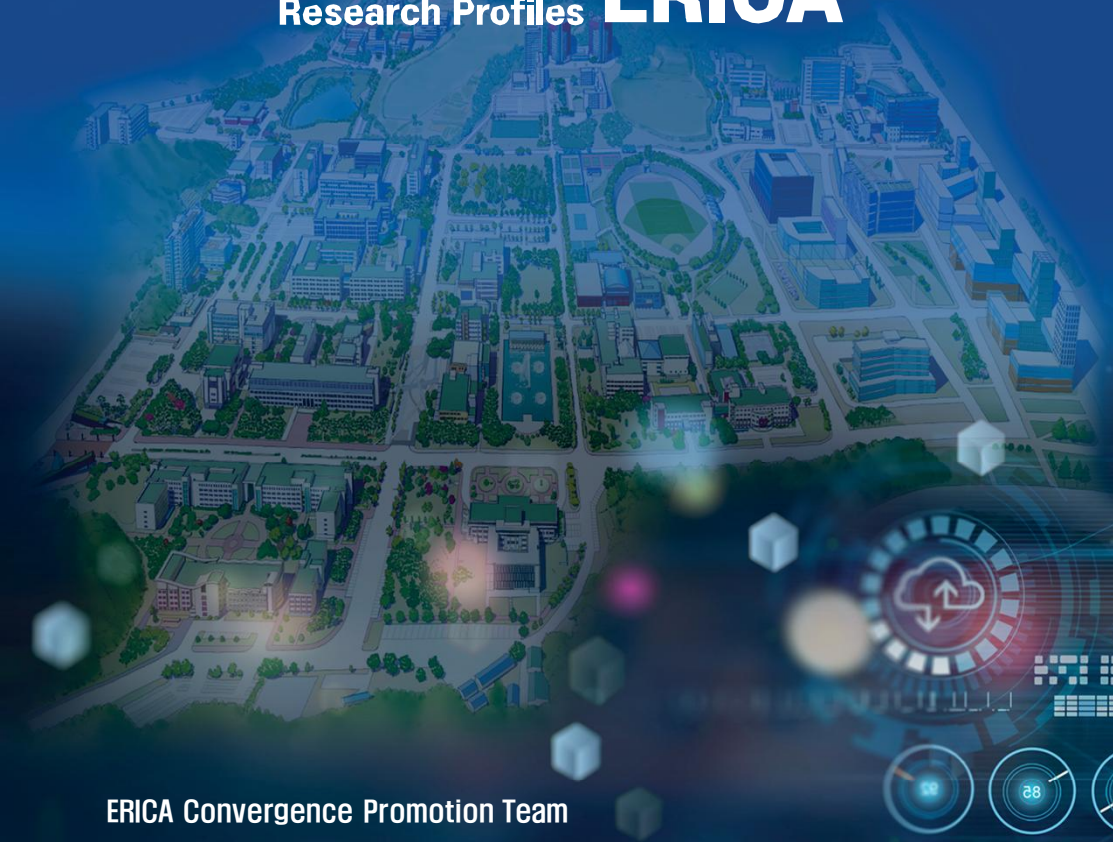
2022

HANYANG UNIVERSITY Research Profiles ERICA



ERICA Convergence Promotion Team

Administration Bldg. 2F
55, Hanyangdaehak-ro, Sangnok-gu, Ansan-si, Gyeonggi-do

☎ (+82) 31-400-4864~4867
https://ericabk.hanyang.ac.kr

HANYANG UNIVERSITY ERICA
Education Research Industry Cluster @ Ansan

FOUR BK21
CONVERGENCE INSTITUTE OF ERICA

2022

HANYANG UNIVERSITY Research Profiles ERICA

HANYANG UNIVERSITY ERICA
Education Research Industry Cluster @ Ansan

Young-Deuk Kim

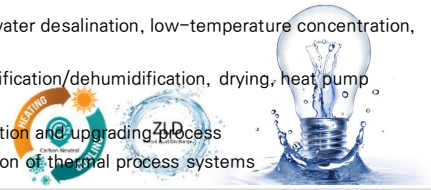
- Prof., Dept. of Mechanical Engineering, College of Engineering Sciences
- Ph.D., Hanyang University (Dept. of Mechanical Engineering)
- E-mail : youngdeuk@hanyang.ac.kr
- Office Phone: (+82) 31-400-5254
- Homepage : http://eee.hanyang.ac.kr/

Research Keywords

#heat and mass transfer	#water treatment	#Desalination	#low-temperature concentration	#zero liquid discharge
#dehumidification and dry	#humidification	#temperature swing adsorption	#gas purification	#heat pump

Research Objectives

- Thermally- and membrane-based water treatment, seawater desalination, low-temperature concentration, and zero-liquid discharge process
- Adsorbent- and membrane-based highly efficient humidification/dehumidification, drying, heat pump process
- Catalyst-, adsorbent- and membrane-based gas purification and upgrading process
- Design, modeling, simulation and performance optimization of thermal process systems



Brief Research Experience

- Professor, Dept. of Mechanical Engineering, Hanyang University (2014 ~ present)
- CEO, Energy & Synergy Eng. Co., Ltd. (2021 ~ present)
- Manager of Research Cooperation, Ansan Green Environment Center (2022 ~ present)
- Research Scientist, Water Desalination and Reuse Center (WDRC), KAUST (2013)
- Post-Doctoral Fellow, Water Desalination and Reuse Center (WDRC), KAUST (2011 ~ 2013)
- Research Fellow, Dept. of Mechanical Engineering, NUS (2010 ~ 2011)
- Post-Doctoral Fellow, Dept. of Mechanical Engineering, Hanyang University (2009 ~ 2010)
- 62 SCIE/SCI-indexed journal articles (Water Res., J. Membr. Sci., Desalination, Chem. Eng. J., Energy Convers. Manag.)
- h-index 28, i10-index 41 (Google scholar)

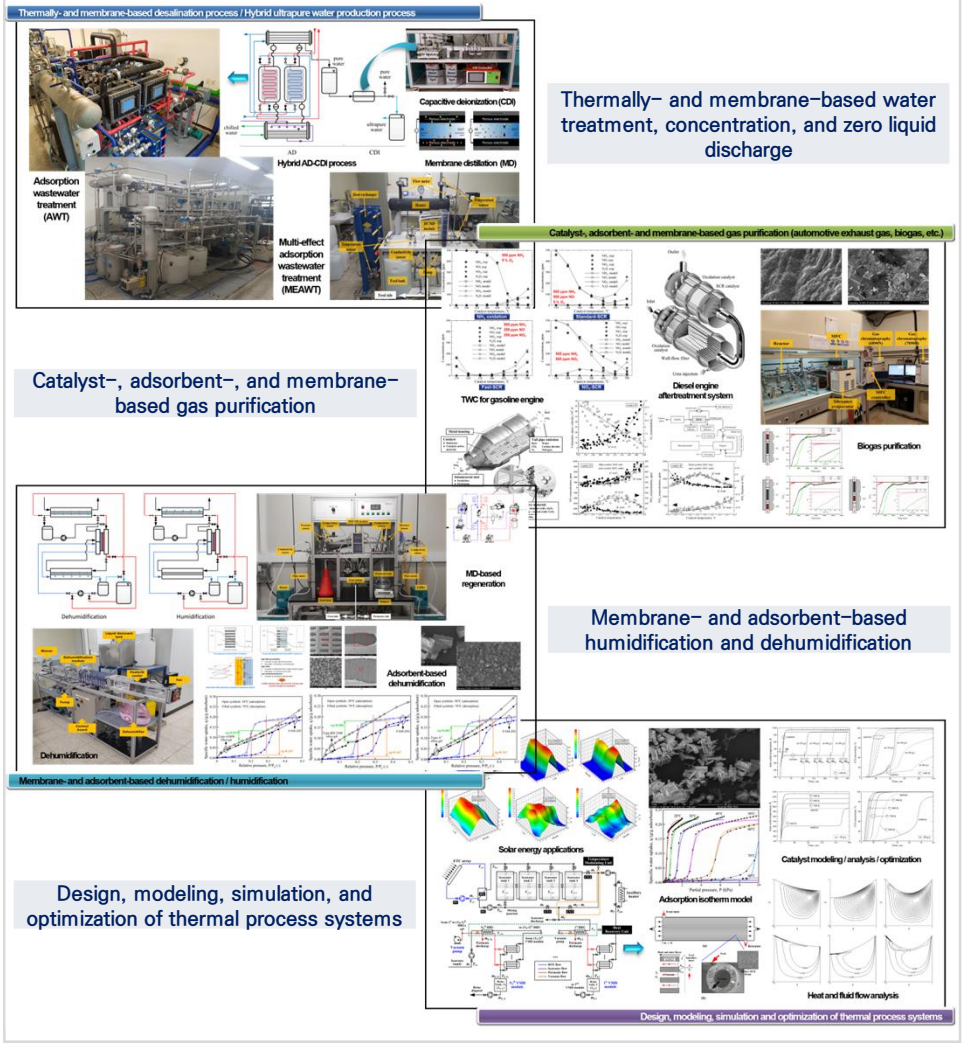
Collaborative Research Fields

Major Research Topics

- Thermally- and membrane-based water treatment, concentration, and zero liquid discharge
- Membrane- and adsorbent-based humidification and dehumidification
- Catalyst-, adsorbent-, and membrane-based gas purification
- Design, modeling, simulation, and optimization of thermal process systems

EEE
Energy & Environmental Engineering Lab.

Research Topics



Thermally- and membrane-based water treatment, concentration, and zero liquid discharge

Catalyst-, adsorbent-, and membrane-based gas purification

Membrane- and adsorbent-based humidification and dehumidification

Design, modeling, simulation, and optimization of thermal process systems

Ho Jun Kim

- Prof., Dept. of Mechanical Engineering, College of Engineering Sciences
- Final degree : Ph.D. in Mechanical Engineering (Texas A&M University, College Station)
- E-mail : hojunkim9158@hanyang.ac.kr
- Office Phone: 031-400-5247
- Homepage : https://orcid.org/0000-0002-6752-8905

Research Keywords

#Plasma Physics	#PECVD	#Dry Etch	#Cleaning	#CFD

Research Objectives

- In our lab, we focus on industry-sponsored research relating to new semiconductor/display equipment development.
- Purpose of our research is to obtain the uniform process results on the wafer/substrate by design and modification of the low temperature plasma process reactor.
- We are creating a digital twin of a smart semiconductor/display equipment based on our research findings regarding equipment development.

Brief Research Experience

- Assistant Professor Department of Mechanical, Smart, and Industrial Engineering, Gachon University Head of the Smart Factory Division (2022.03 – 2022.08)
- Assistant Professor Department of Mechanical Engineering, Gachon University (2020.03 – 2022.02)
- Assistant Professor Department of Mechanical Engineering, Dong-A University (2018.03 – 2020.02)
- Principal Engineer Samsung Electronics (2014.03 – 2018.02)
- Senior Engineer Samsung Electronics (2008.08 – 2014.02)
- Tes Visiting Professor (2020.07 – 2022.07)
- SK Hynix Visiting Professor (2019.04 – 2020.02)

Collaborative Research Fields

- Ab-initio Calculations
- Molecular Dynamics
- Reactive Molecular Dynamics
- Artificial Intelligence

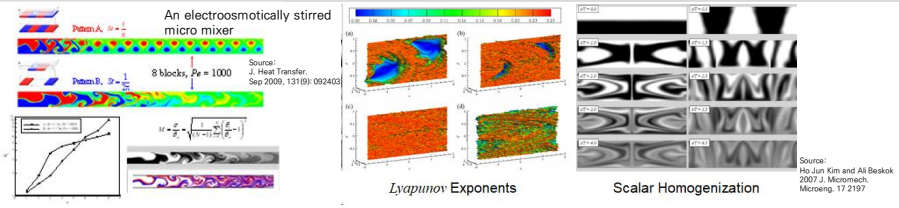
Major Research Topics

- Chaotic Transport
- Turbulence Simulation
- Supercritical Flow Reactor
- Plasma Process Simulation
- Plasma Reactor Design

Research Topics

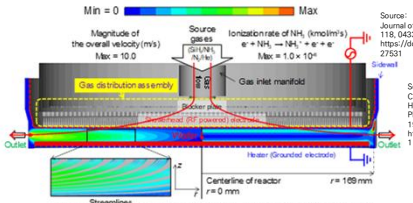
Numerical Investigation of Chaotic Transport

- Computation of stretching and its efficiency in chaotic systems
- Mixing, reaction and chaos in multi-dimensional flows
- Periodic point and invariant manifold in chaotic dynamics



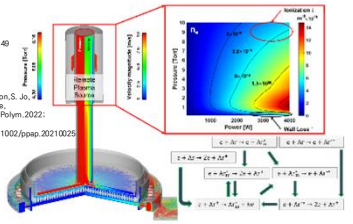
Plasma Discharge (low temperature plasma, plasma processes, plasma treatment)

- Process plasma (Capacitively Coupled Plasma) simulations: PE-TEOS, PE-SiN, PE-SiON, ACL, PE-ALD
- Process plasma (Inductively Coupled Plasma) simulations: HDP-SiO_2, HDP-SiN, HDP-ACL
- Remote plasma: fluorine chemistry, NF_3 plasma dissociation, fluorine transport, cleaning process



Cross section of the semiconductor manufacturing reactor

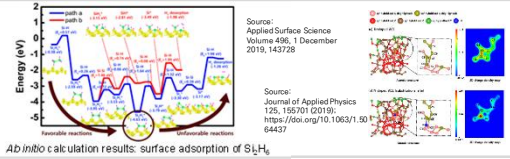
Capacitively Coupled Plasma Reactor



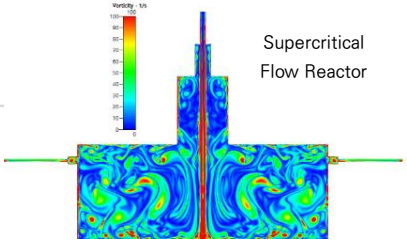
Inductively Coupled Plasma Reactor

Surface Chemistry & Supercritical Flow Reactor

- Molecular dynamics: deposition, etching
- Ab initio calculation: reaction rate, activation energy
- Supercritical flow reactor: turbulence modeling, simulation



Ab initio calculation results: surface adsorption of Si_2H_6



Supercritical Flow Reactor

Yoomin Ahn

- Prof., Dept. of Mechanical Engineering, College of Engineering Science
- Final degree : Ph.D. in Purdue University
- E-mail : ahnym@hanyang.ac.kr
- Office Phone: 031-400-5281
- Homepage : http://memslab.hanyang.ac.kr

Research Keywords

# Microsystem	# Fuel cell	# Micro-machining	# Bio Electro-chemistry	# Eco-friendly energy

Research Objectives

- Hydrogen production for micro fuel cell by microscale microbial fuel cell
- Development of a flexible self-sustainable photosynthetic microbial fuel cell using sunlight without fuel for textile-based wearable microelectronics
- Development of ecofriendly power source suitable for paper-based lateral-flow microfluidic device for medical diagnosis
- Development of disposable microbial electrochemical sensor that can detecting contamination of environment and drinking water

Brief Research Experience

- Professor, Hanyang University, Dept. of Mechanical Engineering (1994-present)
- Visiting Professor, Oregon State University, USA (2018-2019)
- Guest Researcher, Technische Universitaet Braunschweig, Germany (2011-2012)
- Foreign Research Staff Member, Tohoku University, NICHe, Japan (2003-2004)
- Postdoctoral Research Associate, Seoul National University (1993-1994)
- Postdoctoral Fellow, Purdue University, USA (1992-1993)
- Application Engineer, Samsung Hewlett-Packard Co. Application Center (1997-1998)

Collaborative Research Fields

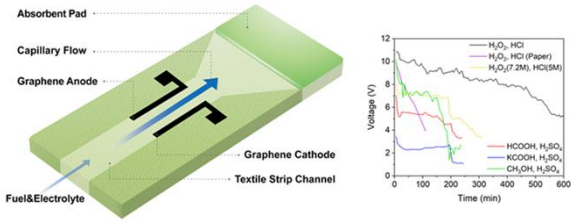
- Wastewater treatment microbial fuel cell device development
- Development of microbial fuel cell device using seawater or soil
- Development of textile-based wearable biosensor and electronics
- Development of paper-based disposable biochip for on-site medial diagnosis
- Hydrogen generating microorganism electrochemical device development

Major Research Topics

- Hydrogen production by microscale microbial fuel cells
- Self-sustainable photosynthetic microbial fuel cell for wearable microelectro-devices
- Eco-friendly power sources for paper-based microfluidic devices
- Disposable microbial electrochemical sensor for detecting environmental pollution

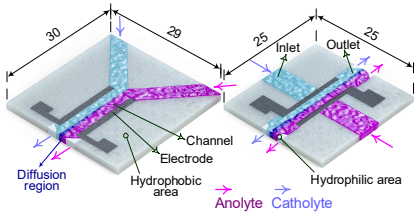
Research Topics

- Wearable fabric-based self-pumping, single-stream microfluidic fuel cell



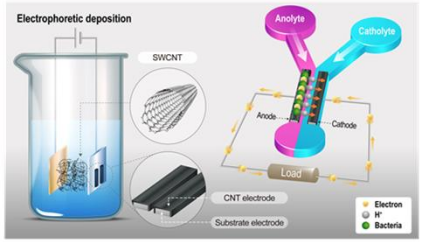
- A membraneless single-stream fuel cell was fabricated with a fabric substrate, which improves the sustainable of self-pumping microfluidic fuel cells.

- Flexible Paper-based mediatorless enzymatic microfluidic biofuel cells



- A glucose biofuel cell was micromachined to be precise and mass-producible. The microchannel of the biofuel cell was designed with Y-/cross-shaped structure.

- Co-laminar microfluidic microbial fuel cell integrated with electrophoretically deposited carbon nanotube flow-over electrode



- A co-laminar flow microbial fuel cell is developed using micromachining techniques. Electrodeposition is used for carbon nanotube electrode microfabrication.

Hyun Ik Yang

Multiphysics Simulation Analysis

- Affiliation and Position : Mechanical Engineering, Professor
- Final Degree : Ph.D in Mechanical Engineering, Columbia Univ
- E-mail : skynet@hanyang.ac.kr
- Phone : 031-400-5285
- Homepage : https://scholarworks.bwise.kr/erica/researcher-profile?ep=69

Research Keywords

#Welding	#Artificial Neural Network	# Energy harvest from waste	# Machine Learning	# Multiphysics

Research Objectives

- Heat Deformation Prediction for a thin plate unit based on the Large Deformation Theory
- Adaptive Numerical Analysis Method for Efficient Performance Improvement of Artificial Neural Networks
- Biofuel Production Technology Using Organic Wastes
- Efficient Machine Learning Approach using the iIRS Method in Structural Dynamics
- Fitting Product Heat Flow Analysis and Procedure

Brief Research Experience

- Mechanical Engineering, Professor (1995 ~)
- Russia Academy of Natural Science Overseas member
- The Korean CDE Society Life member
- The Korean Society of Manufacturing Technology Engineers Life member(Auditor)
- The Korean Society of Mechanical Engineers (2021, Education Div. Chairperson)
- Major Collaborating Organization List : Korea Institute of Industrial Technology, POSCO, East-West Power Co., Ltd
- Book : Mechanical Element Design(2015, Hantee Media) Translation and Edition
- Award : ASME Design Automation Best Technical Paper Award (1991)
  Russian Academy of Natural Science Silver Medal (2001)
  Damwoo Academic Award (KSMTE, 2020)
  The 32nd Science and Technology Paper Award (KOFST, 2022)

Collaborative Research Fields

- Multiphysics simulation analysis study using various software

Weld Deformation Prediction
- Ship Block Accuracy Analysis
- Analytical Production Process Analysis

AI-based research
- Compensating for The Shortcomings of Machine Learning
- Reduce Cost and Improve Accuracy

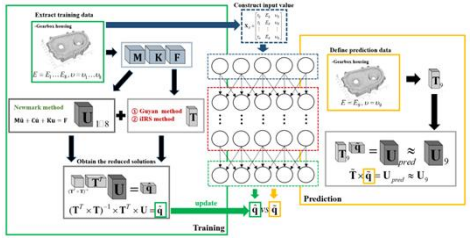
Waste to energy
- Increase The Yield of Hydrothermal Carbonization Process
- Maximize The Vortex Combustion Efficiency

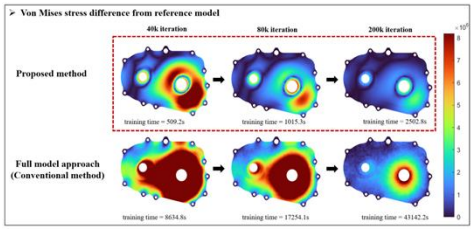
Major Research Topics

- Intelligent Computer Integrated Design LAB
- Conducting Simulation-Based Welding Deformation Prediction and Control technology
- Optimal Design Technology Using Artificial Neural Network
- Development of Waste-To-Energy Technology through Hydrothermal Carbonization and Design of Combustion Furnace

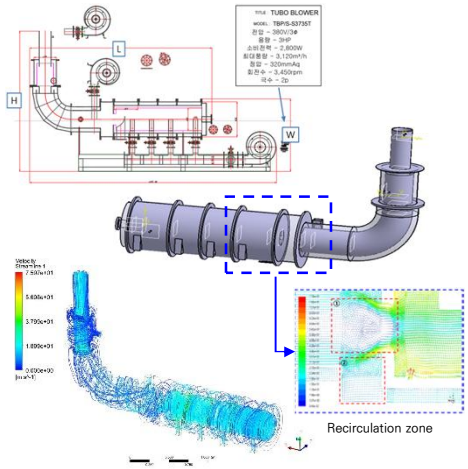
Research Topics

- Efficient deep learning training method using iIRS





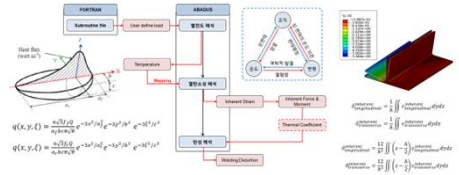
- Mixed Combustion Furnace Development



- Thermal Deformation Control using Simulation Analysis

Welding Analysis Method Development

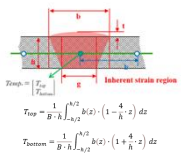
Interpretation Procedure



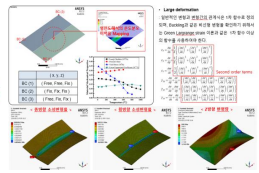
Thermal- Elastoplstic Structural Analysis

Weld Buckling Analysis

Welding Condition

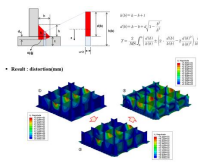


Thermal- Elastoplstic Structural Analysis

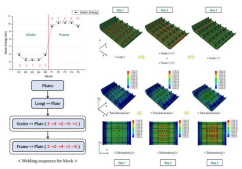


Welding Deformation Prediction and Control using Strain as Direct Boundary Method

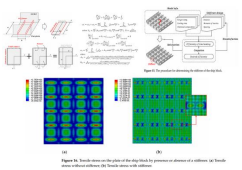
Welding Deformation Prediction



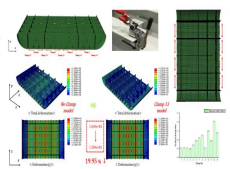
Deformation Control: Welding Sequence

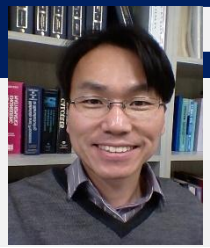


Deformation Control: Lifting



Deformation Control: Clamp





Je Hoon Oh

Bolted Joints, Hemodynamics, Sensors and Energy Harvesters, Inkjet Printing, Display Equipment

- Professor, Department of Mechanical Engineering
- Ph.D., Mechanical Engineering, KAIST
- E-mail: jehoon@hanyang.ac.kr
- Office Phone: +82-31-400-5252
- Website: amid.hanyang.ac.kr

Research Keywords

#FEA	#Bolted Joints	#Hemodynamics	#Cerebral Aneury는	#Wearable Sensors
#Energy Harvester	#Inkjet Printing	#Equipment Design	#Composites	#Mechanical Design

Research Objectives

- Design and evaluation of the mechanically fastened joints based on the analysis and experiment of fastening behavior
- Design and evaluation of the medical screws based on patient's bone characteristics
- Formation mechanism of cerebral aneurysms using numerical simulations and pathophysiology
- Prediction of the rupture risk and treatment outcome of cerebral aneurysms
- Development of phantom blood vessels and endovascular procedure simulators
- Highly flexible wearable pressure sensors and energy harvesters and storages
- Inkjet printing technique for large-area, high-resolution OLED displays
- Design of the ink circulation system for uniform particle distribution without sedimentation
- Design methodology for semiconductor and display equipment

Brief Research Experience

- Professor, Hanyang University ERICA (2004 – present)
- Member, Hanyang University Senate (2019 – present)
- PI, BK21 ERICA-ACE Center, Hanyang University ERICA (2020 – present)
- Director (past) and Trustee, Korean Society of Mechanical Engineers (2019 – present)
- Director (past) and Trustee, Korean Society for Precision Engineering (2013 – present)
- Visiting Scholar, Purdue University (2010 – 2011)
- Senior Researcher, Samsung SDI (2001 – 2004)

Collaborative Research Fields

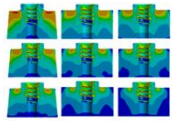
Bolted Joint	Cerebral Aneurysm	Inkjet Printing
▪ Optimum design of dental implants and bone screws based on bone characteristics ▪ Evaluation of medical screws considering the in-vivo environments	▪ Comparison of CFD and FSI with PIV, 4D-MRI, and HF-OCT ▪ Formation, growth, and occlusion of aneurysms ▪ Novel endovascular treatment devices	▪ Integrated wearable system including energy harvesters, sensors, and actuators ▪ Solution-based process and corresponding equipment for large-area, high-resolution OLED displays

Major Research Topics

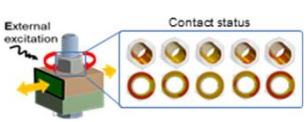
- Design and evaluation of the mechanical fasteners and mechanically fastened joints
- Formation and growth mechanism of cerebral aneurysms, prediction of their rupture risks and treatment outcomes, and development of novel endovascular devices and simulators
- Highly flexible wearable pressure sensors, energy harvesters and storages, and integrated systems
- Inkjet printing technique and equipment for large-area, high-resolution OLED displays

Research Topics

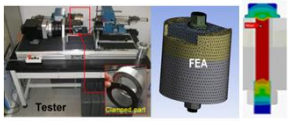
Mechanically fastened joints



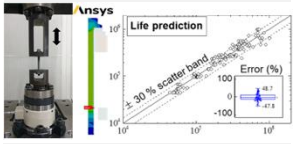
Self-tapping screw



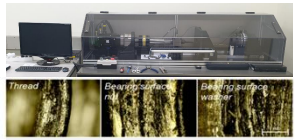
Self-loosening behavior



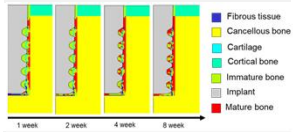
Analysis of a plastic-region tightening



Fatigue life prediction of bolts

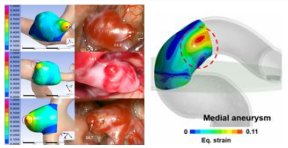


Bolt tightening system

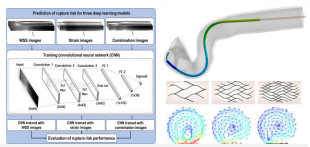


Osseointegration simulation of a dental implant

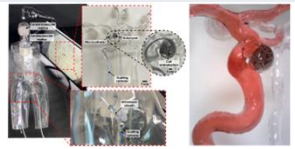
Hemodynamics of cerebral aneurysms and endovascular devices and simulators



Analysis of the aneurysm formation

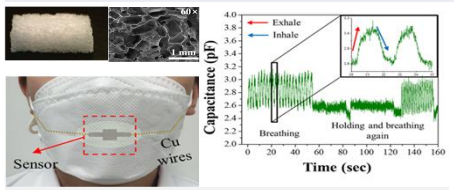


Prediction of the rupture risk and treatment outcome

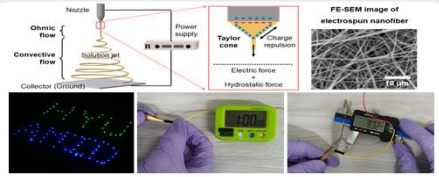


Endovascular procedure simulator

Wearable pressure sensors and energy harvesters

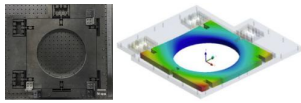


Highly sensitive flexible pressure sensor



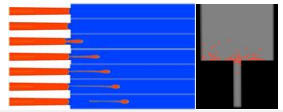
Triboelectric nanogenerator (TENG)

Equipment design and inkjet printing technique for OLED displays



Manufacturing equipment design

Inkjet printing system



Jetting and particle simulation

Junho Oh

Nature-Inspired Nanoengineered Surfaces for Enhanced Thermofluidic Transport Phenomena

- Assistant Prof., Dept. of Mechanical Engineering, College of Engineering
- PhD, University of Illinois at Urbana-Champaign (Mech. Eng.)
- E-mail : junhooh@hanyang.ac.kr
- Office Phone : 031-400-5259
- Homepage : http://better.hanyang.ac.kr

Research Keywords

#Phase change heat transfer	#thermal engineering	#interfacial science	#nature-inspired engineering	#nanoengineered surface
#wettability	#functional surface			

Research Objectives

- **Engineering Better Human Life using Thermofluidics and Interfacial Science**
- Various functionalities of natural surfaces for the solutions of engineering problems
- Advanced thermal management systems for electronics, batteries and other thermal engineering systems
- Nanoengineered surfaces to enhance interfacial phenomena and thermofluidic transport
- Transport phenomena on nanoengineered surfaces addressing Energy-Water-Environment-Health Nexus Problems

Brief Research Experience

- BETTER (Bio-inspired Energy and Thermal Transport Engineering Research) Lab PI
- Postdoctoral Research Fellow, University College London, UK (2019.8-2021.2)
- Internship Researcher, Nokia Bell Labs (2018.5-2018.8)
- Published research articles in Advanced Functional Materials, Nano Letters
- - Dissolvable Template Nanoimprinting Lithography (Nano Lett. 2020)
- - Thin-Film Condensation on Nanostructured Surfaces (Adv. Funct. Mater. 2018)
- - Exploring the Role of Habitat on the Wettability of Cicada Wings (ACS AMI, 2017)
- - Jumping Droplet Active Hot-spot Cooling (Appl. Phys. Lett. 2017, 피인용 64회)
- Cross-disciplinary collaborative research experience in sciences and engineering
- Worldwide collaborative research network all over North America, Europe & Asia
- Key Research Sponsors: NRF, KOFAC

Collaborative Research Fields

- **Thermofluidic Transport and Interfacial Phenomena in Sciences and Engineering**
- Cross-disciplinary collaborative research action related to interfacial phenomena & thermofluidic transport
- Experienced in multidisciplinary collaborative research → expecting effective and synergetic collaboration
- Examples of collaborative research projects:
  - ✓ Biology: Interfacial and transport phenomena observed in nature such as plants, insects and animals
  - ✓ EE: High power electronics cooling for enhanced performance and device lifetime
  - ✓ Pharm&Med: Surgical and interventional instrument, drug delivery, microfluidics and nanomaterials
  - ✓ ChemE, Mat.SE: Durable and functional nanomaterials and coatings
- Other collaborations are welcomed regarding wettability, phase change, heat transfer, fluids and else.

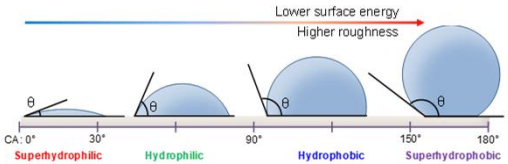
Major Research Topics

- BETTER Lab, Dept. of Mechanical Engineering (http://better.hanyang.ac.kr)
- (Bio-inspired Energy and Thermal Transport Engineering Research Laboratory)
- Multidisciplinary, collaborative research expert on mechanical/electrical/chemical /nano/bioengineering & materials science, biology and medicines
- Published research articles in Advanced Functional Materials, Nano Letters

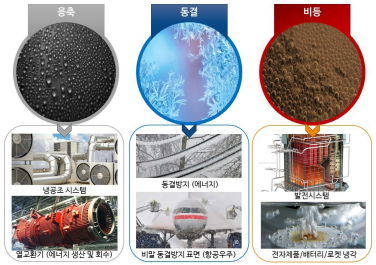
BETTER
ENGINEERING BETTER HUMAN LIFE

Research Topics

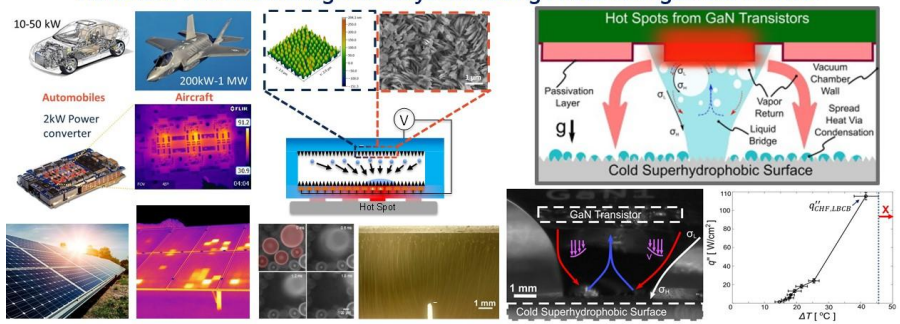
Phase Change Heat Transfer and Surface Wettability



<Wettability of Water – Characterized by Contact Angle >

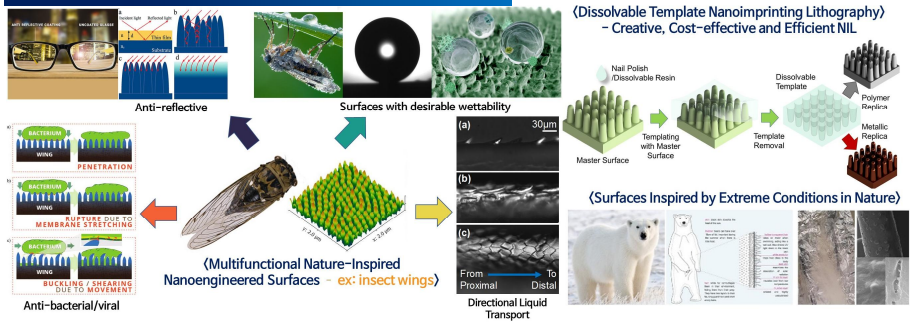


Advanced Thermal Management Systems using Phase Change Heat Transfer



〈Electronics Cooling〉 〈Jumping Droplets Cooling〉 〈Liquid Bridge Confined Boiling〉

Nature-Inspired Nanoengineered Surfaces



Joon Yong Yoon

Analysis and applied research of fluid flow through numerical simulations and experiments

- Prof., Dept. Mechanical Engineering, College of Engineering
- PhD, in Mechanical Engineering(Univ. of Iowa)
- E-mail : joyoon@hanyang.ac.kr
- Office Phone : 031-400-5282
- Homepage : https://scholarworks.bwise.kr/erica/researcher-profile?ep=111

Research Keywords

#Fluid engineering	#CFD	#Flow control	#Cavitation	#Standardization

Research Objectives

- Analysis and applied research of fluid flow through numerical simulations
- Eco-friendly technology research using fluid flow
- Design optimization of various fluid machines through flow analysis
- Development of Algorithms applying AI for lowering computational cost

Brief Research Experience

- An experimental study of the possibility of application of hydrodynamic cavitation to washing plastic waste
- (NRF, 2021~2022)
- Cooling capacity measurement system development for EV fast charging cable
- (NRF 2021~2022)
- Development of standard for industrial valve actuators and reducers
- (KEIT, 2015~2019)
- Prime Minister's commendation in standardization sector(2006)
- Best Researcher in technology transfer sector (2008, Hanyang University)
- ISFMFE "Best Paper Award"(2016)

Collaborative Research Fields

Collaborative Research Fields — **Analysis of the effect of hydrodynamic cavitation on material surface**

Investigation on washing effect on plastic surface through cavitation	Analysis of chemical change due to cavitation
• Investigation on washing principle and • Investigation of working principles and effectiveness of removing odors from plastic • analysis of surface defect of plastic due to cavitation	• One of the disadvantages of recycling plastic through mechanical recycling is the deterioration of quality due to thermal-mechanical degradation • Investigation on the relationship between local extreme conditions of washing and thermal-mechanical degradation due to hydrodynamic cavitation

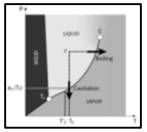
• The global trend for plastic disposal is the transition from the existing linear economy to the circular economy through reuse and recycling.
•• Korea took an economic benefit from 53.7% of plastic, but this value includes incineration for energy recovery, that is, 22.7% of plastic were circulated into the economy.
•The problem of the plastic cleaning process is 1. residual contaminants 2. deodorization 3. wastewater
•it is expected that the recycling rate can be improved by applying hydrodynamic cavitation to solve this problems

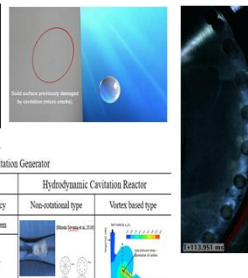
Major Research Topics

- standardization expert with various activity such as the domestic chairman of ISO/TC 153 and member of committee for KATA standardization technology
- Research on eco-friendly technology applying cavitation
- Design optimization of various fluid machines through flow analysis

Research Topics

Eco-friendly technology using cavitation

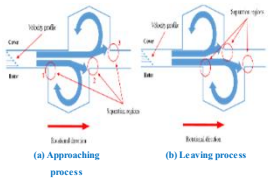




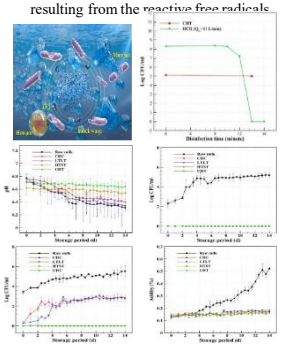
< Phase diagram of Water>

Cavitation Generator

Acoustic Cavitation Reactor		Hydrodynamic Cavitation Reactor	
Single Frequency	Multiple Frequency	Non-rotational type	Vortex based type
Horn type	Dual Frequency system	Rotational type	
Transducer type	Triple Frequency Reactor		

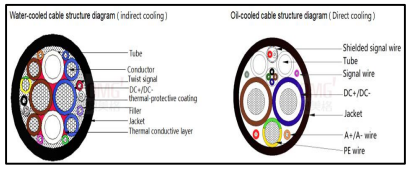


- **Inactivation mechanism**
  - Mechanical effect: destruction of cell membranes
  - Thermal effect: thermal inactivation effect
  - Chemical effect: oxidation effect resulting from the reactive free radicals



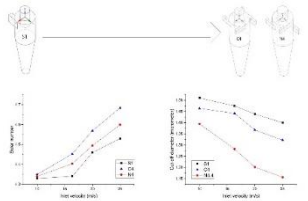
Cooling of super fast charging cable for EV

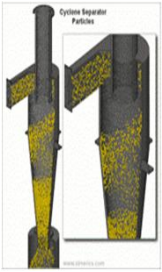
- Heat generation from connection between charging cable and connecter during super fast charging
- Problem with lowering charging time and safety issue
- Direct cooling of charging cable using insulating oil



<Type of liquid cooling cable
– indirect/direct cooling >

Research on dust collection by cyclon separator





- Numerical investigation of 2 novel designs of four-inlet cyclone separator
- The design N4 is the best
- Four-inlet cyclone separator provides better performance than single-inlet one

Seoung Hwan Lee

- Prof., Dept. of Mechanical Engineering, College of Engineering
- Final degree : Ph.D. in U.C Berkeley
- E-mail : sunglee@hanyang.ac.kr
- Office Phone: 031-400-5288
- Homepage : http://iml.hanyang.ac.kr

Research Keywords

# Acoustic emission	# AE senosr	# Ultra-precision machining	# Advanced Manufacturing	# process Monitoring
# Sensor monitoring	# Sensor fusion	# A.I		

Research Objectives

- Development of in-line AFM-based electrical property measurement and inspection system
- Development of automatic repair system through hybrid AFM-based measurement/analysis
- Manufacture of smart non-destructive sensor with variable sensitivity and development of related measurement/analysis-based basic technology
- Material microcrack detection through machine learning-based PVDF sensor signal processing technology development

Brief Research Experience

- Assistant Professor, Hongik Univ. (1997.9 – 1998.8)
- Prof. in Mechanical Eng., Hanyang Univ. (1998.9 –)
- Advisor, Kyunggi Technopark (2000.5 –)
- Selected Papers:
  - Analysis of ductile mode and brittle transition of AFM nanomachining of Silicon, International journal of machine tools and manufacture, 61, 71-79, 2012.
  - Prediction of Burr Types in Drilling of Al-7075 Using Acoustic Emission and Convolution Neural Networks. IEEE Access, 10, 67826-67838
- Funding sources: Korea Construction Equipment Technology Institute/ Korea Technology & Information Promotion Agency for SMEs, TIPA/Korea Evaluation Institute of industrial Technology/National Research Foundation of Korea/ BK21 Four research center

Collaborative Research Fields

- **Process monitoring system development and sensor development using acoustic emission sensor**

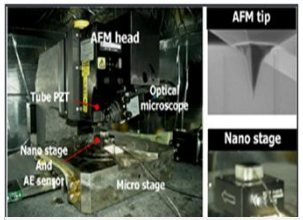
AFM	Advanced manufacturing	3D printing	Sensor development
▪ Development of Nanoscale Process Automation System	▪ Production of acoustic sensors applicable to advanced manufacturing processing using materials such as PVDF and PZT	▪ Improvement of precision and development of fully automated system through the application of 3D printing process monitoring technology	▪ Development of piezoelectric sensor fusion platform

Major Research Topics

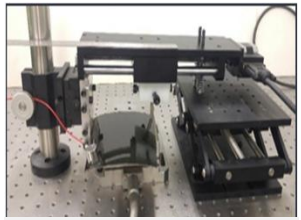
- Process modeling of precision machining
- Sensor monitoring for ultra-precision machining process control
- Advanced manufacturing process development and analysis

Research Topics

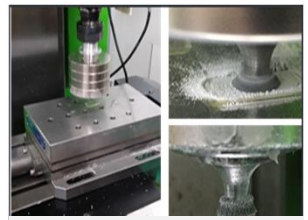
Precision Machining process



Nano Scratch Test

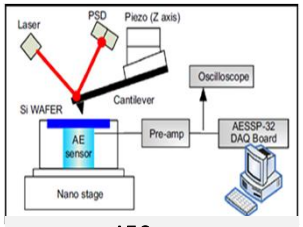


Vehicle Scratch Test

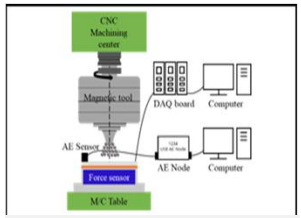


Magnetic abrasive finishing

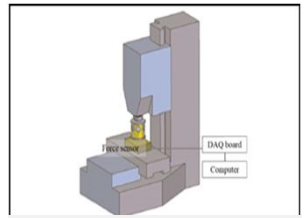
Sensing system



AE Sensor

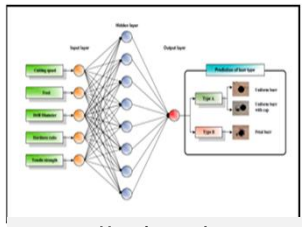


AE Sensor+Force sensor

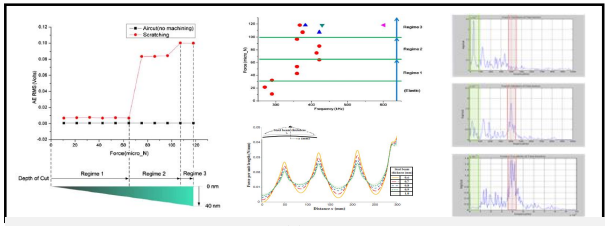


Force Sensor

Signal analysis



Neural network



FFT, RMS, Energy

Won Chul Lee

Interdisciplinary Researcher in Nanoscale and Microscale Areas

- Prof., Dept. Mechanical Engineering, College of Engineering
- PhD, KAIST (Bio and Brain Engineering)
- E-mail : wonchullee@hanyang.ac.kr
- Office Phone : 031-400-5257
- Homepage : https://sites.google.com/site/nanobiohanyang/

Research Keywords

#in situ TEM	#self-assembly	#liquid-cell TEM	#nanofabrication	#graphene
#MEMS	#2D material	#nanocrystal		

Research Objectives

- Collaborative research in interdisciplinary fields including mechanical engineering, MEMS, nanoscience, bioengineering, electrical engineering, material science, chemistry, biology, etc.
- Starting his research carier from BioMEMS and microfluidics areas and studying interdisciplinary areas in nanoengineering and nanoscience
- Recent research focus: in situ TEM, liquid-cell TEM, 2D materials, self-organization, and nanocrystal

Brief Research Experience

- Published research papers in Science, Nature Nanotechnology, etc.
- Founded a venture company (E&M devices, Inc.) in USA
- Major funding source: NRF (National Research Foundation of Ko

Collaborative Research Fields

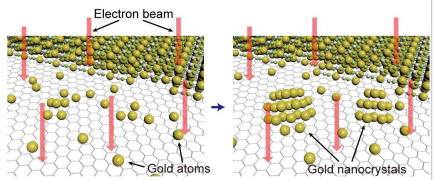
- Nano/micro-scale observation, analysis, fabrication based on TEM, 2D materials, and self-organization

Major Research Topics

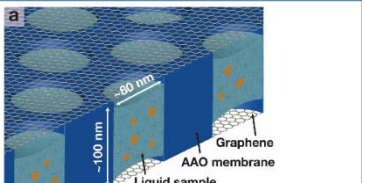
- 나노바이오 기계시스템 연구실 (https://sites.google.com/site/nanobiohanyang/)

Research Topics

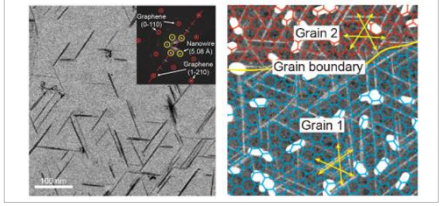
in situ TEM



liquid-cell TEM



2D materials & self-organization



- Reversible Disorder-Order Transitions in Atomic Crystal Nucleation, *Science* 2021.
- A Large-Scale Array of Ordered Graphene-Sandwiched Chambers for Quantitative Liquid-Phase Transmission Electron Microscopy, *Advanced Materials* 2020.
- Ligand-Dependent Coalescence Behaviors of Gold Nanoparticles Studied by Multichamber Graphene Liquid Cell Transmission Electron Microscopy, *Nano Letters* 2020.
- Precise Identification of Graphene's Crystal Structures by Removable Nanowire Epitaxy, *Journal of Physical Chemistry Letters* 2017.
- Graphene-templated Directional Growth of an Inorganic Nanowire, *Nature Nanotechnology* 2015.

Nahm-Gyoo Cho

- Prof., Dept. of Mechanical Engineering
- Final degree : Ph.D. in Tokyo Institute of Technology (Mechanical Engineering)
- E-mail : ngcho@hanyang.ac.kr
- Office Phone: 031-436-8111
- Homepage : http://pmelab.wixsite.com/pmehanyang

연구 키워드

# Precision Measurement	# Sensor Development	# Driving Error	# Form Error	# 3D Vision Measurement

Research Objectives

- Development of precision measurement systems for Multi-D.O.F. error motions of rotational and linear devices
- Development of precision measurement system for form error of mechanical parts and products
- Precision motion control system development for linear and rotational devices through error motion compensation
- Multi-DOF motion measurement and high-precision measurement system for large area surfaces mechanical parts through 3D vision

Brief Research Experience

- Professor, Hanyang Univ. Mechanical Engineering, (1995~)
- KIST Brain-Pool Researcher (1994~1995)
- 49 research papers published in renowned international journals and conferences
- 105 research papers published in renowned domestic journals and conferences

Collaborative Research Fields

- **Development of smart manufacturing and monitoring technology based on high-efficiency, high-quality sensing systems**

Smart Sensor

- Precise error motion monitoring and control system of real-time linear and rotary drive systems
- Detailed monitoring of product state based on vision systems

Sensor Fusion

- Improvement of registration, processing speed, and accuracy through fusion of several different data obtained by multiple sensors
- Ultra-precision registration of area data obtained by multiple sensors
- Ultra-precision measurement and self-calibration technology through error separation of multiple sensor data

3D Printing

- 3D printed non-assembly precision force sensor design and fabrication technology based on 3D Printing
- Precision Multi-D.O.F Nano-positioning stage design and fabrication technology through 3D Printing

Stereovision

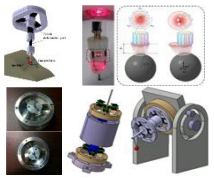
- Development of precision measurement system using precision and compact stereo vision
- Large-area precision measurement technology through stereovision

Major Research Topics

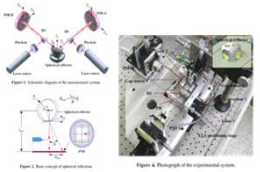
- Measurement system and sensor development
- Measurement of machine error motion and form error
- Development of precision positioning technology
- Surface form measurement of machined product surfaces through 3D vision technology

Research Topics

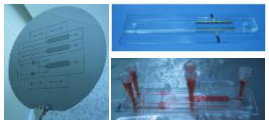
Measurement of machine error motion and form error



Multi DOF force sensor

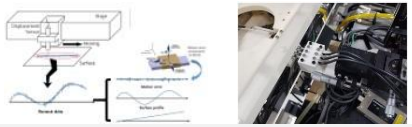


Measurement sys. for 3 DOF micro displacement

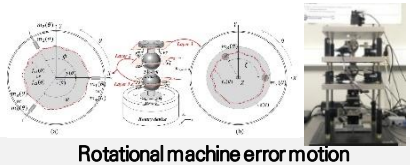


Micro needle for viscosity detection

Measurement of machine error motion and form error



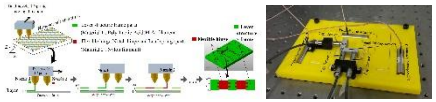
Linear machine error motion and form error measurement



Rotational machine error motion and form error measurement

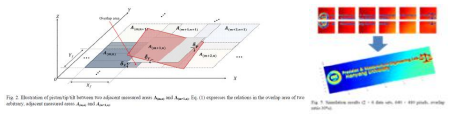
Development of precision positioning technology

Multi-DOF Nano-positioning stage

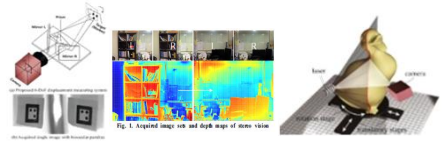


3D printed nano-positioning stage

Development of 3D vision technology



3D vision based high-precision large-area surface measurement system



3D data measurement through stereovision

Joonmyung Choi

Multiscale Mechanical Design Combining Nanoscale Physics and Modeling

- Assistant Professor, Department of Mechanical Engineering
- Ph.D. Seoul National University
- E-mail : joonchoi@hanyang.ac.kr
- Tel : 031-400-5243
- Homepage : msmlab.wordpress.com

Research Keywords

#Multiscale mechanical design	#Surface engineering	#Interface mechanics	#Molecular dynamics	#Continuum mechanics
#Nanocomposites	#Functional polymers			

Research Objectives

- Precision design for multifunctional smart materials and structures based on atomic scale mechanism
- All-atom simulations for polymer and polymer nanocomposites
- Simulations for nanoscale process under extreme environment
- Mechanical analysis of interphase in heterogeneous materials
- Multiphysics modeling for the mechanical behavior of materials

Brief Research Experience

2019.03. – Today
Hanyang University ERICA

2017.10. – 2019.02.
Samsung Electronics

2016.09. – 2017.09.
Seoul National University

•Research Achievements

43 SCI Papers
- ✓ Composites Science and Technology
- ✓ Carbon
- ✓ Applied Surface Science

+1k Citation, H-index 18

U.S. Patent #2
Korea Patent #2

•Sponsored by:

NRF 한국연구재단, SAMSUNG, inSilico, LINC+, HEAD, KITECH 한국생산기술연구원, UT DALLAS

•Work Experiences

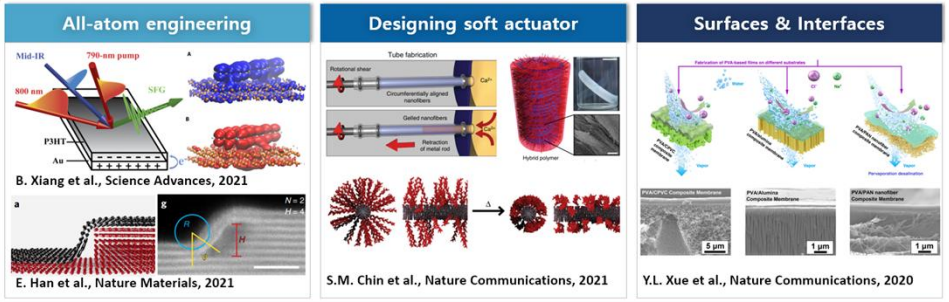
Development of practical CAE methodology for optimal process design in semiconductor and display manufacturing

Collaborative Researches with:

Collaborative Research Fields

- Suggesting a theoretical model explaining the phenomena discovered.

Limitations: CAE methods are ready, but lack of experimental data!



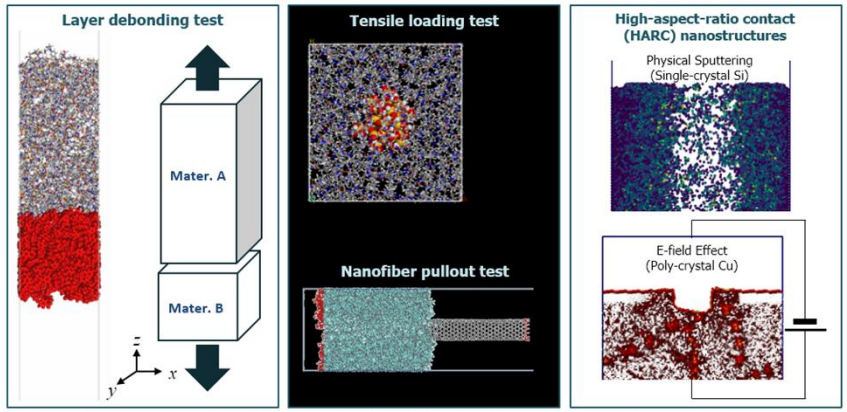
- In the case where it is difficult to draw a clear conclusion due to lack of theoretical explanation
- In the case where you are curious about the mechanism for an accidental (but interesting) outcome in an experiment
- In the case when it is necessary to predict the theoretical value for an extreme area that cannot be reached with the present experimental technology

Major Research Topics

- Multiscale Structural Mechanics Laboratory (http://msmlab.wordpress.com)
- Ph. D. Student: 3 / M.S-Ph.D. Integration Course Student: 4 / B.S. Intern: 2 (2022.03.)

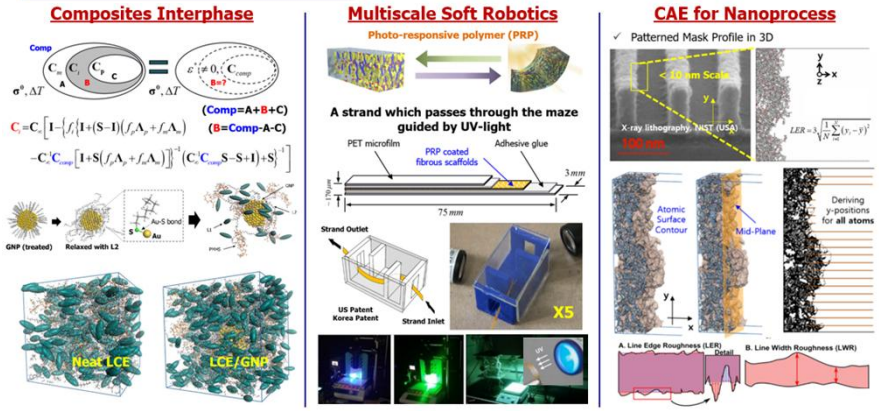
Research Topics

Representative Examples



➢ Quantitative analysis of the mechanical behavior in nanocomposites and/or nanostructures *in silico*

About MSM Lab.



➢ Multiscale design of multifunctional materials and structures

Suk Joon Hong

Optical Nanoprocessing Laboratory

- Assoc. Prof. Prof., Dept. of Mech. Eng., College of Engineering
- KAIST, PhD in Mech. Eng.
- E-mail : sukjoonhong@hanyang.ac.kr
- Office Phone : 031-400-5249
- Homepage : https://sites.google.com/site/onlhanyang

Research Keywords

#selective laser process	#ablation	#sintering	#pyrolysis	#nanomaterial synthesis

Research Objectives

- **Analysis of photothermal/photochemical reaction by continuous or pulsed laser, Development of selective laser process**

- Selective laser sintering for metal nanoparticles
- Selective laser nanowelding of metal nanowires
- Laser-induced growth of metal oxide layer
- Laser pyrolysis of polymer films
- Applications: electrical/optical/mechanical devices

Brief Research Experience

- Published more than 90 SCIE papers (h-index: 40, i10-index: 67, Total citation: 8,040 from Google Scholar)
- Selected publications:
  - ✓ Nature communications 12 (1), 1-11 (2021)
  - ✓ Advanced Functional Materials 31 (1), 2170002 (2021)
  - ✓ Advanced Materials 30 (5), 1703878 (2018)
  - ✓ ACS nano 11 (12), 12311-12317 (2017)
- Collaboration with domestic/international institutes including KAMIC of KITECH, KERI, Laser Thermal Lab at UC Berkeley,, HiLASE center for the development of ultrafast laser and the relevant optical processing
- Research sponsors: NRF, ADD, KITECH, etc.

Collaborative Research Fields

- **Selective laser process for emerging materials**

Materials	Laser source	Applications
• Hydrogel • Conducting polymer • 3D printable materials	• Femtosecond laser • SLM based beam shaping • Burst mode	• Microfluidic devices • Untethered microrobots • Wearable devices

Major Research Topics

- Optical nanoprocessing Laboratory (https://sites.google.com/site/onlhanyang)
- Development of selective laser process techniques for targeted materials
- Fabrication of electrical/optical/mechanical devices
- Published research articles in Advanced Materials, ACS Nano, Nature Communication

Research Topics