MATERIALS SCIENCE & ENGINEERING
The development of materials, which has led the core of human history, always makes humankind dream of new ages.

The Department of Materials Science and Engineering at POSTECH will help turn the dreams of scientists and engineers into a reality.

We will keep challenging for innovation that will make the dreams of mankind come true by nurturing global leaders.
The Department of Materials Science and Engineering (MSE) was established in December 1986 simultaneously with the founding of POSTECH. Started as The Department of Metallurgy and Materials Science, the name was first changed to The Department of Materials & Metallurgical Science in 1990 and was again renamed as Materials Science & Engineering in 2001. The undergraduate program initially started with thirty students admitted in 1987 and the maximum capacity expanded to thirty five in 1990. Currently, twenty five students are being admitted as MSE majors annually, and up to ten undeclared students may be admitted to MSE after one year from their admission to POSTECH. The graduate program was started in 1988 with fifteen students pursuing Master’s and five students pursuing Ph.D. degrees. At present, about fifty five graduate students are being admitted annually.

Academically, MSE connects science and engineering. The department of MSE at POSTECH is taking a leading role in research related to the materials industry and is striving to become the international capital in the field of materials science by active research and education. The department aims to educate students to acquire fundamental and pivotal knowledge in the overall fields of materials science and specialized knowledge that will allow students to go into the specific field of their choice applying materials science and engineering. In accordance, students are required to take courses that will help them gain an overall understanding of materials in their second and third years. In their third and fourth years, students may select courses according to their interests from the wide range of courses that cover the various aspects of materials.

The Department is currently focusing on research of Advanced Structural Materials, Electronic Materials for Information Technologies, Energy and Environmental Materials, and Biomaterials. However, there is a great possibility of MSE advancing into other various fields due to its highly flexible applicability.

POSTECH, Now Truly World-Class

<table>
<thead>
<tr>
<th>World Rank</th>
<th>Institution</th>
<th>Country</th>
<th>Overall score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Harvard University</td>
<td>United States</td>
<td>96.1</td>
</tr>
<tr>
<td>2</td>
<td>California Institute of Technology</td>
<td>United States</td>
<td>96.0</td>
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<tr>
<td>3</td>
<td>Massachusetts Institute of Technology</td>
<td>United States</td>
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<td>4</td>
<td>Stanford University</td>
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<td>Imperial College London</td>
<td>United Kingdom</td>
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<tr>
<td>6</td>
<td>University of Cambridge</td>
<td>United Kingdom</td>
<td>91.2</td>
</tr>
<tr>
<td>7</td>
<td>University of Oxford</td>
<td>United Kingdom</td>
<td>91.1</td>
</tr>
<tr>
<td>8</td>
<td>University of California Berkeley</td>
<td>United States</td>
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<td>9</td>
<td>Yale University</td>
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<td>Swiss Federal Institute of Technology Zurich</td>
<td>Switzerland</td>
<td>83.4</td>
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<tr>
<td>12</td>
<td>University of Tokyo</td>
<td>Japan</td>
<td>82.0</td>
</tr>
<tr>
<td>13</td>
<td>University of Hong Kong</td>
<td>Hong Kong</td>
<td>79.2</td>
</tr>
<tr>
<td>14</td>
<td>University of Tokyo</td>
<td>Japan</td>
<td>75.6</td>
</tr>
<tr>
<td>28</td>
<td>Pohang University of Science and Technology (POSTECH)</td>
<td>Republic of Korea</td>
<td>75.1</td>
</tr>
</tbody>
</table>

28 National University of Singapore | Singapore | 72.9 |
36 University of Melbourne | Australia | 71.0 |
37 Peking University | China | 70.7 |
39 Ecole Polytechnique | France | 69.5 |
41 Hong Kong University of Science and Technology | Hong Kong | 69.0 |
55 Brown University | United States | 64.9 |
79 Korea Advanced Institute of Science and Technology | Republic of Korea | 59.7 |
109 Seoul National University | Republic of Korea | 56.0 |
Educational Objectives

Nurture Future Global Leaders

The best faculty in Korea

World-Leading Research Technology

Encourage students to participate in overseas conferences and provide financial support.

Center for Futuristic Material-Systems (The second phase of the BK21 Project)

Government Funding: ₩870 million/yr.
Funded by POSTECH: ₩60 million

The Best Education Programs & Research Facilities
- Based on the Master’s program
- Students only pay the initial admission fee
- The best scholarship offered in Korea
- Outstanding educational conditions
- Continued investment

Opportunities to participate in overseas conferences

Scholarship
Standard: ₩990K
Additional: ₩300K

The Times Higher Education Supplement ranked POSTECH 28th on its world rankings in September, verifying POSTECH as a genuine world-class university on the international arena.

During its short 24-year history, POSTECH has set goal and has been executing plans to promote its global status.

As a top research university in Korea, POSTECH has weaved its way to join the distinctive research universities in the Asian region and to advance its global rank further on the world stage.

However, many ranking systems had failed to put a high weight on education and research, and assigned heavy weights to universities with name recognition that often comes with a long history or a size. But on the Times Higher Education Supplement 2010 released last September, POSTECH was revealed to be the 28th global university for education and research work. The data was compiled by Thomson Reuters, an authority on research citation data for more than half a century, which conducts an invitation-only reputation survey of more than 13,000 academics.

The Times singled out POSTECH’s growth to be most astonishing among the top 200, and stated that the results put POSTECH as truly world-class. This is the first time in the history of Korea’s higher education that a Korean university became included in the world’s top 30.
Program Overview

The curriculum of MSE focuses on the development and improvement of engineering materials which play an essential role in the advancement of high technology industry. Engineering materials can be broadly divided into conventional metallic, ceramic, electronic, and polymer/biomaterials, and the curriculum of MSE is composed of the following four areas according to the division of materials.

Based on understanding of each material’s characteristics and manufacturing processes, MSE aims to develop and make applicable new materials in demand by various fields of engineering. Since the understanding of basic theories and principles which classify structures and properties of each material is necessary to develop new materials that are demanded by the future industrial world, students are made to build up basic knowledge in their major by completing all lower division major requirement courses. Upper division courses include major elective courses such as electronic materials, advanced structural materials, environment/energy materials, and biomaterials to provide a diverse and systematic education.

**Metallic materials**
This area of study focuses on the mechanical, physical, and chemical properties of metals and practical applications, such as various manufacturing processes based on a general understanding of crystal structure, microstructure, and phase transformation of metallic materials. We also introduce alloy design and plastic working for the development of materials and processing methods that are suitable for various purposes.

**Ceramic materials**
Courses in ceramic materials cover the characteristics, uses, manufacturing processes, mechanical and physical properties, atomic bonding structure, microstructure, and phase transition of various ceramic materials, such as ceramic semiconductors, structural materials, ferroelectric materials, optical materials, and censors.

**Electronic materials**
Courses in electronic materials aim to give students an understanding of the properties and working principles of electronic materials and devices, particularly focusing on semiconductors. Accordingly, semiconductor physics and the basic theories and working principles of semiconductor electronic and optical devices that employ semiconductor physics are covered, as well as various manufacturing processes.

**Polymer/biomaterials**
To aid students understanding of polymers as an organic material, the lectures are mainly focused on synthesis, structure, structure-property relations, and physical and chemical structure of polymers. The importance of advanced polymer materials, their extensive applications, and the fundamental concepts of biomaterials are also introduced.
International Acknowledgement

JoongAng Ilbo’s university evaluation team was the first to analyze and compare global competitiveness of the universities in Korea at the individual department level for its University Rankings 2009. In these rankings, POSTECH ranked 41st in Materials Science and 45th in Chemistry and was recognized as a university close to the world’s highest level. The department’s ranking of 41st is far ahead of Seoul National University, which ranked 67th, and is recognized as the best in Korea.

Rankings

**Materials Science**

<table>
<thead>
<tr>
<th>University</th>
<th>Ranking</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington (US)</td>
<td>1</td>
<td>100(12.30)</td>
</tr>
<tr>
<td>POSTECH</td>
<td>41</td>
<td>41(5.49)</td>
</tr>
<tr>
<td>Seoul National</td>
<td>67</td>
<td>34(4.72)</td>
</tr>
</tbody>
</table>

Based on the number of citations per paper published in SCI journals during 2004-2008 among the top 237 universities out of 472 (based on the number of published papers) in the field of materials science.

**Chemistry**

<table>
<thead>
<tr>
<th>University</th>
<th>Ranking</th>
<th>Score</th>
</tr>
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<tbody>
<tr>
<td>Caltech (US)</td>
<td>1</td>
<td>100(15.23)</td>
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<tr>
<td>POSTECH</td>
<td>45</td>
<td>55(9.26)</td>
</tr>
<tr>
<td>Seoul National</td>
<td>156</td>
<td>33(6.31)</td>
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</table>

Based on the number of citations per paper published in SCI journals during 2004-2008 among the top 357 universities out of 713 (based on the number of published papers) in the field of chemistry.

**Molecular Biology, Genetics Engineering**

<table>
<thead>
<tr>
<th>University</th>
<th>Ranking</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvard (US)</td>
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<td>100(36.54)</td>
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<tr>
<td>Seoul National</td>
<td>131</td>
<td>15(9.03)</td>
</tr>
</tbody>
</table>

Based on the number of citations per paper published in SCI journals during 2004-2008 among the top 138 universities out of 271 (based on the number of published papers) in the field of molecular biology and genetics.

**Engineering**

<table>
<thead>
<tr>
<th>University</th>
<th>Ranking</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvard (US)</td>
<td>1</td>
<td>100(6.13)</td>
</tr>
<tr>
<td>POSTECH</td>
<td>150</td>
<td>29(2.37)</td>
</tr>
<tr>
<td>Seoul National</td>
<td>242</td>
<td>21(1.94)</td>
</tr>
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</table>

Based on the number of citations per paper published in SCI journals during 2004-2008 among the top 386 universities out of 772 (based on the number of published papers) in the field of engineering.

Career Path after Graduation

- **POSCO/Samsung/Doosan/Hynix/SK/G M Daewoo/STX**
  - Employment 31% (80 ppl)
  - Study abroad 2% (6 ppl)
  - Graduate Schools 67% (171 ppl)

- **POSCO/Samsung Electronics/LG Philips/Hynix/Hyundai Heavy Industry**
  - Ph.D. Program 76
  - Study abroad 5
  - Research Laboratory 1
  - Employment at Corporations 64

- Corporations/universities/overseas/government-supported research institute

- Employment of students graduated for the last 10 years
- Students graduated with Master’s Degree
- Students graduated with Ph.D.
Overview

Over the last 100 years, materials scientists have made tremendous advances in developing revolutionary materials that shape everyday life. High purity semiconductors, glass fibers, polymers, bio-materials, structural steels, carbon fiber composites are but a few examples of materials that fundamentally impact human life. The field of Materials Science and Engineering is currently evolving at a more rapid pace than at any point in history, and creating new technological opportunities over the limitations by the availability of suitable solid materials, and hence, impacting a broad range of modern science and technologies.

Department of MSE at POSTECH is consistently recognized as a world-class, of course the top in the nation, research institution, based on its advanced academic program, its world-recognized faculty, and the high caliber of its students. Materials scientist and engineers at POSTECH are pursuing a new paradigm that will take our discipline in exciting directions: nano electronics and photonics materials and systems, advanced structural materials, energy and environmental materials, bio and organic materials, and fundamental/computational materials science. This new landscape offers tremendous opportunities and challenges and POSTECH’s MSE department is extremely well positioned to remain at the forefront of this materials revolution.

1. Nano Electronic Materials and Systems
2. Nano Photonics Materials and Systems
3. Advanced Structural Materials
4. Energy and Environmental Materials
5. Bio and Organic Materials
6. Fundamental/Computational Materials Science
1. Nano Electronic Materials and Systems

The field of nano-scale electronic materials and systems is a diverse and rapidly-evolving area in the MSE. A wide variety of unique electronic and mechanical properties have been discovered for materials with nanoscopic dimensions, have made breakthrough technologies and new functionalities in the field of electronics. POSTECH’s MSE department excels in the areas of inorganic and organic nanowires, carbon nano tubes and graphenes, nano biosensors, high resolution lithography, and sub-nano-scale characterization.

2. Nano Photonics Materials and Systems

Nano photonics, born out of the combination of three major sciences, nanotechnology, and optoelectronics, is one of the most important technologies for realizing sustainability of our life and the earth in the 21st century.

Nano photonics can provide high bandwidth, high speed, high efficiency, and ultra-small optoelectronic components and devices which will revolutionize telecommunications, display, computation, sensing, and lighting. The physics and application of nano-scale photonic structures are widely investigated in the department of MSE. In particular we are interested in nano-photonic structures which can enhance light-matter interaction by orders of magnitude, ultra-high efficiency light emitters (LEDs and lasers) and solar cells.
3. Advanced Structural Materials

This area focuses on the relationships between the chemical and physical structure of materials and their structural properties and performance. Fundamental and applied research in this field responds to an ever-increasing demand for improved or better-characterized materials which will lead the innovation of infrastructures in transportation, large-scale power plants, etc., in near future. POSTECH’s MSE department excels in the areas of light-weight materials, high temperature/high strength materials, advanced steel technologies, and process development and characterization.

4. Energy and Environmental Materials

With the increased demand for fossil fuels and subsequent concerns on environmental issues such as climate change, research in energy and environmental technology is more important than ever. This research involves both developing materials for alternative energy sources more affordable and efficient to become a viable replacement for fossil fuels, and developing materials that enable tremendous energy savings. Here in the MSE department at POSTECH, we have focused on fuel cells, organic photovoltaics, dye-sensitized solar cells, batteries, and highly efficient inorganic and organic light emitters.

5. Bio and Organic Materials

The main research topics are biomedical nanomaterials for nanobiomedicine, and organic electronic materials and devices on the basis of an in-depth understanding of the fundamental concepts on bio, organic, and polymeric materials science and engineering. Nanobiomedicine is the term for the exploitation of advanced nanobiotechnology to biosensors, bio-imaging, drug delivery and tissue engineering. The research for organic electronic materials and devices focuses on next-generation flexible electronics and displays, organic semiconductor devices, organic light-emitting diodes, and organic solar cells.
6. Fundamental/Computational Materials Science

In this field of research, both computational and analytical techniques based on theoretical models are used to study the properties of condensed matter and atomic/molecular systems, aiming to enhance the communication between experimental materials research and theoretical/computational works on both existing and new/advanced materials and their applications. Major research directions include the development of new computational methods, theoretical modeling of mechanical/optical/electrical properties of materials, and nanostructures for the applications in bio, energy and electronic as well as advanced structural materials.
Electron Microscopy and Advanced Materials Analysis Lab.

Research Topics
- Aberration-corrected Scanning Transmission Electron Microscopy
- Atomic scale imaging and electronic/chemical analysis
- In-situ TEM/STEM analysis
- Study on multifunctional complex materials including multiferroic, piezoelectric, magnetostrictive materials, and so on
- Development of new electron microscopic analytical technique

Research Interests

Electron Microscopic Scope
- Atomic Scale Analysis with Aberration-corrected STEM and EELS (Electron Energy Loss Spectroscopy)
- Electric/Magnetic Field Analysis with Differential Phase Contrast in STEM
- Dynamic Analysis with In-situ TEM Facilities (electric, magnetic, and heating/cooling)

Materials Scientific Scope
- Piezoelectric/Ferroelectric Oxides: BaTiO3, (KNa)NbO3, Pb(MnNb)O3-PbTiO3
- Multiferroic Oxides: Co2Z-type hexaferrite, BiFeO3, and piezoelectric & magnetostrictive composite
- Atomically Thin 2-dimensional Materials: h-BN, graphene, WTe2, MoTe2, and MoS2
- Cathode Oxides in Lithium-ion Battery: LiFePO4, LiMnPO4, and MnO2
- Ferromagnetic Oxides: Sr2FeReO6, Sr2CrReO6, LaMnO3, and CoFe2O4

Selected Publications
2. Insights into cationic ordering in Re-based double perovskite oxides, Scientific Reports, 6, 19746 (2016).
4. Emergence of Room-Temperature Ferroelectricity at Reduced Dimensions, Science, 18, 1314 (2015).
8. Orientation-Dependent Array of Antisite Defects in LiFePO4 Crystals, Angewandte Chemie, 48, 543 (2009).
Biomedical Nanomaterials Lab

Research Topics

- Nanomedicine: The use of nano-biotechnology in medicine which requires multidisciplinary research including materials science and engineering, physics, chemistry, modern biology, and life sciences.
- Biomaterials research topics for nanomedicine at BNL include Drug Delivery, Tissue Engineering, Biosensor, and Bio-Imaging.

Research Interests

Nanomedicines

Medical applications of nanomaterials
- Targeted gene and drug delivery
- Biointegrated cell therapy
- Tissue engineering scaffolds
- Regenerative medicines
- In vitro and in vivo biosensing
- Real-time bioimaging

Bioelectronic Medical Devices

[1] Wearable devices for healthcare
- Smart ocular lens for ubiquitous healthcare
- Biosensor, drug delivery device, power source

[2] Optogenetic systems
- Optogenetic diagnosis and therapy
- Theranostic systems

Selected Publications

Nano-Photonic Glasses Lab

Research Topics

- Novel Nano-structured Photonic Glasses
- Glasses Containing Semiconductor Quantum Dots
- Advanced Glasses for White LEDs
- Rare-earth Doped Glasses for Information Generation, Amplification and Storage
- Glasses for Nuclear waste disposal

Research Interests

Nanoglasses with QDs and Tare-Earth

- Tunable optical transitions in visible and NIR region
- Broad absorption and photoluminescence bands from QDs
- Controlled precipitation of QDs using laser, rare-earth and metal nanoparticles
- Interactions of QDs with rare-earth and metal nanoparticles Nano-photonic devices with QDs
- Glasses for lasers and fiber-optic amplifiers
- Nano-structured glasses for efficient emission

Glasses for Optoelectronic

- Phosphor embedded glasses for white LEDs
- Ray optimization for high efficacy optoelectronics
- Surface modification of optoelectronic devices
- Glasses containing rare-earths and QDs for white LEDs
- New glasses for mobile displays and cellular phones

Glasses for Nuclear Waste Disposal

- Vitrification of radioactive wastes
- Glass-ceramics for immobilization of nuclear wastes
- Development of advanced process for waste-forms

Selected Publications

Semiconductor Integrated Device & Process Lab

Research Topics
- Nonvolatile Resistive Memory Device (ReRAM)
- Neuromorphic Device

Research Interests
3D vertical Resistive Switching Memory Device (ReRAM)
- Resistive switching memory for next generation non-volatile memory application
- Excellent scalability, high speed operation, and low power consumption

Selection devices
- Requirements for high density memory array (4F²)
- Bi-directional selection device such as diode, OTS, MIT, MIEC.

Sub-5nm ReRAM
- Quantized conductive filamentary switching in Sub-5nm era

Neuromorphic device
- High efficiency of biological synapse
- Large connectivity (~10⁴) between neurons
- Synaptic adaptation
- Learning and function
- Low power consumption (~15W)

Selected Publications
1. Daeseok Lee, Jiyong Woo, Sangsu Park, Euijun Cha, Sangheon Lee, and Hyunsang Hwang, "Dependence of reactive metal layer on resistive switching in a bi-layer structure Ta/HfOx filament type resistive random access memory" Applied Physics Letters 104(8), 083507 (2014)


**Laboratory of Multiferroic and Photovoltaic Nanostructures**

**Research Topics**

- Quantum and Statistical Mechanics
- Nonvolatile Nanoscale Multiferroic Memories
- Quantum-Dot-Sensitized Solar Cells

**Research Interests**

**Quantum and Statistical Mechanics**
- First-principles calculations of electronic and spin structures of several important multiferroic materials
- New bonding mechanisms of multiferroics based on orbital-structure calculations
- Statistical mechanical theory of displacive phase transitions and mode-mode couplings
- Landau-Lifshitz-Ginzburg theory of ferroics

**Multiferroics**
- Fabrication and characterizations of new multiferroic materials
- Ultra-high-density multiferroic memory devices based on nanorods and nanodisks
- High-density resistive random access memory (RRAM) devices based on nanorods

**Solar Cells**
- Synthesis of nanostructured oxide photoelectrodes for enhanced electron transport
- Fabrication and characterizations of quantum-dot-sensitized solar cells (QDS-SC)

**Selected Publications**


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**Hyun Myung Jang**

Ph.D., Professor

**Education**

1985. Ph.D., Univ. of California, Berkeley
1976. B.S., Seoul National Univ.

**Professional Experiences**

2010-present, Nomination Committee Member, Nobel Prize in Physics, the Royal Swedish Academy of Sciences
2008, Se-Ah Distinguished Professor of Materials Science, POSTECH
2007-present, Chairman, Mater. Sci. & Engr. Division, Korea Academy of Science and Technology (KAST)
2002, One Thousand Great Scientists Gold Medal by International Biographical Center (IBC), Cambridge, England
1999-present, Fellow elected, Korea Academy of Science and Technology (KAST)
1999-2004, Director, National Research Laboratory (NRL) for Ferroelectrics
1999, registered in Marquis Who’s Who in Science and Engineering
1998-2000, Department Head, Dept. of Materials Science and Engineering, POSTECH
1998, registered in Marquis Who's Who in the World
1996-present, Professor, MSE, POSTECH
1991-1996, Associate Professor, MSE, POSTECH
1986-1987, Massachusetts Institute of Technology (MIT), Research Fellow

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Homepage: http://ferro.postech.ac.kr/
Nanowire Photonics Lab

Research Topics

- Functional x-ray Imaging
- Soft Matter Dynamics
- 3D Nanofabrication

Research Interests

**Functional X-ray Imaging**
- X-ray nano(micro)-imaging
- X-ray fluorescence microscope
- in-situ, real-time, 3-D visualization of biological system

**Soft Matter Dynamics**
- Dynamic study of soft matter using ultrafast X-ray imaging
- Smart hydrogels and polymers
- Colloidal suspension dynamics

**3D Nanofabrication**
- 3D wiring of conducting polymers for flexible electronics
- 3D photonic integration of polymer nanowires
- 3D nanowire arrays for organoelectronics

Selected Publications

3. Jaeyeon Pyo, Ji Tae Kim, Jewon Yoo and Jung Ho Je, "Light propagation in conjugated polymer nanowires decoupled from a substrate" Nanoscale 6, 5620 (2014)
4. Jewon Yoo, Jaeyeon Pyo and Jung Ho Je, "Single inorganic-organic hybrid nanowires with ambipolar photoresponse" Nanoscale 6, 3557 (2014)
Hybrid Nano Materials Lab.

Research Topics

- Understanding the nucleation and growth mechanism of nanomaterials
- Development of new materials or critical advances of current materials for next generation electronic devices
- Combining organic and inorganic materials to attain synergistic properties
- Creating customer-designed electronics with multifunctions

Research Interests

Program 1: Solution-based synthesis of nanostructured materials
- Synthesis of nanoparticles, Nanowires, and nanosheets
- Material design for high performance thermo-, electronic devices
- Assembly of the nanomaterials for device fabrication

Program 2: Fabrication of deformable electronic devices
- Stretchable tactile sensors for electronic skins
- Wearable textile devices
- Drug delivery by mechanical stimulation
- Self-healing electronics

Program 3: Design of New organic/inorganic hybrid materials
- Self-healing conductive materials
- Micropatterning of composite materials
- Mechanical analysis of viscoelastic composite materials
- Functional composite materials for 3D Printing

Selected Publications


2. "Design of Conductive composite Elastomers for Stretchable Electronics" M. Park, J. Park, U. Jeong, Nano Today 2014, 9, 244-260. (*Invited review article)


Device Materials and Physics Lab

Research Topics
- From a range of solid-state device materials/physics and their developments into technology
  - Si optoelectronics
  - Nano electronics/Photonics/Optoplasmonics
  - Complex Oxides Spintronics
  - Gas-phase growth of semiconductor nanowires

Research Interests

Nano Optoelectronics
- Low-dimensional materials: synthesis of high quality one-dimensional semiconductor crystals by gas-phase process
- Nano-optoelectronic devices: development of hybrid optoelectronic systems (broadband Si nano optoelectronics / nanowire photonics / nano optoplasmonics) based on bottom-up approaches and exploration of photonic processes

Quantum Electronics and Complex Oxides Electronics
- Quantum electronic devices: study of fundamental device physics on electron dynamics in low and their assemblies dimensional materials
- Complex oxides electronic devices: characterizations of complex oxides, e.g., multiferroic materials and devices, spin-polarized tunneling devices, and colossal magnetoresistive devices.

Energy Conversion Cells and Bioelectronics
- Nano energy conversions: characterizations of energy conversion cells based on low dimensional materials, e.g., nanostructured array solar cells, nanowire Li-ion battery and fundamental study of energy conversion at the nanometer scale.
- Bioelectronics: investigation of Nano-bio interfacing electronics

Selected Publications
1. Large electro-optical susceptibility mediated by internal photoconductive gain in Ge nanowires, Nano Letters 12, 5913 (2012).
8. The role of NiOx overlayers on spontaneous growth of NiSis nanowires from Ni seed layers, Nano Letters 8, 431 (2008).

Moon-Ho Jo
Ph.D., Professor

Education
2001. Ph.D., Univ. of Cambridge
1995. B.S., Yonsei Univ.

Professional Experiences
2015-present, Professor, MSE, POSTECH
2013-2014, Associate Professor, MSE, POSTECH
2002-2013 Associate Professor, MSE, YONSEI UNIV.
2008-2012 Associate Professor, MSE, POSTECH
2008-Present, Associate Professor, MSE, POSTECH
2008-2008, Assistant Professor, MSE, POSTECH

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Phone
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Homepage
http://ndmpl.postech.ac.kr
Advanced Materials Laboratory for Energy and Environment

Research Topics

- Development of active materials for lithium ion batteries
- Novel materials of lithium ion batteries
- The beyond of lithium ion batteries for energy storages

Research Interests

The research interest of our group is in energy storage materials especially for rechargeable lithium ion batteries that are important to power a variety of applications including portable devices and power tools. There are many challenging issues to be answered in lithium ion batteries: the increase of energy density and the finding of new materials. The goal of researches is to solve these problems through the approaches based on basic knowledge of materials science, the relationship between structures and properties.

Selected Publications

1. S. Yoo and B. Kang, “Thermally driven metastable solid-solution Li0.5FePO4 in nanosized particles and its phase separation behaviors”, Nanotechnology, 24, invited paper (2013)
Structural Nano Materials & Processing Lab

Research Topics

- Structural Nano Material Design by Computer Simulations
  - Materials: Nano, Ultrafine, Porous, Powder, Amorphous, Glasses and Metallic Composite
  - Methods: Multi-Scale Modeling, Finite Element Method, 3-Dimensional Image Processing
  - Applications: Ultrahigh Strength Steel, Light Alloy (Ti & Mg), BIO Mechanics, MEMS, Energy

Research Interests

Mechanical characterization and processing for structured nano materials using multi-scale modeling

- Development of nano mechanics model (K-E-B Creep model)
- Unified model for deformation of nano/micro/macro scale materials (Phase mixture model)
- Finite element method constitutive model development
- Fully coupled Deformation-Temperature-Phase transformation simulation

Severe plastic deformation processing for ultrafine/nano grained materials

- HPT (High Pressure Torsion)/ECAP (Equal Channel Angular Pressing) simulation and experiment
- Microstructural evolution prediction (Dislocation Cell Model): Grain size, misorientation angle
- New process development for industrialization: continuous process, combined process

Nanocrystalline structural materials

- New unified deformation mechanism map of stress and strain rate, in terms of temperature and grain size
- Understanding abnormal behavior in nano materials
- Database and software development for the unified deformation mechanism map

Selected Publications

Ultrafast Nano Optoelectronics Lab.

Research Topics

- Optical studies of electronic property of nanomaterials
- Optoelectronic application of nanomaterials

Research Interests

Understanding emerging new electronic properties of nanomaterials with optical spectroscopy techniques

- Optical spectroscopy: Study on fundamental electronic structure (Absorption spectroscopy, Luminescence spectroscopy, Raman spectroscopy)
- Femtosecond time-resolved spectroscopy: Study on ultrafast control and relaxation process of electronic states (Transient absorption spectroscopy, Time-resolved photoluminescence spectroscopy, Time-resolved Kerr rotation spectroscopy)

Novel optoelectronic applications based on atomically thin 2D crystals

- Quantum optoelectronics: Development of device application based on spin/valley electronic states
- Solar energy harvesting / Telecommunication: Photovoltaic, light emitting diode, laser based on atomically thin 2D crystal and their heterostructure

Selected Publications


Nano Photonics and Optoelectronics Lab

Research Topics
- Semiconductor light emitters: from visible to deep ultraviolet LEDs
- Growth of 2-dimensional materials and their optoelectronics applications
- 3-dimensional nanostructured materials and their energy harvesting applications: solar cells, water splitting, artificial photosynthesis, electronic noses, and novel photonics components

Research Interests

Novel Semiconductor Light Emitters
- AlGaN-based deep ultraviolet LEDs
- High-power white LEDs for solid-state lighting
- All-semiconductor white LEDs for smart lighting

3-dimensional (2D) nanostructures for energy and environment
- Novel electrodes for solar cells and photo-electrochemical cells
- Integrated smart sensors
- Multi-functional high-performance optical filters

2-dimensional optoelectronic materials and devices
- Growth of wafer-level 2D materials
- All-2D-Nitrides light emitters
- 3D-2D hybridized nanostructures

Selected Publications

Jong Kyu Kim
Ph.D., Professor

Education
2002. Ph.D., POSTECH
1997. B.S., Yonsei Univ.

Professional Experiences
2013-present, Associate Professor, MSE, POSTECH
2012-present, Assistant Professor, MSE, POSTECH
2006-2009, Research Assistant Professor, Rensselaer Polytechnic Institute (RPI)
2003-2006, Postdoctoral Fellow, Rensselaer Polytechnic Institute
1997-2002, Graduate Student Researcher

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Clean Steel and Non-ferrous Metals Processing Lab

Research Topics

- Thermodynamics & Reaction Kinetics for Clean Steel technology
- Optimization of Continuous Steel Casting Processes
- Computational Modeling of Fluid Dynamics and Heat Transfer in a Continuous Caster Mold
- Non-ferrous Metal Extraction and Refining Processes

Research Interests

Nonferrous Metal Extraction and Refining Related Process Development and Optimization
- Computational modeling of heat distribution in a reactor and validation with real process data

Clean Steelmaking Process
- Thermodynamics and reaction kinetics of slag/metal/gas reactions for high-cleanliness steel quality
- Optimization of ladle refining slags and mold flux for clean steels
- Control of inclusion level in a steel

Process Optimization of Continuous Caster for Clean Slab Surface Quality
- Control of initial solidifying shell thickness and fluid dynamics in a mold to enhance the steel slab surface quality
- Computational modeling approaches of heat and fluid flow phenomena in a continuous steel casting processes

Selected Publications

Smart Soft Materials Lab

Research Topics

- Development of polymer based biomimetic soft actuators
- Design of functional soft materials including stimuli-responsive hydrogels and polymers
- Combination of functional polymers with inorganic materials for multi-functional smart materials
- Development of new types of stimuli-sensitive polymers/gels enabling chemomechanical systems
- Design of anisotropic hydrogels for advanced functional soft actuators

Research Interests

Our researches will be focused to create novel functional soft materials such as stimuli-responsive hydrogels and polymers. Stimuli-responsive hydrogels are able to generate mechanical energy by deforming their shape arising from chemical changes of composing polymers in response to stimuli. To develop more intelligent and sophisticated man-made actuators with high efficiency, it will be important to understand the fundamental operating system and structural engineering abundant in natural and biological systems.

Selected Publications

Computational Materials Science & Engineering Lab

Research Topics

- Computational Materials and Process Design
- Multiscale Simulation of Microstructural Evolution
- Atomic Scale Analysis of Nano-Structural Evolution
- Development of Advanced Computational Techniques

Research Interests

Prediction and Control of Microstructural Evolution in Polycrystalline Materials
- Multi-scale simulations combining Phase Field Simulation (Microstructural Evolution)
  Computational Thermodynamics (Local Equilibrium)
  Atomistic Simulation (Interfacial Properties)

Atomic Scale Analysis of Nano-Structural Evolution
- Structural Evolution of Nano-structured Materials
- Effect of Impurity atoms on Crack Propagation Behavior
- Deformation Mechanism

Computational Materials Design of LIB & post-LIB
- Structural Stability in Cathode and Anode Materials for Li-Ion Battery and Post-LIB

Infrastructure for Computational Approaches
- "Metallic+Covalent+Ionic" Interatomic Potential Database
- "Phase Field + Thermodynamics + Interface" Multi-scale Simulation Technique
- Size Effect on Fundamental Physical Properties

Selected Publications

Computational Nano Materials Design Lab.

Research Topics

- Theory-guided novel materials design
- Mechanism of energy conversion reactions
- Defect characteristics in semiconductor materials
- First-principles many-body calculations
- Development of multiscale simulation framework

Research Interests

- Theory-guided optimization and novel materials design using First-principles calculation
  - High-throughput screening of new composition photo-absorber materials
  - Optimizing materials functionality by building structure-property relationships
- Identification of chemical reactions at catalyst surface during energy conversion process
  - Building physical and chemical insight into catalytic conversion reactions at materials surfaces
  - Elucidating the role of defects or defect complexes in chemical reaction processes
- Utilization of defects or dopants on electronic and optical properties of materials
  - Identifying thermodynamics and kinetics of defects in semiconductor
  - Enhancing the desired materials properties by controlling defective sites
- Development of new simulation methods for efficient prediction of materials properties
  - Developing new methods which can overcome time and length scale limitation
  - Improving the accuracy of current first-principles calculation methods

Selected Publications

Jang-Sik Lee
Ph.D., Associate Professor

Education
2002 Ph.D., Seoul National Univ.
1999 M.S., Seoul National Univ.
1997 B.S., Seoul National Univ.

Professional Experiences
2013-present, Associate Professor, MSE, POSTECH
2012-2013, Visiting Professor, Univ. of Texas at Dallas, USA
2011-2013, Associate Professor, MSE, Kookmin Univ.
2006-2011, Assistant Professor, MSE, Kookmin Univ.
2004-2006, Senior Research Engineer, Samsung Electronics
2002-2004, Director's postdoctoral fellow, Los Alamos National Laboratory, USA

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Research Topics
- Nanostructured nonvolatile memory devices
- Functional nanoelectronic materials and devices
- Self-assembled nanostructured materials and devices
- Flexible nanoelectronic devices

Research Interests
Nanostructured nonvolatile memory devices
- Nanostructured resistivity switching memory
- Nanostructured phase change memory

Functional nanoelectronic materials and Devices
- Self-assembled nanoparticles
- Layer-by-layer assembled charge-trap memory devices

Self-assembled nanostructured materials and devices
- Anodic aluminum oxide (AAO) nano-templates
- Block copolymer nano-templates

Flexible nanoelectronic devices
- Flexible organic thin-film transistors
- Flexible nano-floating gate memory

Selected Publications
Nano Device and Display Lab

Research Topics

- Architecture of nano-structures and nano-rods
- Plasmonic materials for absorption and transmission of photons
- Nano-patterning and nano-structured architecture for nano light emitting diodes (LEDs)
- Pattern transfer for flexible organic light emitting diodes (OLEDs)
- Nano-photonic structures for flexible photovoltaic solar cells

Research Interests

GaN-based Light Emitting Diodes
- Architecture of nano LED
- Nanostructures for photon extraction
- Vertical LED with laser lift-off technique
- Highly reflective Ohmic contact electrodes (>90%)
- Low contact resistivity electrodes (<=10^4 Qcm^2)
- 2005 Best 50 Research from KRF
- 2005 Korea Technology Festival (Silver prize)

Organic Light Emitting Diodes
- Substrate technologies for flexible OLEDs
- Printing processes for flexible displays
- OLEDs on steel sheets
- Plasmonics for light extraction
- Dielectric/Metal/Dielectric electrode for top OLED
- 2008 Best 50 Research from KRF
- 2010 Korea Patent Festival WiPO prize

Organic Photovoltaic
- Flexible amorphous Silicon solar cells
- Flexible organic photovoltaic solar cells
- Transparent conducting electrode for top solar cells
- Design and simulation of high efficient solar cells
- Light trapping technologies

Architecture of Nano Structures
- Nano pyramid
- Nano imprint
- Anodic aluminium oxide (AAO)
- Nano lens

Selected Publications


Structural Materials Lab (SMAT Lab)

Research Topics

- Advanced Structural Materials
  - Applicable to all industries (Construction, Transportation, Defense, etc.)
  - Excellent mechanical properties (strength, ductility, toughness, etc.) are generally required for structural applications

Research Interests

Nanocomposites
- Development of high-performance amorphous alloys and amorphous alloy matrix composites
- Composite design (matrix, fiber, preform) via liquid pressing process

E-beam Technologies
- Surface alloying by high-energy E-beam irradiation to improve surface properties (hardness, wear and corrosion resistance)

Structural Steels
- Development of high strength low alloy steels: Pipeline steels, TRIP & TWIP steels
- Fracture mechanics study: Fracture toughness analysis, fracture mechanisms

Dynamic Deformation
- Testing under dynamic loading conditions
- Dynamic deformation and fracture behavior
- Application to armor plates and penetrators

Selected Publications


Biomolecular Materials Lab.

Research Topics

- Nanobiotechnology based on sequence-controlled biopolymers
- Darwinian evolution of biomaterials
- Molecular machinery for diagnostic, imaging, gene-editing and therapeutic applications
- Multifunctional biopolymers capable of controlling cellular life
- Synthetic cellular system toward understanding origins of life

Research Interests

Our lab is strongly interested in engineering macro- and biomolecular materials. In particular, a variety of sequence-controlled biopolymers (e.g., nucleic acids, amino acids, etc.) are of interest. Based on them, we aim to create novel biomaterials that do not exist in nature but produce unprecedented functions to control cellular life. To this end, we develop a variety of innovative techniques to generate functional biopolymers in high throughput.

We explore a wide range of potential applications to utilize novel biomaterials and methodologies. We envision that they would be highly valuable for a variety of biomedical applications such as point of care, molecular diagnostics, in vivo imaging, personalized medicine, and genome editing.

Selected Publications


Seung Soo Oh
Ph.D., Professor

Education
2012. Ph.D., Univ. of California, Santa Barbara
2005. B.S., Seoul National Univ.

Professional Experiences
2016-present, Assistant Professor, MSE, POSTECH
2014-2016, Research Fellow, Harvard Medical School/Massachusetts General Hospital
2012-2014, Postdoctoral Researcher, Institute for Collaborative Biotechnologies, UCSB

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Nano-Analysis & Microstructure Control Lab

Research Topics

- Advanced analysis by Total Analysis System (TAS): Cs-corrected TEM, 3D-AP, 3D-EBSD, SIMS
- Microstructure Control for Advanced High Strength Steels: Linepipe, TRIP, High-Mn, etc.
- Analysis of Si-based Memory Device Structure, InGaN Based LED, Si-nanocrystal Based LED & Solar Cell.

Research Interests

Identification of Phase Transformation of High-Mn Steels and Other Alloys using 3D-EBSD
- Effects of step-wise staining on the phase distribution of γ austenite, ε martensite and α martensite in Fe-17wt.% Mn steels containing 0.01wt.% carbon.

Analysis for Elemental Segregation of Grain Boundary and Interfaces using APT (Atom Probe Tomography) and Nano-SIMS
- Nano-SIMS provided the fact that boron atoms were strongly segregated at the prior γ grain boundaries of medium carbon steels containing 50 ~ 100 ppm boron. APT results showed carbon and boron atoms segregated along grain boundary and carbides precipitated both on the boundaries and in grain interior.

Compositional Analysis of the MQW (Multi Quantum Wall) in GaN-based LED using Cs-corrected STEM and APT
- In spite of high density of dislocation in InGaN based LED, why the quantum efficiency of radiative recombination is so high? One of the strong possible explanations is the fluctuation of indium composition in InGaN/GaN MQW and we have successfully analyzed for the fluctuation of indium composition in InGaN active layer by using STEM-HAADF and APT. That is a first result of direct evidence for existence of indium fluctuation in InGaN well layer.

Analysis of CMOS Devices using EF-TEM and APT
- As the scale of transistor has been getting smaller, the importance of atom-size and ppm-level analysis has been increased. To investigate the actual state of elements in MOSFET system, the analytical tools for small-region-investigation should be developed or modified considering analytical spot size and detection limit. And by using APT, we have investigated a real n-MOSFET device.

Selected Publications

5. Sungmin Park, Wooyoung Jung, Chan Gyung Park, “Role of nickel catalyst during the growth of the ZnO nanowalls investigated by TEM and APT,” Jpn. J. Appl. Phys. Accepted (2013)
Research Topics

- Epitaxial growth of high-quality complex oxide thin films
- Structure-property relationship of oxide heterostructures
- Novel oxide electronic devices for next generation switching

Research Interests

Our lab aims 1) to synthesize high-quality oxide thin films and heterostructures, 2) investigate structure-property relationship of oxide heterostructures and 3) design novel functionality for electronic device applications.

High mobility oxide thin films

- Development of novel growth methods using MBE and PLD
- Design of materials for desirable electrical property by doping

Structure-property relationship of oxide heterostructures

- Electronic band structure
- Electrical transport property

Next generation electronic devices

- Tuning of electrical transport in nanoscale oxide heterostructures
- Mott FET, Oxide 2DEG and Modulation doping

Selected Publications

<table>
<thead>
<tr>
<th>Major Field</th>
<th>Faculty</th>
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<tbody>
<tr>
<td><strong>Electronic / Photonic Materials</strong></td>
<td>Hyunsang Hwang, Jang-Sik Lee, Jong Heo, Jonghwan Kim, Jong Kyu Kim</td>
</tr>
<tr>
<td></td>
<td>Jong-Lam Lee, Junwoo Son, Moon-Ho Jo, Si-Young Choi, Unyong Jeong</td>
</tr>
<tr>
<td><strong>Advanced Structural Materials</strong></td>
<td>Byeong-Joo Lee, Hyoung Seop Kim, Sung Hak Lee</td>
</tr>
<tr>
<td><strong>Energy / Environmental Materials</strong></td>
<td>Byeong-Joo Lee, Byoungwoo Kang, Donghwa Lee, Jong Heo, Moon-Ho Jo</td>
</tr>
<tr>
<td><strong>Bio / Organic Materials</strong></td>
<td>Jang-Sik Lee, Jung Ho Je, Sei Kwang Hahn, SeungSoo Oh, Unyong Jeong, Youn Soo Kim</td>
</tr>
<tr>
<td><strong>Computational Materials Science and Engineering / Characterization</strong></td>
<td>Byeong-Joo Lee, Chan Gyung Park, Donghwa Lee, Hyoung Seop Kim, Hyun Myung Jang</td>
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<td>Jung Ho Je, Jonghwan Kim, Si-Young Choi</td>
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MSE Faculty Major Field
Center for Advanced Aerospace Materials (CAAM)

Center for Information Materials

Fuel Cell Research Center

X-Ray Imaging Center
As the global competition for technology supremacy intensifies, Korean industries should be and are actively seeking to concentrate in such advanced fields as aerospace. Recognizing the importance of this research field for Korean industries and national defense, the Center for Advanced Aerospace Materials (CAAM) was founded in 1990 to serve as a coherent research base for aerospace materials research and development and became one of the Engineering Research Centers supported by The Korea Science and Engineering Foundation (KOSEF) in 1994. CAAM provides the facilities and creative atmosphere for research in the interdisciplinary fields of science and engineering of aerospace materials. Faculty and staff members are involved in fundamental and applied research on the processing, characterization and application of the advanced materials needed for aerospace applications. Studies range from theoretical inelastic deformation studies to the practical application and development of high-performance materials used in engineering applications for aerospace structures.

Research Objectives

CAAM provides the facilities and creative atmosphere for research in the processing, characterization and application of advanced materials needed for aerospace applications. In addition, reliability assessment of application of material parts and property measurement for development of the application field are emphasized.

- Manufacturing Process Technology: Dissolution/Casting, Innovative Processing Techniques (Powder Metallurgy/Mechanical alloying)
- Applied Processing Techniques: Rolling, Extrusion, Forging, Superplastic Forming, Joining/Joining, Surface treatment
The history of human civilization has advanced with the development of materials. The development of silicon materials with high purity was a special turning point in the computer technology which has led the IT industry. Moreover, it is expected that development of new materials applying nano technology and material synthesis will be more and more important since the advanced information technologies of 21C - optical communication, wireless communication, and display - are based on mobility and credibility. Although IT uses various types of information transmitting media, electrons and light will likely be most employed until the mid-21st century; the technology to use spintronics will be developed in the long-term.

Currently, research on the development of materials needed for generation, delivery, storage, and display of information is in progress. Miniaturized and lightweight future IT equipment requires new materials which can handle huge amounts of information rapidly. Unless these materials are developed, the advanced IT equipment can not be realized.

As the pace of technology development is getting faster and faster, the time to develop materials related to the technology is too tight in many cases. In particular, fundamental material dependence on foreign countries is getting worse as the nation focuses on the development of production technology. Therefore, basic research institutions like our university must carry out research on 1) performance improvement of present IT materials, 2) development of advanced materials for future IT, and 3) properties and structures of materials to emphasize new material development. The Center for Information Materials provides human resources and new materials technology for the IT industry while studying key materials for the future IT industry. In addition, the center aims to induce globalization of information material research groups by concentrating the research capabilities of the ceramic, semiconductor, and polymer fields of MSE at POSTECH.
A fuel cell is an electrochemical cell that converts a source fuel (hydrogen, methane, butane gas) into an electrical current continuously. A fuel cell using hydrogen as fuel is non-polluting, quiet, and much more effective than existing thermoelectric power plants or internal-combustion engines. Also, the fuel cell has a wide range of uses, from the energy source of small electronic products to that of large power plants. The type of fuel cell is usually defined depending on the electrolyte substances. The Solid Oxide Fuel Cell (SOFC) is a fuel cell that uses solid oxides with oxygen ion or proton conductivity as the electrolyte substance.

Because all the components are made of solids, SOFCs have simple structures compared with other fuel cells and are resistant to corrosion or loss of electrolyte. In addition, SOFCs don’t need a noble metal catalyst and can easily supply fuel through direct internal reforming due to their high operating temperature. It is also possible for SOFCs to generate thermal hybrid power using waste heat since they emit high temperature gas. Thanks to these advantages, SOFCs have been actively studied for commercialization in other countries such as USA, Europe, and Japan.

Nano technology and its applications (development of nano-porous electrodes and nano-thinning of electrolyte) are used in fuel cell technology. MEMS technology and the electronic control technology needed for production of powder and thick film, storage of hydrogen, and transformation and supply of fuel are also included in fuel cell technology. Therefore, fuel cell technology is a renewable energy technology that converges advanced materials technologies and other engineering technologies.

The Fuel Cell Research Center was established in 2004. The primary research goal of the center is the development of core technologies needed in fuel cell applications. Although all kinds of fuel cells are of interest, SOFCs are currently intensively studied. Materials of electrode and electrolyte, micro or metal-supported SOFC, and performance evaluation of SOFC are under study.

**Research Area**
- Development of Metal-supported SOFC: The center is developing a fuel cell for power generation with kW to MW capacity.
- Development of Micro SOFC: The center is developing a fuel cell to replace batteries in small electronics with mW to dozens of W capacity.
One of the most crucial requirements for progress in nanoscience and nanotechnology is without any question the capability to image and characterize nanostructures in materials devices and living specimens in their natural working conditions. Most of the imaging methods developed so far provide limited information and/or are possible in limited circumstances. For instance, conventional methods can only provide limited information when imaging and characterizing nanostructures in materials devices or living specimens in the natural conditions. Most current methods provide limited information and/or are possible in limited circumstances. In order to overcome these limitations, we must achieve an alternative breakthrough in nanostructure analysis. Specifically, a new concept of imaging absolutely must be realized that makes it possible to visualize and characterize nanostructures and phenomena dynamically and systematically, providing three dimensional information about the internal structure of matter in-situ under natural working conditions. For the domain of X-ray imaging, most of the research groups at the world forefront utilize only a portion of the many phenomena characterizing the interaction between X-rays and matter. As a result, the extracted information is only a portion of the potentially available information. In contrast, we propose a new paradigm of X-ray imaging technology methodology that comprehensively extracts diverse structural and chemical information such as structural inhomogeneities, strain distributions, lattice distortions, and compositional distributions by exploiting different interactions between X-rays and matter in a synchronized and integrated fashion. We define this novel approach as functional X-ray imaging. This is a unique and creative method entirely different from the current concept of X-ray imaging.

**Research Area**

1. Functional x-ray imaging  
2. Bio-medical imaging  
3. Soft matter dynamics  
4. Nanofabrication

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**Functional x-ray imaging:**  
(L) lattice distortion in SiC wafer  
(R) Transmission x-ray Microscopy

**Bio-medical imaging:**  
(L) Neurons in Cerebellum  
(R) In-vivo 3D visualization of single alveolus in mouse lung

**Soft matter dynamics:**  
(L) Decreased surface tension of pure water by x-ray irradiation  
(R) X-ray-Induced Changes in Wettability

**Nanofabrication:**  
(L) the growth of zinc on hydrogen bubbles  
(R) Freestanding metallic wires fabricated by localized electrochemical deposition
Pursuit of Excellent

Ever since its birth in 1986 as Korea first research-oriented university, POSTECH has stayed the course as a pioneer of Korea higher education. Today POSTECH is globally recognized as a leading science and technology university in Korea and Asia.

In 2006, POSTECH launched an ambitious plan. In commemoration of the 20th anniversary, POSTECH declared Vision 2020, whose goal is to become a world top 20 research-oriented university by 2020. Broad international collaboration is a crucial success factor to achieve POSTECH’s Vision, and the university has made a variety of efforts in all fronts in the globalization of the university.
In accordance with the founding principles, POSTECH provides customized education to the selected few. The university commands 10 departments and 9 graduate schools/institutes/programs, tirelessly striving to retain the unique trait of the elite and individually-customized education for the 3,000 brightest minds.

POSTECH has taken exceptional actions to achieve excellence in education. POSTECH students-to-faculty ratio is a low 5.25 for undergraduate. POSTECH reportedly makes the largest investment per student in Korea; every student receives full scholarship. We aggressively seek and invite worldly renowned scholars and top-class international students; at the same time, POSTECH provides Korean students strong support for study and work abroad through a wide range of programs.

As Korea first and leading research-oriented university, research is at the heart of POSTECH all activities. POSTECH, a home to 59 research institutes, provides a variety of state-of-the-art research facilities that include the sole synchrotron radiation facility in Korea. POSTECH support for creative research at all levels of the university has produced numerous distinguished achievement; POSTECH was placed 20th in citations per faculty index by the 2009 Times Higher Education Supplement World University Rankings. POSTECH provides service and facilities to support global education and research, such as full bilingual administrative assistance.

Today, with over 12,000 graduates actively and widely contributing to diverse areas of the society, POSTECH prepares for a greater future of realizing its Vision 2020. Postechians focus efforts in their continued pursuit of excellence, guided by Integrity, Creativity and Aspiration.

Global POSTECH

As POSTECH embarks upon the new challenge of growing out of Korea and Asia and further advances into a world top 20 research-oriented university by 2020, the university has made multilateral efforts to seek a global environment at home as well as enhance visibility abroad. With the 3-Year Globalization Plan, the pursuit is expected to be expedited.

POSTECH 3-Year Globalization Plan

The POSTECH 3-Year Globalization Plan strategically categorizes and prioritizes the efforts to be made in order to enhance all levels of POSTECH globalization, including campus globalization, international visibility, and international cooperation.

The Plan consists of three major tasks: recruit international human resources, establish global hub for research collaborations, and build a global environment for the international members of the university. A budget of approximately US$150 million has been set aside for the Plan to achieve the university short-term goal of becoming a world top 50 by 2013 and the ultimate goal of Vision 2020.

Life at POSTECH

Recognizing the importance of students as the most critical element in the success of any university, POSTECH invests in student welfare to a great extent so that they have excellent environments for their academic and daily lives. The amount invested in each student amounts to $50,000, ten times as high as the tuition. To keep abreast with the globalization, 70% of the students are participating in one or more of the Study Abroad Programs including overseas language programs. All the students are provided with on-campus accommodations at a nominal cost, while married graduate students are assigned to one-bedroom flats. Most undergraduate students enjoy scholarships of various kinds, recovering over 100% of their tuition, while all the graduate students are supported by either teaching or research assistantship, and other incentives, recovering over 180% of their tuition.

All these efforts for advanced infrastructure for high quality education and research and the intensive and focused investment in its manpower are dedicated to the University vision 2020 to grow into a top 20 university in the world by the year 2020.
Campus Map