the properties of metal doped-TiO_2 nanowires and their catalytic activity in 4-nitrophenol reduction with different hydrogen sources.
- **Research Contents** The research contents are divided into four main activities:
  ❶ Preparation of metal doped-TiO2 nanowires catalysts
  ❷ Characterization of metal doped-TiO2 nanowires catalysts by using XRD, SEM, EDX, TEM-Mapping, UV-Vis, XPS, Raman, FTIR, TPD, TPR.
  ❸ 4-nitrophenol reduction reaction
  ❹ Product analysis
- **Research Outputs** International Conference presentation and Journal manuscript are being prepared.
- **Collaboration with KIST researcher** Collaboration with KIST researcher was perform with characterization of samples. The manuscript of the result data will be prepared as the author collaboration with KIST researcher.

KIST School Partnership Technical Report

General Information Principal Investigator

Muhammad Ridwan Ph.D

Affiliation (department)	University of Bhayangkara Jakarta Raya
Position	Vice Dean, Faculty of Engineering
Project Title	Synthesis of graphene-like Carbon active from Indonesian biomass as a catalyst support towards Hydrazine Dehydrogenation reaction
Project Period	2019.01.01~2019.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

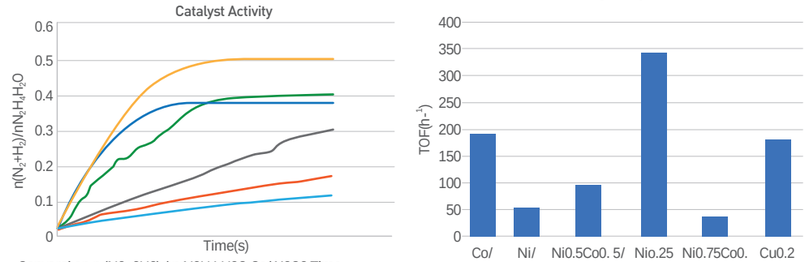
- **Project Title** "Synthesis of graphene-like Carbon active from Indonesian biomass as a catalyst support towards Hydrazine Dehydrogenation reaction"
- **Research Field** Hydrogen generation system
- **Research Duration** 2019.01.01 ~ 2019.12.31
- **Research Objectives**
  ·the topic was shifted from graphene synthesis to zeolite synthesis
  ·To synthesis a zeolite–Y from Lampung's Zeolite as a catalyst support in order to develop an effective and efficient catalyst system with a high TOF towards hydrazine dehydrogenation reaction, hence can support the PEM fuel cell system.
- **Research Contents** The use of zeolite as a catalyst support is based on its superiority, namely because of the porous structure, chemically stable and heat resistant. The porous structure results a high surface area so that it has more active sites (Rianto, et al., 2012). Zeolite as a buffer serves to spread active metals so that it can be used effectively. Zeolite used is faujasite type zeolite in the form of NaY and HY.
  In this research, zeolite was used as a catalyst support in order to evaluate the acidity of zeolite towards the dehydrogenation reaction.

Experiments:
·Optimize the reaction condition
·Screening and evaluation of active metal from the transition metal for a catalyst system
·Using different catalyst support system in order to improve the TOF of hydrazine dehydrogenation.
·Screening and evaluation of materials for catalyst support such as TiO2, Al2O3, Natural Zeolite, Zeolite Na-Y

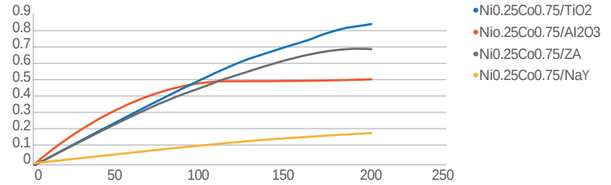
Characterization method:
Scanning electron microscope (SEM), Transmission electron microscope (TEM), X-ray diffraction (XRD), Brown-Emmet-Tellet (BET) Surface Area, Fourier Transform Infra Red (FTIR), CO Chemisorption analysis.

- **Research Outputs**

❶ the catalyst active metal composition was determined to achieve the maximum catalytic activity.
❷ The maximum value of TOF is 344 h-1 for Ni0.25Co0.75/Al2O3 catalyst system



❸ After the optimum metal active composition was determined, the role from catalytic support was determined by varying the support such as Al_2O_3, TiO_2, Natural Zeolite and Zeolite NA-Y.
❹ It was shown that the higher activity is for the Ni0.25Co0.75/TiO2 catalyst system with TOF of 359 h^{-1}.



❺ While the Al2O3 and Zeolite has the acidity characteristics, it shown that it has a reverse effect which can decrease the catalytic activity towards dehydrogenation reaction.
❻ And the TiO2 support shows the highest activity supposedly because its basicity characteristic.
❼ Important role from catalyst support (the role of metal oxide support) shows can also increase the activity.
❽ Achieve high TOF of hydrazine dehydrogenation reaction.
❾ Preparing manuscripts is on progress

KIST School Partnership Technical Report

General Information Principal Investigator

Nova Eka Diana, S.Kom., M.Eng.

Affiliation (department)	Informatics Department, Faculty of Information Technology, Universitas YARSI
Position	Manager of Research Development / Faculty Member
Project Title	CardioAR: an Augmented Reality Platform for Cardiovascular System Study
Project Period	2019.01.01~2019.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** CardioAR: an Augmented Reality Platform for Cardiovascular System Study
- **Research Field** Medical Simulation, Immersive Technology
- **Research Duration** 12 months
- **Research Objectives** This project is highly significant in Indonesia as a Cardiovascular disease is considered the leading cause of death in Indonesia, with a percentage of 37%. Having more than 83 medical schools in Indonesia, only 22% of these institutions have been accredited with the high rank. The remaining schools are still lack of resources and tools that yield to an average or almost underperformed graduates. There are many textual and audio resources to study medical subjects and currently, there is no an immersive platform for medical learning. Thus, the ultimate goal of this project is to develop an application that will revolutionize the approach to understanding the medical subjects, especially on the cardiovascular system through two specific aims leading to two expected outcomes:
  1. Design and development of an immersive cardiovascular learning system (CardioAR) using the emerging augmented reality technology
  2. Generate improved understanding of how immersive technology is used in medical learning through a proven usability testing.
- **Research Contents** This research applies an interdisciplinary effort to tackle the development of novel modeling modalities for grappling with complicated organs and neurons, and user-interface/user-experience research to measure the usability of applications in immersive visualization environments.
  Specifically, this project will create a better understanding of the cardiovascular system in medical schools and develop an immersive approach for medical learning and training in Indonesia. This project will also closely engage specific focus groups to better understanding the needs of CardioAR stakeholders and how these approaches can be adopted for learning and teaching platform in medical schools.
  These aims also have a broader research impact as they will provide a starting point to generate awareness of augmented reality technologies and to scale-up immersive learning platform in Indonesia.
  In this project, research training of undergraduate students is a critical component of the activities. Grant funds will be used to support not only researchers but student activities. We plan to have YARSI students visit KIST to perform research using immersive technologies for 1month. Although the student exchange will be for a short time, we will design the student projects to be a year or more duration and will be an integral part of ensuring the continual progress of the project.
- **Research Outputs**
  1. An Android-based augmented reality application for immersively studying the cardiovascular system
  2. Generate awareness of the research result through publication
- **Collaboration with KIST researcher** We are working with Dr. Deukhee Lee (dkylee@kist.re.kr), Center for Medical Robotics, Bio-Medical Science and Technology to execute the heart 3D model reconstruction. We stayed in his laboratory for about three weeks and had a structured discussion on how to conduct our research.

KIST School Partnership Technical Report

General Information Principal Investigator

Dipl.-Ing. Haznan Abimanyu, PhD.

Affiliation (department)	Research Center for Chemistry, Indonesian Institute of Sciences
Position	Senior Researcher
Project Title	Bacterial consolidated bioprocessing of lignocellulosic biomass for lactic acid production
Project Period	2019.01.01~2019.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Bacterial consolidated bioprocessing of lignocellulosic biomass for lactic acid production
- **Research Field** Bioprocess Engineering
- **Research Duration** 12 months
- **Research Objectives** This study is focused on exploring the production of lactic acid from lignocellulosic biomass especially oil palm empty fruit bunch (EFB) through separate hydrolysis and fermentation (SHF), simultaneous saccharification and fermentation (SSF) and consolidated bioprocessing (CBP) methods.
- **Research Contents** This research consists of ① pretreatment of EFB for delignification, ② separate hydrolysis and fermentation of pretreated EFB to lactic acid, ③ simultaneous saccharification and fermentation of pretreated EFB to lactic acid, and ④ consolidated bioprocessing of pretreated EFB to lactic acid.
  The optimization condition of hydrolysis and fermentation process is conducted in order to achieve high conversion efficiency of lignocellulosic biomass to lactic acid.
- **Research Outputs** Product lactic acid
  Publications

KIST School Partnership Technical Report

General Information Principal Investigator

Dasari Harshini Haznan Abimanyu, PhD.

Affiliation (department)	Department of Chemical Engineering, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal
Position	Associate Professor
Project Title	Development of Novel Perovskite based nano materials for low temperature CO oxidation
Project Period	2019.01.01~2019.12.31
Budget	5,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Development of Novel Perovskite based nano materials for low temperature CO oxidation
- **Research Field** Nano materials, Heterogeneous catalysis
- **Research Duration** 2019.01.01 ~ 2019.12.31
- **Research Objectives**
  - ·Development of novel Perovskite material (SrMnO3) for lowtemperature soot oxidation by modifying B (Fe, Ni) site in ABO3 structure for soot oxidation applications.
  - ·Characterization of the samples using XRD, BET, SEM, O2-TPD and Soot- TPR analysis.
  - ·Catalytic activity is evaluated for the perovskites.
- **Research Contents** In this thesis, the performance of $SrMn0._{98}B_{0.02}O_3$ (B = Fe, Ni) perovskites was evaluated for catalytic soot oxidation applications. All the samples exhibited a nano-crystalline hexagonal structure (XRD analysis) with the crystal sizes ranges 30 to 46 nm. XPS analysis reveals the presence of multiple valence states of Ni cations (Ni^2+/Ni^3+) and Mn cations (Mn^4+/Mn^3+) cations with the stable divalent strontium and trivalent iron cation on the surface of the perovskites. O_2-TPD analysis infers that the sample $SrMn_{0.98}Ni_{0.02}O_3$ showed the highest quantity of surface adsorbed oxygen molecules (78.87 µmol.g^{-1}) followed by SrMnO3 sample (72.16 µmol.g-1). Furthermore, the soot-TPR analysis confirms that the sample $SrMn_{0.98}Ni_{0.02}O_3$ shown the higher catalytic activity than SrMn0.98Fe0.02O3 due to synergetic effect between Mn - Ni cations, the higher reducibility tendency of the metal ions and the higher quantity of active oxygen species initiated the structural defects in the catalysts. The superior catalytic activity of soot oxidation of the assynthesized samples was observed in the order of $SrMn_{0.98}Ni_{0.02}O_3$> $SrMn_{0.98}Fe_{0.02}O_3$>$SrMnO_3$>bare soot.
- **Research Outputs** “Soot oxidation studies on $SrMn_{0.98}B_{0.02}O_3$ (B – Fe, Ni) perovskites”, International conference on Materials and Intelligent Manufacturing (ICMIM, Materials science and Engineering, 2019).

KIST School Partnership Technical Report

General Information Principal Investigator

Dr. Hari Prasad Dasari

Affiliation (department)	Department of Chemical Engineering
Position	Assistant Professor
Project Title	Development of quaternary ceria based catalyst for soot oxidation
Project Period	2019.01.01~2019.12.31
Budget	10,000,000 KRW

including Scope and Contents Summary of the Project

- **Project Title** Development of quaternary ceria based catalyst for soot oxidation
- **Research Duration** 2018.01.01-2018.12.31
- **Research Objectives**
  ❶ Synthesize quaternary metal oxide solid solution
  ❷ Minimize 50% conversion temperature (T50) of soot oxidation
  ❸ Improve OSC of catalyst

- **Research Contents**
  ·On addition of dopant in CeO2 (T50= 530 °C) to form binary metal oxide (T50=426°C), activity is improved due to improvement in reactive planes, reduction in F2g peak intensity, reduction in bandgap and increase in Ce reducibility.
  ·Increase in activity with the presence of redox metal oxide in ternary metal oxide CeO2-HfO2-Mn2O3 (T50= 530 °C) is correlated to improved reactive facet planes, F2g peak intensity, bandgap value, reducibility and oxygen vacancy which improves the oxygen mobility
  ·Quateranry metal oxide reduces the activity due to reduction in surface properties along with the modification in particle size that confirms the sintering of metal oxide which reduces the active sites for catalytic activity

- **Research Outputs**
  Ternary metal oxides of Ce0.90Hf1−0.90−xMnxO2−δ, CHMx, (x=0.00, 0.03, 0.05 and 0.07), and quaternary mixed oxides of Ce0.90Hf1−0.90−xMnxO2−δ, CHMY, (Y=Li, Ag, Ba and K) are developed using the EDTA−Citrate method. The synthesized metal are compared using different characterization techniques oxides and studied for soot oxidation activity. The structural parameters obtained using XRD shows that the ternary samples have lower crystallite size and particle size and higher lattice strain, reactive facet planes of (220) and (200) and surface area. With the improvement in reactive planes, defect sites are formed, which reduces the oxygen vacancy formation energy and thus enhances metal reducibility and surface oxygen vacancy. With respect to change in reactive planes, the corresponding reduction in optical bandgap and improvement in Ce 3+ and Mn 4+ reducibility is observed along with higher surface oxygen vacancy concentration.