KAIST
Department of Materials Science and Engineering

Faculty & Research Labs

2020

KAIST
Department of Materials Science and Engineering

Striving to lead and innovate for the future.

CONTENTS

Welcome to Our Department 06

Department Overview 08

- Materials Research and KAIST 08
- Mission and Vision of KAIST 09
- Mission and Vision of KAIST DMSE 10
- Current Reputation 11
- KAIST DMSE in Numbers 12

Research 13

- Vision and Strategy 13
- Research Overview 14
- Faculty Members and Laboratories 15
- Research Centers 76

Education 77

- Vision and Strategy 77
- Curriculum 78
- Care and Support System 80
- Career Paths 82

Collaboration and Outreach 84

- International Collaboration 84
- K-Materials YouTube Channel 87

Administration and Contacts 88

- Administrative Staff Members 88
- Campus Map 89

Welcome to Our Department

Since its founding in 1971, KAIST has been dedicated to fostering outstanding talent in science and engineering and to developing science and technology that can contribute to creating a better country and world. As a result of this dedication, KAIST has risen as Korea's number one research-oriented science and engineering university.

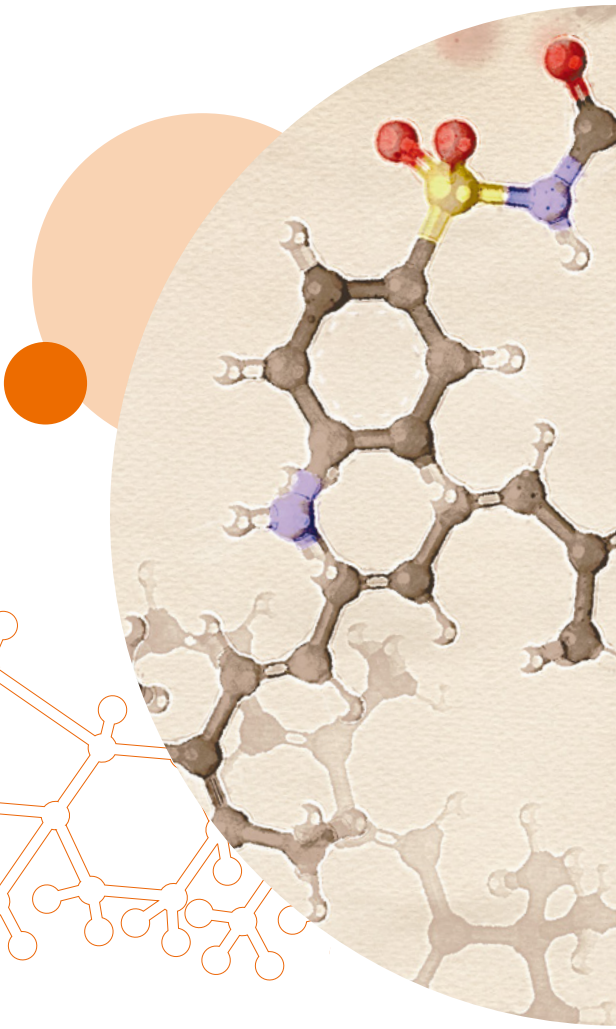
The QS World University Rankings recently ranked our department 13th in the world in materials science, which is historically the highest ranking among all engineering disciplines at all universities in Korea. This provides further evidence that the Department of Materials Science and Engineering KAIST is at the forefront of global materials research and education.

In response to the rapidly changing global educational environment, we have created the “Vision 2031” plan. We firmly believe that with Vision 2031, our department will lead science and technology development in Korea in the 21st Century and beyond.

Thank you for your interest in the Department of Materials Science and Engineering, KAIST.

Department Head,
Sang-Hee Park

“Striving to lead and innovate for the future”



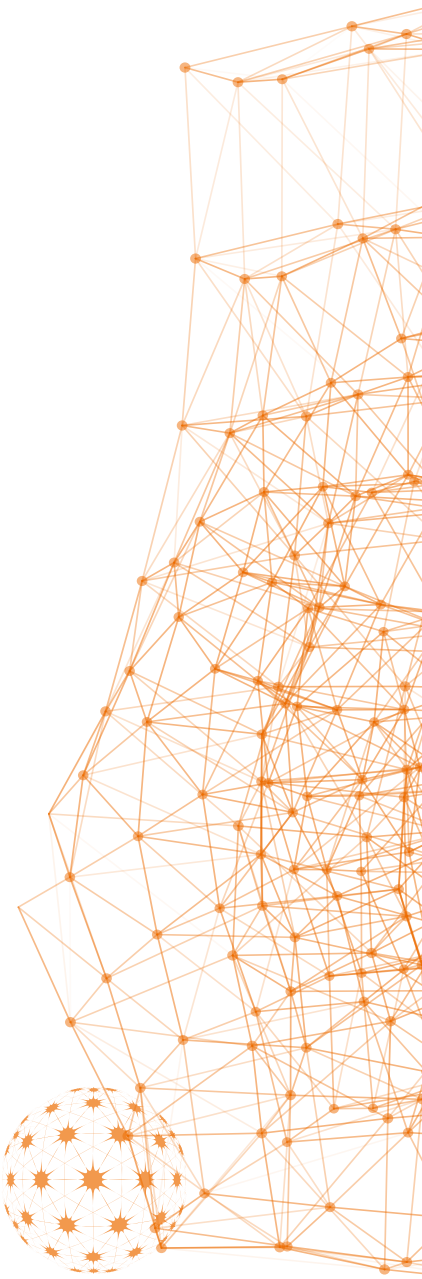
Department Overview

Materials Research and KAIST

The core of materials science and engineering (MSE) is the understanding of how materials' structure and chemical make-up at the micro-, nano-, and atomic scale are related to their properties such as electrical, optical, mechanical, magnetic, and thermal behavior. Utilizing such relationships, new compounds, phases, micro- and nano- structures, and devices with novel properties, high performance, and tuned functionalities are made.

Our goal is to apply these new materials to various applications such as semiconductors, displays, energy materials, sensors, structural materials, and biomaterials. MSE also develops economical and efficient synthesis and production methods for manufacturing.

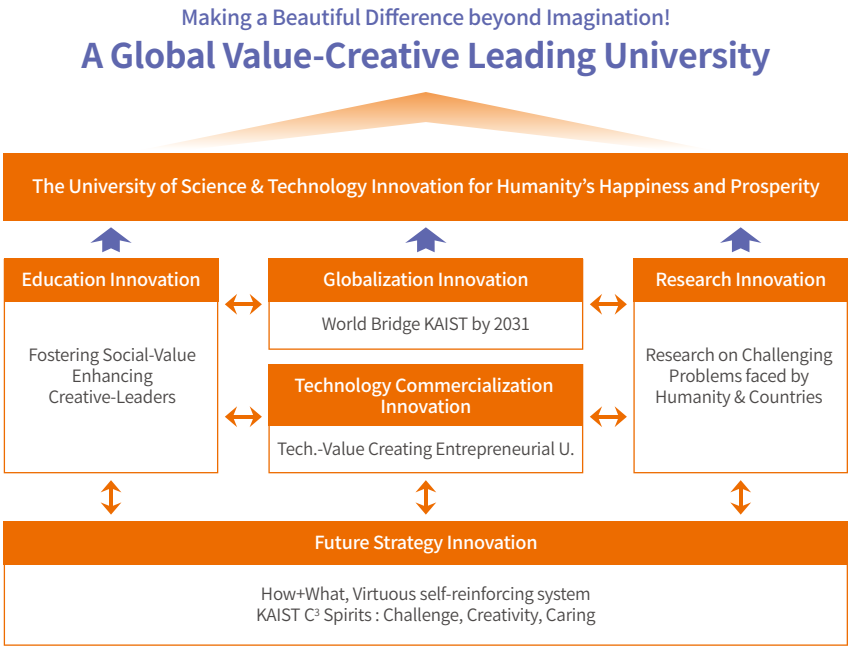
In the coming era of globalization, our department will continue to strive towards internationalization and interdisciplinary research and education. MSE will continue to contribute to the rapidly changing world that constantly requires innovation and breakthroughs. It is a field of continuous growth and expansion, and one of the most exciting and challenging fields in engineering.



Mission and Vision of KAIST

The Korean government established KAIS (the original name of KAIST) in 1971 as the first research-oriented science and engineering graduate school in Korea, with a clear and focused mission of national economic growth through innovation in science and technology. With an almost 200-fold increase in gross domestic product in less than 50 years, the Republic of Korea has risen to become the 11th largest economy in the world, and KAIST alumnae are continuing to transform many sectors of industry.

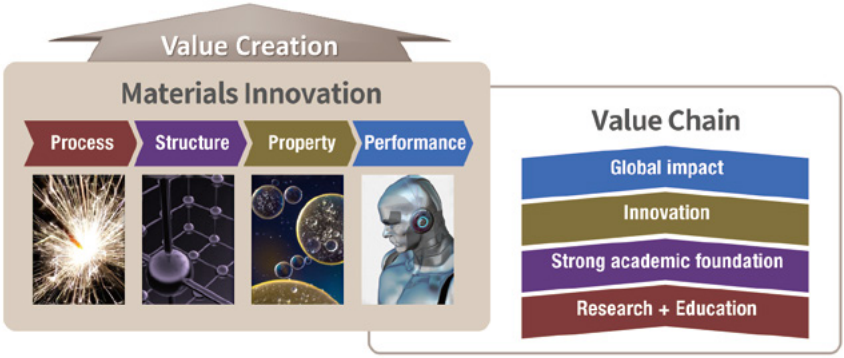
In the new era, KAIST's mission has broadened: KAIST will educate, research, and lead in innovations to serve the happiness and prosperity of humanity. KAIST will foster talents who exhibit creativity, embrace challenges, and possess caring minds in creating knowledge and translating it into transformative innovation.



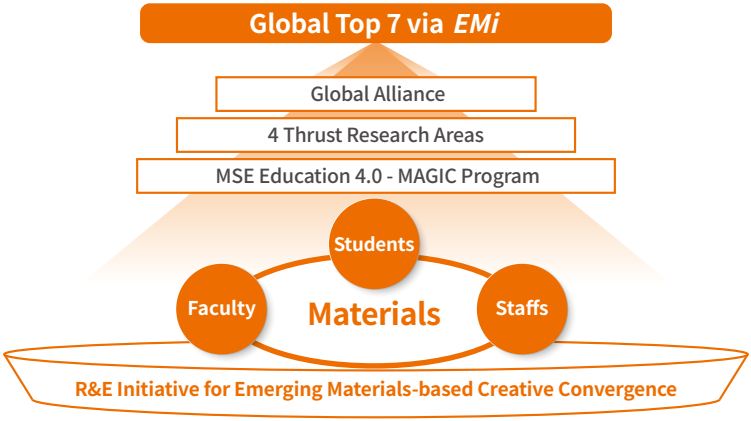
Mission and Vision of KAIST DMSE

"Striving to lead and innovate for the future"

Members of the Department of Materials Science and Engineering in KAIST endeavor to create value for our society through innovation in materials. To fulfill this mission, we continuously enhance our research and education framework so that innovations with global impact can flourish on a rich and firm academic foundation.



We envision becoming one of the global top seven MSE departments through our renovation in education framework, focused thrust in four research areas, and active global alliances.



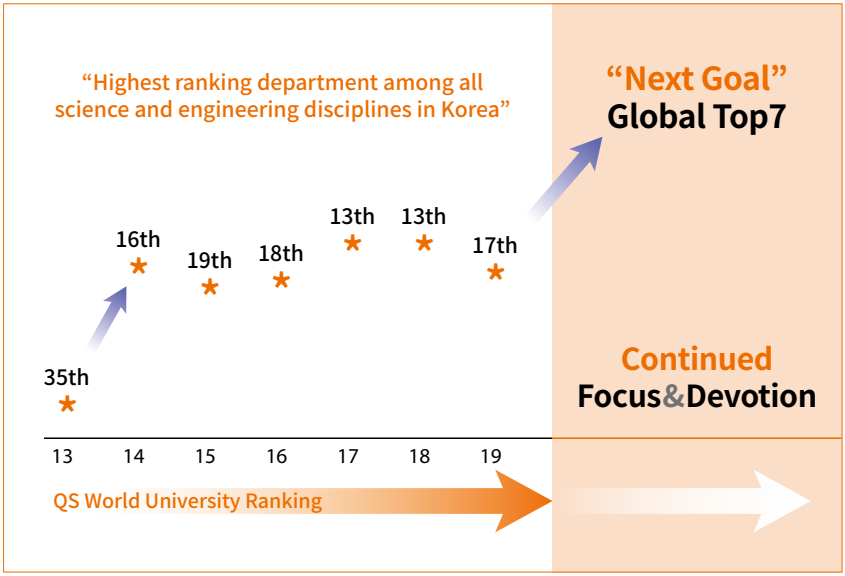
**EMi: Emerging Materials Initiative, MAGIC: Materials/Academics/Globalization/Industries/Collaborations*

Current Reputation

Despite its short histroy, KAIST is highly acclaimed in both acdemia and industry.

THOMSON REUTERS	Most Innovative Universities in Asia 2016~2018: 1st World's Most Innovative Universities 2018: 11th
nature INDEX	Leading research institutions in 2020: 79th Top Young Universities in the World 2019: 4th
QS	World University Rankings 2018: 40th

KAIST DMSE was the first department in all universities in Korea to become one of global top 20 in science and engineering subject areas and has been the highest-ranking department since then (*QS Ranking by Subject).



KAIST DMSE in Numbers (as of August 31, 2020)

Current Members

Faculty & Staff

Professor	Emeritus Professor	Research Professor	Researcher	Staff	Total
31	16	3	28	29	**107**

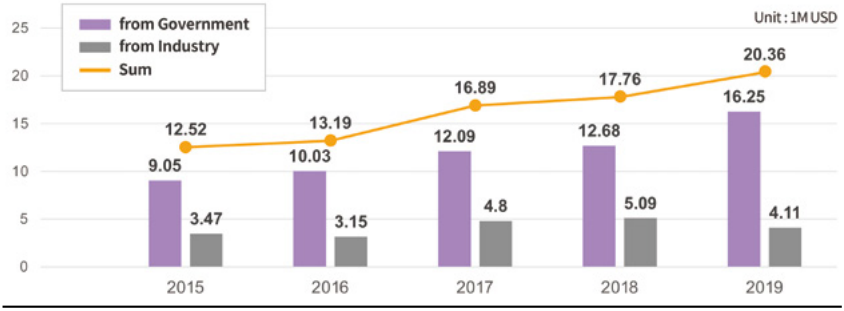
Students

BS	MS	MS-Ph.D. Integrated Program	Ph.D.	Total
171	128	24	225	**548**

Research Activities

Year	2017	2018	2019
Number of Professors	27	29	26
Number of Research Projects	178	196	206
Total Research Funding	KRW 20.05 billion (USD 16.89 million)	KRW 21.10 billion (USD 17.76 million)	KRW 24.17 billion (USD 20.36 million)
Avg. Funding per Professor	KRW 742 million (USD 0.62 million)	KRW 727 million (USD 0.61 million)	KRW 929 million (USD 0.78 million)
Papers Published in SCIE Journals	223	251	239
Avg. Number of Papers per Professor	8.259	8.655	9.192
Avg. Impact Factor per Paper (Main-author papers only)	7.103	9.800	9.185

R&D Funding Variation of KAIST, DMSE



Research

Vision and Strategy

We identified four focused research areas based on current and prospective global issues and core strengths of our department: healthcare, energy & environment, artificial intelligence, and defense (**HEAD**). We aim to become a global hub for pioneering research with global impact in these areas. Towards this goal, we are adopting a "quality-first" policy on research management and evaluation, and motivate our faculty members, research staffs, and students through various forms of incentives.

We are actively participating in broad spectrum of projects. On one side, with Global Singularity Projects we are focusing on spearheading academic discovery; on the other, with End-Run Projects we are facilitating commercialization-targeted research. Strategic global alliances with top institutes as well as close collaboration with industry are also keenly pursued and serve as keys to achieving our vision.

Research Overview

HEAD Research Areas and Faculty

Become a global leader in HEAD sectors

Healthcare

- Optical detectors
- Biomarker/diagnostic materials /devices
- POC type diagnostic devices
- Optical therapy equipment

Energy/Environment

- Next generation secondary battery
- Artificial photosynthesis
- Solar energy hydrogen power
- Environmentally friendly materials
- Particulate matter

H E A D

Artificial Intelligence

- AI/big data based materials design
- Next-generation semiconductors /display materials/processes/devices
- Wearable/portable materials/devices

National Defense

- Groundbreaking metal materials
- Early warning sensor
- Metamaterial-based devices
- Multifunctional composite materials

Faculty Members and Laboratories

Faculty	Laboratory	P
Bae, Byeong-Soo	Lab. of Optical Materials & Coating (LOMC)	16
Chang, Jae-Byum	Molecular Bioimaging and Molecular Biomimetics Lab.	18
Cho, EunAe	Energy Conversion & Storage Materials Lab. (ECSM)	20
Choi, Pyuck-Pa	Nanostructured Materials & Advanced Characterizations Lab.	22
Chung, Sung-Yoon	Atomic-Scale Defects Research Lab	24
Han, Seung Min Jane	NanoMechanics Lab.	26
Hong, Seungbum	Materials Imaging & Integration Lab.	28
Jeon, Seokwoo	Flexible Devices & Metamaterials Lab.	30
Jung, WooChul	Sustainable Energy Materials Laboratory	32
Jung, Yeon Sik	Functional Nanotechnology Laboratory	34
Kang, Jeung Ku	Nano Materials Simulation & Fabrication Lab.	36
Kang, Jiheong	Dynamic Materials Design Laboratory	38
Kang, Kibum	Nano and 2D Materials Laboratory	40
Kim, Do Kyung	Nano Ceramics Research Lab	42
Kim, Il-Doo	Advanced Nanomaterials and Energy Lab.	44
Kim, Kyung Min	Future Semiconductor Technology Lab	46
Kim, Sang Ouk	Soft Nanomaterials Lab	48
Lee, Hyuck Mo	Computational Materials Science Laboratory	50
Lee, Keon Jae	Flexible and Nanobio Device Lab	52
Nam, Yoon Sung	Nano-Bio Interface Laboratory	54
Oh, Jihun	Laboratory for Energy and Sustainability (LENS)	56
Paik, Kyung-Wook	Nano Packaging & Interconnect Lab.	58
Park, Byong-Guk	Nano Spintronics Laboratory	60
Park, Chan Beum	Advanced Biomaterials Laboratory	62
Park, Sang-Hee	Soft & Smart Materials & Devices Laboratory	64
Park, Steve	Organic and Nano Electronics Laboratory	66
Shin, Byungha	Energy Materials Lab	68
Shin, Jonghwa	Advanced Photonic Materials and Devices Lab	70
Yeom, Jihyeon	PLatforms Utilizing nano-Structure Lab (PLUS Lab)	72
Yuk, Jong Min	Emerging Materials and Electron Microscopy lab.	74

Bae, Byeong-Soo

Lab
Lab. of Optical Materials & Coating (LOMC)

Website
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Education
Ph.D., Univ. of Arizona (1993)

Research Interests
Sol-gel hybrid materials, Display materials, Coating

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Biography

Prof. Bae received his Ph. D. in Materials Engineering from University of Arizona, USA in 1993. Since joining KAIST in 1994, his lab has been working on sol-gel processed materials for display and opto-electronic applications. He has developed functional coatings, micro-optical devices, oxide TFT devices, LED encapsulant, flexible opto-electronics platform, and wavelength converter technologies using sol-gel process and materials. He founded a spin-off company, Solip Tech. Co. Ltd. to commercialize his R&D achievements of siloxane hybrid materials and has been a CEO. Currently, he is a Director of Wearable Platform Materials Technology Center in KAIST. He has won awards including the Korea Technology Grand Award and Woongbi Order of Science and Technology Merit.

Publications and Patents

- B.-S. Bae *et al*., "Optically Transparent Multiscale Composite Films for Flexible and Wearable Electronics", *Adv. Mater.* , 1907143 (2020).
- B.-S. Bae *et al*., "Flexible Hard Coating: Glass-Like Wear Resistant, Yet Plastic-Like Compliant, Transparent Protective Coating for Foldable Display", *Adv. Mater.* , 29, 1700205 (2017).
- B.-S. Bae *et al*., "Quantum Dot/Siloxane Composite Film Exceptionally Stable against Oxidation under Heat and Moisture", *J. Am. Chem. Soc.* , 138, 16478 (2016)
- B.-S. Bae *et al*., "Chitin Nanofiber Transparent Paper for Flexible Green Electronics", *Adv. Mater*., 28, 5169 (2016).
- B.-S. Bae *et al*., "High-Performance Hybrid Plastic Films: a Robust Electrode Platform for Thin-Film Optoelectronics", *Energy & Environ. Sci.* , 6, 1881 (2013).
- B.-S. Bae *et al*., "Rollable Transparent Glass-Fabric Reinforced Composite Substrate for Flexible Devices", *Adv. Mater.* , 22, 4510 (2010).

Lab. of Optical Materials & Coating (LOMC)

Principal Investigator
Bae, Byeong-Soo

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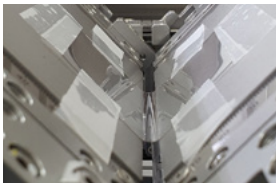
Youtube
https://www.youtube.com/watch?v=tQuuR9HjYHQ

Current Research Topics

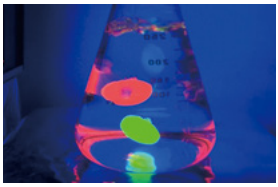
- Design and fabrication of sol-gel siloxane hybrid materials for displays, optics and electronics
- Flexible/stretchable display platform (substrate, electrode, cover) materials
- Wavelength converter technology of quantum dot siloxane materials for display and sensor applications (coating, photolithography, ink-jet printing)
- Low dielectric constant and loss siloxane material for 5G communication and high-speed display
- Wearable (stretchable) biosensor devices

Research Highlights

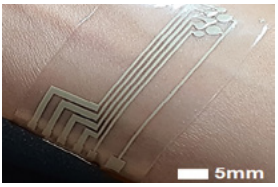
Sol-gel synthesized siloxane hybrid materials (Hybrimers) are newly developed unique optical material to replace currently used optical glass and plastics. Using the Hybrimer technologies, we have developed and commercialized optical waveguide devices, flexible display substrate and cover film, transparent conducting film, LED encapsulant, quantum dot siloxane phosphor printing, 5G communication low-k materials. We are also developing wearble biosensor devices based on Hybrimer material platform.



Foldable hard coating film



Quantum dot siloxane



Wearable biosensor

Core Facilities

FT-IR spectroscopy, MOCON, DSC, TGA, TMA, 3D confocal microscopy, CO_2 Laser cutter, UTM, Plasma cleaner, ALD, Folding tester, DIC analyzer, UV curing chamber

Chang, Jae-Byum

Lab
Molecular Bioimaging and Molecular Biomimetics Lab.

Website
http://sites.google.com/site/jbchang03

Education
Ph.D., MIT (2014)

Research Interests
Brain imaging, Super-resolution, Molecular biomimetics

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Rm. 2404, W1-1

Biography

Prof. Chang received his Ph.D. in materials science and engineering from MIT in 2014. He then worked at MIT Media lab as a postdoc with Prof. Ed Boyden and developed a new brain imaging tool. After working at Sungkyunkwan University for 3 years as an assistant professor, he joined DMSE as a faculty member in 2018. His lab (Molecular Bioimaging and Molecular Biomimetics Lab) is focusing on two topics: super-resolution molecular imaging of biological systems, and nanoscale synthesis of functional materials by mimicking the structures and molecular arrangements of biological systems. His lab is working at the boundary between biological science/medicine and materials science.

Publications and Patents

- K.B. Min *et al*., "Multiplexed expansion microscopy of the brain through fluorophore screening," *Methods* (2019).
- J.-B. Chang *et al*., "Iterative expansion microscopy," *Nat. Methods* 14, 593 (2017).
- J.-B. Chang *et al*., "The orientations of large aspect-ratio coiled-coil proteins attached to gold nanoparticles," *Small* 12, 1498 (2016).
- J.-B. Chang *et al*., "Design rules for self-assembled block copolymer patterns using tiled templates," *Nat. Commun*. 5, 3305 (2014).
- J.-B. Chang *et al*., "Aligned sub-10-nm block copolymer patterns templated by post arrays," *ACS Nano* 6, 2071 (2012).
- E.S. Boyden *et al*., *Iterative expansion microscopy*, US 20160305856A1 (2016).
- J.-B. Chang *et al*., Standard topographical arrangements for template regions that orient self-assembly, US 8966411B2 (2013).

Molecular Bioimaging and Molecular Biomimetics Lab.

Principal Investigator
Chang, Jae-Byum

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Current Research Topics

- Super-resolution molecular imaging
- 2-D, 3-D hydrogel fabrication
- Bio-templated material growth
- Nanoscale material growth

Research Highlights

Our laboratory combines biology and materials science to conduct multidisciplinary studies, including:

1. Super-resolution molecular imaging: We develop new molecular imaging techniques for brain science and cancer research by using hydrogels.
2. 2D, 3D hydrogel fabrication: We develop new hydrogel fabrication techniques to make hydrogels with better functionalities for tissue engineering and soft robotics.
3. Bio-templated material growth: We use complex biological systems, such as whole animal organs, as templates to synthesize more functional materials.
4. Nanoscale material growth: We develop new material synthesis techniques to make more complex materials by growing materials inside functional hydrogels.

We are making breakthroughs in various fields by working at the intersections of hydrogels, biological systems, fabrication, and material growth.

Core Facilities

Spinning disk confocal microscopy

Cho, EunAe

Lab
Energy Conversion & Storage Materials Lab. (ECSM)

Website
http://ecsm.kaist.ac.kr/

Education
Ph.D., KAIST (2002)

Research Interests
Fuel Cell, Water Electrolysis, Battery

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Biography

Prof. Cho received her Ph. D. in MSE from KAIST in 2002. After working in fuel cell research center at Korea Institute of Science and Technology (KIST), she joined DMSE as a faculty member in 2014. Her lab (Energy Conversion & Storage Materials Lab) is focusing on developing electrode materials for fuel cells, water electrolysis and Li-ion batteries. Her contributions to the field have been acknowledged by Leading Scientist Award of Emerging 100 Technologies (2013), Fuel Cell Research Award (2018) and Minister of Science and ICT's Award (2018). She is a prolific inventor with 110 domestic and 31 international patents and has published 124 peer-reviewed papers. She has served as an AFC-IA Annex 31 representative of International Energy Agency (IEA) since 2012.

Publications and Patents

- E.A. Cho *et al*., "Stabilizing role of Mo in TiO_2-MoO_x supported Ir catalyst toward oxygen evolution reaction", *Applied Catalysis B : Environmental*, 280, 119433 (2021)
- E.A. Cho *et al*., "Key functional groups defining the formation of Si anode solid-electrolyte interphase towards high energy density Li-ion batteries", *Energy Storage Materials*, 25, 764-781 (2020).
- E.A. Cho *et al*., "Method of manufacturing nanocatalyst for fuel cell electrode", US 20190044154 A1 (2019).
- E.A. Cho *et al*., "Ga-doped Pt-Ni Octahedral Nanoparticles as a Highly Active and Durable Electrocatalyst for Oxygen Reduction Reaction", *Nano Letters*, 18(4), 2450-2458 (2018).
- E.A. Cho *et al*., "Promotion of electrochemical oxygen evolution reaction by chemical coupling of cobalt to molybdenum carbide", *Applied Catalyst B: Environmental*, 227, 340-348 (2018).

Energy Conversion & Storage Materials Lab. (ECSM)

Principal Investigator
Cho, EunAe

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ECSM Lab.

Current Research Topics

- Development Pt based or Non – PGM catalyst for PEMFC.
- Designing catalyst for water electrolysis.
- Anode & Cathode materials for lithium ion battery, Li-S battery and Na-ion battery.

Research Highlights

1. **Fuel cell** is an eco-friendly energy device which converts chemical energy of fuels to electricity by electrochemical reactions, but high fabrication cost is a problem. So we are focusing on development of ultralow-Pt and non-precious catalyst for PEMFC by controlling nanostructure of the catalysts based on understanding of the ORR and HOR.

2. **Water electrolysis** can be applied in energy storage system connected with renewable energy, but highly-active and long-term durable catalyst is required. We are designing desirable catalyst.

3. **Rechargeable battery** is a environmentally-friendly electrochemical energy storage device. With ever-increasing demands for high energy density, we synthesize new cathode and anode materials to meet those requirements with mechanistic studies and perform electrochemical analysis.

Core Facilities

fuel cell test station, potentiostat, battery cycler, polisher, glove box, electrospinning machine, 3-zone furnace

Choi, Pyuck-Pa

Lab
Nanostructured Materials and Advanced Characterization Laboratory

Website
http://nmac.kaist.ac.kr/

Education
Ph.D., Univ. of Goettingen (2003)

Research Interests
Structural materials, Alloys, Nano-characterization

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Biography

Prof. Choi obtained his Ph.D degree in Physics in 2003 from the University of Göttingen. After working as a postdoctoral researcher at the University of Ulsan until June 2006, he moved to the Korea Institute of Science and Technology to work as a senior research scientist until April 2009. In 2009 he accepted a group leader position at the Max-Planck-Institut für Eisenforschung in Düsseldorf to become the head of the "Atom Probe Tomography research group", which he led until January 2016. In February 2016, he was appointed as an associate professor at the MSE department at Korea Advanced Institute of Science and Technology. His research work focuses on (i) advanced materials characterization techniques (atom probe tomography), (ii) alloy design, (iii) structural materials, (iv) additive manufacturing. He has published more than 120 peer-reviewed papers in prestigious journals.

Publications and Patents

- W.S. Choi, P. Choi *et al*., "Effects of transformation-induced plasticity on the small-scale deformation behavior of sinigle crystalline complex concetrated alloys", *Scripta Mater*. 176, 122 (2020)
- C. Jung, P. Choi *et al*., "Effects of phase composition and elemental partitioning on soft magnetic properties of AlFeCoCrMn high entropy alloys", *Acta Mater*. 171, 31 (2019)
- H. Im, P. Choi *et al*., "Elemental partitioning and site-occupancy in γ/γ' forming Co-Ti-Mo and Co-Ti-Cr alloys", *Scripta Mater*. 154, 159 (2018)

Nanostructured Materials & Advanced Characterizations Lab.

Principal Investigator
Choi, Pyuck-Pa

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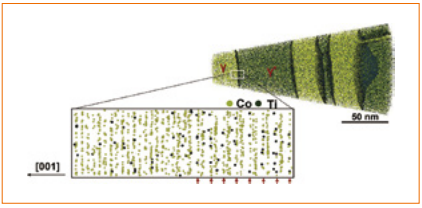
Current Research Topics

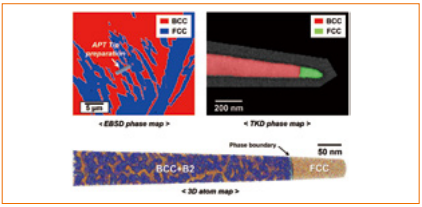
- Advanced Characterization of Metallic Nanostructure (APT, TEM)
- Engineering Alloys & Process Design (Co, Ni)
- Additive Manufacturing of Alloys

Research Highlights

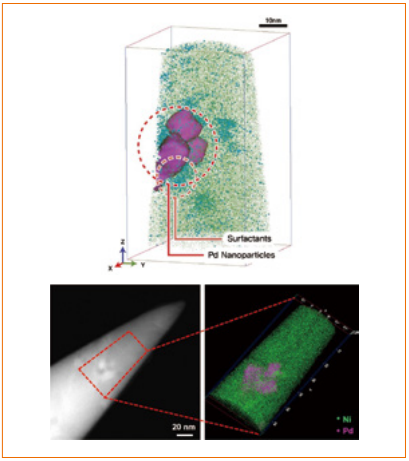
Co-Ti-Mo superalloy



High entropy soft magnetic alloy



APT/TEM analysis of nanoparticles



Core Facilities

Access to LEAP 4000X HR 3D Atom Probe & IVAS 3.8 Software, Insstek MX-Mini Metal 3D Printer, Arc-melting furnace, Electropolishing specimen preparation system

Chung, Sung-Yoon

Lab
Atomic-Scale Defects Research Lab

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Education
Ph.D., KAIST (2001)

Research Interests
Energy materials, STEM analysis, Materials physics

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Biography

Prof. Chung received his Ph. D. in materials science and engineering from KAIST in 2001. After working at MIT as a post-doc researcher (2001-2003) and at Inha University as a faculty member, he moved to KAIST in 2012 and established the Atomic-Scale Defects Research Laboratory in-depth convergence research of energy materials. To understand the critical correlation between lattice defects and resulting physical properties of oxides, he has been carrying out DFT quantum-mechanical calculations in addition to atomic-scale analysis through STEM. He was a key contributor to success of "A123Systems" for high-power nanophosphates.

Publications and Patents

- S.-Y. Chung *et al*., "Strong Nonlinear Current-Voltage Behaviour in Perovskite-Derivative Calcium Copper Titanate," *Nat. Mater*. 3, 774 (2004).
- S.-Y. Chung *et al*., "Multiphase Transformation and Ostwald's Rule of Stages during Crystallization of a Metal Phosphate," *Nat. Phys*. 5, 68 (2009).
- S.-Y. Chung *et al*., "Quadruple-Junction Lattice Coherency and Phase Separation in a Binary-Phase System," *Nat. Commun*. 6, 8252 (2015).
- H.-I. Yoon *et al*., "Probing Dopant Segregation in Distinct Cation Sites at Perovskite Oxide Polycrystal Interfaces," *Nat. Commun*. 8, 1417 (2017).
- J. Bak *et al*., "Atomic-Scale Perturbation of Oxygen Octahedra via Surface Ion Exchange in Perovskite Nickelates Boosts Water Oxidation," *Nat. Commun*. 10, 2713 (2019).

Atomic-Scale Defects Research Lab

Principal Investigator
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Current Research Topics

- Atomic-scale probing of lattice defects in energy materials
- Elucidation of defect-property relationship in electrocatalysts
- Materials with high safety and power for rechargeable batteries
- Nanostructure control at crystal surface and interface

Research Highlights

- C. W. Song, J. Lim, H. B. Bae, and S.-Y. Chung*, "Discovery of Crystal Structure-Stability Correlation in Iridates for Oxygen Evolution Electrocatalysis in Acid," *Energy & Environmental Science* (DOI: 10.1039/d0ee01389g) (2020).
- J. Bak, H. B. Bae, and S.-Y. Chung*, "Atomic-Scale Perturbation of Oxygen Octahedra via Surface Ion Exchange in Perovskite Nickelates Boosts Water Oxidation," *Nature Communications* 10, 2713 (2019).
- Y. Heo, S. Choi, J. Bak, H.-S. Kim, H. B. Bae, and S.-Y. Chung*, "Symmetry-Broken Atom Configurations at Grain Boundaries and Oxygen Evolution Electrocatalysis in Perovskite Oxides," *Advanced Energy Materials* 8, 1802481 (2018)
- H.-I. Yoon, D.-K. Lee, H. B. Bae, G.-Y. Jo, H.-S. Chung, J.-G. Kim, S.-J. L. Kang and S.-Y. Chung*, "Probing Dopant Segregation in Distinct Cation Sites at Perovskite Oxide Polycrystal Interfaces," *Nature Communications* 8, 1417 (2017).

Core Facilities

Precision ion polishing system, High frequency (Giga Hertz) impedance analyzer, Multi potentiostat/galvanostat with EIS, Cold isostatic pressing machine

Han, Seung Min Jane

Lab
NanoMechanics Lab.

Website
http://nanomech.kaist.ac.kr/

Education
Ph.D., Stanford Univ. (2006)

Research Interests
Mechanical Behavior of Nanoscale Materials

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Biography

Prof. Han received her Ph.D. in Materials Science and Engineering from Stanford University in 2006. After working at Stanford University as an acting assistant professor, she joined KAIST in 2010 as an assistant professor. Her research group focuses on the understanding of the mechanical behavior of materials at the nanoscale with the emphasis on the development of composites for high strength, light weight structural applications as well as for energy device applications with enhanced reliability. Her contributions to the field have been acknowledged by Young Investigator Award (2015) from the Korean Institute of Metals and Materials and election to the membership of Young Korean Academy of Science and Technology (2020). Prof. Han also contributed to Materials Research Society as a MRS Bulletin organizer and 2021 Spring Meeting Chair.

Publications and Patents

- Y.B. Kim *et al*., "Strengthening Effect of a Single Atomic Layer Graphene in Metal-Graphene Nanolayered Composite," *Nat. Comm*. 4, 2114 (2013).
- B.I. Hwang *et al*., "Role of Graphene in Reducing Fatigue Damage in Cu/Gr Nanolayered Composite," *Nano Lett*. 17, 4740 (2017).
- D.H. Kim *et al*., "Conversion Reaction of Nanoporous ZnO for Stable Electrochemical Cycling of Binderless Si Microparticle Composite Anode," *ACS Nano* 12, 10903 (2018).
- C.G. Ahn *et al*., "Multifunctional Polymer Nanocomposites Reinforced by 3D Continuous Ceramic Nanofillers" *ACS Nano* 12, 9126 (2018).
- S.M. Han *et al*., "*Flexible Display Panel*", US14806566 (2015)

NanoMechanics Lab.

Principal Investigator
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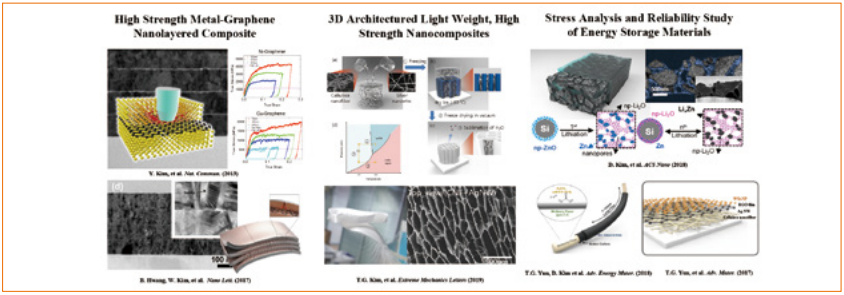
Current Research Topics

- High Strength Metal-Graphene Nanolayered Composites
- 3D Architectured Light Weight, High Strength Nanocomposites
- Stress Analysis and Reliability Study of Energy Storage Materials

Research Highlights

The main focus of our research is on the understanding of the mechanical behavior of materials at the nanoscale with emphasis on the nanostructures applied to various energy materials. Representative contributions include development of high strength, fatigue tolerant metal-graphene nanolayered composites, ultra lightweight, architectured 3D nanocomposites, and analysis of mechanics of energy storage materials.



Core Facilities

Hysitron Ti750 Nanoindenter, Hysitron PI-95 In-situ SEM-Pico Indenter, Nanomechanics i-Micro Nanoindenter, In-situ Bending Fatigue Tester, Olympus Optical Microscope Eclipse LV100ND Machine, KVT Sputter Deposition System, Operon Freeze Dryer, KVR Rapid Thermal Annealing.

Hong, Seungbum

Lab
Materials Imaging & Integration Lab.

Website
http://mii.kaist.ac.kr/

Education
Ph.D., KAIST (2000)

Research Interests
Materials Imaging, Machine Learning , Atomic Force Microscopy

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Biography

Prof. Hong received his Ph. D. in Materials Science and Engineering from KAIST in 2000. He joined DMSE as a faculty member in 2017. His prior career includes post-doctoral fellowship at EPFL (2000-2001), project leader at Samsung Advanced Institute of Technology (2000-2007) and tenured staff scientist at Argonne National Laboratory (2007-2017). His work focuses on understanding "structure-property relationship" via materials imaging & machine learning, and on innovating "materials design" via materials integration. His recognition includes Frontier Awards from Samsung (2007), Young Investigator Outstanding Achievement Award from ISIF (2008), Frontier Scientist from KAST (2014) and Grand Prize of Excellence in Learning and Teaching from KAIST (2020).

Publications and Patents

- S. Hong *et al*., "Principle of Ferroelectric Domain Imaging using Atomic Force Microscope," *J. Appl. Phys.* 89, 1377-1386 (2001).
- S. Hong *et al*., "Charge gradient microscopy," *Proc. Natl. Acad. Sci. USA* 111, 6566 – 6569 (2014)
- S. Hong *et al*., "Screening Mechanisms at Polar Oxide Heterointerfaces," *Reports on Progress in Physics* 79, 076501 (2016).
- J. Ryu *et al*., "Intrinsically stretchable multi-functional fiber with energy harvesting and strain sensing capability," *Nano Energy* 57, 911 -923 (2019).
- S. Hong *et al*., *"Apparatus and Method for Constructing Library for Deriving Material Composition,"* US 16/719,547, EP 19218126.1 (2019).

Materials Imaging & Integration Lab.

Principal Investigator
Hong, Seungbum

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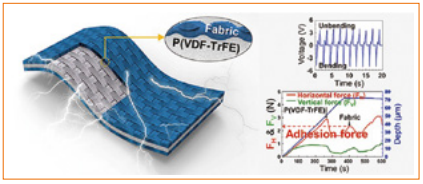
MII
Materials Imaging & Integration

Current Research Topics

- Fast and reliable characterization of piezo/ferroelectric materials and device applications
- Visualization of electrochemical properties and phenomena in battery materials
- Multi-structure Ferroelectric Materials and Integration
- Applications for Electroactive Polymer Films and Piezoelectric Driven Osteoconduction

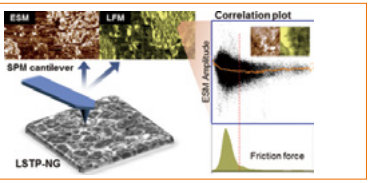
Research Highlights

Energy Harvesting



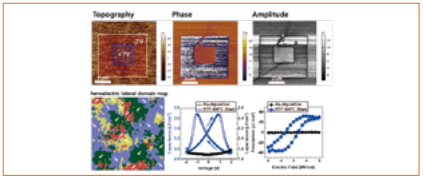
J. Kim et al., Nano Energy (2020)

Visualization of ionic Behavior



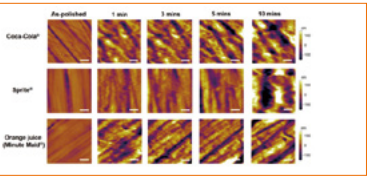
H. Kim et al., ACS Appl. Energy Mater. (2020)

Ferroelectric Oxide



F2Cπ2 2019 Conference (ISAF-EMF-ICE-IWPM-PFM)

AFM Analysis of Teeth



P. Li, C. Oh et al., J. Mech. Behavior. Biomed. Mater. (2020)

Core Facilities

Asylum Research / Cypher ES AFM System, Asylum MFP 3D, Clean bench, Glove box.

Jeon, Seokwoo

Lab
Flexible Devices & Metamaterials Lab.

Website
http://fdml.kaist.ac.kr

Education
Ph.D., UIUC (2006)

Research Interests
Non-oxidized graphene flake, CVD graphene & composites, 3D nanostructured materials

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Biography

Prof. Jeon received his Ph. D. in materials science and engineering from Univ. of Illinois at Urbana-Champaign in 2006. After his postdoctoral position at Columbia University, he joined DMSE as a faculty member in 2008. His lab (Flexible Devices & Metamaterials Lab) is focusing on synthesis and applications of low-dimensional materials (graphene, CNT, and 2D materials), fabrication of 3D nanostructures, and their applications. He received 'Early Career Scientist Award' by Korea Academy of Science and Technology (2015) represented his academic and honors. He has produced more than 155 publications and 95 patents in this research fields.

Publications and Patents

- G. Hyun *et al.*, "Hierarchically Porous Au Nanostructures with Interconnected Channels for Efficient Mass Transport in Electrocatalytic CO2 Reduction," *Proc. Natl. Acad. Sci. USA*, Accepted (2020).
- M. Park *et al.*, "Efficient Solid-State Photoluminescence of Graphene Quantum Dots Embedded in Boron Oxynitride for AC-Electroluminescent Device," *Adv. Mater.* 30, 1802951 (2018).
- Y. Kim *et al.*, "Strengthening Effect of a Single Atomic Layer Graphene in Metal-Graphene Nanolayered Composite," *Nat. Commun.* 4, 2114 (2013).
- J. Park *et al.*, "Three-dimensional nanonetworks for giant stretchability in dielectrics and conductors," *Nat. Commun.* 3, 916 (2012).

Flexible Devices & Metamaterials Lab.

Principal Investigator
Jeon, Seokwoo

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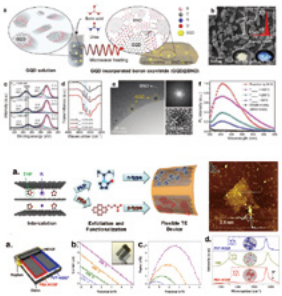
Current Research Topics

- Non-oxidized graphene flake & Graphene quantum dot
- Mobile-hot wire CVD graphene
- Fabrication of 3D nanostructures via Proximity-field nanopatterning and its applications (sensor, energy devices, mechanical reinforcement, etc)

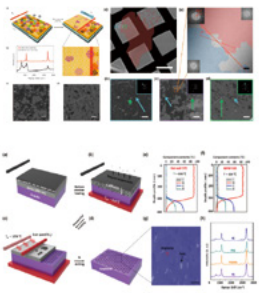
Research Highlights

Graphene Flakes



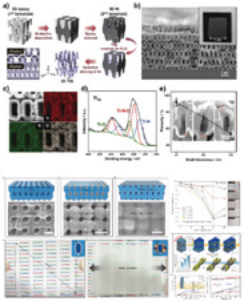
Development of flake based graphene forming methods and applications

CVD Graphene



CVD based carbon nanomaterials and 2D materials growth and applications

3D Nanostructured Materials



Fabrication of 3D functional nanostructures and their applications

Youtube: https://www.youtube.com/watch?v=Vt-lJwbnqk4&t=21s

Core Facilities

AFM-Raman measurement system, Scanning electron microscope for E-beam lithography, Fluorescence Spectrophotometer, Laser (355 nm, IR), STP Etcher, Atomic layer deposition, Multi-channel potentiostat

Jung, WooChul

Lab
Sustainable Energy Materials Laboratory

Website
http://seml.kaist.ac.kr

Education
Ph.D., MIT (2010)

Research Interests
Fuel cells, H2 reformers, Heterogeneous catalysts

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Biography

Prof. Jung received his Ph. D. in materials science and engineering at MIT in 2010. After working at Caltech as a postdoctoral fellow, he joined DMSE as a faculty member in 2013. His lab (Sustainable Energy Materials Lab) is focusing on developing emerging oxide-based catalysts for energy applications. His contributions to the field have been acknowledged by Young Scientist Award (2016, The Korean Institute of Metals and Materials), Songam Distinguished Research Award (2018, KAIST) and Minister's Commendation (2019, The Ministry of Science and ICT). He has served as an editor of Electronic Materials Letters (EML) and as an editorial board member for Materials Reports: Energy (MRE).

Publications and Patents

- W. Jung *et al.*, "A tailored oxide interface creates dense Pt single-atom catalysts with high catalytic activity," *Energy Environ. Sci.* accepted.
- W. Jung *et al.*, "Unravelling inherent electrocatalysis of mixed-conducting oxide activated by metal nanoparticle for fuel cell electrodes," *Nat. Nanotechnol*. 14, 245 (2019).
- W. Jung *et al.*, "In situ synthesis of supported metal nanocatalysts through heterogeneous doping," *Nat. Commun*. 9, 4829 (2018).
- W. Jung *et al.*, "Exceptionally enhanced electrode activity of $(Pr,Ce)O_{2-\delta}$-based cathodes for thin-film solid oxide fuel cells," *Adv. Energy Mater*. 8, 1703647 (2018).
- W. Jung *et al.*, "Enhanced oxygen exchange of perovskite oxide surfaces through strain-driven chemical stabilization," *Energy Environ. Sci.* 11, 71 (2018).

Sustainable Energy Materials Laboratory

Principal Investigator
Jung, WooChul

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SEML
Sustainable Energy Materials Laboratory

Current Research Topics

- H_2 & syngas production via water splitting and reforming process
- Electricity generation via ceramic fuel cells
- Design & synthesis of complex catalyst materials
- Investigation of interfacial reaction kinetics and pathways

Research Highlights

SEML is developing emerging materials for energy applications. More specifically, the main goal of our research activities is to understand the reactions that occur at the ***interfaces between ionic solids (oxides in particular) and gases*** and thereby to improve the reaction kinetics for high-temperature applications in chemical and electrochemical catalysis, such as solid oxide fuel cells, electrolyzers, and hydrocarbon reformers.

Our research focuses on (1) ***'how precisely to characterize the surfaces of ionic solids and their reactions with various gases,'*** and (2) ***'how to improve catalytic reactivity levels at the ionic solid surfaces.'*** In this regard, to understand the interface reaction mechanisms and identify the key descriptors governing the overall reaction rate, we have been actively developing model oxide structures with well-defined interface geometries and analyzing true surface properties and reaction characteristics using a variety of electronic, chemical, and electrochemical techniques.

Core Facilities

Pulsed Laser Deposition system, High Pressure Mass Spectroscopy, Gas Chromatography, Gas/Temperature controlled Furnace Systems, Impedance Spectroscope, Atomic Layer Deposition System

Jung, Yeon Sik

Lab
Functional Nanotechnology Laboratory

Website
http://funnano.kaist.ac.kr

Education
Ph.D., MIT (2009)

Research Interests
Self-Assembly, Nano-Printing, 3D Nanostructuring & Devices

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Office
Rm. 1404, W1-1

Biography

Prof. Jung is a full professor at the Dept. of Materials Science and Engineering of KAIST. His research area includes sub-10 nm nanofabrication based on directed self-assembly of block copolymers and nanotransfer-printing, printable sensor devices, nanopatterned catalysts, 2-dimensional nanostructures, and quantum-dot optoelectronic devices. He joined KAIST as an assistant professor in 2010, and has published more than 120 journal papers and earned more than 50 patents including 7 US patents mostly in the field of nanofabrication and devices. He received several awards including Minister's Award and Excellent Research Award from KAIST. He received his Ph.D. degree (2009) in materials science and engineering from MIT (Massachusetts Institute of Technology). Prior to joining KAIST, Prof. Jung was a post-doc fellow at Lawrence Berkeley National Laboratory (2009) and also worked for Samsung-Corning (2001-2003) and KIST (2003-2005).

Publications and Patents

- "Thermodynamic-Driven Polychromatic Quantum Dot Patterning for Light-Emitting Diodes Beyond Eye-Limiting Resolution", *Nature Communications* 11, 3040 (2020)
- "Fabrication and Applications of 3D Nanoarchitectures for Advanced Electrocatalysts and Sensors", *Advanced Materials* 1907500 (2020)
- "Carboxylic Acid-Functionalized, Graphitic Layer-Coated Three-Dimensional SERS Substrate for Label-Free Analysis of Alzheimer's Disease Biomarkers" *Nano Letters* 20 2576-2584 (2020)
- "Cascade Surface Modification of Colloidal Quantum Dot Inks Enables Efficient Bulk Homojunction Photovoltaics", *Nature Communications* 11, 103 (2020)
- "Thermally assisted nanotransfer printing with sub–20-nm resolution and 8-inch wafer scalability", *Science Advances* (in press, 2020)

Functional Nanotechnology Laboratory

Principal Investigator
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FUNNANO

Current Research Topics

- Sub-10 nm Self-assembly for Next-generation Nanomanufacturing
- Ultrahigh-resolution Transfer-Printing for 2D & 3D Materials
- Optical and Gas Sensors Based on Nanofabricated Materials
- Quantum Nanocomposites for Optoelectronic Applications

Research Highlights

Funnano Lab. is interested in enhancing device performances using novel nanotechnologies. Research is focused on self-assembly and printing of polymers, nanoparticles, and nanowires for the fabrication of 2D & 3D sub-10 nm nanoarchitectures. Our nanofabrication technology aims for high levels of precision, reliability, and reproducibility suitable for large-scale manufacturing of high-performance devices. Our sub-10 nm nanoarchitectures can be potentially applied to energy storage & conversion, optoelectronics, and molecular sensors. For example, printing-based fabrication technology of ultrahigh-resolution quantum dot patterns was recently published in *Nature Communications*.

Core Facilities

6-inch ICP-RIE, Glove box with thermal evaporator, Micro-probe characterization system, in situ Reflectometry, Clean room

Kang, Jeung Ku

Lab
Nano Materials Simulation & Fabrication Lab.

Website
http://nanosf.kaist.ac.kr

Education
Ph.D., Stanford Univ. (2002)

Research Interests
Nanomaterials for Energy Storage and Conversion, In-situ Mapping Technique, Ab Initio Calculation Methods

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Biography

Prof. Kang obtained his Ph.D. degrees from Stanford University (2002.4). Also, he was a Postdoctoral Fellow at California Institute of Technology (Caltech, 2002) and joined as the KAIST faculty on January in 2003. In 2007, he was selected as the junior member for National Academy Science and became Di-rector for National Research Laboratory (NRL, 2007-2019). Also, he received the "young scientist award: from Korean President in 2008. At KAIST, he served as CFO (Chief Financial Officer), Dean of Budge and Planning Office, University Senate, and head at the Graduate School of EEWS (Energy, Environment, Water, and Sustainability). Prof. Kang was also appointed as a KAIST chair professor in 2011 and directors for WCU (World Class University, 2008-2013) and BK21+ (2013-2019). Since 2019, he is working as an affiliated professor at Caltech.

Publications and Patents

- J. K. Kang *et al.,* "Extra adsorption and adsorbate superlattice formation in metal-organic frameworks", *Nature* 527, 503 (2015).
- J. K. Kang *et al.,* "Nickel oxide encapsulated nitrogen-rich carbon hollow spheres with multiporosity for high-performance pseudocapacitors having extremely robust cycle life", *Energy & Environmental Science (Displayed as Front Cover)* 8, 188 (2015).
- J. K. Kang *et al.,* "Energy states of a core-shell metal oxide photocatalyst enabling visible light absorption along with efficient charge separation and its utilization to solar-to-fuel conversion of carbon dioxide", *Advanced Energy Materials (Displayed as Front Cover)* 8, 1702895 (2018).
- J. K. Kang *et al.,* "Isotherms of Individual Pores by Gas Adsorption Crystallography", *Nature Chemistry* 11, 562 (2019).
- J. K. Kang *et al.,* "Atomic - scale spacing between copper facets for the electrochemical reduction of carbon dioxide", *Advanced Energy Materials (Displayed as Front Cover)* 10, 1903423 (2020).

Nano Materials Simulation & Fabrication Lab.

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Current Research Topics

- Ultrafast Chargeable Batteries and Supercapacitors
- Photocatalytic and Electrochemical Energy Conversion Materials
- High-efficiency and Stable Photovoltaic Devices
- Hydrogen Generation and Storage Techniques

Research Highlights

It is our belief that the recent major advancements in introducing complexity, heterogeneity, and biologically derived components within materials construction provides conspicuous evidence for the evolution of materials to an unprecedented level unseen in synthetic crystalline materials. We are now at a stage in materials engineering where the building blocks in synthetic crystals can act synergistically to carry out a particular function. The question now arises, what is next? The next generation of materials will be what we consider the materials beyond that will incorporate complexity through endowing the materials with multiple functional groups. We have shown that introducing the multiple functionalities within materials could provide the possibilities of unique sequences that code for specific properties. Nowadays, first-principles design became important aid of experiment. With an aide of first-principles design, in-situ analysis and experimental prototypes, we will realize new innovative materials for energy systems covering artificial photosynthesis, ultrafast chargeable batteries and super-capacitors, high-efficiency solar cells, and hydrogen techniques.

Core Facilities

SGI Supercomputers, In-Situ Small Angle X-ray (SAXS) Mapping System, Scanning Electron Microscope (SEM), 600 MHz Solid-State Nuclear Magnetic Resonance (NMR) System, Solar-Cell Simulator

Kang, Jiheong

Lab
Dynamic Materials Design Laboratory

Website
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Education
Ph.D., Univ. of Tokyo (2017)

Research Interests
Dynamic materials, stretchable electronics, Energy storage devices

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Biography

Prof. Kang received a B.S degree in Chemistry from Seoul National University and studied under the direction of Prof. Aida at the University of Tokyo, obtaining a Ph.D in polymer chemistry in 2017. After postdoctoral research at Stanford university in the laboratory of Prof. Bao, he joined DMSE as a faculty member in 2020. His lab (Dynamic Materials Design Lab) is focusing on developing dynamic materials based on organic chemistry and supramolecular chemistry to address fundamental and social issues of energy and health. His contributions to the field have been acknowledged by the BASF rising star award (2014) and Reaxys Phd prize (2016).

Publications and Patents

- J. Kang *et al.,* "A rational strategy for the realization of chain-growth supramolecular polymerization," *Science.* 347, 6222 (2015).
- J. Kang *et al.,* "Tough and water-insensitive self-healing elastomer for robust electronic skin," *Advanced Materials.* 30, 1706846 (2018).
- J. Kang *et al.,* "An integrated self-healable electronic skin system fabricated via dynamic reconstruction of a nanostructured conducting network," *Nature Nanotechnology.* 13, 1057 (2018).
- J. Kang *et al.,* "Self-healing soft electronics," *Nature Electronics.* 2, 144 (2019).
- J. Kang *et al.,* "An ultrastretchable and self-healable nanocomposite conductor enabled by autonomously percolative electrical pathways ," *ACS Nano.* 13, 6531 (2019).

Dynamic Materials Design Laboratory

Principal Investigator
Kang, Jiheong

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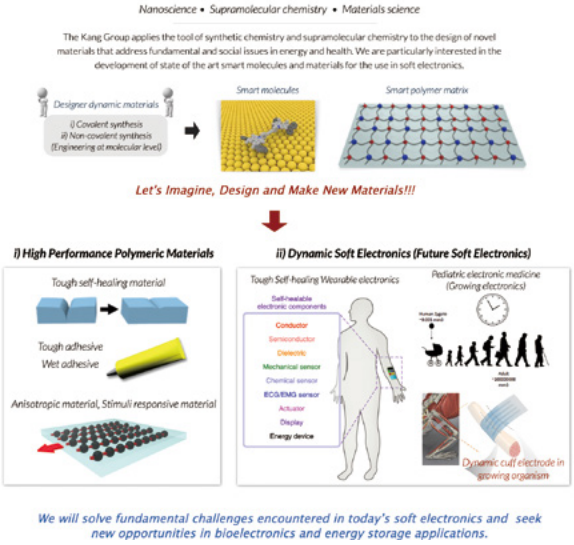
DMDL
Dynamic Materials Design lab

Current Research Topics

- Mechanically tough self-healing materials
- Stimuli responsive materials
- Dynamic soft electronics for wearable and bioelectronics
- Iontronics

Research Highlights



Core Facilities

Impedance spectroscopy, Rheometer, Dynamic Mechanical anlaysis, Organic synthesis set-up

Kang, Kibum

Lab
Nano and 2D Materials Laboratory

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Education
Ph.D., POSTECH (2012)

Research Interests
Semiconductor materials, MOCVD, 2D materials

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Biography

Kibum Kang is an assistant professor of Materials Science and Engineering at KAIST, South Korea. He received his B.S and PhD degree in Materials Science and Engineering from POSTECH, South Korea (2007 and 2012 respectively). After 4 years of postdoc experience in Jiwoong Park group in Cornell University and the University of Chicago (2013~2017), he joined KAIST (2018). His research focuses on investigating atomic-level engineering using metal-organic chemical vapor deposition (MOCVD) and nano/2D materials for next-generation semiconductors.

Publications and Patents

- High-Mobility Three-Atom-Thick Semiconducting Films with Wafer-Scale Homogeneity, Kibum Kang et al., *Nature*, 520, 656 (2015)
- Layer-by-Layer Assembly of Two-Dimensional Materials into Wafer-scale Heterostructures, Kibum Kang et al., *Nature*, 550, 229 (2017)
- Coherent, Atomically Thin Transition-metal Dichalcogenide Superlattices with Engineered Strain, S. Xie, L. Tu, Y. Han, L. Huang, K. Kang, K. U. Lao, P. Poddar, C. Park, D. A. Muller, R. A. DiStasio Jr., and J. Park, *Science*, 359, 1131 (2018)
- Wafer-scale synthesis of monolayer two-dimensional porphyrin polymers for hybrid superlattices, Y. Zhong, B. Cheng, C. Park, A. Ray, S. Brown, F. Mujid, J. Lee, H. Zhou, J. Suh, K. Lee, A. J. Mannix, K. Kang, S. J. Sibener, D. A. Muller, J. Park, *Science*, DOI: 10.1126/science.aax9385 (2019)

Nano and 2D Materials Laboratory

Principal Investigator
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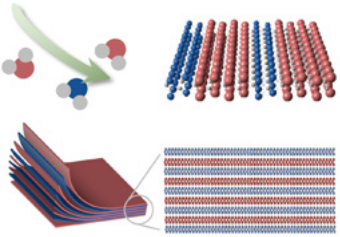
Current Research Topics

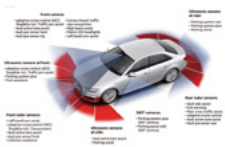
- Gas-phase growth of 2D and van der Waals semiconductors
- MOCVD growth process
- Interlayer engineering of van der Waals materials

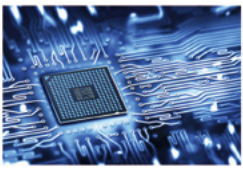
Research Highlights

We strive for the development of next-generation semiconductor materials and atomic-level engineering. These will impact both fundamental material science and practical applications (e.g. IoT, healthcare, self-driving, bio-inspired devices, and etc).

Selected publications:
Nature 550, 229 (2017), Nature 502, 656 (2015),
Science 366, 1379 (2019), Science 359 1131 (2018)







Core Facilities

8-inch PEMOCVD, Thermal MOCVD

Kim, Do Kyung

Lab
Nano Ceramics Research Lab

Website
http://mse2.kaist.ac.kr/~ncrl

Education
Ph.D., KAIST (1987)

Research Interests
Energy Materials, Optical Ceramics, Nano Ceramics

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Office
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Biography

Prof. Kim received his Ph. D. in materials science and engineering from KAIST in 1987. After working in Agency for Defense Development (ADD), he joined DMSE as a faculty member in 1994. His lab (Nano Ceramics Research Lab.) is focusing on nanomaterials for rechargeable batteries, optical and electrical applications. His contributions to the field have been acknowledged by being named a fellow of the American Ceramic Society and fellow of National Academy of Engineering. He is a prolific inventor with 47 patents and 264 journal papers.

Publications and Patents

- S. Ryu *et al*., "A study on cobalt substitution in sodium manganese mixed-anion phosphates as positive electrode materials for Na-ion batteries" *Journal of Power Sources.* 444, 227274 (2019).
- H. J. Ma *et al*., "Microstructural freezing of highly NIR transparent Y2O3-MgO nanocomposite via pressure-assisted two-step sintering" *Journal of the European Ceramic Society*. 39(15), 4957-4964 (2019).
- J-H. Kim *et al*., "A Robust Approach for Efficient Sodium Storage of GeS2 Hybrid Anode by Electrochemically Driven Amorphization," *Adv. Energy Mat*. (2018).
- J. H. Yun *et al*., "Suppressing Polysulfide Dissolution via Cohesive Forces by Interwoven Carbon Nanofibers for High-Area-Capacity Lithium Sulfur Batteries" *Nano Letters.* 18(1), 475 (2018).
- J-H. Kim *et al*., "Enhancing the Sequential Conversion-Alloying Reaction of Mixed Sn-S Hybrid Anode for Efficient Sodium Storage by a Carbon Healed Graphene Oxide" *SMALL*. 14(4), 1702605 (2018).

Nano Ceramics Research Lab

Principal Investigator
Kim, Do Kyung

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Current Research Topics

- Rechargeable Secondary Batteries
- Ultra-High Temperature Ceramics(UHTC) for Aerospace
- Optical Ceramics

Research Highlights

Nano Ceramics Research Lab(NCRL) studies ceramic materials used in a variety of parts. Currently, NCRL is developing electrode materials for next generation batteries such as lithium-sulfur and sodium-ion batteries. To enhance their electrochemical performance, we introduce new electrode materials or fabricate nanoscale structure. In addition, NCRL is contributing to the development of aerospace industry through the development of UHTC (Ultra-High Temperature Ceramics). The goal of UHTC research is to develop a high-thermal resistant material for rockets that can withstand an extreme environment at an altitude of 30 km or more.
Ceramic processing and characterization techniques are crucial for various fields of research. NCRL strives to become the pioneer of research into practical ceramic materials to propel the development of next-generation technologies.

Core Facilities

Cell Cycler, Hot Press, Electrospinning Setup, Microload Test System
Hydraulic Press, CW Laser (980nm)

Kim, Il-Doo

Lab
Advanced Nanomaterials and Energy Lab.

Website
http://advnano.kaist.ac.kr

Education
Ph.D., KAIST (2002)

Research Interests
Gas Sensor, Energy Storage System, Energy Generation

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Biography

Prof. Kim received his Ph. D. in materials science and engineering from KAIST in 2002. After working in KIST as a senior research scientist, he joined DMSE as a faculty member in 2011. His lab (Advanced Nanomaterials and Energy Lab) is focusing broadly on novel synthesis of various organic/inorganic nano-materials and their applications in chemical sensors, next generation energy storage devices such as Li-air battery and water-driven power generators. He has published 285 papers, and held 206 patents. He have received many awards, including the 2019 Korea 10 Nanotechnology Award, Scientist of the year from Korean Journalists. He is serving as associate editor of *ACS Nano*.

Publications and Patents

- J. Bae *et al*., "Self-operating transpiration-driven electrokinetic power generator with an artificial hydrological cycle," *Energy Environ. Sci*., Published Online, (2020).
- D. S. Choi *et al*., "Ultrastable Graphene Encapsulated 3 nm Nanoparticle by in situ Chemical Vapor Deposition," *Adv. Mater*. 30 (50), 1805023 (2018).
- J. S. Jang *et al*., "Metal Organic Framework-Templated Chemiresistor: Sensing Type Transition from P-to-N Using Hollow Metal Oxide Polyhedron via Galvanic Replacement", *J. Am. Chem. Soc*, 139 (34), 11868 - 11876 (2017).
- W. T. Koo *et al*., "Accelerating Palladium Nanowire H2 Sensors Using Engineered Nanofiltration," *ACS Nano*, 11 (9), 9276 – 9285 (2017)

Advanced Nanomaterials and Energy Lab.

Principal Investigator
Kim, Il-Doo

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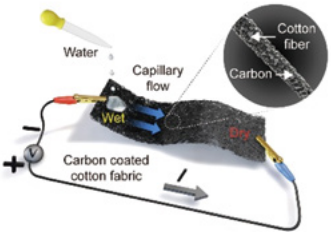
Current Research Topics

- Water Transpiration Driven Energy Harvester
- Ultra-sensitive Chemical Sensors for Hazardous Gas
- Nanofiber-based Nanoelectronics & Energy Storage Materials
- Design of Polyelemental Nanocatalyst

Research Highlights

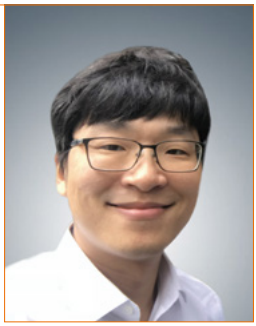


- J. H. Cha & D. H. Kim et al., Advanced Science, 1903318 (2020)
- J. Bae et al., Energy & Environmental Science, 13, 527 (2020)
- G. Song & J. Y. Cheong et al. Nature Communications, 10, 2364 (2019)
- W. T. Koo et al., Advanced Science, 6, 1900250 (2019)
- D. S. Choi. & C. Kim et al. Advanced Materials, 30 (50), 1805023 (2018)
- S. J. Kim et al. . Advanced Materials, 29 (36), 1700737 (2017)

Core Facilities

Yarn Electrospinning Machine, 24 Channels of Battery Charge-discharge System for Li-air Battery, High Temperature Operating Gas Sensing Equipment, 2~3 inch RF/DC Sputter Systems

Kim, Kyung Min



Lab
Future Semiconductor Technology Lab

Website
https://semi.kaist.ac.kr/

Education
Ph.D., Seoul National Univ. (2008)

Research Interests
Memristor materials, Neuromorphic computing device, In-memory computing device

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Biography

Prof. Kim received his Ph. D. in materials science and engineering from Seoul National University in 2008. After working in Samsung Electronics as a senior engineer and Hewlett Packard (HP) Labs in the USA as a research scientist, he joined DMSE as a faculty member in 2017. His lab (Future Semiconductor Technology Laboratory) is focusing on developing emerging semiconductor technology and devices enabled by memristors. He published over 60 papers in his career at *Nature Nanotechnology*, *Advanced Materials*, *Nano Letters*, *Nature communication*, etc.

Publications and Patents

- Young Seok Kim, *et al*., "Stateful In - memory Logic System and Its Practical Implementation in a TaOx - based Bipolar - type Memristive Crossbar Array", *Adv. Intell. Syst*, 1900156 (2020)
- Hanchan Song, *et al*., "Designed Memristor Circuit for Self-limited Analog Switching and its Application to Memristive Neural Network", *Advanced Electronic Materials*, 5, 1800740 (2019)
- Yumin Kim, *et al*., "Nociceptive Memristor", Advanced Materials, 30, 1704325 (2018)
- Kyung Min Kim, *et al*., "Low power, self-rectifying, and forming-free memristor with an asymmetric programing voltage for a high density crossbar application", *Nano Letters* 16, 6724-6732 (2016)
- Kyung Min Kim, *et al*., "Memristors for Energy-Efficient New Computing Paradigms", *Advanced Electronic Materials*, 2, 1600090 (2016)

Future Semiconductor Technology Lab

Principal Investigator
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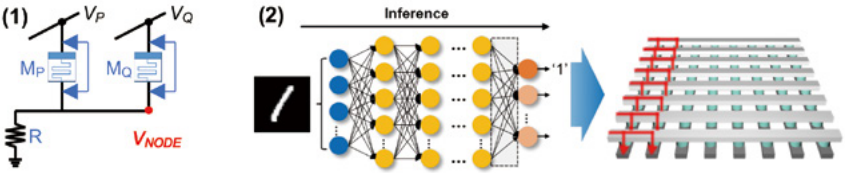
Youtube
https://www.youtube.com/watch?v=1VxUnhY1PKg

Current Research Topics

- Memristive physics and materials
- Memory, Logic and neuromorphic devices
- Emerging semiconductor materials and processing

Research Highlights

Our research group, FuST, is a pioneer in the field of memristive materials and devices. We have signature technologies regarding the memristors, which allows us to investigate their application for the emerging semiconductor devices. We develop in-memory computing device, neuromorphic device, and security devices for changing the computing paradigm over the conventional von-Neumann computers. Also, we propose novel computing algorithms to maximize the efficiency of the memristive hardware.



Core Facilities

ALD equipment, Sputter equipment, E-beam equipment, Keithley 2636B & 4200A, NI-PXIe 1071, Server computer

Kim, Sang Ouk

Lab
Soft Nanomaterials Lab

Website
http://softnano.kaist.ac.kr

Education
Ph.D., KAIST (2000)

Research Interests
Soft Nanomaterials, Block Copolymer Self-Assembly, Carbon Nanotubes & Graphene, Energy & Environmental Science

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Biography

Prof. Kim received his Ph. D. in chemical engineering from KAIST in 2000. After working in University of Wisconsin as a post-doctoral researcher, he joined DMSE as a faculty member in 2004. His research lab (Soft Nanomaterials Lab) is focusing on self-assembly of soft nanomaterials (block copolymer lithography & graphene oxide liquid crystal), chemical modification of carbon nanotubes & graphene, and its applications in energy & environmental science. His contributions to the field have been acknowledged by Clarivate Analytics as a highly cited researcher (2018) and the youngest fellow member of Korea Academy of Science and Technology (2020).

Publications and Patents

- S. O. Kim *et al*., "Epitaxial Self-Assembly of Block Copolymers on Lithographically Defined Nanopatterned Substrates," *Nature*. 424, 411 (2003).
- S. O. Kim *et al*., "Liquid crystals: Electric fields line up graphene oxide," *Nat. Mater*. 13, 325 (2014).
- S. O. Kim *et al*., "Dopant-specific unzipping of carbon nanotubes for intact crystalline graphene nanostructures," *Nat. Comm*. 7, 10364 (2016).
- S. O. Kim *et al*., "Highly tunable refractive index visible-light metasurface from block copolymer self-assembly," *Nat. Comm*. 7, 12911 (2016).
- S. O. Kim *et al*., "Graphene oxide liquid crystals: A frontier 2D soft matter for graphene-based functional materials," *Chem. Soc. Rev*. 47, 6013 (2018).
- S. O. Kim *et al*., "Unravelling inherent electrocatalysis of mixed-conducting oxide activated by metal nanoparticle for fuel cell electrodes," *Nat. Nanotechnol*. 14, 245 (2019).

Soft Nanomaterials Lab

Principal Investigator
Kim, Sang Ouk

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https://www.youtube.com/watch?v=BiFpYUyUBcc

Current Research Topics

- Directed Molecular Assembly of Soft Nanomaterials
- Directed Self-Assembly of Block Copolymers
- Nanoscale Assembly & Chemical Modification of Carbon Nanotubes and Graphene
- Nanomaterials for Energy & Environment

Research Highlights

- S. O. Kim *et al*., "Epitaxial Self-Assembly of Block Copolymers on Lithographically Defined Nanopatterned Substrates," *Nature*. 424, 411 (2003).
- J. Y. Kim and S. O. Kim *et al*., "Liquid crystals: Electric fields line up graphene oxide," Nat. Mater. 13, 325 (2014).
- J. Lim and S. O. Kim *et al*., "Dopant-specific unzipping of carbon nanotubes for intact crystalline graphene nanostructures," *Nat. Comm*. 7, 10364 (2016).
- J. Y. Kim and S. O. Kim *et al*., "Highly tunable refractive index visible-light metasurface from block copolymer self-assembly," *Nat. Comm*. 7, 12911 (2016).
- S. P. Sasikala and S. O. Kim *et al*., "Graphene oxide liquid crystals: A frontier 2D soft matter for graphene-based functional materials," *Chem. Soc. Rev*. 47, 6013 (2018).
- Y. Choi and S. O. Kim *et al*., "Unravelling inherent electrocatalysis of mixed-conducting oxide activated by metal nanoparticle for fuel cell electrodes," *Nat. Nanotechnol*. 14, 245 (2019).

Core Facilities

IR&NIR Laser Scanning System, Reactive Ion Etching System, Electrospinning System, Melt-Spinning System, Wet-Spinning System, Electro-Chemical Analysis System

Lee, Hyuck Mo

Lab
Computational Materials Science Laboratory

Website
http://triangle.kaist.ac.kr

Education
Ph.D., MIT (1989)

Research Interests
Machine Learning based Material Design,
Thermodynamic and First-principle calculations

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Rm. 2412, W1-1

Biography

Prof. Lee received his Ph. D. in material science from MIT in 1989. After graduation, he worked as a DMSE faculty member for 31 years since 1989. His lab (Computational Material Science Lab) is focusing on material design by various computational simulations like Thermodynamic and First-principle calculations and Machine Learning. His contributions to the field have been acknowledged by a Young Scientist Award by the President of Korea (2000). He is a prolific inventor with 13 domestic and 3 international patents and a passionate engineer with 194 international journals(SCI).

Publications and Patents

- S. W. Yoon *et al*., "Thermodynamics-Aided Alloy Design and Evaluation of New Pb-Free Solder, Sn-Bi-In-Zn System", *Acta Mater*., 45, 3 (1997).
- B.-J. Lee *et al*., "Prediction of Interface Reaction Products between Cu and Various Solder Alloys by Thermodynamic Calculation", *Acta Mater*., 45, 5 (1997).
- K, Kang *et al*., "Hierarchical analysis of alloying element effects on gas nitriding rate of Fe alloys: A DFT, microkinetic and kMC study," *Acta. Mater*. 174 (2019).
- C. Lee *et al*., "Ag2S-CoS Hetero-nanowires Terminated with Stepped Surfaces for Improved Oxygen Evolution Reaction", *Catal. Commun*., 129, 105749 (2019)
- C. Lee *et al*., "Atomically Embedded Ag via Electro-diffusion Boosts Oxygen Evolution of CoOOH Nanosheet Arrays", *ACS. Cat*. 10, 1 (2020)

Computational Materials Science Laboratory

Principal Investigator
Lee, Hyuck Mo

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Youtube
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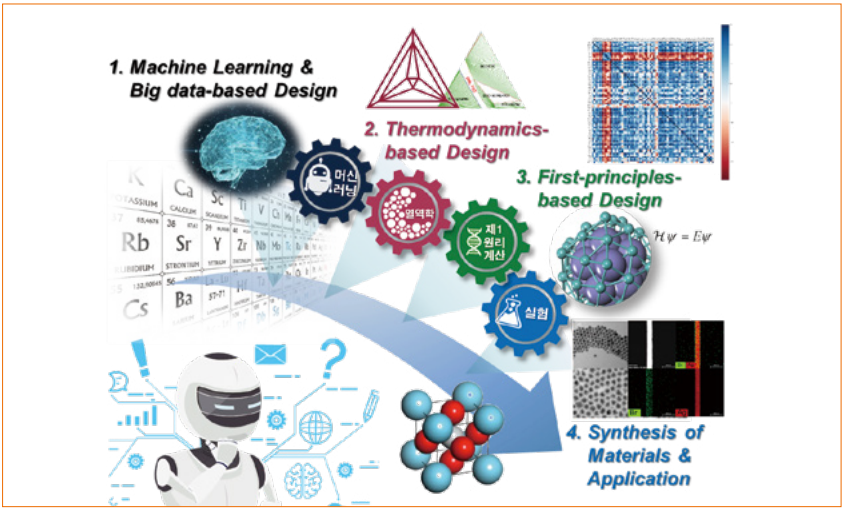
Current Research Topics

- Thermodynamic and first-principle calculations
- Machine learning based material design for energy materials
- Nano materials for highly efficient electrocatalyst

Research Highlights



Core Facilities

Parallel computing cluster(Intel Xeon E5-2650 v3)

Lee, Keon Jae

Lab
Flexible and Nanobio Device Lab

Website
http://fand.kaist.ac.kr/

Education
Ph.D., UIUC (2006)

Research Interests
Self-powered Flexible Electronics, Flexible Electronics, Health-care, Memory, Laser-Material Interaction

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Biography

Prof. Lee received his Ph. D. in materials science and engineering from University of Illinois at Urbana-Champaign (UIUC) in 2006. After then, he joined DMSE as a faculty member in 2019. His lab (Flexible and Nano-bio Device Lab, FAND) is focusing on developing Self-powered Flexible Electronics Systems such as flexible displays, artificial skins, biomedical applications and semiconductor devices. His contributions to the field have been acknowledged by a 'Minister's Award from Ministry of Science , ICT and Future Planning (2014)', 'KAIST Top 10 Research Award (2015)', 'KAIST Institute Fusion Research Award (2017)', 'KAIST Impact Award for top 1 % citation (2019)', and 'KAIST Technology Innovation Award (2019)'. He was also selected as a 'Young KAST member from Korean Academy of Science and Technology' from 2018. He is a prolific inventor with 166 domestic/international patents and over than 110 paper publications. He also founded a start-up company called 'Fronics' in 2016.

Publications and Patents

- H. Lee, J. Choi, S. Lee, J. Shin, M. Jeong, D. J. Joe, D. Kim, C. Kim, J. Park, J. Lee, D. Kim, C. Shin, K. Lee*, "Monolithic Flexible Vertical GaN Light-Emitting Diodes for Transparent Wireless Brain Optical Stimulator", 30, 1800649, 2018, *Adv. Mater.*
- J. Han, K. Bae, S. Hong, H. Park, J. Kwak, H. Wang, D. J. Joe, J. Park, Y. Jung, S. Hur, C. Yoo, K. Lee*, "Machine Learning-based Self-powered Acoustic Sensor for Speaker Recognition", *Nano Energy*, 53, 658, 2018
- D. Park, D. J. Joe, D. Kim, H. Park, J. Han, C. Jeong, H. Park, J. Park, B. Joung, K. Lee* "Self-Powered Real-Time Arterial Pulse Monitoring using Ultrathin Epidermal Piezoelectric Sensors", *Adv. Mater.*, 29, 1702308, 2017
- K. Park, J. Son, G. Hwang, C. Jeong, J. Ryu, M. Koo, I. Choi, S. Lee, M. Byun, Z. Wang, K. Lee* "Highly-Efficient, Flexible Piezoelectric PZT Thin Film Nanogenerator on Plastic Substrates" *Adv. Mater.*, 26, 2514, 2014
- K.-I. Park, M. Lee, Y. Liu, S. Moon, G.-T. Hwang, G. Zhu, J. E. Kim, S. O. Kim, D. K. Kim, Z. L. Wang, K. Lee*, "Flexible Nanocomposite Generator Made of BaTiO3 Nanoparticles and Graphitic Carbons", *Adv. Mater.*, 24, 2999, 2012

Flexible and Nanobio Device Lab

Principal Investigator
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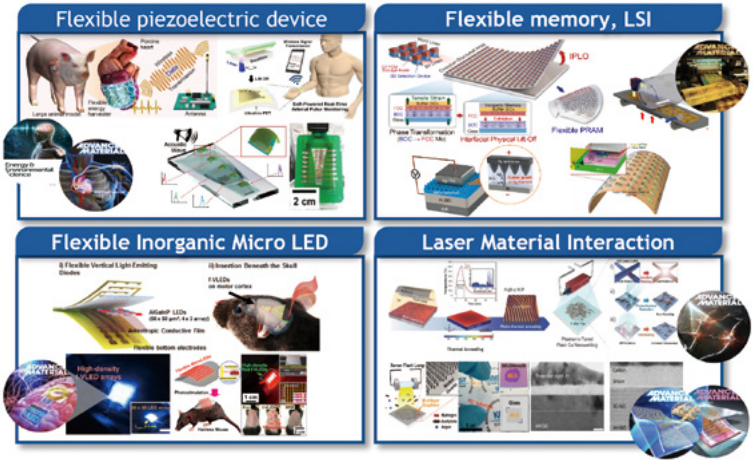
Current Research Topics

- Flexible piezoelectric acoustic & pressure sensor, nanogenerator
- Flexible inorganic microLED for display & biomedical applications
- Flexible neuromorphic memory/LSI, high-density memory
- laser–material interaction for Flexible Applications

Research Highlights



Core Facilities

Atomic Layer Deposition, RF-sputtering system, Plasma enhanced chemical vapor deposition, Rapid thermal annealing, Keithley 4200 SCS, Inductive Coupled Plasma Reactive Ion Etcher, Eximer laser, Xe flash lamp, Mask Aligner

Nam, Yoon Sung

Lab
Nano-Bio Interface Laboratory

Website
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Education
Ph.D., MIT (2010)

Research Interests
Nano-biomaterials, Biological Engineering

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Biography

Yoon Sung Nam is an associate professor of Materials Science and Engineering at KAIST. He received his Ph.D. in Biological Engineering from MIT in 2010 and worked as a George W. Beadle Argonne Named Postdoctoral Fellow at Argonne National Laboratory. He holds a B.S. in Chemical Engineering from Seoul National University and a M.S. in Biological Sciences from KAIST. Dr. Nam's research group focuses on bio-inspired materials platforms, particularly related to functional nanomaterials, for practical applications in catalysis and medicine. He has a strong interest in identifying key factors and processes of biochemical recognition and selection of molecules/materials in biological systems.

Publications and Patents

- Low-power and Low-drug-dose Photodynamic Chemotherapy via the Breakdown of Tumor-targeted Micelles by Reactive Oxygen Species, Geok Leng Seah et al., Journal of Controlled Release (2018) 286, 240-253G.-D. Hong *et al., Hydrogen reduction catalysts*, US 20140200880 A1 (2014).
- Sub-nanomolar FRET-based DNA Assay Using Thermally Stable Phosphorothioated DNA-functionalized Quantum Dots, Jae Chul Park *et al., ACS Applied Materials & Interfaces* (2019) 11, 37, 33525-33534
- Virus-templated Self-mineralization of Ligand-free Colloidal Palladium Nanostructures for High Surface Activity and Stability, Insu Kim *et al. , Advanced Functional Materials* (2017) 27, 1703262

Nano-Bio Interface Laboratory

Principal Investigator
Nam, Yoon Sung

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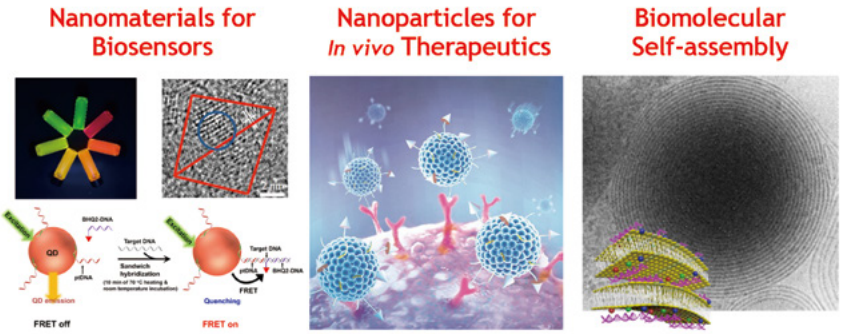
Current Research Topics

- Biosensing Nanomaterials for Molecular Diagnostics
- Phage Engineering for Therapeutic Applications
- In vivo Vaccine Delivery
- Bio-inspired Hybrid Nanomaterials for Energy, Environmental, and Biomedical Applications

Research Highlights

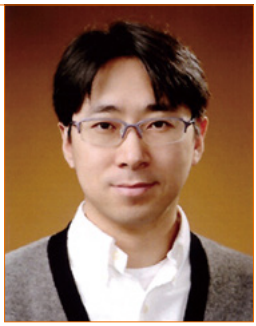
Nature-inspired design, synthesis, and assembly of nanoscale materials



Core Facilities

Microplate Reader, NanoDrop, HPLC, GC, ELS-Z, IPCE, UV—Vis Spectroscopy, Fluorescence spectrophotometer, FT-IR ...

Oh, Jihun



Lab
Laboratory for Energy and Sustainability (LENS)

Website
http://les.kaist.ac.kr

Education
Ph.D., MIT (2010)

Research Interests
Energy materials, Photovoltaics, Catalysis, Artificial Photosynthesis

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Office
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Biography

Prof. Oh received his Ph. D. in materials science and engineering at Massachusetts Institute of Technology (MIT) in 2010. After postdoctoral fellowship at National Renewable Energy Laboratory (NREL) in the US, he joined KAIST as faculty in 2013. His lab (Lab. for Energy and Sustainability) is focusing on designing and developing disruptive materials and systems for an efficient and sustainable energy technology. His contributions to the field have been acknowledged by a Korean Chemical Society's Young Investigator Award (2014) and KAIST Technology Innovation Award (2018). He holds 8 domestic and 4 international patents.

Publications and Patents

- B. Kim *et al*., "Over a 15.9% solar-to-CO conversion from dilute CO_2 streams catalyzed by gold nanoclusters exhibiting a high CO_2 binding affinity," *ACS Energy Lett*. 5, 749 (2020).
- Tan *et al*., "Modulating local CO_2 concentration as a general strategy for enhancing C-C coupling in CO_2 electroreduction," *Joule* 4, 1104 (2020).
- S. Park *et al*., "Germanium-on-nothing for epitaxial liftoff of GaAs solar cells," *Joule* 3, 1782 (2019).
- S. Oh *et al*., "An optically and electrochemically decoupled monolithic photoelectrochemical cell for high-performance solar-driven water splitting," *Nano. Lett*. 17, 5416 (2017).
- J. T. Song *et al*., "Nanoporous Au thin films on Si photoelectrodes for selective and efficient photoelectrochemical CO_2 reduction," *Adv. Energy Mater*. 7, 1601103 (2017)

Laboratory for Energy and Sustainability (LENS)

Principal Investigator
Oh, Jihun

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Youtube
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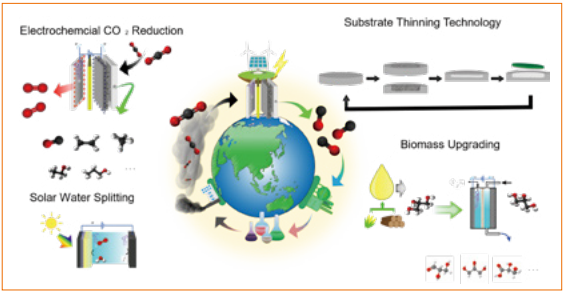
Laboratory for
Energy and Sustainability

Current Research Topics

- Electrochemical CO_2 reduction to valuable chemicals.
- Photoelectrochemical cells for solar water splitting.
- Substrate thinning technology for cost-effective solar cells.
- Biomass upgrading via glycerol electrochemical oxidation.

Research Highlights

Can we build a sustainable and clean society like nature has done for millions of years? The Laboratory for Energy and Sustainability (LENS) at Korea Advanced Institute of Science and Technology (KAIST) aims to develop innovative and transformational materials and systems that can replace the current fossil-fuel based technologies using renewable energy. We conduct both fundamental and applied studies to develop a highly efficient and low-cost technology to convert and store renewable energy into electricity and other valuable commodity chemicals. Recently, we identify the key factors to tailor CO_2 electrolysis to ethylene and achieve the world-best, 15.9%-efficient, solar powered CO_2 conversion system with flue gas.



Core Facilities

Potentiostat, Gas chromatography, High performing liquid chromatography, Atomic layer deposition, Sputter, E-beam evaporator.

Paik, Kyung-Wook

Lab
Nano Packaging & Interconnect Lab.

Website
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Education
Ph.D., Cornell Univ. (1989)

Research Interests
Electronic Packaging Materials & Processes, Electrical Conductive Adhesives, Interconnection

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Biography

Kyung W. Paik received the Ph.D. degree from the Cornell University at the department of Materials Science and Engineering in 1989. And he worked at the General Electric Corporate Research and Development from 1989 to 1995 as a Senior Technical Staff. He joined the KAIST as a professor at the department of Materials Science and Engineering in 1995, and served as the Vice President of Research during 2011 ~ 2013. In his Nano-Packaging and Interconnect Laboratory (NPIL), he has been working in the areas of Anisotropic Conductive Adhesives(ACAs) materials and processing, 3-D TSV NCFs interconnect materials, and display packaging technologies. He established 2 start-up companies, H&S HighTech Co. and Cressem Co., using his patents.

Publications and Patents

- K.-W. Paik *et al*., "Fundamentals of Passives: Discrete, Integrated, and Embedded," *Fundamentals of Microsystems Packaging, McGraw Hill*, 0-07-137169-9, pp 420-465, (2001).
- K.-W. Paik *et al*., "Nano-materials in Anisotropic Conductive Adhesives (ACAs)," *NanoPackaging, Springer*, 978-3-319-90362-0, pp 369-408, (2018).
- K.-W. Paik *et al*., "A Study on the Flexible Chip-on-Fabric Assemblies Using Anisotropic Conductive Films and Metal-Laminated Fabric Substrates," IEEE TRANSACTIONS ON COMPONENTS PACKAGING AND MANUFACTURING TECHNOLOGY, (2020).

Nano Packaging & Interconnect Lab.

Principal Investigator
Paik, Kyung-Wook

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Current Research Topics

- Conductive adhesives for electronic packaging technology
- Anchoring Polymer Layer ACFs
- 3D through silicon via interconnection technology

Research Highlights

Conductive adhesives for electronic packaging technology

· Anisotropic conductive film (ACF) development for LCD driver IC interconnection
· Development of conductive adhesive materials (ACF/ACA/NCF/NCA) for COB, COG, COF, FOG, FOB applications
· Process development and reliability evaluation
· Ultrasonic bonding for ACF interconnection
· Development of wafer level packages using conductive adhesives
· Fine pitch 2-metal layer chip-on-flex(COF) packaging

3D through-silicon-via (TSV) interconnection technology

· Development of non-conductive adhesive for 3D TSV interconnection
· Development of wafer-level bonding process for chip-stacking using NCF
· Reliability evaluation of fine-pitch Cu/Sn-Ag double bump interconnection

Core Facilities

Flip chip bonder, thermo-compression bonder, film coater

Park, Byong-Guk

Lab
Nano Spintronics Laboratory

Website
http://nanospin.kaist.ac.kr

Education
Ph.D., KAIST (2003)

Research Interests
Spintronic materials and devices, Spin-based smart devices, THz source, Spin thermoelectrics

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Biography

Prof. Park received his Ph. D. in materials science and engineering from KAIST in 2003. He worked as a postdoc at Twente University, Netherlands, and a research scientist at Hitachi Cambridge Laboratory, Cambridge, UK, before he joined DMSE, KAIST in 2011. His research focuses on the development of new functional spintronic materials and devices. His achievements have been acknowledged by a Top 100 National R & D excellence award (2018), KAIST's TOP 10 Research Achievements award (2018), and The Scientist of the Month (Oct, 2019) by the Ministry of Science and ICT.

Publications and Patents

- M.-G. Kang, *et al*., "Negative spin Hall magnetoresistance of normal metal/ferromagnet bilayers", *Nature Commun*. 11, 3619 (2020)
- S. C. Baek, *et al*., "Spin currents and spin-orbit torques in ferromagnetic trilayers" *Nature Mater*. 17, 509 (2018)
- S. C. Baek, *et al*., "Complementary logic operation based on electric-field controlled spin-orbit torques" *Nature Electro*. 1, 398 (2018)
- D.-J. Kim, *et al*., "Observation of transverse spin Nernst magnetoresistance induced by thermal spin current in ferromagnet/non-magnet bilayers", *Nature Commun*. 8, 1400 (2017)
- Y.-W. Oh, *et al*., "Field-free switching of perpendicular magnetization through spin-orbit torque in antiferromagnet/ferromagnet/oxide structures", *Nature Nanotechnol*. 11, 878 (2016)

Nano Spintronics Laboratory

Principal Investigator
Park, Byong-Guk

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Youtube
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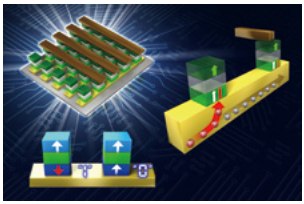
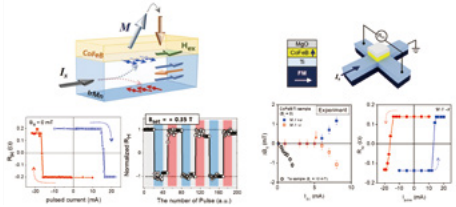
Current Research Topics

- Magnetic materials and spintronic devices
- Spin-orbit torque-based MRAM, reconfigurable spin logic (logic-in-memory), spintronic THz source/detector
- Spin thermoelectric & energy harvesting

Research Highlights

- The interest of our Lab. is to develop novel electronic materials and devices utilizing electron's spin and to understand underlying physics of magnetic nanostructures. The spintronics offer ultralow power non-volatile memories, reconfigurable logics, IOT sensors, and energy harvesters. Our main research achievements include:
- Materials development of efficient spin current generation and manipulation
- Demonstration of field-free spin-orbit torque switching
- Realization of spin-based logic devices, performing complementary logic operations
- Spin thermoelectric materials for sensors or energy harvesting devices





Core Facilities

UHV magnetron sputtering system, atomic layer deposition, maskless photolithography, Ion-miller, magnetic probe stations, vibrating sample magnetometer

Park, Chan Beum

Lab
Advanced Biomaterials Laboratory

Website
http://biomaterials.kaist.ac.kr

Education
Ph.D., POSTECH (1999)

Research Interests
Biomaterials for Energy, Sustainability, and Healthcare

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Biography

Prof. Park received his B.S. (1991), M.S. (1995), and Ph.D. (1999) degrees from POSTECH, then pursued postdoctoral research at the University of California, Berkeley (1999-2002), and worked as an assistant professor at the Arizona State University (2002-2006) before joining KAIST. Currently, he serves as the head of the Department of Materials Science and Engineering at KAIST and a director of the Creative Research Initiative (CRI) center supported by the Korean Government. His research interests include the development of artificial photosynthetic platforms, green and sustainable materials, and self-assembled amyloid materials. He has published over 180 peer-reviewed papers with a total of over 11,000 citations, h-Index 57. He is the recipient of many awards including the Research Excellence Award (KAIST), the Scientist of the Month Award (Republic of Korea), the Technology Innovation Grand Prix Award (KAIST), and the Prime Minister's Award (Republic of Korea).

Publications and Patents

- "Clinically accurate diagnosis of Alzheimer's disease via multiplexed sensing of core biomarkers in human plasma," *Nature Communications* 11, 119 (2020)
- "Chemical sensing platforms for detecting trace-level Alzheimer's core biomarkers," *Chemical Society Reviews*, doi.org/10.1039/D0CS00107D (2020)
- "Nicotinamide adenine dinucleotide as a photocatalyst," *Science Advances* 5, eaax0501 (2019)
- "Continuous 3D titanium nitride nanoshell structure for solar-driven unbiased biocatalytic CO2 reduction," *Advanced Energy Materials* 9,1900029, (2019)
- "Unbiased biocatalytic solar-to-chemical conversion by FeOOH/BiVO4/perovskite tandem structure," *Nature Communications* 9, 4208 (2018)

Advanced Biomaterials Laboratory

Principal Investigator
Park, Chan Beum

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Youtube
https://www.youtube.com/watch?v=-mUaT-sdQA8

Current Research Topics

- BioSolarCells: Photobiocatalytic materials for artificial photosynthesis
- Green and sustainable materials from naturally abundant resources
- Design of carbo-organic materials for plastic batteries
- Amyloid self-assembly and photomodulation of amyloidosis
- Electrical and photoelectrochemical biosensing platforms

Research Highlights

Core Facilities

HPLC, GC, FT-IR, atomic force microscope, fluorescence microscope, spectrophotometer, UV-Vis spectroscopy, microplate reader, electrospinner, solar simulator, potentiostat

Park, Sang-Hee

Lab
Soft & Smart Materials & Devices Laboratory

Website
https://www.ssmd.kaist.ac.kr/

Education
Ph.D., Univ. of Pittsburgh (1997)

Research Interests
Text

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Biography

Prof. Park received her Ph. D. in chemistry from University of Pittsburgh in 1997. After working in Electronics and Telecommunications Research Institute (ETRI), she joined MSE as a faculty member in 2014. Her lab is focusing on developing next generation display such as ultra-high resolution flexible display and skin display, sensors involving pressure, bio-materials, fingerprint, and vein, and semiconductor devices by investigating new materials and device structure. Her contribution to the display technology has been acknowledged by a National Academy of Engineering of Korea Award (2013) and Fellow Award of Society Information Display (2017). She had transferred technologies and I.P. 11 times to several companies and registered more than 60 domestic patents and 15 international patents.

Publications and Patents

- T. Jin *et al*., “Ultrathin Nanofibrous Membranes Containing Insulating Microbeads for Highly Sensitive Flexible Pressure Sensors,” *ACS Applied Materials & Interfaces* (2020).
- G.-J. Joen *et al*., “Highly Sensitive, Stable, Scalable Pressure Seonsor based on a Facile Baking-Inspired Foaming Process for Human Computer Interface,” *Journal of Materials Chemistry C*. (2020).
- J. Bae *et al*., “Effect of High Film Stress of Mo Source and Drain Electrodes on Electrical Characteristics of Al Doped InZnSnO TFTs,” *IEEE Electron Device Letters*. (2019).
- S.-H. Park *et al*., *Flat panel display device and method of forming passivation film in the flat panel display device (6926572 B2)*
- Y. Y. Nam *et al*., "Memristive Logic-in-memory Integrated Circuits for Energy-Efficient Flexible Electronics", *Advanced Functional Materials*. (2018).
- J. H. Ahn *et al*., "Efficient Suppression of Defects and Charge Trapping in High Density In-Sn-Zn-O Thin Film Transistor Prepared using Microwave-assisted Sputtering Method". (2017).

Soft & Smart Materials & Devices Laboratory

Principal Investigator
Park, Sang-Hee

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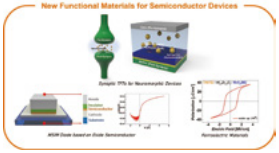
SSMD
Soft & Smart Materials & Devices Laboratory

Current Research Topics

- Flexible/High Performance Oxide TFT and Encapsulation Technology for Display Application
- Vertical/Trench Structured Oxide TFT for High-Resolution Next-Generation Display (AR, VR, Hologram)
- Sensor for Wearable Device and Health Care Application (Pressure Sensor, Bio-Sensor, Fingerprint Sensor, Vein Sensor)
- Functional Semiconductor Device Based on Oxide Semiconductor (Diode, Synaptic Transistor & Memristor for Neuromorphic Device)

Research Highlights

Our research group focuses on developing world-class high-performance oxide semiconductor based electronic devices. Professor Sang-Hee Ko Park is one of the leading oxide semiconductor scientists, especially on Oxide Thin Film Transistors for the next generation display.
In addition to display application, our group is trying to apply various oxide semiconductors to novel functional devices like wearable sensor, diode and neuromorphic devices.



Core Facilities

Atomic Layer Deposition x2, Sputter, Force Gauge & Automatic Stand System, Probe Station & Semiconductor Analyzer

Park, Steve

Lab
Organic and Nano Electronics Laboratory

Website
http://steveparklab.kaist.ac.kr

Education
Ph.D., Stanford Univ. (2014)

Research Interests
Electronic Skin, Biosensor, Thin-film Crystallization

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Biography

Prof. Steve Park is an assistant professor in the Department of Materials Science and Engineering at KAIST since 2016. Prof. Park received his Bachelor's degree at the University Illinois at Urbana-Champaign, and Master's and PhD at Stanford University, all in Materials Science and Engineering. He then went on to conduct his postdoctoral scientist work at Columbia University. Prof. Steve Park's research interests are in tactile sensing electronic skin for wearable and robotic applications, solution-based thin-film crystallization for flexible electronics, and biosensors.

Publications and Patents

- S. Park *et al*., "Parallel Signal Processing of a Wireless Pressure-Sensing Platform Combined with Machine-Learning-Based Cognition, inspired by the Human Somatosensory System," *Adv. Mater*., 1906269 (2019).
- S. Park *et al*., "Recent Progress and Future Prospects for Skin-Attachable Devices for Health Monitoring, Robotics, and Prosthetics," *Adv. Mater*. 1904765 (2019).
- S. Park *et al*., "Inorganic polymer micropillar-based solution-shearing of large-area organic semiconductor thin-film with pillar size dependent crystal size," *Adv. Mater.* 30, 1800647 (2018).
- S. Park *et al*., "Pressure Insensitive Strain Sensor with Facile Solution-based Process for Tactile Sensing Applications," *ACS Nano*. 12, 7546 (2018).
- S. Park *et al*., "Clinically accurate diagnosis of Alzheimer's disease via multiplexed sensing of core biomarkers in human plasma," *Nature communications*., 11, 119 (2020)

Organic and Nano Electronics Laboratory

Principal Investigator
Park, Steve

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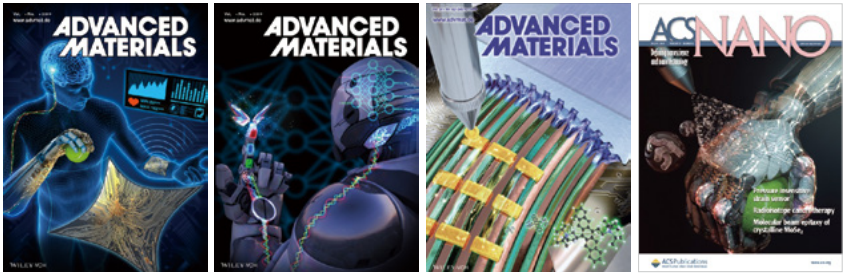
STEVE PARK RESEARCH GROUP

Current Research Topics

- Skin-inspired stretchable electronics
- Electrochemical biosensors
- Biocompatible and functional wireless implantable devices
- 3D printed electronics
- Thin-film crystallization for flexible electronics

Research Highlights



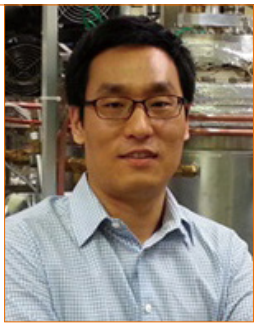
Passive component-based soft, functional electronics for wearable and implantable devices.

Solution processable ink-based tunable, economical electronics and bio/chemical sensors.

Core Facilities

Shearing machine, probe station for thin-film crystallization, 3D printer for printed electronics, Langmuir system for biosensorVector network analyzer for wireless device

Shin, Byungha



Lab
Energy Materials Lab

Website
http://energymatlab.kaist.ac.kr

Education
Ph.D., Harvard Univ. (2007)

Research Interests
Energy materials, Photovoltaics, Optoeletronic devices, Photoelectrochemical energy conversion

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Biography

Prof. Shin received B.S. in MSE from Seoul National University in 2000, M.S. in MSE from the University of Michigan in 2002, and Ph.D. in Applied Physics from Harvard University in 2007. From 2007 to 2010, he was a post-doctoral researcher at Stanford University. From 2010 until he joined KAIST in Feb 2014, he worked at IBM Watson Research Center in as a post-doctoral researcher and a Research Staff Member. His past research experience includes study of thin film growth kinetics and high-k dielectric materials for microelectronic applications. His primary research interest is developing novel materials for energy applications with the current emphasis on halide perovskite optoelectronic devices (PV and LED), chalcogenide thin film solar cells, and photoelectrochemical water splitting.

Publications and Patents

- B. Shin *et al*., "Efficient, stable silicon tandem cells enabled by anion-engineered wide-bandgap perovskites", *Science* 368, 155 (2020).
- B. Shin *et al*., "Carrier-resolved photo-Hall effects," *Nature* 575, 151 (2019).
- B. Shin *et al*., "Aging of a vanadium precursor solution: influencing material properties and phoeoelectrochemical water oxidation performance of solution-processed BiVO4 photoanodes," *Adv. Funct. Mater*. 2, 180662 (2018).
- B. Shin *et al*., "Stability of halide perovskite solar cell devices: in situ observation of oxygen diffusion under biasing," *Adv. Mater*. 30, 1802769 (2018).
- B. Shin *et al*., "Reduced graphene oxide as a catalyst binder: greatly enhanced photoelectrochemical stability of Cu(In,Ga)Se2 photocathode for solar water splitting" *Adv. Funct. Mater*. 28, 1705136 (2018).
- B. Shin *et al., Photoelectrode including catalyst retaining layer, method of preparing the same, and photoelectrochemical cell including photoelectrode*, US 20190062929 A1 (2019).

Energy Materials Lab

Principal Investigator
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EML
Energy Materials Lab

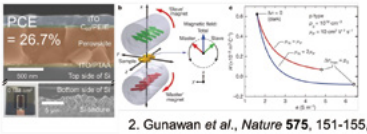
Current Research Topics

- Hybrid organic-inorganic perovskite LEDs
- Hybrid organic-inorganic perovskite solar cells
- Photoelectrochemical water splitting
- Earth-abundant inorganic solar cells

Research Highlights

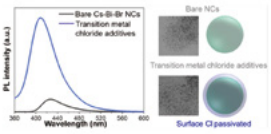
Photovoltaic (PV)

◇ Perovskite-based tandem solar cell[1]
◇ Carrier-resolved Photo-Hall effect[2]



1. Kim *et al.*, *Science* **368**, 155-160, 2020

2. Gunawan *et al.*, *Nature* **575**, 151-155, 2019



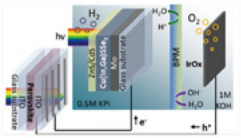
Light-Emitting Diodes (LED)

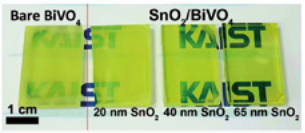
◇ Low-dimensional Perovskites[3]
◇ Colloidal Perovskite Nanocrystals[4]

3. Shin *et al.*, *ACS Appl. Energy Mater.* **3**, 192-199, 2020
4. Kim *et al.*, *ACS Appl. Energy Mater.* **3**, 4650-4657, 2020

Photoelectrochemical (PEC) Water Splitting

◇ $Cu(In,Ga)(S,Se)_2$ Photocathode for HER[5]
◇ $BiVO_4$ Photoanode for OER[6]





5. Koo *et al.*, *ACS Appl. Energy Mater.* **3**, 2296-2303, 2020
6. Byun *et al.*, *J. Mater. Chem. A* **5**, 6905-6913, 2020

Core Facilities

High-vacuum evaporator system, Close-space sublimation system with four heating zones, Atomic layer deposition, Solar simulator, QE measurement system, multi-glove box etc.

Shin, Jonghwa

Lab
Advanced Photonic Materials and Devices Lab

Website
https://apmd.kaist.ac.kr

Education
Ph.D., Stanford Univ. (2008)

Research Interests
Metamaterials, Nanophotonics, Solar energy & display devices

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Biography

Prof. Shin received his Ph. D. in electrical engineering from Stanford University in 2008. After working as a postdoctoral researcher in the Department of Physics at KAIST, he joined DMSE at KAIST as a faculty member in 2012. His lab (Advanced Photonic Materials and Devices Lab) is focusing on exploring the ultimate limits of fine-structured materials interacting with waves, developing fundamental theory as well as new nanofabrication processes. His group is collaborating with industry for practical applications such as microwave metasurfaces, novel displays, and radiative cooling devices. His contributions to the field have been acknowledged by The Korean Institute of Metals and Materials' Young Scientist Award (2016) and The Optical Society of Korea's Rising Stars 30 Award (2020).

Publications and Patents

- J. Jung *et al*., "Broadband metamaterials and metasurfaces: a review from the perspectives of materials and devices," *Nanophotonics* 9, 3165 (2020).
- T. Chang *et al*., "Broadband giant-refractive-index material based on mesoscopic space-filling curves," *Nat. Commun*. 7, 12661 (2016).
- J. Kim *et al*., "Highly tunable refractive index visible-light metasurface from block copolymer self-assembly," *Nat. Commun*. 7, 12911 (2016).
- T. Chang *et al., Wideband ultra-high refractive index mesoscopic crystal structure using space-filling of electric dipole and optical device using the same*, US 10295885 (2019).

Advanced Photonic Materials and Devices Lab

Principal Investigator
Shin, Jonghwa

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Current Research Topics

- Highly non-linear or non-local metamaterials
- Highly tunable optical nanostructures
- Smart materials for radiative cooling and heating
- Metasurfaces for future displays, microwave absorbers, and bio-sensors

Research Highlights

Our lab focuses on new types of interaction between light and structured materials and how to utilize them in applications. An example of our work is a nonlinear metamaterial with billion-times enhanced nonlinear coefficients in terahertz.

Core Facilities

Ultra-thin film deposition system for plasmonic metals, Femto-second laser system with OPO, Cluster computers with GPU

Yeom, Jihyeon

Lab
PLatforms Utilizing nano-Structure Lab (PLUS Lab)

Website
http://yeom-lab.com

Education
Ph.D., Univ. of Michigan (2017)

Research Interests
Nanomaterials, Chiral materials, Nanotechnology

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Biography

Prof. Yeom recently joined DMSE as a faculty member in 2020. Her lab (Novel Nanomaterials and Platforms Lab) is focusing on developing new platforms using novel nanomaterials for next-generation bio- and spectroscopic-analysis creating Big Data. She received her Ph. D. at the University of Michigan in 2017 where she researched chiral nanomaterials with Prof. Kotov. She then conducted her postdoctoral research with Prof. Langer at MIT. Her work focused on the design of chiral nanostructures for drug delivery and their chiral specific interactions with biological systems such as cellular membranes and proteins. During her career, she has been recognized with numerous awards including MIT Hacking Medicine First Place Winner (2018) and Charles G. Overberger Research Award (2016). Recently on September 2020, she also has been selected as a "POSCO Science Fellow" with her research on blood-based disease early diagnosis using novel chiral nano platforms.

Publications and Patents

- J. Yeom *et al*., Chiral Templating of Self-Assembling Nanostructures by Circularly Polarized Light, *Nature Materials*, 14, 66–72, (2015)
- J. Yeom *et al*., Chiromagnetic Nanoparticles and Gels, *Science*, 359, 6373, 309-314, (2018)
- J. Kim* and J. Yeom* *et al*., Assembly of Gold Nanoparticles into Chiral Superstructures Driven by Circularly Polarized Light, *J. Am. Chem. Soc*, 141, 30, 11739-11744, (2019)
- J. Yeom *et al*., Chiral Supraparticles for Controllable Nanomedicine, *Adv. Mater*., 1903878, (2019)
- J.Yeom, and N.Kotov, *Synthesis of chiral nanoparticles using circularly polarized light* US10279394B2

PLatforms Utilizing nano-Structure Lab (PLUS Lab)

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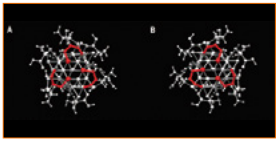
Current Research Topics

- Chiroplasmonic based Nano-Structural Platforms
- Chiromagnetic based Nanomedical Platforms
- Semiconductor Platforms for Big Data
- Next-generation Bio Detection Platforms

Research Highlights

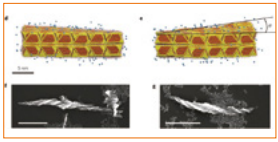
<Selected Publications>

Science(2018)



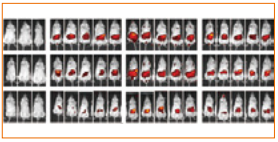
Chiromagnetic Nanoparticles and Gels

Nature Materials(2015)



Chiral Templating of Self-Assembling Nanostructures by Circularly Polarized Light

Advanced Materials(2020)



Chiral Supraparticles for Controllable Nanomedicine

<Vision>

- Bridging the gap between fundamental research and innovation

<Research Plan>

- Development of Novel Nanomaterials
- Exploring new properties of chiral nanomaterials
- Design and Assembly of nanomaterials
- Building Innovative platforms for bio- and spectroscopic analysis

Core Facilities

UV-Vis-NIR(163-2500nm) Circular Dichroism Spectrophotometer (JASCO J-1700)

Yuk, Jong Min

Lab
Emerging Materials and Electron Microscopy Lab.

Website
http://yuklab.kaist.ac.kr

Education
Ph.D., KAIST (2012)

Research Interests
Bio-, energy-, nano-, and 2D-materials,
In-situ electron microscopy

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Biography

Prof. Yuk received his Ph. D. in materials science and engineering from KAIST in 2012. After working in KAIST, Institute for Basic Science, and U.C. Berkeley, he joined DMSE as a faculty member in 2016. His lab (Emerging Materials and Electron Microscopy Lab) is focusing on the Bio-, Nano-, Energy-, and 2D-materials using in-situ electron microscopy. His contributions to the field have been acknowledged by POSCO Science Fellowship (2014).

Publications and Patents

- J.M. Yuk *et al*., "Graphene veils and sandwiches" *Nano Lett*. 11, 3290 (2011).
- J.M. Yuk *et al*., "High-Resolution EM of Colloidal Nanocrystal Growth Using Graphene Liquid Cells" *Science* 336, 61 (2012).
- J. Park *et al*., "3D Structure of Individual Nanocrystals in Solution By Electron Microscopy" *Science* 349, 290 (2015).
- J.Y. Park *et al*., "Atomic visualization of a non-equilibrium sodiation pathway in copper sulfide" *Nat. Commun*. 9, 922 (2018).
- H.K. Seo *et al*., "Strong Stress-Composition Coupling in Lithium Alloy Nanoparticles" *Nat. Commun*. 10, 3428 (2019).

Emerging Materials and Electron Microscopy Lab.

Principal Investigator
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Youtube
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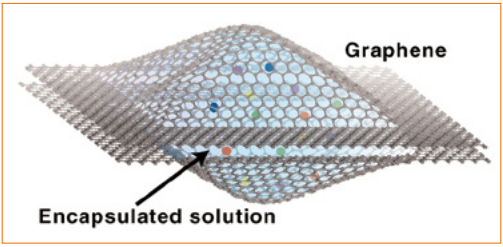
Current Research Topics

- Development of operando liquid-phase TEM platform
- Development of active materials for rechargeable battery
- The in-situ observation of bio-, energy-, nano- and 2D- materials
- Image processing and machine learning for TEM data

Research Highlights

Emerging Materials and Electron Microscopy (EM)2 lab is exploring in-situ study of structure, phase, nucleation, growth, defects, interface, and facets in bio-, energy-, nano- and 2D-materials and direct imaging or 3D imaging of soft materials.



Especially, we utilize a new type of liquid cell for in-situ TEM based on entrapment of a liquid film between layers of graphene. It facilitates atomic resolution imaging while sustaining the most realistic liquid conditions under electron-beam radiation. Furthermore, we are developing the operando graphene liquid cells that enable us to flow liquid, apply voltage and heat up inside the TEM. These state-of-the-art in-situ TEM technology will lead us to beyond the knowledge.

Core Facilities

Transmission Electron Microscopy(TEM), Chemical Vapor Deposition(CVD), Electrochemical cell tester, Liquid holder(Protochips), Cryo Holder(Gatan), Heating Holder (Protochips)

Research Centers and Distinguished Programs

Distinguished Government Research Centers

- Engineering Research Center(ERC) funded from National Research Foundation (NRF) by Korean Government (1)
  - ○ Wearable Platform Materials Technology Center (P.I.: Prof. Byeong-Soo Bae)
- National Creative Research Initiatives (2)
  - ○ Multi-Dimensional Directed Nanoscale Assembly Creative Research Initiative Center (P.I.: Prof. Sang Ouk Kim)
  - ○ Creative Research Initiative Center of Photosensitizing Systems for Biocatalytic Photosynthesis and Amyloid Engineering (P.I.: Prof. Chan Beum Park)
- BK21 FOUR (Brain Korea 21 Fostering Outstanding Universities for Research)
  - ○ R&E Initiative for K-Materials Global Innovation (Director: Prof. Yeon Sik Jung)

Education and Research Programs with Industry

- **EPLL** (with LG Innotek)
- **EPSS** (with Samsung Electronics)
- **KEPSI** (with SK Hynix)
- **LGenius** (with LG Display)
- **CEPP** (with LG Chem)

R&D Programs with Industry

- Cooperative Research Program with **POSCO**
- **MLCC** Center from Samsung Electromechanics

EDUCATION

Vision and Strategy

We are reforming our education system to nurture new generation of materials innovators who are self-motivated, pioneer new fields, and solve global challenges. In particular, our effort is focused on three aspects: curriculum, supporting system, and internationalization.

We design and continuously revise our curriculum to provide our students firm and rich academic soil with emphasis on core materials research capabilities as well as on their application in cutting-edge research in HEAD areas. In particular, students are encouraged to learn new research methodology based on artificial intelligence. We also place strong emphasis on comprehensive care and support systems for our students, which includes personal interactions, from systematic learning systems to birthday lunches. We actively seek global collaboration in education with joint degrees and student exchanges.

Establish a system to foster materials innovators for the AI/Industry 4.0 generation

Part 1. Firm and rich academic fundamentals

- Emphasize core materials research capabilities
- Strengthen HEAD-related curriculum
- Prepare students for the era of AI

Part 2. Systematic support

- Reform courses and learning systems to Edu 4.0 standards
- Boost benefits for rising research staff members
- Pursue 100% satisfaction from students

Part 3. Globalized platform

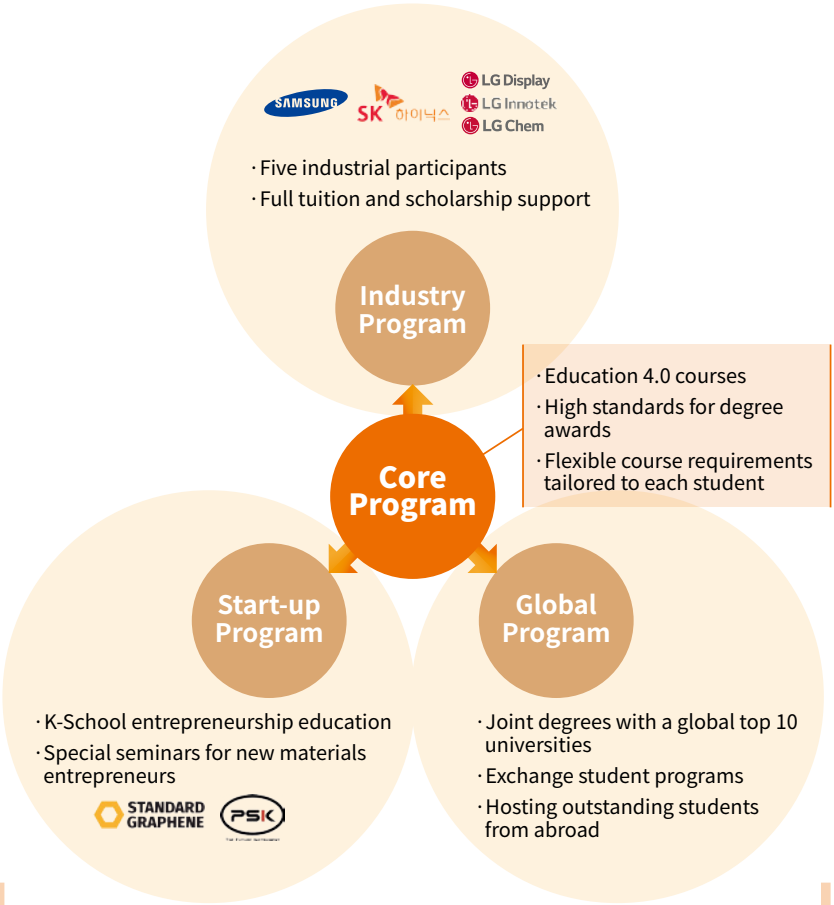
- Facilitate joint degree programs with global top universities
- Promote student exchanges with key partners
- Support oral presentations in top conferences

Curriculum

MAGIC-4 programs summarize the structure of curriculum provided by our department. They are designed to emphasize the core understanding of materials science as well as to facilitate the application of the core knowledge to actual engineering problems.

MAGIC*- 4 Education Program

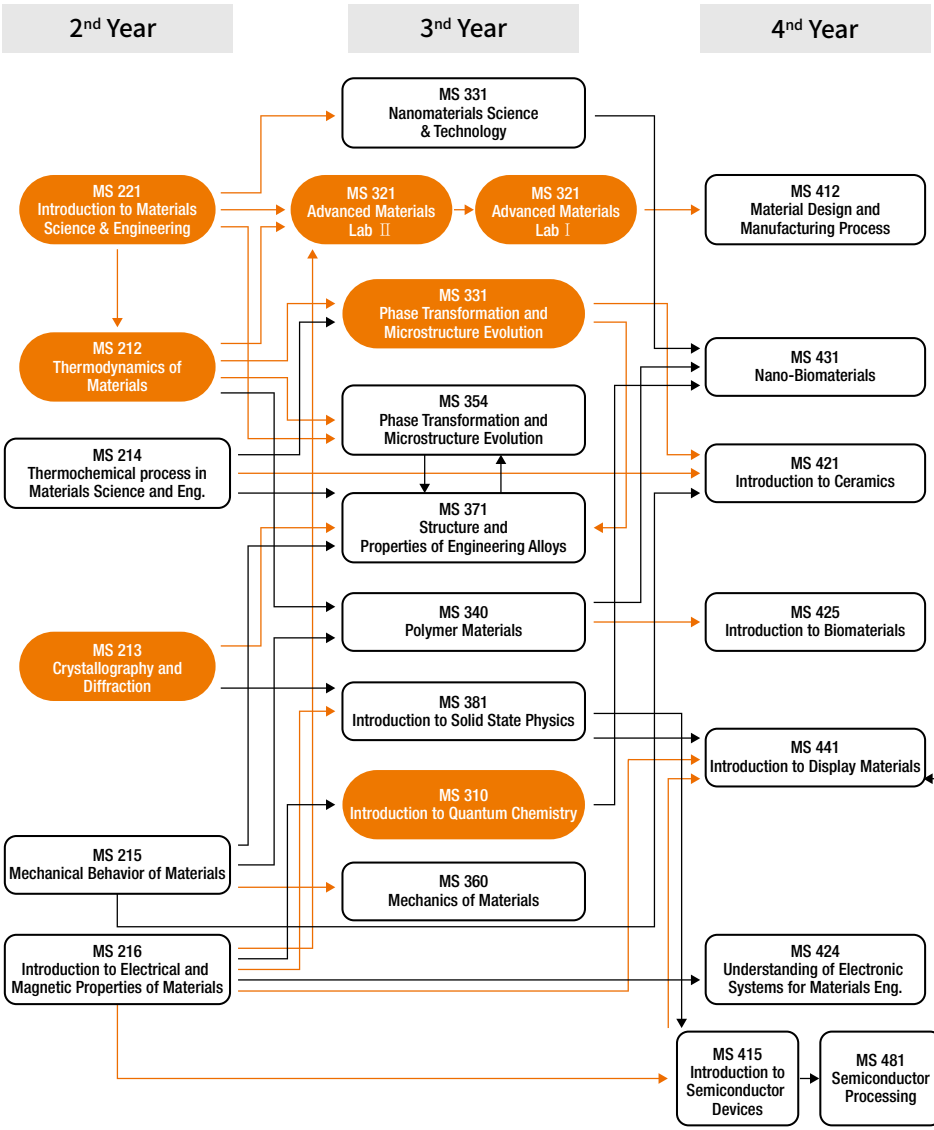
Upgrade the existing university-industry cooperation education program to the 4-track innovator fostering program



* **MAGIC**: **M**aterials/**A**cademies/**G**lobalization/**I**ndustries/**C**ollaborations

■ Undergraduate-level courses

Students are encouraged to design their own curriculum with choices of various elective courses. Many graduate-level courses are also open to undergraduate students to offer opportunity for more in-depth learning.



Care and Support System

■ Core-Shell Advisory System

Provide In-depth/Convergence Research Guidance Through Multiple Guidance Professors of Complementary Dynamics

- In-depth Guidance on Research Expertise
- Detailed Advice on Overall Research Process

● Core Academic Advisor
(Primary Academic Advisor)

Complementary collaborative guidance

● Shell Academic Advisor
(Secondary Academic Advisor)

- Guidance on Convergent, Multifaceted Broad Impact Research
- Guidance to Strengthen Global Impact in Terms of Applicability and Commercialization

■ Support Package

K-Materials Academic Awards

Present “Excellent Thesis” Awards
(Excellent International Student Thesis Award, Excellent Cooperation Award)

100% of Graduate Student Satisfication

Implement Independent Departmental Stipend Policy - higher than that of the institutional standard

Practical Safety Training
(100% completion rate)

Foster Self-initiated Materials Innovators

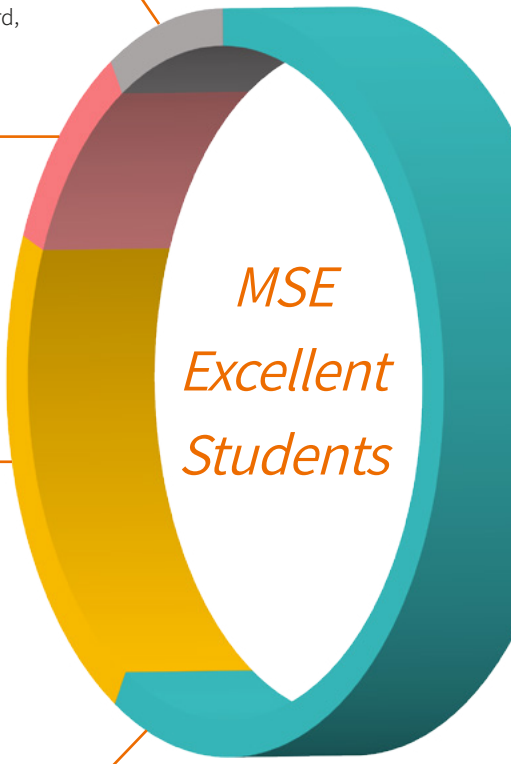
Implement Core-Shell Advising Professor System

Facilitate Creative Convergence Research
(Implement Joint Lab Seminars and Other Programs)

Host Excellent Int’l Students

Assign Academic Advisors for Undergraduate Exchange Students

Assign Mentoring Professors for Graduate International Students



■ Student Care Activities

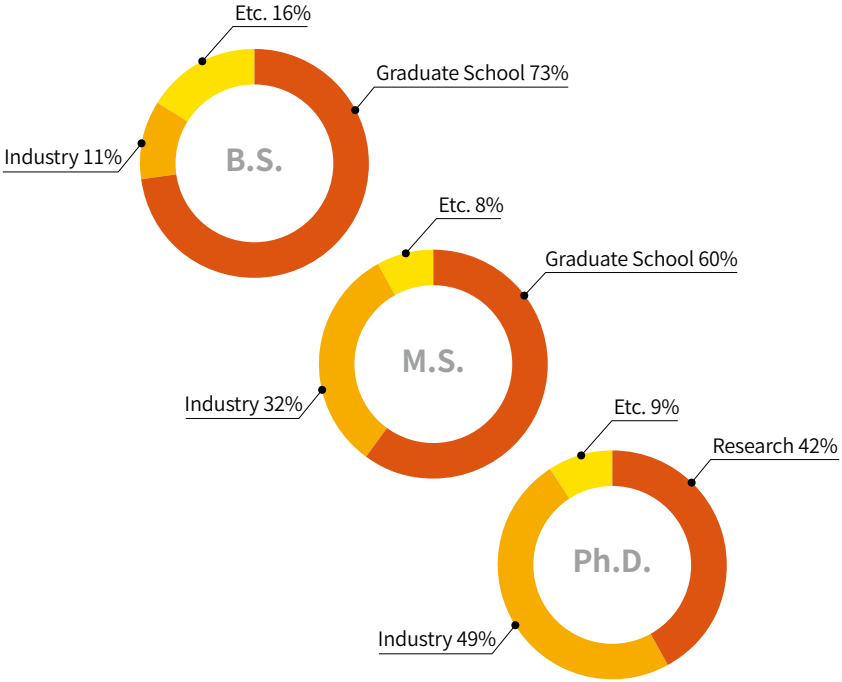
DMSE provides online care activities to all undergraduate students to improve their sense of belongings and self-esteem, even in the era of global pandemic. Online activities include

- Online welcoming party for new undergraduate students
- Online career consultation program
- Online group chat using KakaoTalk, a popular messaging app, between students and academic advisors
- Online birthday gifts

Career Paths

Compared to other departments, KAIST DMSE has a high rate of students continuing to higher degrees: 73 percent of undergraduate students enter master programs, and 60 percent of master students enter doctoral programs.

Student Career Paths



Alumni

February, 2020

B.S. Degree	Master Degree	Ph.D. Degree	**Total**
810	1,982	1,184	**3,976**

Collaboration and Outreach

International Collaboration

International collaboration in education and research with prominent global institutions as well as renowned scholars is a core strategy towards academic excellence and technological innovation in materials science and engineering. To share breakthroughs and major achievement in materials development, DMSE is organizing the KAIST Emerging Materials Symposium, inviting internationally-renowned speakers since 2016. Even during the middle of the global pandemic, the symposium series continues as the first KAIST Emerging Materials e-Symposium, held online from Sept. 21 to 25, 2020, and KAIST DMSE has invited 20 prominent speakers headed by Prof. Andre K. Geim, Univ. of Manchester, the 2020 Nobel Laureate.

Collaboration agreements with 7 MSE departments/centers from 7 universities in 4 countries

Country	Date	Univ.	Areas
Japan	Oct 2012, June 2017	MSE, Tohoku Univ.	Metals & Ceramics
Singapore	Oct 2012, June 2017	MSE, Nanyang Technological University	Bio-Materials
UK	Sept 2012	Center for Plastic Electronics, Imperial College London	Plastic Electronics
USA	Jan 2013	U Chicago Argonne, LLC	Energy & Nanoscale Materials
USA	Nov. 2012, April 2016	MSE, MIT	MSE
USA	Nov. 2017	MSE, Northwestern Univ.	MSE
USA	Nov. 2012	MSE, UIUC	Flexible Electronics

KAIST Emerging Materials Symposium

Date	Venue	Main Speakers
Aug. 2, 2016	KAIST	Paul S Weiss, Editor-in-Chief, ACS(American Chemical Society), Jilian M. Buriak, Editor-in-Chief, Chemistry of Materials and 7 Editor-in-Chiefs
Aug. 7, 2018	KAIST	Chris Schuh, Coordinating Editor of ActaMaterialia, Paul S Weiss, Editor-in-Chief, ACS(American Chemical Society), Tim Swager, Associate Editor of Macromolecules, Vincent Dusastre, Editor-in-Chief, Nature Materials
Sept. 6, 2018	KAIST	Prof. Nathan Lewis, Editor-in-Chief, Energy and Environmental Science, Reginald M. Penner, Associate Editor, ACS Nano
Sept. 21–25, 2020	KAIST (Online)	Novel Laureate Prof. Andre Geim, 4 Editor-in-Chiefs from ACS Nano, Nano Energy, Energy Storage Materials, ACS Materials Letters, Accounts of Materials Research, and 16 prestigious speakers

K-Materials lectureship from internationally-renowned leaders

Year	Name	Position	Afflation
2017	Paul C. McIntyre	Department Chair, MSE	Stanford Univ.
2017	Erik Luijten	Department Chair, MSE	Northwestern Univ.
2018	Harm-Anton Klok	Department Head, MSE	EPFL
2019	Dierk Raabe	Director of Max-Planck-Institut Fur Eisenforschung RWTH Aachen Univ.	
2019	Michael J. Aziz	Gene and Tracy Sykes Professor of Materials and Energy Technologies	Harvard Univ.

2020 KAIST Emerging Materials e-Symposium (Sept. 21–25, 2020)

K-Materials YouTube Channel

KAIST DMSE is adopting multiple ways to communicate with the society and to bring useful and fun materials to all audience who are interested in materials science and engineering. As part of the effort, DMSE is providing various contents in YouTube:

1. K-Materials

- Emerging Materials Symposium
- Highlights of recent research and technological development
- Summary of doctoral dissertations
- Introduction of DMSE labs and centers
- Author interviews for selected publications

2. Safety Materials

3. Fun Materials

- DMSE student activities
- Material trivia and others

https://www.youtube.com/c/kmaterials

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Campus Map

KAIST DMSE and its labs are located at the main campus of KAIST in Daejeon.

W1, W8, E4 building

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