KOREA BASIC SCIENCE INSTITUTE

2013
ANNUAL REPORT

KBSI KOREA BASIC SCIENCE INSTITUTE

KBSI

Annual Report

Open World-class Research Platform, KBSI

Open world-class basic research institution analyzes creative paradigms with basic science! Korea Basic Science Institute changes the future of creative economy with basic science.

Top 10 Achievements of KBSI in 2013

1

Dr. Kwang Hwa Chung took office as the 10th president of KBSI

- Had the inauguration at Daedeok Headquarters on 7th Feb 2013
- Served as President of KRISS and Dean of GRAST

2

Development of optical image technologies of high resolution using non-toxic nano particles

- Joint research with IBS Center for Nanoparticle Research
- Published in Nature Materials [IF=35.749, 2013.2.18.] [Dr.Seung-Hae Kwon's team, Chuncheon Center]

3

International collaboration achieved the outcome of the first development of high-functionality conductor in the world

- Collaborated on development of conductor of excellent conductivity as well as of good elongation and flexibility with Michigan University
- Published in Nature[IF=38.597, 2013.8.1.] [Dr. Jin-Gyu Kim's team, Division of Electron Microscopic Research, Daedeok Headquarters]

4

Succeeded in the first development of ultra-precision thermal image microscope system in Korea

- Development of advanced analytical equipment capturing thermal properties of specimens by combining infrared thermal devices with the microscope system
- Able to obtain 100 images per sec with a difference of 0.005K in temperature
- Applicable to analyzing machines for detecting semiconductor element and analyzing equipments in the field of nanotechnology or biotechnology [Dr. Geon-hee Kim's team, Center for Analytical Instrumentation Development]

5

Technology transfer and localization of an analyzing machine for detection of semiconductor element

- Transferred patented technology related to development of analyzing machine for detects of semiconductors to a small-medium business
- Scheduled to provide the end product to the korean market within a year
- Held a signing ceremony for the technology transfer on 2nd Dec 2013

6

Direct observation on polarization phenomenon of ferroelectrics

- Development of a direct imaging method to simultaneously analyze polarization phenomena and atomic structures of ferroelectric oxide materials (based on aberration-corrected electron microscopy)
- Contributed to the development of next-generation memory and complex functional oxides
- Outcome from a joint research with Oak Ridge National Laboratory in U.S.
- Published in Advanced Materials[IF=13.877, 2013.3.18.][Dr. Young-Min Kim's team, Division of Electron Microscopic Research, Daedeok Headquarters]

Research review on cryogenic fuel cells with nuclear magnetic resonance techniques

- Noted as an authority in the study of fuel cells with nuclear magnetic resonance technologies by an international review journal
- Published in Progress in NMR Spectroscopy[IF=6.022, 2013.7.1.] [Dr. Oc-Hee Han, Daegu Center]

7

8

Revealed an influence of oxygen deficiency on metal to insulator

- Demonstration of a morphotropic phase transformation in single-crystalline VO_2 nanobeams caused by thermal reduction in a hydrogen environment
- Applicable to development of optical devices, next-generation memory and next generation switch devices
- Published in Nano Letters[IF=13.198, 2013.3.4.][Dr. Woong-Ki Hong's team, Jeonju Center]

Performed joint research and signed MoU with international research institutes

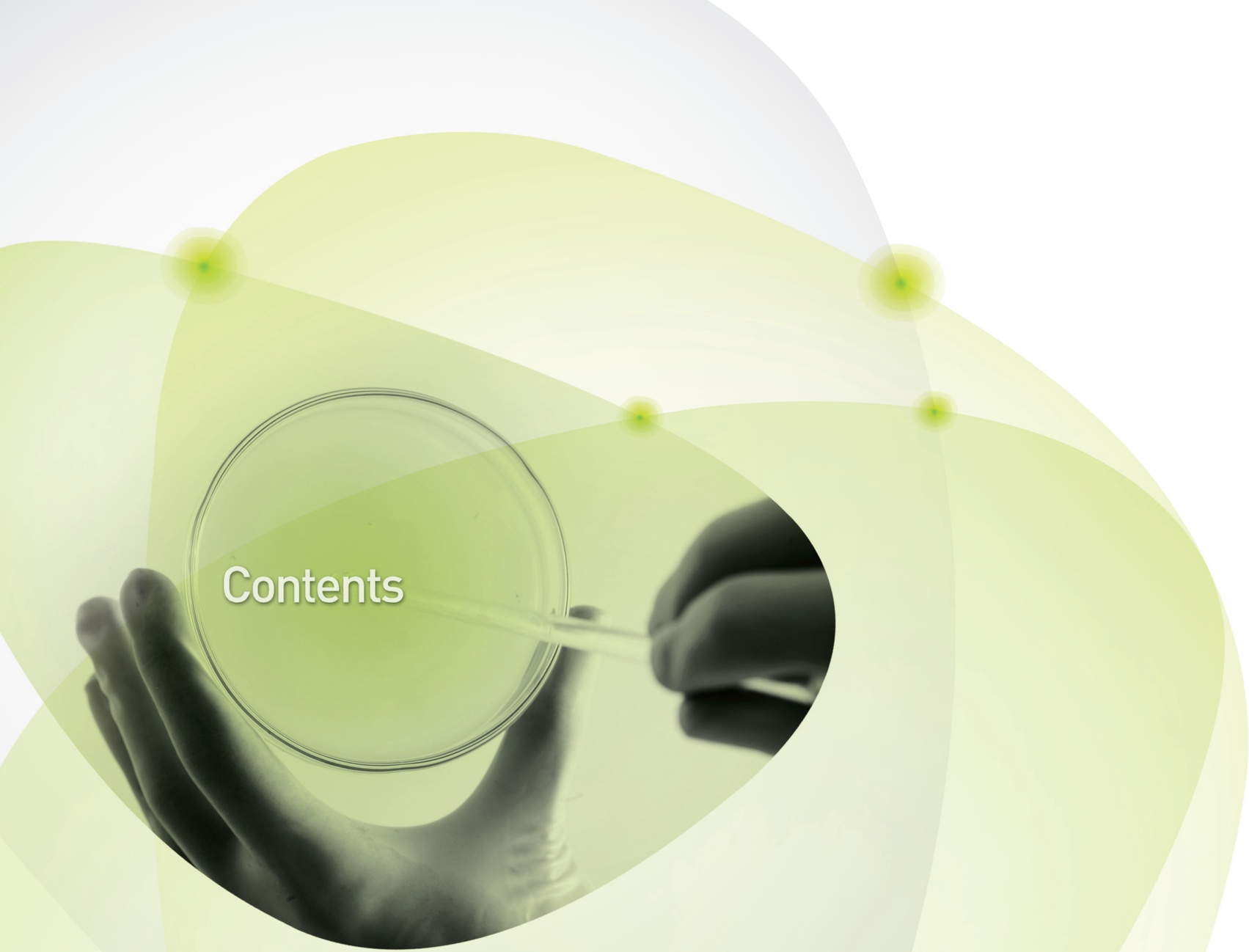
- Signed MoU for collaboration in biomedical imaging field with Harvard School of Medicine and Massachusetts General Hospital on 12th Sep 2013
- Signed MoU for joint research with University of Wollongong on 3rd Sep 2013

9

10

KBSI 2012 Annual Report won at New York Festivals

- Won "World's Best Annual Report Special Award" at 2013 New York Festivals, one of the top 3 international advertising festivals
- Enhanced convenience of readers with a unity of design components
- Given awards at International Conference Hall, Korea Press Center on 4th Dec 2013



KOREA BASIC SCIENCE INSTITUTE

ANNUAL REPORT 2013

Contents

Open World-class Research Platform, KBSI

We are determined to be the world's top player in scientific research infrastructure for basic science research.

Korea Basic Science Institute(KBSI) aims to be a global platform to support all the international scientists seeking aid in the basic science research. To fulfill its aim, KBSI has built large cutting-edge research equipments and facilities, utilizing them in collaborations such as joint research and analysis support, as well as in analytical science research such as development of analysis methods and new analytical devices. In addition, KBSI is carrying out a grave mission to manage mega-sized research facilities in Korea and to nurture experts for them.

In 2013, KBSI put emphasis on analysis services designated to solve problems of small-medium businesses(SMB) as well as social and national issues, following the government policies for the Creative Economy and national happiness. They were analytical services for SMB and fusional joint research for national well-being and environmental protections that KBSI has focused on. By transferring technologies, developed for new analytical devices, and performing roles of training analysis experts and managing national research facilities, KBSI has become an institute providing an infrastructure for Creative Economy in Korea.

KBSI analyzed around 130,000 specimens from 5,397 users, of which 24.2% were from companies such as SMB. To meet the needs of fusional analysis supports, KBSI is providing an analysis service package which enables a specimen to be analyzed by various analysis equipments.

The fusional joint research with analysis supports of KBSI led 1,216 publications of research papers. About 89% of those numbers, 1,089 papers were published in the leading scientific journals.

Remarkable papers, such as 'High-resolution three-photon biomedical imaging using doped ZnS nanocrystals', 'Stretchable nanoparticle conductors with self-organized conductive pathways' and 'Enhanced tunneling electroresistance effect due to a ferroelectrically induced phase transition at a magnetic complex oxide interface', were published in Nature and Nature Materials.

Accelerated to develop new analytical research devices, KBSI has developed key technologies for development of 'Ultra-precision thermal image microscope' and 'Portable mass spectrometer'. Commercialization of these technologies are driven by companies chosen for the technology transfer and further joint research.

Development of 'Utlra-precision thermal image mciroscope', especially, led to localization of analyzing machine for detects in semiconductor element by transferring source technology spined off from it.

KBSI, furthermore, is enhancing national happiness with development of analysis methods for food/environment as well as solving national problems such as disease, disaster and environment issues by adopting analytical science and technology on them. By analyzing radioactive levels on food and daily necessities and developing high-tech forensic analysis methods, KBSI has contributed to national safety. Besides, KBSI is trying to protect national happiness with a technology discriminating the origin of foods, bio-imaging technology for early diagnosis and analytical technology for cultural heritage.

To satisfy the mission of nurturing analytical experts, KBSI is running an educational program for whole learning steps, from an elementary school student to PhD student. Each step has a unique program, such as X-Science and Junior Doctor for youth, user training program designed for research equipments users and Graduate School of Analytical Science and Technology(GRAST) for students to be professionals with Master's degree or Ph.D.

KBSI, as an overall management institute for national research facilities and equipments, is monitoring whole process of establishment, operation, co-utilization and even disuse of government-funded research facilities and equipments. In particular, 57,740 units of research equipments of 354 institutes were all inspected, the inspection laying groundwork for an effective and systematic management.

KBSI is now moving forward to create new technology which makes people to enjoy whole benefits from it, also leading this research support institute, from good KBSI to great KBSI, as a world leading research institute.

President of KBSI
Kwang Hwa Chung

History

1988. 08
Korea Basic Science Center(KBSC) established as an affiliate of Korea Science & Engineering Foundation

1992. 03~04
Four local Centers(Seoul, Busan, Daegu, Gwangju) established

1999. 05
Established as a corporate body

1999. 12
Jeonju Center established

2001. 01
Name changed to Korea Basic Science Institute(KBSI)

2001. 11
Chuncheon Center established

2005. 05
Suncheon Center established

2005. 10
'National Fusion Research Institute' established affiliated organization

2006. 04
Ochang Center established

2006. 05
Gangneung Center established

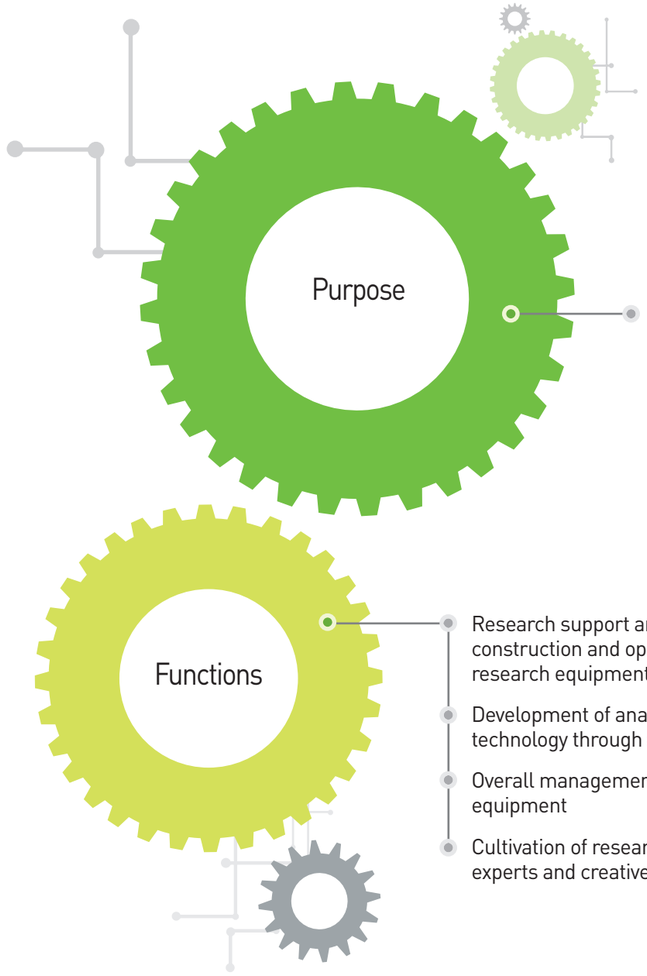
2008. 04
Jeju Center established

2009. 03
Graduate School of Analytical Science and Technology(GRAST) established jointly with Chungnam Univ.

2009. 08
National Research Facilities Equipment Center(NFEC) established

2012. 12
Western Seoul Center established

Purpose & Functions



Research support and collaboration to advance basic science, the foundation for national science and technology development

- Research support and collaboration through construction and operation of high-tech large research equipment
- Development of analytical equipment and technology through analytical science research
- Overall management of national facilities and equipment
- Cultivation of research equipment experts and creative future talents

Vision & Development Goals

Vision

Open World-class Institute, KBSI

Development Goals

- Representative institute for construction, operation and use of large research equipment
- World-class institute for basic science research support
- Institute for overall management of national research facilities and equipment
- Leading institute for analytical science and research

Management Goals

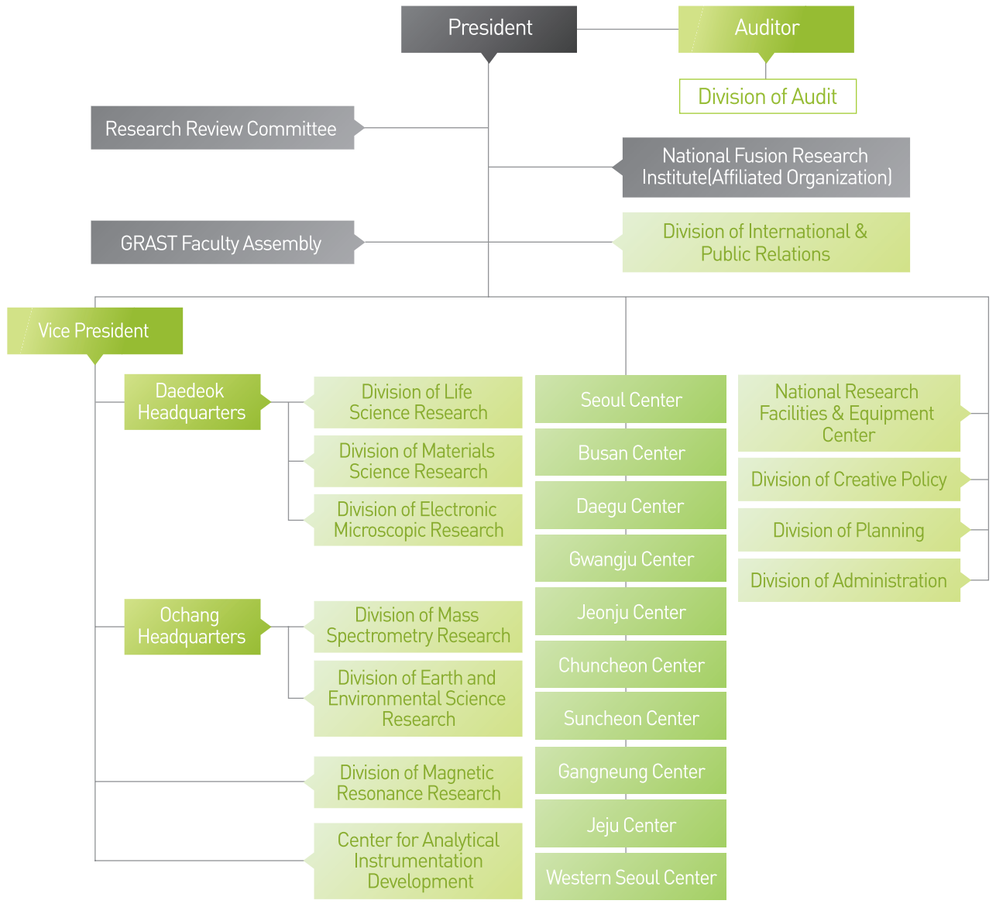
Research Field

- Strengthen research support for future creation
  - Strengthen world-class research support
  - Strengthen analytical science and research competency
  - Strengthen support of small and medium-sized enterprises for technology development
- Activate industry-university-institute collaboration
  - Collaboration on use of nano-bio electronic microscope
  - Collaboration on use of high-field MRI
  - Collaboration on ultra high resolution mass spectrometer
  - Collaboration on high resolution secondary ion mass spectrometer
- Development and construction of high-tech research equipment
  - Development and use of high-tech analytical equipment
  - Construction of national analytical facilities and equipment
- Develop analytical technology for safe lives of people
  - Develop analytical technology for response to national disasters
  - Develop analytical technology for safe food

Administration Field

- Construct foundation for customer value creation
  - Enhance the analysis support system
  - Make local center operation efficient
  - Enhance the research project operation system
- Facilitate global cooperation and achievement
  - Activate cooperation with domestic and overseas institutes
  - Strengthen the result diffusion system
  - Construct the strategic promotion system
- Advance research facilities and equipment and train overall management
  - Advance overall management of national research facilities and equipment
  - Train analytical science experts
  - Facilitate popularization of science using high-tech equipment
- Establish a clean research culture
  - Build a transparent management infrastructure
  - Strengthen audit and purification systems
  - Expand high-integrity organizational culture

Organization



Personnel, Equipment and Budget

Personnel

(Dec. 31. 2013)

Researchers	Engineers	Administrators	Total
129	47	46	222

* President included in researchers category

Equipment

(Unit : Million won)

Category	Daedeok Head quarters	Ochang Head quarters	Local Centers										Total
			Seoul	Busan	Daegu	Gwangju	Jeonju	Chun cheon	Sun cheon	Gang neung	Jeju	Western Seoul	
Equipment	145	116	81	47	31	44	22	19	9	13	10	-	537
Amount	50,679	48,866	21,239	16,687	9,261	12,240	6,958	5,773	2,548	3,789	2,803	-	180,841

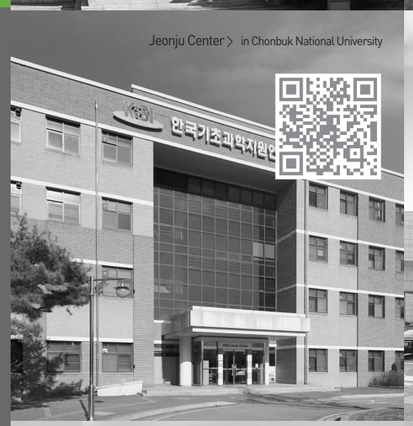
* Statistics of equipment over 30 million won

Budget

(Unit : Million won)

Operating Revenue	
Category	Budget
Government contribution	76,841
1. Basic fund	14,246
2. General R&D projects	42,495
3. Facilities and equipment	20,100
4. Loan payment and interests	-
Income	22,861
1. Public (government)	16,866
2. Private	200
3. Other R&D projects	-
4. Technology supports	4,864
5. Technical fees	100
6. Others	831
Total	99,702

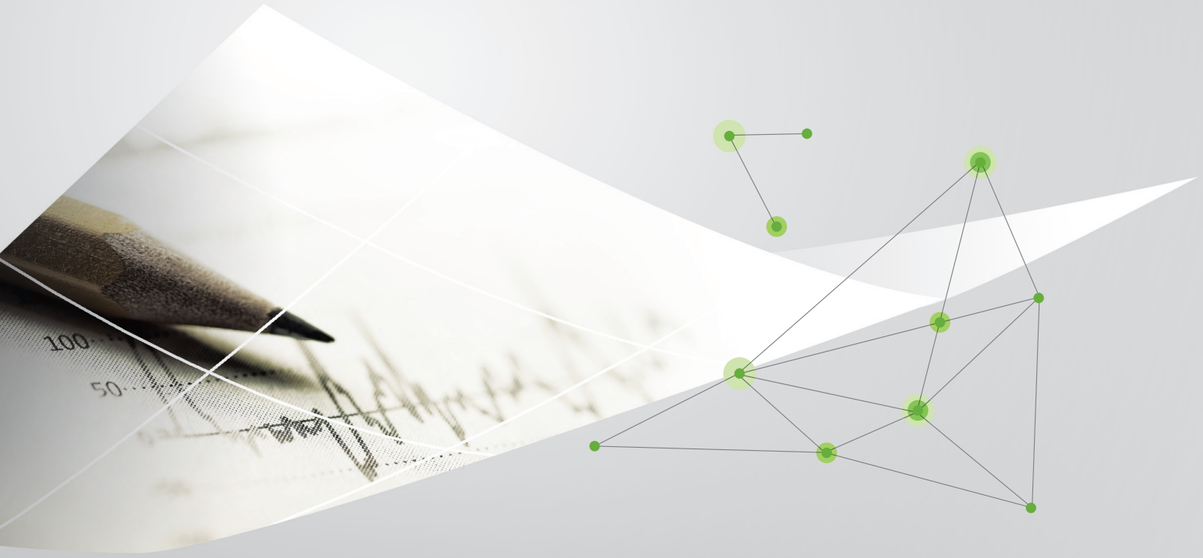
Operating Expense	
Category	Budget
Wages	16,344
1. Research personnel	13,539
2. Research Support Personnel	1,191
3. Retirement reserves	1,128
4. Others	486
Direct research expenses	58,472
1. In-house projects	42,495
2. Government/public projects	14,207
3. Private projects	170
4. Other R&D projects	-
5. Technology supports	1,600
Operating costs	4,686
Facilities and equipment	20,100
Others	100
Total	99,702



KBSI Network

KBSI supports national basic science research and performs differentiated and specialized research based on regional industrial fields through the institute's 12 bases across the country.

2013 KBSI Navigation



Korea Basic Science Institute (KBSI) is a government-supported research institute that supports researches and conducts collaboration in order to promote basic science.

KBSI has built a nationwide research and analysis supporting network by utilizing Daedeok Headquarters, Ochang Headquarters and ten local centers, supports basic science research, and conducts collaborations for researchers of universities, companies, private and government-supported institutes.

KBSI also installs and uses state-of-the-art large research equipment, develops new analytical methods-the basis of analytical science-and research equipment and trains analytical science specialists.

KBSI paves the way for a "Creative Economy" which puts top priority on people's happiness and safety through science and technology such as the support of advanced fusion research and collaborations; creation of venture ecosystem focusing on research equipment development; and the creation of new jobs for research equipment experts.

The 2013 KBSI Navigation can be utilized to comprehensively understand various research and analysis service outcomes of KBSI in 2013 and guide the direction for future research and new projects.

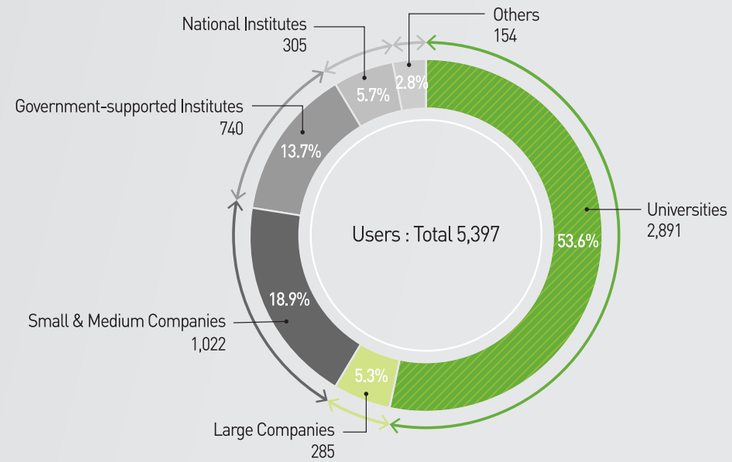
Statistical trends of analytical services

[Unit : No. of cases, No. of samples, No. of users]

2011	Cases	16,251
	Samples	121,306
	Users	5,457
2012	Cases	16,309
	Samples	132,049
	Users	5,486
2013	Cases	16,927
	Samples	129,493
	Users	5,397

Statistics of analytical service users

[Unit : No. of users]



User publications

[Unit : No. of papers]

2009	Total	741
	SCI	604
2010	Total	744
	SCI	692
2011	Total	787
	SCI	745
2012	Total	742
	SCI	639
2013	Total	**704**
	SCI	**637**

Publications

[Unit : No. of papers]

2011	**Domestic**	Total	97
		SCI	38
	Foreign	Total	281
		SCI	277
2012	**Domestic**	Total	124
		SCI	69
	Foreign	Total	411
		SCI	393
2013	**Domestic**	Total	**103**
		SCI	**49**
	Foreign	Total	**410**
		SCI	**394**

Publication by author type

[Unit : No. of papers]

2011	1st Author	112
	Corresponding Author	59
	Co-author	207
2012	1st Author	174
	Corresponding Author	77
	Co-author	284
2013	1st Author	**152**
	Corresponding Author	**76**
	Co-author	**285**

Research funds per researcher

[Unit : Million won]

2011	Commissioned funds	149
	Government funding and commissioned funds	616
2012	Commissioned funds	153
	Government funding and commissioned funds	630
2013	Commissioned funds	**149**
	Government funding and commissioned funds	**592**

Patents

[Unit : No. of cases]

2011	**Domestic**	Application	81
		Registration	27
	Foreign	Application	38
		Registration	5
2012	**Domestic**	Application	44
		Registration	47
	Foreign	Application	42
		Registration	5
2013	**Domestic**	Application	**51**
		Registration	**64**
	Foreign	Application	**47**
		Registration	**22**

Technology transfers

[Unit: No. of cases, No. of institutes, Million won]

2011	Transfers of profit	8
	Transferred institutes	8
	Technology fee revenue	158
2012	Transfers of profit	3
	Transferred institutes	3
	Technology fee revenue	150
2013	Transfers of profit	**4**
	Transferred institutes	**5**
	Technology fee revenue	**251**

Specialized High-tech Research Support

KBSI builds the foundation to advance national science through world-class research support capabilities with high-tech research equipment and a specialized research support system in the fields of bio science, nano science, and environmental science.

01

BIO Science

Biotopia in the post-genome era for human's healthy life

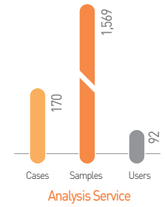
Human's quality of life will improve through various research of life. In order to research a biological substance, the basis of biological phenomena, Bio Science research includes comprehensive research on cellular imaging, proteomics, metabolomics, biological imaging, and marine biology; investigation of the structure of biological substances using high-tech analytical equipment and fusion technology; and identification of in vivo function and control mechanisms.

Cellular Imaging Research
Proteomics Research
Nuclear Magnetic Resonance Research
In vivo Imaging Research
Mass Spectrometry Research
Metabolomics Research
Degenerative Disease Research
Biological Imaging Research
Marine Biology Research

Cellular Imaging Research

Cellular imaging research is based on the cell biology with advanced equipment and analytical technology, studying the function of protein in cells through the analysis of protein-protein interaction network in cell signaling

[Division of Life Sciences Research]



Main Research Activity

- Study of protein-protein and chemical-protein interaction using a cellular imaging based platform technology
- Functional study of drugs on expression and interaction of proteins
- Identification of cellular kinase networking focused on protein-protein interaction

Representative Research Case

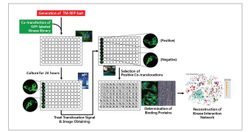
Development of cell imaging-based platform technology for making an intra-cellular signal network mapping

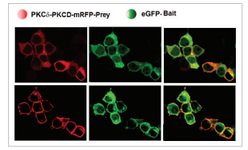
Integrative research on cellular kinase signal network and identifying a new drug to control their interaction are important to cure the intractable disease, such as cancer. To understand cellular kinase communication network system, we have developed cell imaging-based platform technology and established RFP/GFP tagging kinase vector library to explore their interaction. We hope our study and results of cellular signal pathway, cell-to-cell communication, and their functions to be applied to help overcome intractable disease.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	11 (SCI 9)	Domestic 6 / International 3	Application 2 / Registration 3
Analytical Methods	· Development of reporter assay system for analysis of Wnt signaling activity · Development of detection methods for ER stress and insulin resistance on the Human Liver Cells		
Projects	· Identification and functional study of Novel Wnt Signaling-Associated Kinases · Development of cell imaging-based platform technology for high throughput screening of Novel Drugs and Targets · NBIT based Kinase signaling control		
Training of Equipment	· Education and training programme for equipment engineer : Confocal Laser Scanning Microscope (CLSM)		
Equipment	Installed	· Bio-Liquid Chromatograph (Bio-LC) · Confocal Laser Scanning Microscope (CLSM)	· Microscope-based Cell Analysis System (Tissue FAXS) · Amino-acid Analysis System (HPLC & UPLC)
	To Be Installed	· Automated High-speed Cytometry Sorter System · Automatic Confocal Cell Screening Explore System	

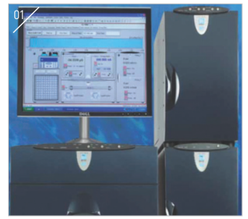
Image





Cell imaging-based platform technology for analysis of cellular kinase signal network and results

Equipment



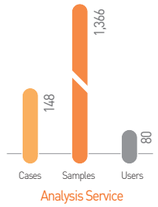
Bio-Liquid Chromatograph (Bio-LC)

Confocal Laser Scanning Microscope (CLSM)

Microscope-based Cell Analysis System (Tissue FAXS)

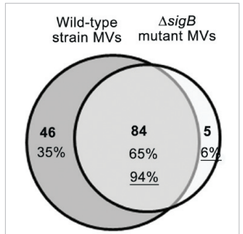
Proteomics Research

Our goal of research is to elucidation of biological functions using cutting-edge proteomic methods such as quantitative analysis, PTM analysis, and protein-protein interaction.



[Division of Life Sciences Research]

Image



Venn diagram of extracellular membrane vesicle (MV) proteins identified by LC-ESI-MS/MS between wild-type L. monocytogenes MVs and △sigB mutant MVs

Equipment

01

MALDI-TOF/TOF-MS

02

N-terminal Protein Sequencer

03

LC-MS (Orbitrap MS/MS & Q-TOF MS/MS)

Main Research Activity

- Development of analytical methods for scientific forensic technologies and control of biological hazards
- Identification of cellular networking and pathways via proteomic approaches

Representative Research Case

Transcription factor σ^B plays an important role in the production of extracellular membrane-derived vesicles in Listeria monocytogenes

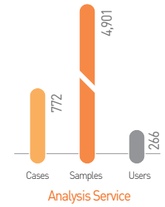
We have provided important data about the new protein secretion system of L. monocytogenes via MVs. Wild-type strain-derived MVs contained a higher amount of major virulence factor InlB than △sigB mutant-derived MVs, and these MVs also significantly contained stress response proteins regulated by σ^B, which play pivotal pathological functions during infection. Our results provide the first observation that transcription factor σ^B contributes to the number of MVs produced and the kinds of proteins contained in the MVs. The challenge for future studies is to understand how the MVs specifically contribute to pathogenesis in vivo.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	29 (SCI 24)	Domestic 11 / International 10	Application 6 / Registration 2
Analytical Methods	• A global proteome study of mycobacterium gilvum PYR-GCK Bacterium for the analysis of central carbon metabolism highway of Pyrene • Isolation of Alginate Lyase-producing Bacterium from the gut microflora of sea urchin		
Projects	• Elucidation of oil degradation mechanisms using metaproteomics • Construction of high efficient hydrogen-producing *Thermococcus Onurineus* NA1 using proteomic technology • Development of original technology for bio-analysis of the mechanism of infectious disease • Discovery and development of diagnostic marker using membrane vesicle and secreted proteins • Development of scientific forensic technologies using cutting-edge high-tech analytical equipment • Exploration and functional verification of chemical drug target proteins using the method of chemical proteomics • Development of control and omics analysis method for the biological hazard		
Training of Equipment	• Education and training programme for equipment engineer		
Equipment	Installed	• Matrix-Assisted Laser Desorption Ionization Mass Spectrometer (MALDI-TOF/TOF MS) • Liquid Chromatograph-Mass Spectrometer (Orbitrap LC MS/MS & Q-TOF LC MS/MS) • N-terminal Protein Sequencer • Next Generation Sequencer	
	To Be Installed	• LC MS/MS (LTQ-Orbitrap LC MS/MS) • 2D-LC MS/MS (Q-TOF LC MS/MS)	

Nuclear Magnetic Resonance Research

The researches in macromolecular structure, interaction, and dynamics are carried out using NMR spectrometers.



[Division of Magnetic Resonance Research]

Main Research Activity

NMR technologies have been developed to obtain 3D structures of biological macromolecules and to investigate their interactions. By using these technologies, total 25 papers were published.

Representative Research Case

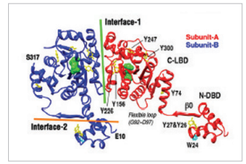
Complex structure and mechanism analysis of microbial quorum sensing

Determination of complex structure of microbial quorum sensing protein LsrR and Phospho-AI-2 and verification of sensing mechanism.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	27 (SCI 26)	Domestic 18 / International 11	Application 1 / Registration 4
Analytical Methods	• pH measurement of NMR sample using protein sensor • Folding structure analysis of QseC sensor domain from enterobacteria • The analytical method of protease stability using high-performance liquid chromatography • Analysis of binding nature of Plk1 PBD using X-ray • Production and X-ray structure analysis of LsrR protein • Production and X-ray structure analysis of artificial antibody of repeat protein • Crystallization of Stereptomyces coelicolor DraK sensor domain • Folding structure analysis of Stereptomyces coelicolor DraK sensor domain		
Projects	• Structure analysis of protein-protein interaction and inhibitor design • Biomolecular structure and mechanism study using NMR • The development of Plk1 PBD inhibitors and its structure analysis using NMR/X-ray • Production and structure analysis of repeat protein • Development of protein sensor using NMR		
Training of Equipment	• Interesting biochemical experiments classroom		
Equipment	Installed	• 900 MHz Cryo NMR, Avance II 900 • 800 MHz Cryo NMR, Avance HD 800 • 700 MHz Cryo NMR, Avance HD 500 • 500 MHz Cryo NMR, Avance 500 • 400 MHz NMR, AVANCE III 400 • Auto-iTC • Macromolecular x-ray diffraction system, MicroMax-007HF R-AXIS IV++ • Protein synthesizer • Multi-Angle Light Scattering System	

Image



Structural overviews of the LsrR tetramer and the C-Lsr dimer

Equipment

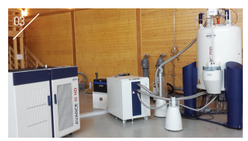
01

900 MHz NMR

02

800 MHz NMR

03

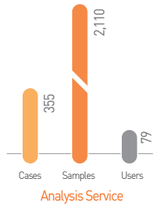


700 MHz NMR

In vivo Imaging Research

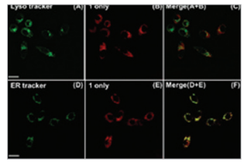
In vivo imaging researches for diagnosis and treatment of disease were performed with 600 MHz microimaging, animal 4.7 T/9.4 T MRI, PET/CT/SPECT and human 3 T MRI systems to investigate and establish the basis of preclinical studies.

[Division of Magnetic Resonance Research]



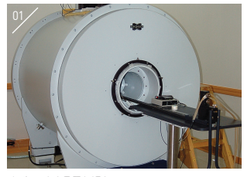
Analysis Service

Image

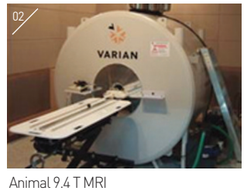


Confocal laser fluorescence microscopy images of KB cells with prodrug 1 and Lyso-Sensor Blue DND-167 or ERtracker Red.

Equipment



Animal 4.7 T MRI



Animal 9.4 T MRI

Animal PET/CT/SPECT

Main Research Activity

The researches are focused on the development of MR method for high resolution, MR imaging applications for diseases, PET radiotracers and bioimaging ligands in various disease-specific animal, and fusion studies through MRI/PET/NIR imaging modalities to evaluate early detection and monitor the therapeutic effect of diseases.

Representative Research Case

Folate-based near-infrared fluorescent theranostic gemcitabine delivery

A series of heptamethine cyanine derivatives bearing a carbamate ethyl disulfide group and gemcitabine, an anticancer drug, was newly synthesized. This drug delivery system is a new theranostic agent, wherein both therapeutic effect and drug uptake can be easily monitored at the subcellular level, by in vivo and in vitro fluorescence imaging.

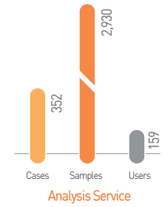
Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	25 (SCI 25)	Domestic 21 / International 12	Application 2 / Registration 0
Analytical Methods	· Advanced algorithm development for MRS analysis · Biomarker detection of cancer with gene mutation · Labeling pattern analysis of tumor metabolism using 13C-isotope tracer technique · PET/MRI fusion imaging based on the natural compound derivatives · Synthesis and application of cleaved iron-oxide nanoparticles for MRI T2 contrast agents · Analysis of intensity and sensitivity of single- and multiple-channel RF head coils in 3.0-T MRI system · Analysis on the various surface modification of the MRI probe		
Projects	· Installation and utilization of human research MRI · Identification of drug-binding proteins using in vivo imaging technology · Development of radiotracer for diagnosis using PET · Advanced algorithm development for MR Spectroscopy · MRI application S/W development · Test on the SAR measuring instrument for MRI · Development of diagnosis probes and treatment agents for tumor targeting · Analysis of intensity and sensitivity quantification methods for commercial RF head coils · Development of MRI image acquiring methods for Water and fat analysis · Method development for the application of the iMQC NMR/MRI signal		
Training of Equipment	· Understanding and practice of MRI equipment		
Equipment	Installed	· 4.7 T/9.4 T animal MRI · 600 MHz/800 MHz microimaging System · 3 T human MRI · Animal PET/CT/SPECT	
	To Be Installed	· 7 T human MRI (2014)	

Mass Spectrometry Research

Scientists in the Division of Mass Spectrometry (MS) Research support the research for the drug discovery, the diagnostic and therapeutic technology, and environmental science, using the high-resolution mass spectrometers such as 15T FT-ICR MS. Also, several remarkable achievements have been performed in the development of mass spectral instruments and the international collaboration projects such as chromosome-centric human proteome project and human brain proteome project.

[Division of Mass Spectrometry Research]



Analysis Service

Main Research Activity

The outstanding publications in post-translational modification analysis of proteins and glycan structure analysis were produced. As the application research, we supported the medical and pharmaceutical science by the recombinant protein characterization and early diagnosis technology for the cancers using mass spectrometry. Many significant patents were obtained from new ideas while developing the portable mass spectrometer, MALDI-TOF mass spectrometer and the library of glycoprotein mass spectra.

Representative Research Case

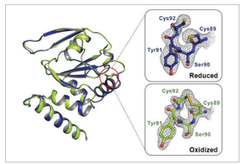
Structural and functional characterizations of HP0377, a thioredoxin-fold protein from Helicobacter pylori

In the study for understanding the role of HP0377, which is a thioredoxin-fold protein, mass spectrometry analysis exactly proved that it can form a covalent complex with HP0518, a putative L,D-transpeptidase with a catalytic cysteine residue, via a disulfide bond.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	39 (SCI 36)	Domestic 39 / International 8	Application 11 / Registration 17
Analytical Methods	· Method for the humira c-terminal Lysine isoform analysis using liquid chromatography · Localization method of disulfide bonds of humira antibody using ETD experiments · Three-dimensional culture system of neural stem cell · Quantitative identification of N-glycans released from glycoproteins by using HILIC-FLD combined with Glycobase 3.0 and on-line mass spectrometry · Quantitative analysis method of the in vitro labeling proteome for the discovery of disease biomarker · Mass spectrometry by the extraction and concentration of AAL of abnormal glycoproteins · Hybrid RF mass detector · Ion-trap mass spectrometer using cold-electron ion source · Peptide mass imaging of mouse brain · Separation of the region of interest using laser capture microdissection		
Projects	· Convergence research center program for mass spectrometry based clinical diagnostic analysis · Role of oxidative stress in the Alzheimer's disease · Development of the simple MALDI-TOF for the diagnosis of BRCA mutation and genitourinary infection pathogen · A study on antiasthmatic drug and development of effective substances using OMC 2010 · Development of antibody characterization platform technologies for antibody-biobetter · Development of high sensitivity portable mass spectrometer · Development of antibody variant characterization platform technologies for antibody-biobetter · Development of sample preparation method for chemical detection · Plasma protein quantitative analysis based on the high-resolution targeted mass spectrometry using peptide antibody		
Training of Equipment	Education of engineer for analytical instruments		
Equipment	Installed	· 15 T FT-ICR MS · Hybrid FT-ETD Mass Spectrometer (Orbitrap-Elite) · 2-dimensional gas chromatography/high resolution mass spectrometer system · High-speed Q-TOF Mass Spectrometer · Ion Trap /7 T FT-ICR MS · Triple Quadrupole MS · MALDI Imaging System · ESI-QTOF MS · MALDI/ESI Hybrid Tandem MS · Bioinformation Data Server	
	To Be Installed	· GC/MS for analyzing atmospheric pollution	

Image



Structural and functional characterizations of HP0377

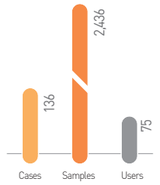
Equipment

High-speed Q-TOF Mass Spectrometer

Automated High Throughput Protein Purification System Upgrade

Metabolomics Research

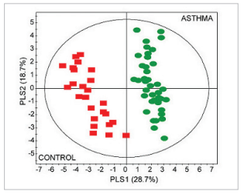
The Metabolomics research field is discovering biomarkers for disease/therapy by profiling metabolites changed by genetic and/or environmental stimulus.



Analysis Service

【 Seoul Center 】

Image



Coefficient plot (right) derived from the metabolite concentrations obtained by metabolite profiling of sera.

Main Research Activity

Metabolic profiling technology was developed based on NMR spectroscopy and Mass spectrometry, and characteristic metabolites associated with asthma, obesity, and hypertension were identified, providing the biomarker for diagnosis.

Representative Research Case

Serum metabolomics reveals pathways and biomarkers associated with asthma pathogenesis

^{1}H-NMR metabolomics approach using sera from patients with asthma was applied to identify the mechanism underlying asthma and potential biomarkers. These data showed that ^{1}H-NMR-based metabolite profiling of serum may be useful for the effective diagnosis of asthma and a further understanding of its pathogenesis.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	15 (SCI 15)	Domestic 26 / International 5	Application 1 / Registration 0
Analytical Methods	· Analysis of components of the traditional paints using Py-GC/MS · Metabolic profiling of high fat diet in mouse model using NMR · Metabolic study of Drosophila models altered in synaptic architectures using HR-MAS NMR and multivariate data analysis · Analysis for separation of optical filiderrole isomers using CE · Classification of optical imidazole isomers using cyclodextrin and cyclofructan · Development of the effective diagnosis method of asthma using NMR/ multivariate data analysis · Assessment of peeling of Astragalus roots using ^{1}H NMR- and UPLC-MS-based metabolite profiling		
Projects	· Investigation of biological pathway and biomarker discovery for diseases using metabolite profiling approach · Development of NMR based metabolomics/chemometrics for diagnosis and treatment of chronic kidney disease · Development of country-of-origin or authenticity discrimination techniques for foods · Development of multiple diagnostic and therapeutic technology in cardiovascular disease using fusion research of metabolomics and bio-imaging · Technical development for discrimination of herbal medicine using metabolom analysis · Metabolic profiling studies for prediction and management of the metabolic syndrome		
Training of Equipment	Molecular structure analysis using NMR		
Equipment	Installed	· On-line liquid chromatography-mass spectrometer-nuclear magnetic resonance system (LC-MS-NMR) · 700 MHz High resolution-magic angle spinning nuclear magnetic resonance (HR-MAS NMR) · 500 MHz Fourier transform-nuclear magnetic resonance (500 MHz FT-NMR) · Gas chromatography-mass spectrometer (GC-MS) · Pyrolyzer-gas chromatography-mass spectrometer (Py-GC/MS)	· Triple quadrupole liquid chromatography-tandem mass spectrometer (TQ LC/MS/MS) · High performance liquid chromatography (HPLC), Prep-high performance liquid chromatography (Prep-HPLC) · Ultra performance liquid chromatography-triple time of flight mass spectrometer (UPLC QTOF MS) · Matrix Assisted Laser Desorption Ionization Imaging mass spectrometer (MALDI Imaging MS)
	To Be Installed	· 800 MHz NMR (2014) · Quantitative liquid chromatography- Mass spectrometer (2014) · Two dimensional gas chromatography time of flight mass spectrometer (2014) · Capillary electrophoresis/Mass spectrometer (2014)	

Equipment

01


On-line LC-MS-NMR system

02

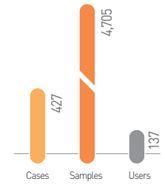

MALDI imaging MS

03


LC/MS

Degenerative Disease Research

By establishment of the infrastructure of research facilities in degenerative disease and anti-aging, we aim to provide scientists in the aging-related animal resources and to support commercialization of spin-offs in related R&D areas.



Analysis Service

【 Gwangju Center 】

Main Research Activity

Research support and collaboration to study aging fields, which is the degenerative disease (e.g.nervous disease, cardiovascular disease, and muscloskeletal disease) by establishing and managing the foundation of a domestic unique of Animal Facility of Aging Science (AFAS) and establishing the research network of pathological, clinical, molecular bio-imaging area to maintain animal strain or disease animal model from laboratory animal.

Representative Research Case

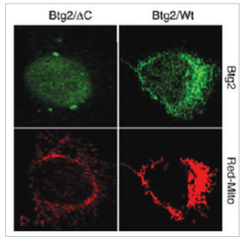
Translocation and regulation mechanism of nuclear protein into mitochondria

Expressed B-Cell Translocation Gene 1 (Btg1) and Btg2 protein are localized with mitochondria. Furthermore, mitochondrial Btg1 and Btg2 play roles in suppression of proliferation and regulation of ROS synthesis.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	7 (SCI 7)	Domestic 0 / International 0	Application 0 / Registration 0
Analytical Methods	· Band-gap energy analysis of transparent conductive oxide films using an optical spectrophotometry · Corelation of coefficient of determination for target organ by specific gene in cell · Measurement of protein purification from bone extraction by Liquid chromatography · concentration and extraction of Norovirus by lectin-magnetic-bead		
Projects	· NGFI-B and Btg2 are bi-functional proteins; Two different organs between nuclear and mitochondria · Functional membrane proteome structure analysis of red blood cell using mass spectrometry		
Training of Equipment	· A basic principle and education of real-time PCR · Super-resolution microscopy in cellular imaging : Breaking through the resolution		
Equipment	Installed	· LCSM · online LC-NMR/MS · LC-MS/MS · Multi-TEM · AFAS · SRM · RT-PCR · ACHA	
	To Be Installed	· Micro-CT (2014)	

Image



Translocation and Co-localization of Mitocondrial Btg1 and Btg2 in mitochondria

Equipment

01


Laser Scanning Confocal Microscope

02


Real-time PCR

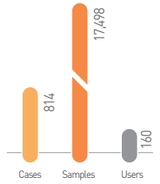
03


Automatic Chemistry Analyzer

Biological Imaging Research

Biological imaging techniques are very powerful and promising approaches to visualize, characterize and measure the biological and pathological processes which are occurred at DNA, protein and molecular levels in living subjects. Biological imaging techniques will be helpful to understand various diseases and offer new diagnostic and therapeutic approaches at early stages for the treatment of various diseases.

【 Chuncheon Center 】



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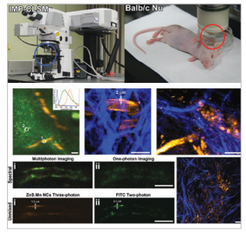


In vivo three-photon imaging of ZnS:Mn targeted to tumour and its vasculature, and comparison between a multi-photon and one-photon imaging.

Equipment

Intravital Multi-photon Confocal Laser Scanning Microscope imaging system

Luminescence and Fluorescence Animal Imaging system

Variable Pressure Field Emitting SEM

Main Research Activity

Our researches are mainly focusing on mechanism study, new drug discovery and screening, and the development of theranostic nanobiomaterials based on development of various nanobiomaterials and animal models (i.e., cancer, depression and transgenic diabetes/obesity). Also, we are performing high-resolution imaging studies, cutting-edge equipment analysis, professionally technical support and research collaboration for disease diagnosis and therapy.

Representative Research Case

High-resolution three photon biomedical imaging using doped ZnS nanocrystals

We report on high-resolution in vitro and in vivo imaging by combining three-photon excitation of ZnS nanocrystals and visible emission from Mn^{2+} dopants. The three photon process was successfully applied to high-resolution in vivo tumour-targeted imaging. The biocompatible ZnS nanocrystals will offer great potential for clinical applications of three-photon imaging.

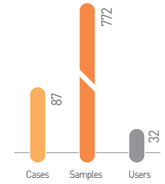
Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	22 (SCI 19)	Domestic 8 / International 2	Application 3 / Registration 1
Analytical Methods	· Prostatic carcinoma cell line to measure simultaneously luminescence and fluorescence : Development of cell strain that enables quantitative and qualitative analysis on therapeutic efficacy and growth of prostate cancer of animal models · Development of test kits and methods to measure ATP levels in a cell : Development of a censor to measure ATP levels in a living cell in a non-destructive way · Development of a hypersensitive censor that gauges copper promptly and easily : development of near-infrared fluorescence copper censor to measure copper ions in cells from blood, serum and urine quick and simple		
Projects	· Study on major depression using in vivo bioluminescence and fluorescence imaging · Biocompatible Nano-medicine-based osteoporosis-control study · Research for stimulating brown adipocyte to prevent obesity · Multi-photon biomedical imaging using biocompatible nanoparticles · Research for Ets1 gene using genomic design technology and zebrafish embryology		
Training of Equipment	· EM(TEM/SEM) user training course · Multi-photon CLSM user training course	· IVIS 200 user training course · CLSM, SEM, IVIS 200	
Equipment	Installed	· Zeta-potential, particle size analyzer · Low vacuum-SEM · VP-FE-SEM · Energy filtering-TEM · MP-CLSM · Fiber Based Fluorescence Animal Imaging system · Luminescence and Fluorescence Animal Imaging system · Intravital Multi-photon confocal laser scanning Microscope imaging system	
	To Be Installed	· Chemi and Gel-Doc System (2014)	

Marine Biology Research

Researches in biomedical manufacturing technology and environment-friendly recovery with marine organisms are carried out.

【 Jeju Center 】



Main Research Activity

Research for the ichthyotoxic mechanism of the harmful dinoflagellate phytoplankton and the various effects of bio-active substances isolated from marine algae.

Representative Research Case

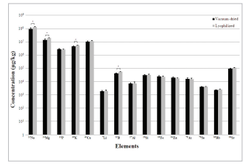
Characterization of compounds in the lyophilized and vacuum-dried sea cucumber Stichopus japonicus

Stichopus japonicus, collected from the sea near Jeju Island of Korea, was lyophilised or vacuum-dried and then analysed by gas chromatography mass spectrometry (GC MS) or inductively coupled plasma mass spectrometry (ICP-MS).

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	22 (SCI 21)	Domestic 7 / International 1	Application 0 / Registration 0
Analytical Methods	· Analysis of amino acids in cell-wall peptidoglycan using amino acid analyzer		
Projects	· Culture of microalgae and development of new potential materials · Specific analysis in marine biology · Isolation and bioprospecting of novel species of archaea from extreme environments · Genomic study of non-culturable microorganisms in food and human		
Training of Equipment	· Training of scanning transmission electron microscope · Training of LC/MS system		
Equipment	Installed	· Bio-LC · LC/MS system · Recycling HPLC · Amino acid analyzer · Bio imaging navigator · GC-mass spectrometer · High sensitivity spectral laser confocal microscopy system · Variable pressure field emission scanning electron microscope with scanning transmission electron microscope · Inductively coupled plasma mass spectrometer · Electron Paramagnetic Resonance Spectrometer	

Image



Concentration of inorganic elements in vacuum-dried and lyophilised Stichopus japonicus samples as determined by ICP-MS

Equipment

Headspace Gas Chromatograph Tandem Mass Spectrometer

Variable Pressure Field Emission scanning Electron Microscope with Scanning Transmission Electron Microscope

High Sensitivity Spectral Laser Confocal Microscopy System

02

NANO Science

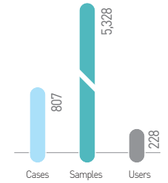
Converting imagination into reality in the nano scale world

KBSI provides state-of-the-art analytical technology to promote progress in national nano sciences by studying the functional mechanisms of advanced materials on a nano scale and investigating the three-dimensional atomic/molecular structures of condensed matters.

Electron Microscopic Research

Division of Electron Microscopic Research is engaged in multi-national collaborations through structural analysis of nano- and bio-materials, and aims to develop convergence imaging techniques using advanced electron Microscope.

【 Division of Electron Microscopic Research 】



Analysis Service

Main Research Activity

The construction of customized high voltage electron microscope that specializes nano-bio convergence analysis was launched, and major imaging techniques (spectroscopy, crystallography, tomography and cryo-electron microscope) were established by improving performance of the microscopes and development of auxiliary systems.

Representative Research Case

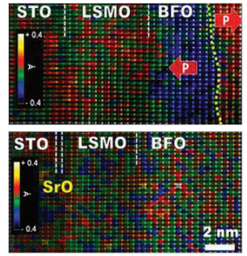
Direct imaging method of polar properties in ferroelectric oxides

Here we demonstrate that a nonpolar phase can be stabilized through heteroepitaxy that occurs with simultaneous changes to the octahedral tilts at the interface of BiFeO3. Using real-space electron microscopic imaging techniques combined with first-principles density functional calculations. We describe how the energetic stability of the polar and antipolar displacements is influenced by the octahedral structure, which at the interface should be sensitive to the chemistry of the terminating layer.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	41 (SCI 37)	Domestic 29 / International 8	Application 9 / Registration 14
Analytical Methods	• Tomography analytical method for 3 dimensional structure analysis of thick specimen • Immuno EM analytical method for the discovery of degenerative neuropathy protein of mouse brain, and 14 others		
Projects	• HVEM operation project • Super Bio-HVEM installation and operation project • Application of HVEM for correlative biological 3D imaging, and 11 others		
Training of Equipment	• 21 cases of public education programs and imaging equipment training		
Equipment	Installed	• High voltage electron microscope, HVEM • UC-Energy filter-transmission electron microscope, UC-EF-TEM • Field emission-transmission electron microscope, FE-TEM • Energy filter-transmission electron microscope, EF-TEM • Bio-transmission electron microscope, Bio-TEM • Field emission-scanning electron microscope, FE-SEM • Electron probe micro-analyzer, EPMA • High temperature x-ray diffractometer, HT-XRD • Environmental-scanning electron microscope, E-SEM • Focused ion beam, FIB	
	To Be Installed	• Multi purpose XRD (2014)	

Image



Direct imaging of polarization behavior in BiFeO3 thin films grown on different interface terminations

Equipment

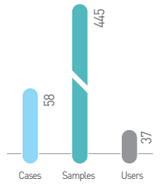
Field Emission- Transmission Electron Microscope

UC-Energy Filtered Transmission Electron Microscope

Functional Nano-materials Research

Scientists in the Division of Materials Science Research are primarily focused on the development of nano-structured and organic/inorganic hybrid materials through molecular simulation and characterization for the high performance green energy storage over the next decade.

【 Division of Materials Science Research 】



Analysis Service

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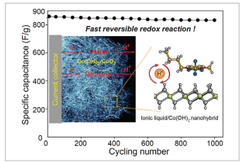
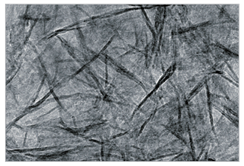
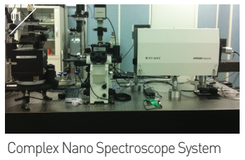




High performance pseudocapacitance of Ionic Liquid/Cobalt Hydroxide Nanohybrids by improving charge transfer and manipulating porous structure

Equipment



Complex Nano Spectroscope System

Solid state Nuclear Magnetic Resonance Spectroscopy

Gas Sorption System by gravimetric method

Main Research Activity

Scientists in the Division of Materials Science Research were able to synthesize the 3D macroporous carbon-composite materials, hydrogen storage materials and examine the electrochemical performance. To develop the high-power and energy density electrodes, graphene oxide based metal oxide composites were fabricated and characterized with MSB, PCT, BET, TEM, XRD, NMR, AFM-Raman, and PPMS.

Representative Research Case

Verification of charge transfer in organic/inorganic hybrid materials

Nanoscale manipulation of morphology and interfacial characteristics of cobalt hydroxides by self-assembly of ionic liquids led to the large surface area, mesopore structure, and fast ion and proton diffusion, resulting in high specific capacitance, high-rate capability, and long-term cycling stability.

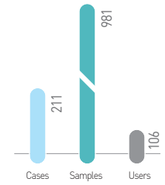
Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	13 (SCI 13)	Domestic 5 / International 0	Application 2 / Registration 3
Analytical Methods	· Development of Raman spectroscopy and SERS-imaging of biomolecules · Development of in-situ Raman analysis of several surfactants functionalized with polymer surfaces		
Projects	· Development of nanostructured materials for hydrogen energy · Development of high-performance energy storage device based on 3D graphene-metal nanoparticle hybrid · Development of energy storage materials based on hollow nanostructured transition metal oxide		
Training of Equipment	· Complex Nano Spectroscope System · 2, 3-D Raman Spectroscopic imaging · Thermal Analysis System		
Equipment	Installed	· Complex Nano Spectroscope System · Electrochemical Analyzer System · Bi-Potentiostat Liquid Cell System for Raman Analysis · Gas Sorption System by Gravimetric or Volumetric Method	

Research of Magnetism

We focus on the magnetic and electric characterization of target devices by exposing them into variable magnetic field or temperature environment.

【 Division of Materials Science Research 】



Analysis Service

Main Research Activity

We carry out a research for application of ferromagnetic materials and magnetic tunnel junction (MTJ). In particular, performance enhancing technology of spin transfer torque oscillator (STO) devices is being investigated.

Representative Research Case

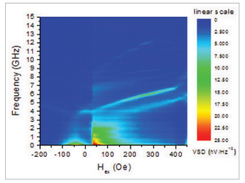
Developing the analysis technology of bias voltage and field for spin devices

A study on analyzing technology for the dependence of magnetic field and bias voltage of the electric resistance and magnetization reversal of spin devices was carried out. For this technology, computer program for automatic measurement was developed.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	56 (SCI 50)	Domestic 36 / International 18	Application 29 / Registration 12
Analytical Methods	· Analysis of ferromagnetic resonance · Raman spectroscopy and surface enhanced Raman scattering (SERS) imaging for analysis of biological materials · In-situ Raman spectroscopy for analysis of surfactants on polymer surfaces		
Projects	· Development of spin device measurement · The development of multi-disciplinary in-situ analytical system for nanotechnology and related science · Development of nanostructured materials for Hydrogen storage · Development of cryogenic scanned probe tera Hz MRI nanoscope · Management of Division of Materials Science Research		
Training of Equipment	· Applied superconductivity workshop : High magnetic field 7 T superconducting magnet, test method of the superconducting magnet. 50 participants. during 12, Dec. (1 day)		
Equipment	Installed	· Physical Property Measurement System, 16 T · Magnetic Property Measurement System, 7 T · EPR System · Complex Nano Optical Spectroscopy System · Magnetic Force Microscopy, MFMa · 500 MHz Solid State FT-NMR · 15 T High Magnetic Field System	
	To Be Installed	· Glow Discharge Mass Spectrometer (2014)	

Image



Contour of the oscillating frequency depending on the magnetic field

Equipment

Cryogenic probestation (CSP)

Physical property measurement system (PPMS)

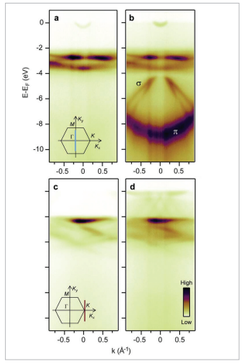
Magnetic property measurement system (MPMS)

Surface Analysis of Low-Dimensional Nano Materials

Exotic surface properties of low-dimensional nano materials for next-generation applications have been studied without exposing samples to air in order to reveal their growth mechanism, electronic structure, atomic structure, etc.

【 Division of Materials Science Research 】

Image

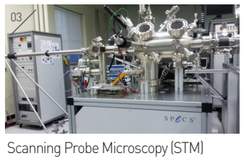


Band structures of the clean Cu (111) substrate and the graphene-Cu (111) system around the (a and b) Γ and (c and d) K points of the first BZ of graphene

Equipment

Angle-Resolved UV Photoemission Spectroscopy (ARUPS)

Micro X-ray Photoemission Spectroscopy (u-XPS)



Scanning Probe Microscopy (STM)

Main Research Activity

We have investigated overall properties of graphene, BN, Dichacogenide transition metals, and topological insulator by measuring their electronic and atomic structures, and chemical composition through the in-situ analysis system which are equipped with u-XPS, STM, NAP-XPS, LEEM/PEEM, ARUPS, etc.

Representative Research Case

An angle-resolved photoemission study on graphene/Cu(111)

Graphene grown on a single-crystal Cu (111) using acetylene was investigated by ARPES from the initial growth stage to the monolayer formation. The growth of the graphene was initiated along the Cu (111) lattice. Then, two rotated graphene domains were grown, where the Dirac bands were similar regardless of the graphene's orientation to the Cu (111).

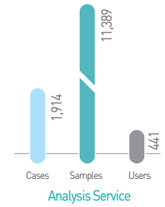
Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	19 (SCI 19)	Domestic 6 / International 2	Application 0 / Registration 4
Analytical Methods	· Stable analysis method for insulator using XPS · Advanced approaches using Kelvin Probe Microscopy to low-dimensional nano materials · Real time analysis of oxide formation on various substrates using HP-XPS		
Projects	· The development of multi-disciplinary in-situ analytical system for nanotechnology and related science · Study of structural properties and electron transfer mechanism in organic/inorganic hybrid device interfaces · Understanding the growth mechanism and selective functionalization of high-quality graphene		
Training of Equipment	· Analysis of chemical composition by using X-ray photoelectron spectroscopy · Surface property characterization of low-dimensional nano materials by using low-energy electron microscopy/photoemission electron microscopy and scanning photoemission microscopy, spectronanoscopy Workshop 2014		
Equipment	Installed	· Micro X-ray Photoemission Spectroscopy · UV Photoemission Spectroscopy · Scanning Probe Microscopy · Linear Sample transfer system · Thermal Evaporator · Plasma Enhanced Atomic Layer Deposition System · High-pressure X-ray Photoemission Spectroscopy	
	To Be Installed	· Low Energy Electron Microscopy/Photoemission Electron Microscopy (2014) · Chemical Vapor Deposition (2014) · DC/RF Magnetron Sputter (2014) · Angle-Resolved UV Photoemission Spectroscopy (2014)	

Surface Physical Property Research

We are equipped with surface analysis instruments to characterize the physical and chemical properties, and we carry out comprehensive research in the field of surface science.

【 Busan Center 】



Main Research Activity

We optimized the deposition condition of TaCx films as a diffusion barrier of copper metallization by using surface analysis instruments, and also characterized the surface of oxide semiconductor and hybrid nanostructures for Li ion secondary batteries.

Representative Research Case

Development of TaCx thin films as a diffusion barrier for Cu Metallization

TaCx films were successfully deposited by using atomic layer deposition. Physical properties of TaCx films were characterized by using various surface analysis systems like x-ray photoelectron spectroscopy. We expect that ALD-TaCx films might be utilized as an alternative substitute to conventional diffusion barrier against Cu.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	42 (SCI 41)	Domestic 58 / International 9	Application 2 / Registration 8
Analytical Methods	· Development of deposition method of single phase Cu_2ZnSnS_4 thin film by using pulsed laser deposition · Development of quantitative analysis method of RuO_2 thin films by using secondary ion mass spectrometry · Development of analysis method of organic silica nanotube by using ToF SIMS		
Projects	· Multi-sensors for heavy metals and pretreatment system of refractory organic matrix · Research and application of bonding technology between metal and organic polymer for energy container		
Training of Equipment	· 105 training courses including exploring surface properties using a microscope · The 6th surface analysis workshop		
Equipment	Installed	· Nano Secondary Ion Mass Spectrometer · Angle-Resolved X-ray Photoelectron Spectrometer · Time of Flight Secondary Ion Mass Spectrometry	· Liquid Chromatography Mass Spectrometer Mass Spectrometer · Inductively Coupled Plasma Atomic Emission Spectrophotometer
	To Be Installed	· Field Emission Scanning Electron Microscope (2014)	

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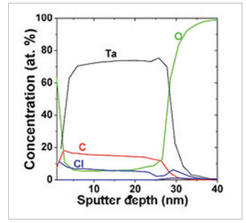


SIMS depth profile of ALD-TaCx Film

Equipment

Nano Secondary Ion Mass Spectrometer

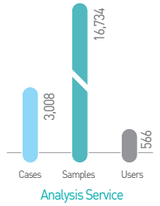
Angle Resolved X-ray Photoelectron Spectrometer

Time of Flight Secondary Ion Mass Spectrometer

High-Tech Function Materials Research

Research support and development of advanced materials including fuel cells, nano complex agents, porous materials, membrane protein, ferroelectrics and smart materials are carried out through molecular characteristics analysis and chemical response tracking of materials with advanced functions.

[Daegu Center]



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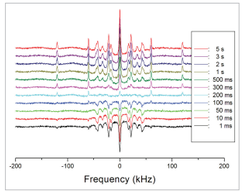


^{27}Al NMR inversion-recovery behavior of the alum crystal at 300 K

Main Research Activity

In 2013, in-situ nuclear magnetic resonance techniques was developed and applied to direct methanol fuel cells to improve the performance of fuel cells.

Representative Research Case

Alum phase transition and NMR relaxation

Alums represent one of the promising materials for storing high solar energies. The phase transition temperatures and processes of Cr^{3+}-doped alums were followed by ^{27}Al NMR relaxation phenomena.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	29 (SCI 27)	Domestic 8 / International 4	Application 0 / Registration 0
Analytical Methods	• GC/MS analysis of taxadiene for the plant transformed with a taxadiene synthase gene • Characterization of nano-pore/channel shape and orientation using ^{2}H nuclear magnetic resonance spectroscopy • Site-specific quantification of deuterium in chemicals without standard reference compounds • ^{27}Al NMR relaxation measurements for alum phase transition		
Projects	• Development and application of nuclear magnetic resonance techniques for investigation of electrochemical reactions and ionic behavior • ^{2}H{^{19}F} REDOR NMR spectroscopy for the 3D bioactive structure of epothilone anticancer drugs • Time-dependent ^{31}P NMR study on GTP hydrolysis in Taxol-stabilized microtubules		
Training of Equipment	• Youth education support programs with scientific instruments : 70 programs Advanced science experience, isolate experimental experience, etc. • Equipment Operation Education for General Users : 2 programs		
Equipment	Installed	• 600 MHz / 400 MHz / 200 MHz solid state FT-NMR Spectrometer • 500 MHz FT-NMR Spectrometer • X-ray / High Resolution X-ray / Multi-purpose X-ray / Multi-Function X-ray Diffractometer • High Resolution Mass Spectrometer • Ultra High Resolution Field Emission Scanning Electron Microscope • Field Emission Scanning Electron Microscope	
	To Be Installed	• Field Emission Tandem Electron Microscope • 400 MHz solid state FT-NMR	

Equipment

01

FT-NMR (Nuclear Magnetic Resonance) Spectrometer

02

High Resolution Mass Spectrometer

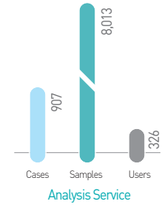
03

Multi-purpose X-ray Diffractometer

Center for Characterization and Analysis of Nanostructures and Carbon-Based Nanomaterials

Jeonju center is performing research support and collaborations to improve nanoscience and nanotechnology. Our research area is specifically focused on the 'characterization and analysis of nanostructures and carbon-based nanomaterials'.

[Jeonju Center]



Main Research Activity

Jeonju center, which is the center for characterization and analysis of nanostructures and carbon-based nanomaterials, supports various research activities and performs joint researches with universities and enterprises. In addition, Jeonju center conducts science education programs for students and equipment users.

Representative Research Case

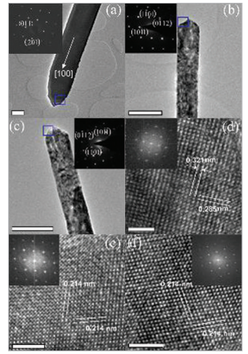
Hydrogen-induced morphotropic phase transformation of single-crystalline vanadium dioxide nanobeams

We report a morphotropic phase transformation in vanadium dioxide (VO_2) nanobeams annealed in a high-pressure hydrogen gas, which leads to the stabilization of metallic phases. Structural analyses show that the annealed VO_2 nanobeams are hexagonal-close-packed structures with roughened surfaces at room temperature, unlike as-grown VO_2 nanobeams with the monoclinic structure and with clean surfaces. Quantitative chemical examination reveals that the hydrogen significantly reduces oxygen in the nanobeams with characteristic nonlinear reduction kinetics which depend on the annealing time.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	34 (SCI 32)	Domestic 12 / International 9	Application 1 / Registration 0
Analytical Methods	• Characterization of photothermally-induced structural phase transition in single-crystalline nanobeams • Development of measurement method of hybrid films of graphene oxide and silver nanowires for flexible and transparent electrode applications • A characterization method on the changes of Biotite in the Weathering process of Granite • Sample preparation method of SEM using tilt & rotation coating stage • Self-assembly and simple synthetic protocol of individual polymer chain-metal nanoparticles for polymer cargo nanocomposites with tunable properties		
Projects	• Development of porous carbon materials-based electrodes for high sensitivity bio-sensor applications • Development of smart nanostructure for environmental remediation • Real-time observation and nanoscale analysis of low-dimensional nanostructures and their properties-coupling behaviors by mechanical strain • Development of in-situ multi-disciplinary characterization system for oxide electronics using ultrafast phase transitions		
Training of Equipment	• Youth Education Support Programs with Advanced Scientific Instruments : 56 programs		
Equipment	Installed	• FE-EF-TEM • UHR FE-SEM • FE-SEM • PSA System	• Single Crystal XRD • AFM system • Micro Raman/PL Spectroscopy System
	To Be Installed	• Cs-STEM	

Image



TEM images and electron diffraction patterns

Equipment

01

Field emission Energy filtered transmission electron microscope (FE-EF-TEM)

02

Micro X-ray photoelectron spectrometer (μ-XPS)

03

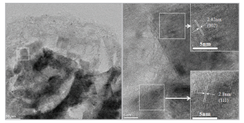
Micro Raman Spectroscopy system (Micro Raman)

New Materials Research

Nano-materials sector has been carried out research, development and professional analysis related rare earth metals (spec. lithium), and metal oxide system. Our center supports joint research and analysis using FE-TEM, FE-SEM, XRD, XRF and DSC/TGA.

[Suncheon Center]

Image



Structural analysis of metallic lithium using SADP analysis of FE-TEM

Equipment

High Resolution-Transmission Electron Microscope (HR-TEM)

Field-Emission Scanning Electron Microscope (FE-SEM)

X-ray Diffractometer (XRD)

Main Research Activity

For the extraction rate of lithium from saltpan-seawater is higher than that from normal seawater, if this technology is used commercially, there would be remarkable in economical efficiency. Also, we perform a structural analysis of extracted lithium from saltpan-seawater.

Representative Research Case

Structural analysis of extracted lithium from saltpan-seawater

We have reported the new anode material with high efficiency for lithium 2nd battery which can be 500 cycles without efficiency loss. We have developed technology for the lithium adsorbent and recovered metallic lithium from bay salt. Carried out structural analysis of extracted lithium from saltpan-seawater.

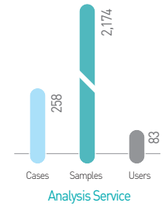
Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	8 (SCI 7)	Domestic 2 / International 3	Application 1 / Registration 1
Projects	· Development of high stability nagative electrode materials using metallic oxide		
Training of Equipment	· Youth Education Support Programs with Advanced Scientific Instruments : 32 programs		
Equipment	Installed	· X-ray Diffractometer System · Field-Emission Scanning Electron Microscope · Field Emission Transmission Electron Microscope · X-ray Fluorescence Spectrometry · Thermal Analyzer	

Nano Materials Imaging Research

Research is performed on characteristics imaging for nano-and micro-samples. The physical characteristics of infinitesimal samples are analyzed and transformed into 2D visualized images.

[Gangneung Center]



Main Research Activity

In 2013, advanced imaging analyses were performed for a number of research fields, such as metal oxide nanomaterials, nanohybrid materials, fluorophore based cell imaging, and medicinal materials, by using various optical nano-imaging instruments in Gangneung Center.

Representative Research Case

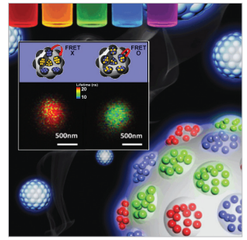
Fluorescence lifetime imaging of multicolor emitting microspheres to study resonance energy transfer efficiency modulation

Fluorescence lifetime imaging microscopy (FLIM) was used to study multicolor emitting microspheres with three-dimensionally controlled nanostructures. Location control and separation of the quantum dots (QDs) within the microspheres are achieved by a supramolecular assembly of block copolymer micelles to control the Föster resonance energy transfer efficiency between the different-colored QDs, which was effectively proved by FLIM.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	11 (SCI 8)	Domestic 3 / International 6	Application 0 / Registration 1
Projects	· Smart nanoporous materials for stimuli-responsive controlled release · Construction of nanoparticle for diagnosis and therapy using nano-imaging and analysis system · Functional control of nanoparticle-superlattice structures		
Training of Equipment	· Advanced user training of transmission electron microscope · Advanced user training of multi-purpose X-ray diffractometer		
Equipment	Installed	· Field Emission Transmission electron Microscope · Field Emission Scanning Electron Microscope · Multi Purpose X-ray Diffractometer · Time-resolved Fluorescence Confocal Microscope · FT-UV-VIS-IR Spectroscopic Imaging Microscope · Wavelength Dispersive X-ray Fluorescence Spectrometer	

Image



Resonance energy transfer efficiency measurement of QDs incorporated block copolymer microspheres by fluorescence lifetime imaging microscopy

Equipment

Analytical Field Emission Scanning Electron Microscope (Analytical FE-SEM)

Field Emission Transmission Electron Microscope (FE-TEM)

Time-resolved Fluorescence Confocal Microscope (FLIM)

03

ENVIRONMENTAL Science

We protect a healthy Earth with environmental science where the past and and future of the Earth environment meet.

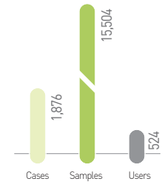
Predictions for environmental changes and prevention of pollution are realized through investigation of global environmental changes and analysis of harmful heavy metals and other pollutants.

Isotope Research
Age Determinating Research
Environmental Research

Isotope Research

Isotope researches are performed by using various advanced mass spectrometers for the analysis of trace elements and environmental isotopes of samples which are of environmental importance. The researches are often in collaboration with researchers in the earth and environmental science fields.

[Division of Earth and Environmental Science Research]



Analysis Service

Main Research Activity

Researches were carried out for the identification of the geographical origin of food using isotopes and Pb-Pb dating methods for identifying the origin of archaeological artefacts.

Representative Research Case

Discrimination of the geographic origin of cabbages

Multivariate statistical treatment based on strontium isotope ratio and multielement analysis of the data facilitated the determination of the origin of Chinese cabbages between Korea and China. These analysis techniques also provided a various agricultural foods.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	14 (SCI 9)	Domestic 16 / International 5	Application 0 / Registration 2
Analytical Methods	• Determination of trace elements in geological reference materials G-3, GSP-2 and SGD-1a by low-dilution glass bead digestion and ICP-MS • Quantifying trace element distributions in agate banding by LA-ICP-MS • Precise determination of the lithium isotope ratio in geological samples using MC-ICP-MS with cool plasma • Sm-Nd isotopic analysis of mixed standard solutions by multi-collector inductively coupled plasma mass spectrometry : evaluation on isobaric interference		
Projects	• Development and implementation of monitoring technologies for CO_2 geological storages • Geochemical study of soils along a Hawaiian chronosequence : Understanding change of the Critical Zone • Trace element-distribution imaging technology for geological materials • Analytical research for radioactive materials • Development of scientific forensic technologies using cutting-edge high-tech analytical equipment		
Training of Equipment	• Training programs for students and experts : 17 programs		
Equipment	Installed	• Multi-collector Inductively Coupled Plasma Mass Spectrometer • Stable Isotope Ratio Mass Spectrometer • Natural Radioactivity Measurement System • Quadrupole Inductively Coupled Plasma Mass Spectrometer • Inductively Coupled Plasma Atomic Emission Spectrometer • Inductively Coupled Plasma Atomic Absorption Spectrometer	

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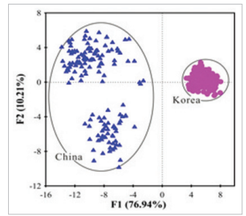
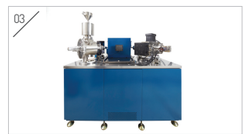


Determining the geographical origin of Chinese cabbages between Korea and China

Equipment

SIRMS

MC-ICP-MS



TIMS

Age Determinating Research

The geochronology team is the unique research group in Korea with a wide range of up-to-date instruments for geochronology, and also comprised of experienced researchers from various fields of geological sciences.

【 Division of Earth and Environmental Science Research 】

Main Research Activity

Paleozoic granitoids in Korea revealed by SHRIMP geochronology, stage partial melting of Nepal Himalaya.

Representative Research Case

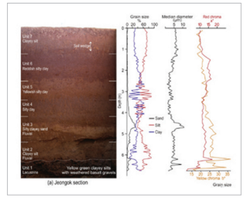
Deposition and weathering of Asian dust in paleolithic sites, Korea

Brown clay-silt (BCS) sequences in paleolithic site in Korea and the loess-paleosol sections of the Chinese Loess Plateau were investigated to reveal depositional environment and weathering process by applying quantitative mineralogical, geochemical and geochronological methods. The properties of the BCSs indicate widespread deposition of Asian dust and subsequent weathering in the late Quaternary, exposed to the high annual precipitation of the Korean Peninsula.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	20 (SCI 15)	Domestic 9 / International 4	Application 0 / Registration 0
Analytical Methods	· ^{40}Ar-^{39}Ar age determination using multi-collector noble gas mass spectrometer · The distribution map of lead isotope compositions for galena from ore deposits in South Korea · Loess deposits in the northern Kyrgyz Tien Shan: Implications for the paleoclimate reconstruction during the Late Quaternary · Reevaluation of Th and U concentrations in marine sediment reference materials using isotope dilution MC-ICP-MS : towards the analytical improvements in dose rate estimation for luminescence dating · Three-dimensional reconstruction of internal zonation in zircon		
Projects	· Characterization of storage strata and development of basis design technology for demonstration of CO_2 geological storage · The distribution mapping of lead isotope in Korea peninsula · Integrative isotope research of accessory minerals for tectonic evolution and characteristics of mesozoic granitoids in South Korea		
Training of Equipment	· Training programs for students and experts : 9 programs		
Equipment	Installed	· High Resolution Secondary Ion Mass Spectrometer · Thermal Ionization Mass Spectrometer	· Optically Simulated Luminescence · Static Vacuum Mass Spectrometer
	To Be Installed	· LA-MC-ICP-MS	

Image

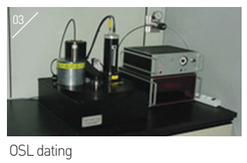


Deposition and weathering of Asian dust in Paleolithic site

Equipment

SHRIMP

Analysis of SHRIMP

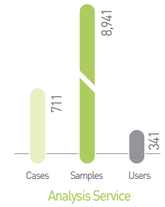


OSL dating

Environmental Research

The environmental analysis field is focused to develop a novel analytical method for comprehensive environmental pollutants and performs accurate identification and structural analysis of chemical species. In collaboration with universities, industry and the government, assessing the exposures to organic and inorganic pollutants as well as reliable quality assurance provided useful information to help understand the environmental impact and manage the environmental risk.

【 Seoul Center 】



Main Research Activity

Hazardous substances including heavy metals are analyzed using ICP-AES, ICP-MS, and XRF. Especially, the analysis of organo-arsenicals in leachate samples by using HPLC-ICP-MS and halogens containing fluorine by using WD-XRF are focused to be developed. With increasing public attention about chemical accidents, analytical techniques specialized to determine accident preparedness substances have been intensively studied.
In addition, Persistent organic pollutants, endocrine disrupters etc. are analyzed for specialized research support. As a national official test facility, we conduct the analysis of dioxin in food. Also efforts are being made for the development of analytical techniques by participating in the national quality control programs.

Representative Research Case

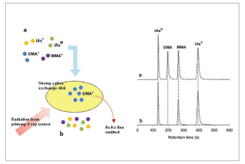
A simplified analysis of dimethylarsinic acid by wavelength dispersive X-ray fluorescence spectrometry combined with a strong cation exchange disk

Dimethylarsinic acid(DMA), one of organic arsenic compounds, has received increasing attention owing to its transformation into a toxic byproduct in metabolic pathway. Therefore, the rapid and sensitive analytical technique for the determination of DMA has been required. In this research, the solid phase extraction for achieving the preconcentration of DMA from sample, the separation of DMA from other arsenic compounds, and the preparedness of XRF specimen, concurrently and X-ray fluorescence spectrometry for the direct analysis without the need for the additional elution step were effectively combined. It minimizes the use of solvents to adhere to green analytical chemistry practices.

Major Achievements

Category	Achievements		
Research Result	Publications	Presentations	Patents
	9 (SCI 5)	Domestic 15 / International 11	Application 0 / Registration 0
Analytical Methods	· Combination of methanol addition and collision cell techniques for the trace analysis of arsenic in leachate containing high chlorine concentration by inductively coupled plasma mass spectrometry · Application of wavelength dispersive X-ray fluorescence spectrometry for the analysis of soil fluorine : 1. A modified pretreatment method to improve LOD · Polychlorinated dibenzo-P-Dioxins and Dibenzo-Furans in liver of piglet according to diseases · Componential analysis of textiles Treated by non-halogen type flame retardants · Analysis of organic components in landfill leachate · Analysis of Non Dioxin-like PCBs and Indicator PCBs in Food		
Projects	· Development of method to assess fluorine level in soil and waste and protocol for contaminated site monitoring · Development of precede management protocols for the surveillance of hazardous chemical substances in soil and groundwater · Safety control of PCBs in food · Method development of PCNs and SCCPs in food		
Training of Equipment	· Technical training course of the environmental materials analysis by using ICP-AES, ICP-MS, and XRF		
Equipment	Installed	· High Resolution Gas Chromatography/High Resolution Mass Spectrometer, HRGC/HRMS · High Performance Liquid Chromatography Inductively Coupled Plasma Mass Spectrometer, HPLC-ICP-MS · Inductively Coupled Plasma Atomic Emission Spectrophotometer, ICP-AES	· Wavelength Dispersive X-ray Fluorescence Spectrometer, WD-XRF · Energy Dispersive X-ray Fluorescence Spectrometer, ED-XRF · X-ray Diffraction Spectrometer, XRD

Image



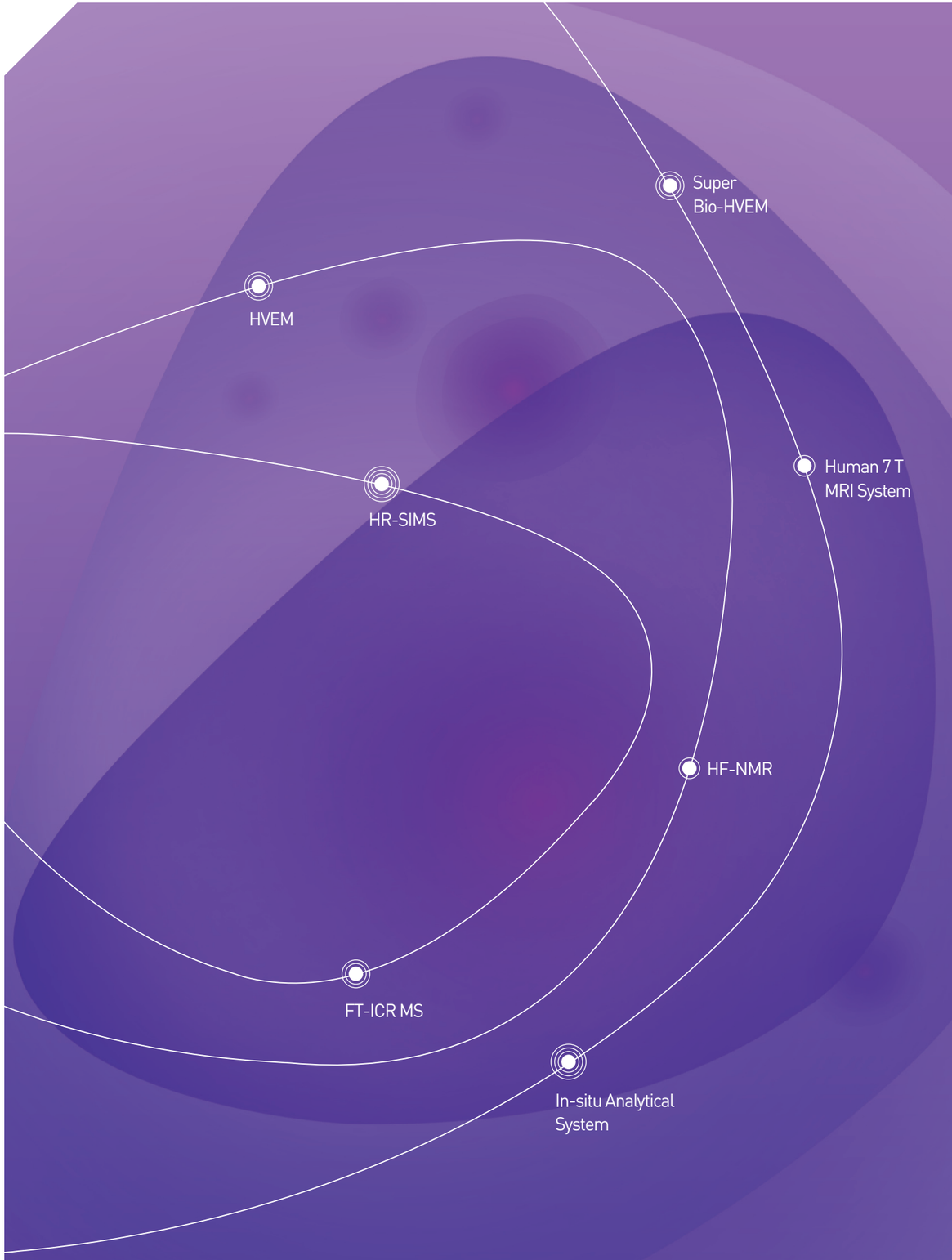
Schematics of the selective pre-concentration of DMA from water samples containing iAs^{V}, iAs^{III}, DMA, MMA using a strong cation exchange (SCX) disk and its direct analysis using XRF without the additional elution step(left). Chromatograms of the sample containing iAs^{V}, iAs^{III}, DMA, MMA before(a) and after(b) passing through the SCX disk obtained from HPLC-ICPMS analysis (right).

Equipment

High Performance Liquid Chromatography -Inductively Coupled Plasma Mass Spectrometer

Wavelength Dispersive X-ray Fluorescence Spectrometer

High Resolution Gas Chromatography / High Resolution Mass Spectrometer



Installation & Operation of National Large-scale Research Equipment

KBSI is making an effort to create the best basic science research environment for domestic and overseas researchers by providing world-class research equipment. This leads to the development of new science and technology and the driving force to become a world-class research institute.

High Voltage Electron Microscope

The High Voltage Electron Microscope (HVEM) utilizes high acceleration voltage for structural analysis at atomic-resolution. The HVEM is employed in basic and applied sciences, such as structural analysis of new materials, structure determination of small proteins, and development of infinitesimal materials.
[Open in April 2004]

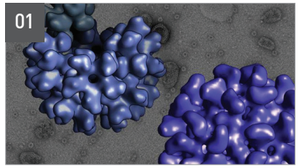
[Division of Electron Microscopic Research]

Characteristics of Equipment

- Observation of three-dimensional (3D) atomic structure of materials by concurrently implementing its atomic resolution (0.12 nm) and high tilt angle (±60˚)
- Chemical signal detection with high collection rate using the state-of-the-art energy filters (HV-GIF) that utilizes the relativity effect
- In-situ and Cryo-EM analysis with customized specimen holder
- Capability of collaboration with remote researchers through remote control system

Major Applications

01



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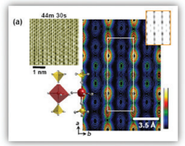

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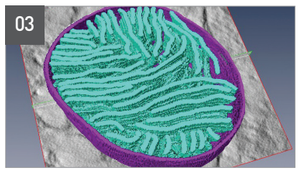

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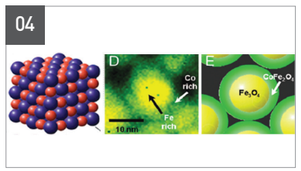


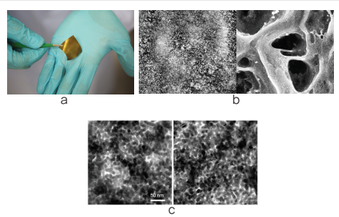
01_ Structural analysis of protein at molecular level
02_ Atomic structure analysis of nanostructured materials
03_ 3D analysis of subcellular structures
04_ Structure and chemical analysis of nanoparticles

Representative Research Case

The world's first development of stretchable nanoparticle conductors

The shortcomings of the existing elastic conductor for the development of a flexible, elastic and excellent conductivity of polyurethane filled with gold nanoparticles and elastic at the same time also help the implementation of classical conductor as possible to contribute to the development of the world's first development. To take advantage of HVEM and its penetration of the tension / contraction, even in order to maintain good electrical conductivity of self-assembled gold nanoparticles to visualize the phenomena.

Image



(a) Newly developed stretchable conductor image (b) Surface image by electron microscope of before and / or after elongation of high stretchable conductor (c) Inner structure analysis of stretchable nanoparticle conductors with self-organized conductive pathways(left) and cross section(right) using HVEM-HREM

Fourier Transform Ion Cyclotron Resonance Mass Spectrometer

The world's first 15 T FT-ICR MS was developed to build the infra of a world-class mass spectrometry in Ochang Headquarters. The profiles of proteome, metabolome, petroleum, and natural product materials are produced and applied for the nationwide collaboration research projects with the ultra-high resolution mass spectrometry.
[Open in December 2007]

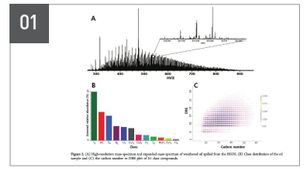
[Division of Mass Spectrometry Research]

Characteristics of Equipment

- The world's best mass resolution : > 10,000,000
- Dual ion source : ESI/MALDI
- Applicable methods: MALDI imaging, APCI, APPI, LC/MS/MS
- Various MS/MS techniques: CID, ECD, IS-CAD
- Accuracy : tolerance ~ 0.03 ppm
- Sensitivity : S/N = 86 (Ubiquitin 100 attomol)

Major Applications

01



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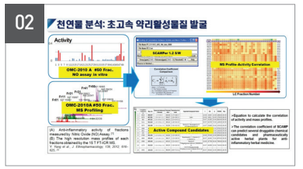
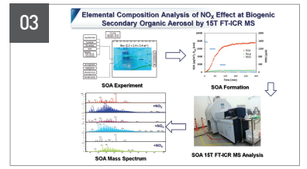


03



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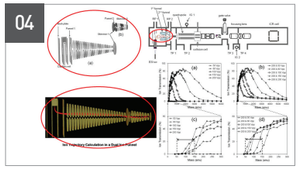


01_ The FT-ICR MS can be used study oils at the molecular level. High-resolution mass spectrum of an oil sample contained over 20 peaks within a~0.4 m/z window, which could be converted into elemental formulas using data interpretation like double bond equivalence (DBE).

02_ High throughput multiple active components discovery method development using activity and mass profiles. The correlation coefficient of SCAMP can predict several druggable chemical candidates and pharmaceutically active herbal plants for the anti-inflammatory herbal medicine.

03_ Understanding of NOx effects on biogenic SOA formation is improved by the comprehensive elemental composition determinations of SOA with the ultra-high resolution 15 T FT-ICR MS. SOA is produced at higher concentration with NOx than without NOx.

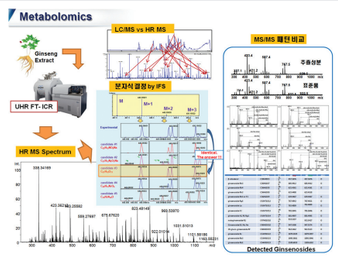
04_ The performance of the dual ion funnel in the ion source of FT-ICR MS could be improved by increasing the ion transmission efficiency for the molecules in the low m/z ranges, such as metabolites, natural products and small biomarkers.

Representative Research Case

High throughput molecular formula determination method for natural product research using UHR MS profiles

- We reported a high-throughput analytical method capable of determining most phytochemicals in a plant extract and of providing their molecular formulae from a single experiment using ultra-high resolution electrospray ionization mass spectrometry (UHR ESI MS).
- UHR mass profiling of a plant extract by 15 T FT-ICR MS showed that multiple compounds were simultaneously detected, and their molecular formulae were decisively determined by a single experiment with ultra-high mass resolution and mass accuracy.
- Simultaneous molecular determination of multiple natural products by UHR ESI FT-ICR MS would be a powerful method to profile a wide range of natural compounds.

Image



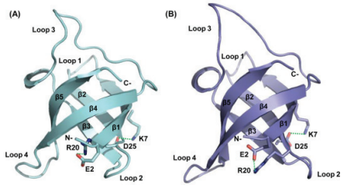
Simultaneous molecular formula determinations for high throughput analysis of natural compounds in a plant extract by ultra-high resolution 15 T Fourier Transform Ion Cyclotron Resonance Mass Spectrometry (Plant Methods. 2013 ; 9: 15.)

High Field-Nuclear Magnetic Resonance

The 900 and 800 MHz Nuclear Magnetic Resonance(NMR) spectrometers, and 4.7 and 9.4 T Magnetic Resonance Imaging (MRI) animal scanners were installed in Ochang Headquarters as the core equipment for researches in molecular structure determination, drug discovery, development of diagnosis and treatment technology. These research equipments are being operated as the national user facilities in Korea.
[Open in April 2006]

[Division of Magnetic Resonance Research]

Image

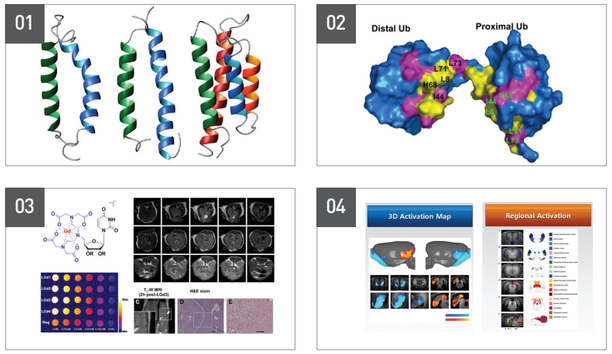


(A) Schematic illustration of DDS bearing Cy7 dye 1 (Scheme 1) as an NIR-based reporter
(B) Confocal laser fluorescence microscopy images of KB cells with prodrug 1 and Lyso-Sensor Blue DND-167 or ERtracker Red.

Characteristics of Equipment

- 900 MHz & 800 MHz NMR : The ^{1}H sensitivity of the cryoprobe is over 4 times higher than that of the room temperature probe, which reduces the experimental time to 1/16 and ^{13}C spectra can be taken with 1mg or less samples.
- 9.4 T and 4.7 T MRI : Animal MRI scanners with 21 cm and 40 cm bore sizes respectively

Major Applications



01_ Research on protein structure and natural product structure
02_ Research on protein-protein interactions and dynamics
03_ Molecular imaging and therapeutic effect monitoring
04_ Brain function study

Representative Research Case

Folate-based near-infrared fluorescent theranostic gemcitabine delivery

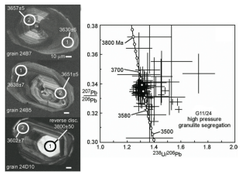
A series of heptamethine cyanine derivatives bearing a carbamate ethyl disulfide group and gemcitabine, an anticancer drug, have been newly synthesized. Their disulfide bonds are readily cleaved by various thiols including glutathione, to result in a subsequent decomposition of the carbamate into amine followed by release of the active gemcitabine, which can be monitored by the fluorescence changes. In the biological experiment, prodrug 1 is preferentially up-taken by folate-positive KB cells over folatenegative A549 cells via receptor-mediated endocytosis to release gemcitabine causing cell death and to emit fluorescence in endoplasmic reticulum. Moreover, it is selectively accumulated in the KB cells which were treated to mice by dorsal subcutaneous injection. This drug delivery system is a new theranostic agent, wherein both therapeutic effect and drug uptake can be easily monitored at the subcellular level, by in vivo and in vitro fluorescence imaging.

High Resolution-Secondary Ion Mass Spectrometer

High Resolution Secondary Ionization Mass Spectrometer (HR-SIMS), which measures the isotope ratio for microscopic areas of solid materials, has been installed and operated as a core-research instrument for age determination, stable isotope research, and nuclide analysis.
[Open in September 2009]

[Division of Earth and Environmental Science Research]

Image

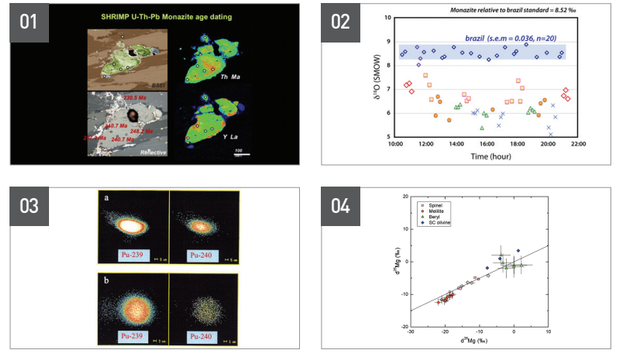


Field research at Isua reas, SW Greenland in 2011 (above)
Cathodoluminescence images and age of zircon from high-P migmatite in Isua area (below)

Characteristics of Equipment

- > 1% Reproducibility of U-Pb age determinations
- Cs-gun and aluminum flight tube exclusively for stable isotopes
- Improved multi-collector for Pu isotopes
- Remote analysis and diagnostics

Major Applications



01_ In-situ U-Pb age determination of accessory minerals
02_ In-situ stable oxygen isotope analysis
03_ Distribution of plutonium isotope in the nuclide particle
04_ Corrected magnesium isotopic ratios of standard minerals (spinel, melilite, beryl and olivine)

Representative Research Case

The Itsaq gneiss complex of Greenland : episodic 3900 to 3660 Ma

Using high resolution secondary ion mass spectrometer (model: SHRIMP-IIe/MC), the age and origin of the Itsaq gneiss complex of SW Greenland were revealed; episodic 3900 to 3660 ma juvenile crust formation and recycling in the 3660 to 3600 Ma Isukasian orogeny

Human 7 T MRI System

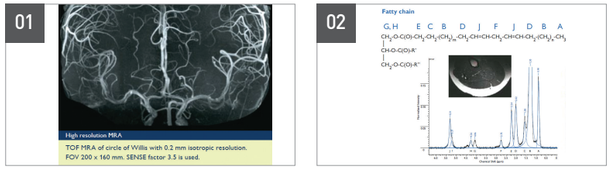
Philips Achieva 7.0 T MRI research system provides the ultra high field strength essential for advanced clinical research in a stable, optimized platform. In particular, it shares the proven technology platform of 3.0 T clinical system for reproducible results to support research needs.
[to be installed in 2014]

[Division of Magnetic Resonance Research]

Characteristics of Equipment

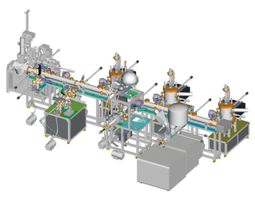
- Superconductive actively shielded compact 7.0 T magnet
- Actively shielded gradient system and 8 channels RF system
- Ultra-high resolution, enhanced fMRI, and spectroscopy

Major Applications



01_ Ultra-high resolution brain MRA(image : NRI, ETH, Zurich)
02_ Ultra-high resolution MRS(image : UTSW, Dallas, USA)

Multi-disciplinary in-situ Analytical System



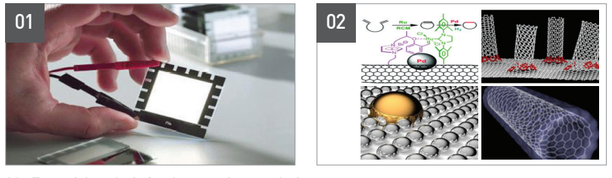
The purpose of this system is to provide the total analytical solution both academic and industry by means of establishing the one-line in-situ analytical system consists of high-ends of leading analysis instruments and device fabrication process.
[to be installed in 2016]

[Division of Materials Science Research]

Characteristics of Equipment

- Combination of the process and the analysis provide the essential information on basic science
- Support nanotechnology and other complex science with qualified data and information on basic knowledge on the new-forthcoming materials for the future.

Major Applications

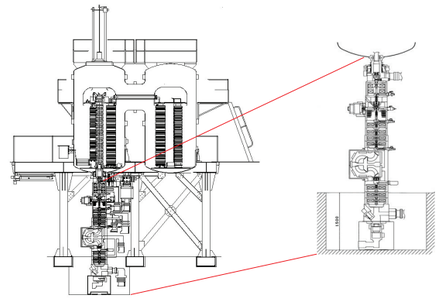


01_ Essential analysis for the organic nano devices
02_ In-situ total surface analysis for the next generation of semiconductor and low dimensional materials

Super Bio HVEM

A High Voltage Electron Microscope with state-of-the-art auxiliary functions, which is optimized for 3D analysis of bio-molecules, is scheduled to be installed. It will be leading as a national user research equipment in nano-bio fusion research fields.
[to be installed in 2015]

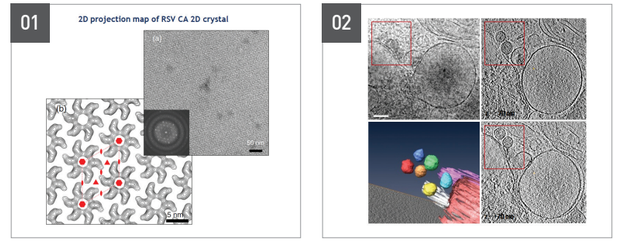
[Division of Electron Microscopic Research]



Characteristics of Equipment

- Advanced cryo-EM function at cryogenic temperature (< 98° K) for the structural analysis of protein complexes
- Enhanced auto-high tilt function (±70°) for the 3D structure analysis
- Reinforced performance with STEM, in-column filter, and high resolution DDD camera (4kx4k)

Major Applications



01_ Characteristic structures of biological macromolecules visualized by high resolution imaging of HVEM
02_ In-vivo ultrastructural imaging of intracellular organelles distinctively larger in size

Development of
Leading-Edge
Analytical Equipment

Development
of National
Agenda-Solving Technology

Advanced Analytical Science Research

Pioneering new research fields in basic science and developing state-of-the-art equipment contribute to advancing national science and technology.
Korea Basic Science Institute develops state-of-the-art analytical technologies by utilizing world-class research equipment to pioneer new research support areas, develop state-of-the-art research equipment and secures basic technology to avoid importing, thus greatly contributing to the enhancement of national competitiveness.

Development of National Agenda-Solving Technology

We develop state-of-the-art analytical technology to resolve national difficulties such as diseases and natural disasters ; and global issues such as environmental pollution, energy, climate change, etc.

Technology to discriminate the origin of agricultural and livestock produce

Development of the integrated analysis technology for discriminating the geographical origin of food, which are currently being circulated in Korean markets, is being established.

【 Seoul Center 】

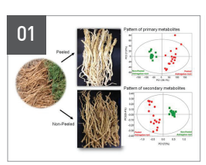
Main Research Activity

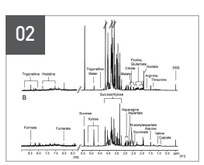
Metabolite profiling based on a combination of ^{1}H NMR and UPLC-MS analyses was performed to evaluate postharvest processing of astragalus membranaceus roots.

Future Plans of Research

An integrated classification system for discriminating the geographical origin or quality of various foods will be developed.

Image





01_ Evaluating quality differences by peeling procedures used in the postharvest processing of astragalus roots

02_ Representative ^{1}H NMR spectra of aqueous extracts of (A) unpeeled and (B) peeled astragalus roots

Bio-imaging technology for early disease diagnosis

Research interests are focussed on the development of multi-modal imaging contrast agents to be used for early diagnosis and therapy monitoring with small-animal in vivo imaging facilities such as magnetic resonance imaging(MRI), and near infra-red(NIR) imaging.

【 Division of Magnetic Resonance Research 】

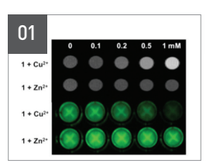
Main Research Activity

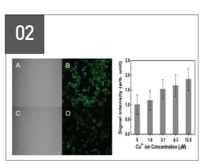
A water-soluble T_1 magnetic resonance imaging contrast agent has been synthesized. The bimodal contrast agent responds to the Cu^{2+} ion in living cells by enhancing the MRI modality signal whereas the optical signal gradually drops. This dual modality probe response depends on the cellular free copper ions in RAW 264.7 cells even at the micromolar level.

Future Plans of Research

Novel multi-modal (MR/NIR/PET) imaging probe platform with specific targeting functions to immune(monocyte/macrophages) and cancer cells will be developed and used for the translational study from animal to bed on in vivo diagnosis and therapy.

Image





01_ T_1-weighted phantom MR image (up), and fluorescence phantom image (down) of 1 (0.2 mM) in the presence of Cu or Zn ions with various concentrations

02_ Bright-field transmission image and fluorescence image of 1 (12.5 μM) with 1 equiv of Cu ions in RAW 264.7 cell lines and changing of MR signal

Culture property preservation and analysis technology

It will be used for the research of the origin and classification of the relics by the development of the analytical techniques for ancient bronze artifacts and the building the base data of lead isotope in the Korean peninsula.

【 Division of Earth and Environmental Science Research 】

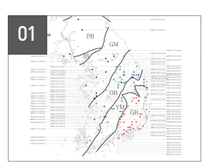
Main Research Activity

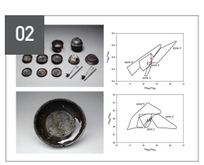
We carried out the lead isotope analysis of galena samples in order to make the distribution map of lead isotope in the Korean peninsula, and performed the preliminary provenance study of bronze artifacts.

Future Plans of Research

To produce the base data of the origin and distribution of the relics, we will establish the estimation system of provenance of excavated bronze artifacts.

Image





01_ The distribution map of Pb isotope ratio in the Korean peninsula

02_ The provenance of bronze bowls in the Mado shipwreck No. 3.

Technology for crime scene investigation

Scene-applicable analytical techniques using biochemical forensic biomarkers are developing for fast and accurate crime scene investigation.

【Division of Life Sciences Research / Division of Earth and Environmental Science Research】

Main Research Activity

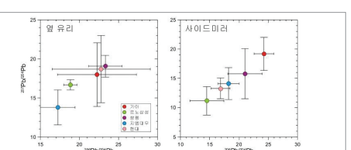
Discrimination of Korean car glasses using a LA-ICP-MS analysis.

Future Plans of Research

The development of chemical fingerprint for tracing geographic provenance in anthropology.

Image

01



01_ Discrimination of Korean car glasses using a LA-ICP-MS analysis.

Analytical technology in disaster science

Center for Analytical Research in Disaster Sciences (CARDS) was established based on the state-of-the-art analytical techniques and infrastructure of KBSI to strengthen scientific resolutions on national environmental disasters.

【Division of Earth and Environmental Science Research】

Main Research Activity

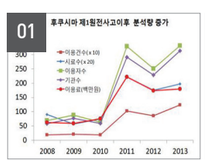
Since 2012, CARDS has been studying researches for the establishment of analytical infrastructure and development of key technologies in (1) environmental radioactivity, (2) environmental contaminants, and (3) forensic sciences.

Future Plans of Research

To consolidate technological basis of CARDS by 2014, research efforts will be focused on the improvement of analytical capabilities, development of sensors/instruments and new technologies.

Image

01



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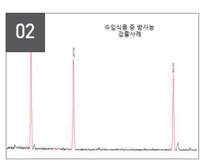


01_ The graph showing the increase after Fukushima daiichi nuclear disaster

02_ Radioactivity detection on imported food

Development of Leading-Edge Analytical Equipment

To meet the demands of cutting-edge research, analytical equipment (whole product or key parts) and ambient systems are remodeled and developed through core technology development of analytical equipment.

Femtosecond multi-dimensional spectrometer

Scientists in Seoul center are developing the world's first two-dimensional chiroptical spectrometer that enables real-time measurements of stereochemical structure and dynamics of chiral biomolecules in femtosecond time scale.

【Seoul Center】

Main Research Activity

Highly sensitive femtosecond chiroptical techniques have been developed and applied to elucidate fundamental amplification mechanism in chiroptical spectroscopy, which will be used in designing and building two-dimensional chiroptical spectrometer.

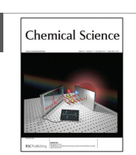
Future Plans of Research

The world's first two-dimensional chiroptical spectrometer will be developed combing state-of-the-art laser technologies, which will be used to study ultrafast reaction dynamics of biological and stereochemical systems.

Image

01

02



01_ Key equipment for development of two-dimensional chiroptical spectrometer

02_ Study on amplification in chiroptical measurement (inside cover, Chemical Science)

High-precision thermal-imaging microscope system

Research on the development of a high-precision thermal imaging microscope is under progress, which can image an absolute temperature distribution and analyze thermal characteristics of micro-scale electronic devices and bio-samples.

【 Center for Analytical Instrumentation Development 】

Main Research Activity

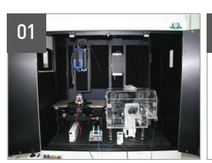
High resolution infrared optical lens, ultra-precision thermal imaging microscope system and the related algorithms were developed. Also, the precise temperature imaging and thermal analysis methods of semiconductor devices and nano-bio samples were developed, as application technologies of thermal imaging microscope.

Future Plans of Research

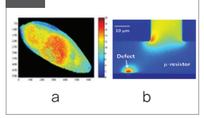
For the utilization of thermal imaging microscope as a joint research equipment in various fields, the future research will be focused on the development of ultra-precision thermal imaging microscope system and IT/BT/NT application technologies.

Image

01



02



01_ Ultra-precision thermal imaging microscope system

02_ Measured microscopic thermal images
(a)Seed (b)Semiconductor device

A heavy ion accelerator employing an 28 GHz superconducting ECR ion source

The KBSI heavy ion accelerator using a 28 GHz superconducting ECR (electron cyclotron resonance) ion source is developing for construction of accelerator driven analytical equipments. It will be used for the various analytical devices using a heavy ion beam such as SIMS, TEM, ERD, NCT, and etc. Also, this facility will be supported for the material process, medical applications, nuclear physics and so on.

【 Busan Center 】

Main Research Activity

The major components of ECR ion source (28 GHz RF system, superconducting magnet, liquid helium recondensed cryostat, high vacuum plasma chamber) and LEBT system have been developed and ready to be operated. The design of RFQ (Radio Frequency Quadrupole) linear accelerator have been finished and are now under construction. Also, another linear accelerator, which is transferred from Tokyo Institute of Technology (TiTech) was installed.

Future Plans of Research

The injector part of heavy ion accelerator will be tested through the extraction of effective heavy ion beam from 28 GHz superconducting ECR ion source. The research for finding an optimum condition of ECR ion source producing a highly charged ion will be progressed in 2014. The RFQ linear accelerator for heavy ion beam will be manufactured with domestic company. A RFQ linear accelerator from TiTech will be finished for the installation and running on application of light ion acceleration.

Image

01

02

01_ A 28 GHz ECR ion source and LEBT system as an injector of heavy ion accelerator

02_ RFQ linear accelerator

Conduction cooling type 15 T high magnetic field material research system

By the cryogen-free type 15 T superconducting magnet system, measurement of various materials properties, evaluation of superconducting wire and magnet, material synthesis and crystal growth are to be done under 15 tesla high magnetic field and below 3 K low temperature.

【 Division of Materials Science Research 】

Main Research Activity

Installation of 2 KA high current power supply, characterization of NbTi LTS wire and 2 G HTS tape, evaluation of 5 T HTS superconducting magnet have been done in 15 T background magnetic field using KBSI made LHe cryostat.

Future Plans of Research

Various materials property measurements under high magnetic field and low temperature, evaluation of superconducting wire and magnet by installed high current power supply, magnetic separation, material synthesis and crystal growth will be done.

Image

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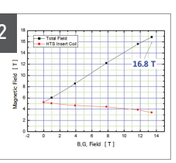

01_ Cryogen free 15 T superconducting magnet system with LHe cryostat and 2,000 A high current power supply

02_ Test result of developed high temperature superconducting magnet - recorded 16.8 T

Portable mass spectroscopy

We are developing a pocket portable mass spectrometer that is able to detect and identify trace chemicals in the field in real time. The application can be found in the area of monitoring environmental pollution and inspection of illegal traffic of controlled substances such as drugs, explosives, chemical warfare agents, and nuclear materials.

【 Division of Mass Spectrometry Research 】

Main Research Activity

For a shrinking mass spectrometer, not only the mass analyzer but the vacuum system, the control electronics, and all of the peripherals must be miniaturized. A tiny high vacuum system has been already developed. We have published our new development of small cold electron ionization source that has a dozen of advantages over conventional hot cathode electron gun.

Future Plans of Research

The ultimate goal of this development is a commercial grade pocket mass spectrometer in a mobile phone size. A tiny control electronics powered with a battery will be completed this year. A high performance sample gas concentration system for detection of trace chemicals in the air will be attempted.

Image

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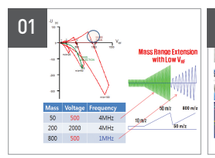

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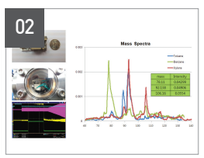


01_ Mass range extension by multi frequency RF scan method.

02_ A tiny mass spectrometer assembled with a cold electronic gun, ion trap, and ion detector.

Reinforcement & Promotion of National Basic Science Support Systems

Leading national S&T infrastructure, KBSI trains future S&T specialists and promotes cooperation among industries, universities and research institutes.

KBSI comprehensively manages national research facilities and equipment with the goal of realizing strategic expansion and systematic joint utilization of research facilities and equipment. Based on our world-class analytical technology, KBSI is fostering analytical S&T experts. Also, KBSI operates various support systems to reinforce industrial technological competitiveness and promote industry-university-institute cooperation by utilizing the research infrastructure.

Operation of National Research Facilities & Equipment Center

NFEC is established by the Framework Act on Science and Technology to provide a systematic support for scientific development in research facilities and equipment. NFEC, as an exclusively responsible Korean organization, will endeavor to maximize R&D productivity by providing an overall management and a systematic support for the development of research facilities and equipment for strategic investment, promotion of co-utilization of research facilities, and the development of high-skilled manpower.

Supports policy-making and improves the system of national research facilities & equipment

Act as a national think-tank by supporting an effective operation and management for boosting the efficiency of investment of national research facilities & equipment, such as systematic-strategic construction, promotion of co-utilization and recycling idling and less used equipment.

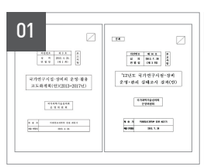
Main Research Activity

In 2013, support was carried out for 8 policy-makings of research facilities and equipment. Also, we laid the foundation for policy-making to cooperate with the government of research facilities and equipment by organizing and operating a supporting consultative group of government agency of research facilities and equipment and the effective utilization task force of national research facilities and equipment.

Future Plans of Research

To support policy establishment for strategic investment and effective management of research facilities and equipment and to prepare legal basis for promotion of co-utilization of large research facilities.

Image


01


02

01_ Agenda to support policy-making
02_ Public hearing & agenda for effective utilization of research facilities and equipment

Organization and management of the 'Deliberative Council on Research Facilities and Equipment Budget'

We improve the efficiency of national R&D investment by operating the 'Deliberative Council on Research facilities and Equipment Budget' for feasibility examinations when the strategy and finance allocates the national R&D budget.

Main Research Activity

Reduced budget of 44.8 billion KRW through holding deliberative council on the research facilities & equipment budget twice and enhanced effective execution of R&D budget by forming the council for amendment regularly(6 times) according to the changes of research environment.

Future Plans of Research

To construct online service for operation of the 'Deliberative Council on Research facilities and Equipment Budget' efficiently and to form the council for amendment more often.

Image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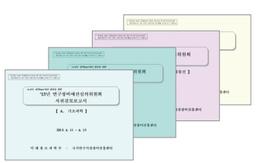


01_ 'Deliberative Council on Research Facilities and Equipment Budget' and deliberation materials

Promotion of the national research facilities and equipment management manual

We provide integrated management manual, from acquisition to refuse for the effective operation and a national management system of research facilities and equipment.

Main Research Activity

In 2013, we revised and distributed the national research facilities and equipment management manual to reflect the changes of research environment. Drove research institute and researcher to manage and operate research facilities and equipment systematically by holding 4 workshops (with a total 439 participants).

Future Plans of Research

To supplement the national research facilities and equipment management manual by reforming the system of research facilites and equipment and to strengthen promotion of the national research facilities and equipment management manual by providing details of it and holding the workshop aiming at operator of research facilities and equipment in universities and research institutes.

Image


01


02

01_ Revised edition of 「the national research facilities and equipment management manual」
02_ A Workshop on 「the national research facilities and equipment management manual」

Operation of national research facilities and equipment management service

We provide major information and national statistical indicators needed in order to establish effective infrastructure policy and invest strategically by upgrading collection, management, and distribution system of research facilities and equipment built through government R&D budget.

Main Research Activity

We requested 2,689 research institutes to register for NTIS information on research facilities and equipment built through government R&D project. Moreover we published 「2011 Investigation and Analysis of National Research Facilities and Equipment」 which include status of research facilities and equipment built through government R&D project during these five years.

Future Plans of Research

We plan to upgrade NTIS(National Research Facilities and Equipment Management Service) through an expansion of database, advancement of statistical service, and development of intelligent search function.

Image

01_ NTIS, national research facilities and equipment management service

02_ The major statistics from national research facilities and equipment management service

Cultivation of equipment engineers

We improve the efficiency of national R&D investment by systematically training equipment engineers who are exclusively in charge of operation and management of it.

Main Research Activity

We designated 10 institutions of professional education, selected 159 students as the second trainers and developed 28 textbooks in order to cultivate equipment engineers who are exclusively in charge of operation and management of research facilities and equipment. Also, it turn out 35 trainers and 94.2 percent of them are employed.

Future Plans of Research

To advance SEE online service and practice material for systematic training of research equipment. Certificate authentication system test operation will be conducted.

Image

01_ 「Research Equipment Engineer Training Project Ⅰ·Ⅱ」

02_ Textbooks of the basic and professional education

Promote support program of high-cost and special research equipment

We support operation costs(employment and maintenance) to universities and research institutes that own research equipment with values of 100 million won more for promoting shared-use of the equipment.

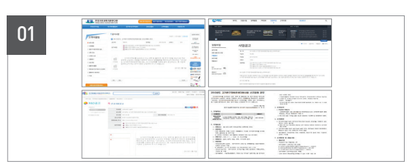
Main Research Activity

We supported 562 million won for 23 equipment in 2013 and analyzed 23,709 samples by opening the equipment to the public. Moreover, we contributed to deriving excellent research results through publishing total of 180 domestic and foreign thesis and registering 8 patents.

Future Plans of Research

The amount of support fees per research equipment will be expanded to improve the effectiveness and satisfaction of operating high-cost research equipment.

Image



01_ A variety of PR Instructional material

Publication of the trend report for research facilities and equipment

We publish 'NFEC PRISM', which analyzes issues of local and international management systems and a survey of research facilities and equipment to provide useful information of policy-making.

Main Research Activity

In 2013, we provided a variety of information by publishing a total of 18 NFEC PRISM reports, including 'The Importance of Basic Science Infrastructure', 'Maintenance Expense Calculation'.

Future Plans of Research

To publish and expand the NFEC PRISM which will be useful to researchers and policymakers, based on user needs for the policy of research facilities and equipment, and the investment trends.

Image

01_ 'NFEC PRISM' reports

Online research service system

OCS (Online research service system) utilizes the most advanced cutting-edge IT technologies for increasing the research support easiness/ease. Users can join simultaneously the analysis process through OCS' technologies in the headquarters and local center. On OCS' web service, to share their opinion for sample analysis, users can communicate KBSI's operator with video conference system. OCS' web service provide various fields of research support(data analysis(S/W), Q&A etc.).

【 Division of Creative Policy 】

Main Research Activity

In 2013, total of 49 analysis equipment is working under OCS. In the research support service area, 577 analysis cases were processed based on OCS. Especially OCS expanded new state-of-the-art media streaming technologies for transferring analysis image data to users. For retaining the best operational condition, OCS has been continuously improved.

Future Plans of Research

To improve the intelligent OCS for promotion of share-use of research facilities, to upgrade OCS's performance for R&D utilization improvement, and to contribute to public understanding of science & technology.

Image

01_ 2013 Korea Science Festival
02_ Science popularization (remote experiment)
03_ Remote analytical service joint research
04_ SIMS International Symposium

Operating Graduate School of Analytical Science and Technology

Graduate School of Analytical Science and Technology[GRAST] was jointly established with Chungnam National University[CNU] as a new university-institute cooperation model to combine education and S&T research. Contributing to national S&T development and securing global research competitiveness, it aims to become the world's leading graduate school in the field of analytical S&T.

【 Daedeok Headquarters-Chungnam National University 】

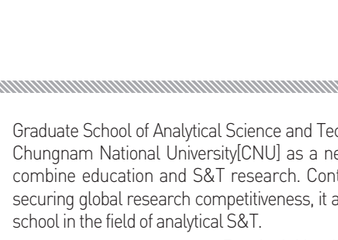
Main Research Activity

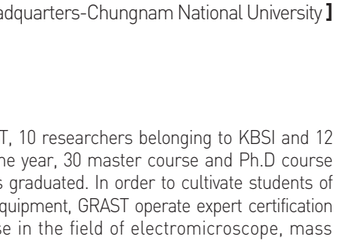
In 2013, there were 22 faculties in GRAST, 10 researchers belonging to KBSI and 12 professors belonging to CNU. In the same year, 30 master course and Ph.D course students entered GRAST and 18 students graduated. In order to cultivate students of executive ability in the field of analytical equipment, GRAST operate expert certification programs. So, 10 students got a license in the field of electromicroscope, mass spectrometry and MRI etc.

Future Plans of Research

GRAST will forster specialist required in the field of research and industry through various programs, including industrial visits, training and commissioned education.

Image





01_ 3rd GRAST International Workshop [Oct. 24, 2013]
02_ 2013 UICEXPO [Oct. 23 ~ 25, 2013]
03_ Center for University-Industry Collaboration [Mar. 25, 2013]
04_ Practical examination of expert certification programs [Oct, 2013]

Publishing Journal of Analytical Science & Technology

The Journal of Analytical Science and Technology(JAST) is an open access peer-reviewed on-line scientific journal which is also printed biannually. JAST was launched by Korea Basic Science Institute in 2010 and is now co-published with Springer since 2013. JAST publishes original research and review articles on all aspects of analytical principles, techniques, methods, procedures, and equipment.

【Division of Creative Policy】

Publication status

- Covering area: Analytical science and technology
- Published language: English
- Published type: On-line (www.jast-journal.com) and off-line
- Article types: Peer-reviewed original research and review articles
- Number of off-line issues: Biannual (8 in April and 15 in December)

Future Plans

JAST's vision is to be an internationally influential and widely read analytical science journal. We aim to provide scientists, researchers, and students worldwide with unlimited access to the latest advances of the analytical sciences.

Image

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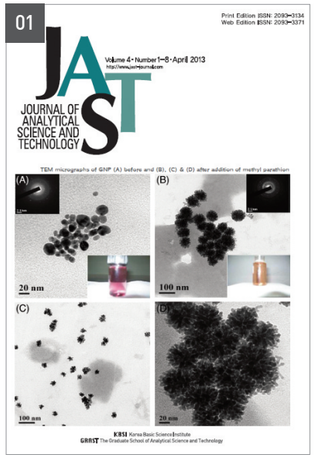

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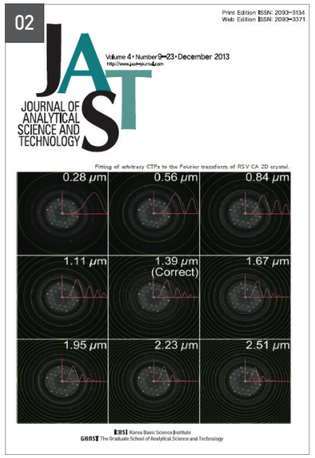
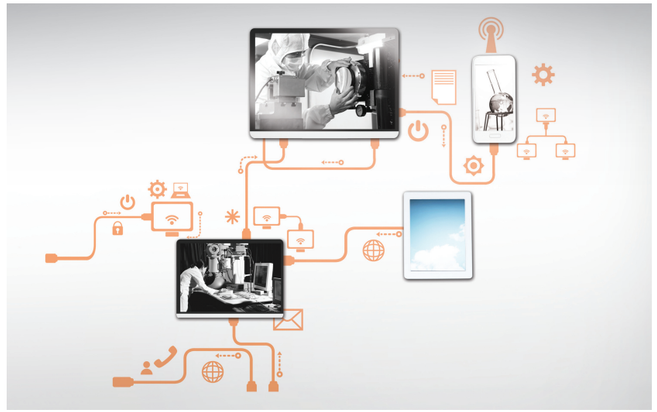


01_ JAST (Journal of Analytical Science and Technology) (volume 4-1~8)
02_ JAST (Journal of Analytical Science and Technology) (volume 4-9~23)

Technology consulting center & membership program for small-medium businesses

With cutting edge research equipments and experts, KBSI counsels analysis and consults techniques for a small-medium business to solve its technical difficulties and to strengthen its technology competitiveness. KBSI also has introduced a small-medium business membership providing 10%~40% discount off of the usage fee.

【Division of Creative Policy】



Main Research Activity

KBSI supported 604 small-medium businesses with analysis services and consulted 301 technical issues in 2013. For the small-medium business membership, 48 firms were selected with benefits of fee discounts, equipment services, analysis methods, information on patent, etc...

Future Plans of Research

We will consolidate support systems for small-medium businesses to boost joint research and to promote co-utilization of high tech research facilities.

Image

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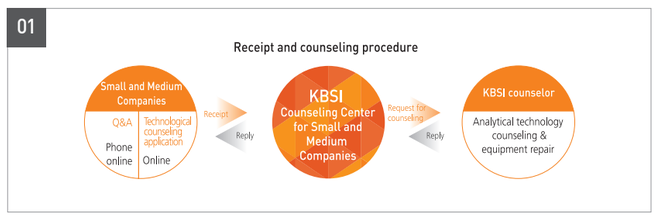

01_ 2013 application process on the small and medium businesses membership system

R&D support for small-medium businesses

With nationwide research-support-networks and outstanding R&D resources, KBSI provides a customized research support for small-medium businesses to enhance their technical innovation and strengthen their competitiveness

【Division of Creative Policy】

Main Research Activity

Since 2013, KBSI has jointly performed 11 R&D projects from Small and Medium Business Administration with 9 small-medium business, such as Taesung Politech Corporation and Yoonseul Corporation, to meet their technical needs

Future Plans of Research

KBSI will utilize cutting edge research infra to solve on-site difficulties of small-medium businesses and to support research activities for them to generate a high value added technology and new products

Image

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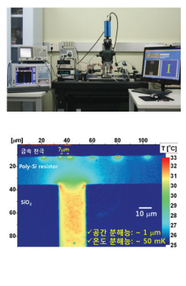

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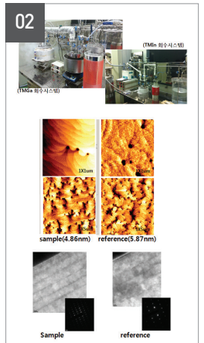


01_ Development of high resolution fault isolation technology for semiconductor failure analysis

02_ Development of collection, refinement, reuse technology for residual quantity from Precursor

Public understanding program for science & technology

The purpose of this project is to improve the public awareness of national R&D activities through providing various outreach programs which are utilizing R&D infrastructures such as equipments and researchers.

【Division of International and Public Relations】

Main Research Activity

In 2013, KBSI provided students and the public with X-Science Program and Junior Doctor Program to improve public understanding of science and technology. A total of 24,887 youths and the public participated in those programs.
「X-Science」: 7 kinds of courses from beginning to intensive level were run at 11 sites of KBSI all over the country. The number of participants of X-Science was 10,033 in 2013.
「Junior Doctor」: '2013 Junior Doctor' was held during summer vacation in Daedeok research complex and KBSI local branches. KBSI planned and arranged the '2013 Junior Doctor' and 29 institutes such as research institutes and universities joined the event. As a result, 9,201 elementary and middle school students participated in Junior Doctor and 586 participants received honorary degrees.
KBSI provided youths with Yusung-gu Science Mentor as well.

Category	Course	Number of programs	Number of participants
X-Science	Science and creativity Class	50	932
	Lab tour	302	6,038
	School visit program	80	2,151
	STEAM related intensive Science Class for high school students	17	287
	Research and Education program	51	95
	In-service teacher training	9	114
	Saturday Science Class	29	416
Junior Doctor		373	9,201
Yusung-gu Science Mentor		12	375
Total		923	19,609

Future Plans of Research

KBSI has provided various outreach programs since 2004. X-Science and Junior Doctor are now acknowledged for outstanding S&T programs for youth and the public. By improving the quality of the programs, KBSI will continue to make an effort for X-Science and Junior Doctor to be representative S&T outreach programs in Korea.

Image

01

02

03

04

01_ Science Class

02_ 2013 Junior Doctor Open ceremony

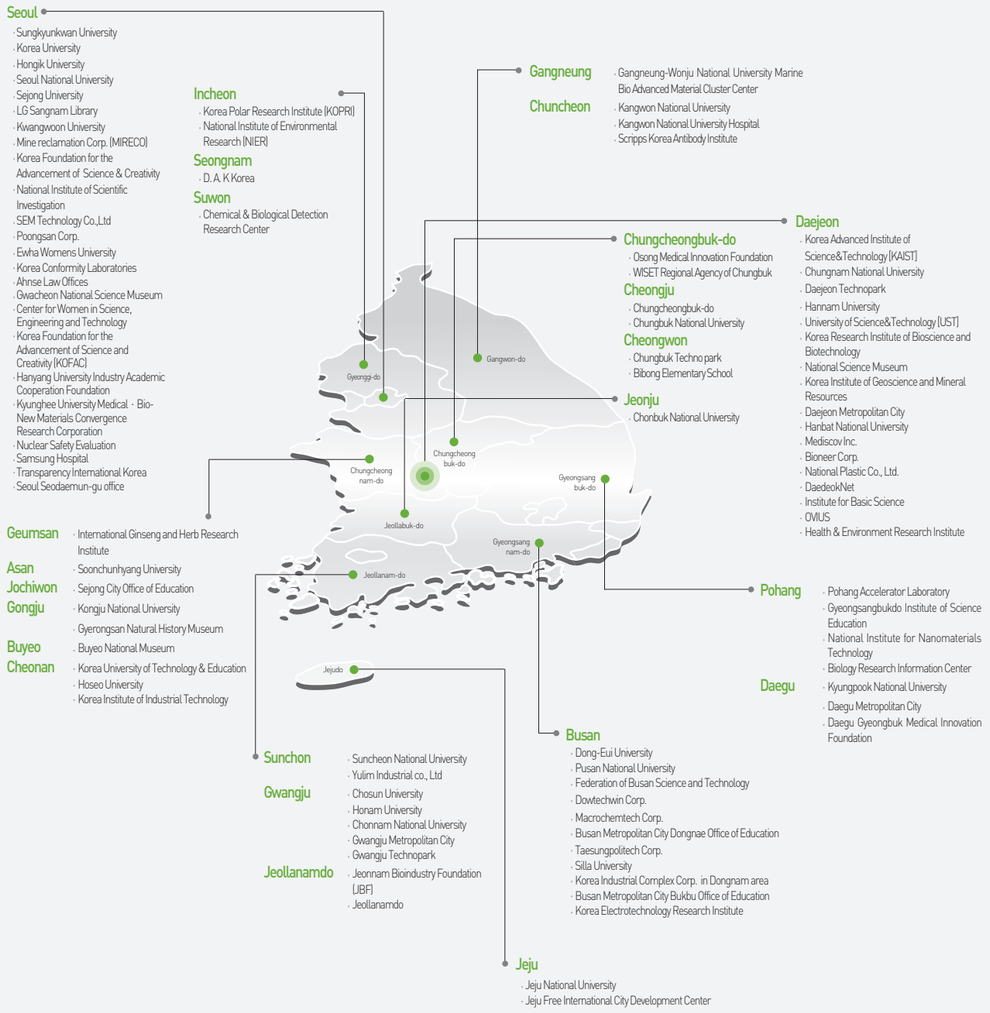
03_ R&E Program

04_ Radiogenic Isotope Understanding Program

National · International Networks

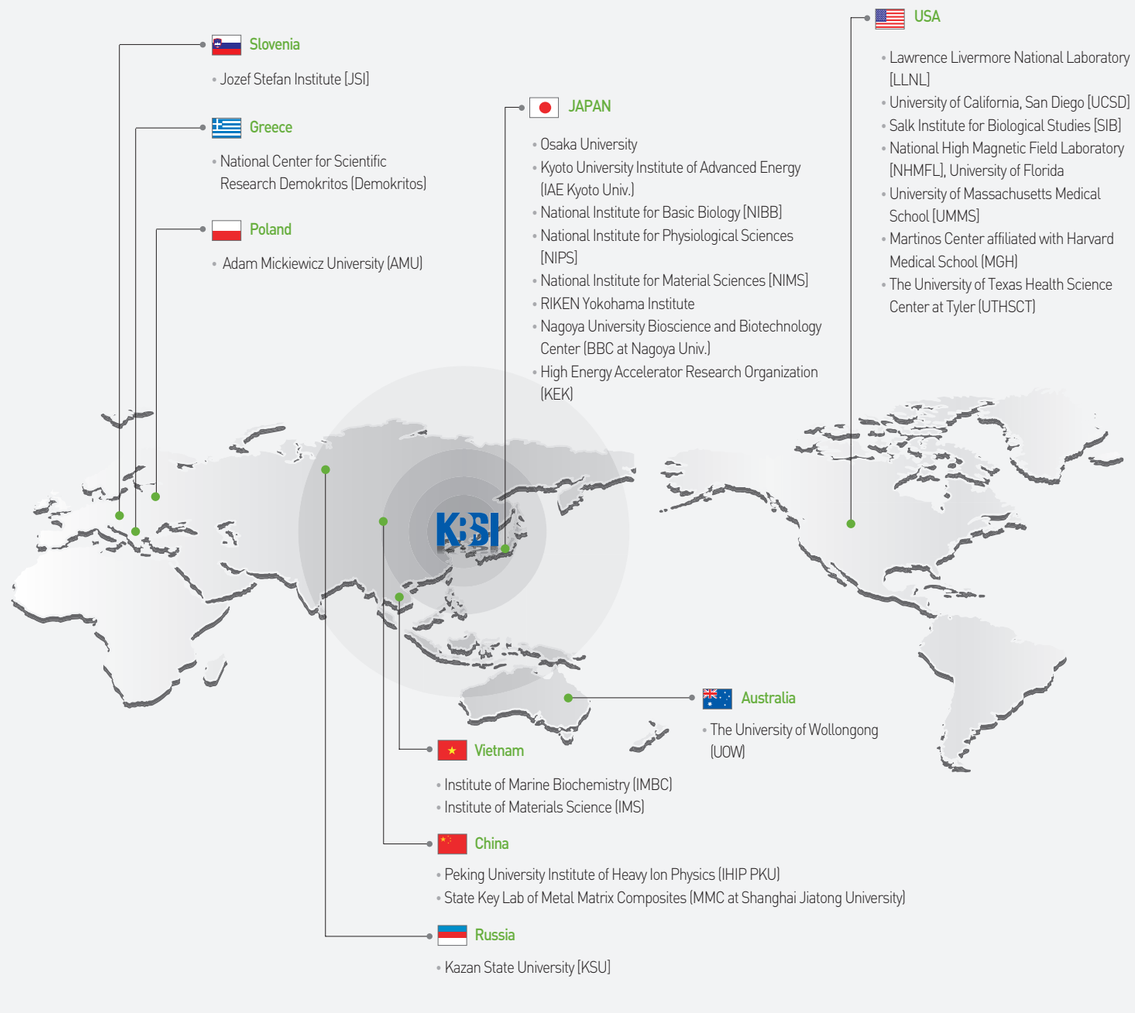
National Network

KBSI is building a cooperative network with various national industries, universities, and institutes to promote the sharing of research facilities and equipment, research collaborations, and exchange of academic knowledge and researchers.



International Network

KBSI is building a network with overseas advanced institutes to reinforce world-class collaboration.



Appendix

Representative Research Publications in Year 2013

01

Development of stretchable nanoparticle conductors

Jin-Gyu Kim, Seung Jo Yoo(co-author), Division of Electron Microscopic Research

Title

Stretchable nanoparticle conductors with self-organized conductive pathways
(IF : 38.597)

Journal

Nature (2013. 8. 1.)

Representative Scientific Instruments Used

High Voltage Electron Microscope (HVEM)

Authors

Yoonseob Kim(Michigan Univ.), Jian Zhu(Michigan Univ.), Bongjun Yeom(Michigan Univ.) Matthew Di Prima(Michigan Univ.), Xianli Su(Michigan Univ.), Jin-Gyu Kim(KBSI), Seung Jo Yoo(KBSI), Ctirad Uher(Michigan Univ.) & Nicholas A. Kotov(Michigan Univ.)

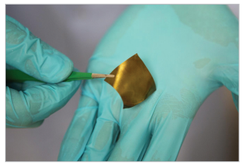
Abstract

The purpose was to develop the good flexible electronics, wires in tortuous zigzag or spring-like patterns, liquid metals, nanowire networks and more have been tried. However, our team have found that spherical gold nanoparticles embedded in polyurethane could outcompete the best of these in stretchability and concentration of electrons. To find out what happened as the material stretched, we took state-of-the-art electron microscope images of the materials at various tensions. From the images we discovered that the nanoparticles rearrange themselves to maintains the conductivity, and this is the reason why we got the amazing combination of stretchability and electrical conductivity.

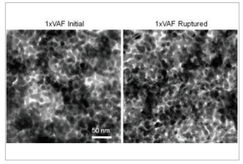
Expected Contribution to Science & Technology

The newly developed stretchable nanoparticle conductors have a wide variety of possibilities, from bendable displays and batteries to medical implants that move with the body. Especially, they can alleviate a lot of diseases-for instance, severe depression, Alzheimer's disease and Parkinson's disease. Moreover, they are able to serve as a part of artificial limbs and other prosthetic devices controlled by the brain.

Image



Photographic image for the stretchable gold nanoparticle conductor.



HVEM images of gold nanocomposites between initial and ruptured condition.

Representative Research Publications in Year 2013

02

High-resolution three-photon biomedical imaging using doped ZnS nanocrystals.

Seung-Hae Kwon(1st author), Chuncheon Center

Title

High-resolution three-photon biomedical imaging using doped ZnS nanocrystals.
(IF : 35.749)

Journal

Nature Materials (2013. 8. 19.)

Representative Scientific Instruments Used

Multi-Photon Confocal Laser Scanning Microscope Imaging System(MP-CLSM),
Intravital Multi-Photon Confocal Laser Scanning Microscope Imaging System(IMP-CLSM)

Authors

JH Yu(IBS,SNU), Zden k Petrá ek(Max Planck), OK Park(KBSI), SW Jun(IBS,SNU), K Shin(IBS,SNU), M Choi(IBS,SNU), YI Park(IBS,SNU), K Park(KBSI), HB Na(IBS,SNU), N Lee(IBS,SNU), DW Lee(IBS,SNU), JH Kim(IBS,SNU), Petra Schwille(Max Planck), T Hyeon(IBS,SNU)

Abstract

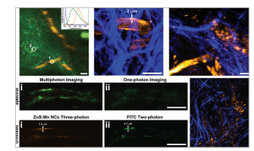
We report on high-resolution in vitro and in vivo imaging by combining three-photon excitation of ZnS nanocrystals and visible emission from Mn^{2+} dopants. The three photon process was successfully applied to high-resolution in vivo tumour-targeted imaging.

Expected Contribution to Science & Technology

The biocompatible ZnS nanocrystals will offer great potential for clinical applications of three-photon imaging.

Image

The living animal model imaging of turnout using real-time Blo-imaging techniques.



In vivo three-photon imaging of ZnS:Mn targeted to tumour and its vasculature, and comparison between a multi-photon and one-photon imaging.

Representative Research Publications in Year 2013

03

Uncovering the origin of enhanced tunnelling electroresistance effect at a oxide heterointerface by atomic resolution transmission electron microscopy

Young-Min Kim(co-author), Division of Electron Microscopic Research

Title

Enhanced tunnelling electroresistance effect due to a ferroelectrically induced phase transition at a magnetic complex oxide interface (IF : 35.749)

Journal

Nature Materials (2013. 2. 17.)

Representative Scientific Instruments Used

Aberration-corrected Scanning Transmission Electron Microscope (STEM)

Authors

Y.W Yin(PSU), J.D. Burton(U. Nebraska), Y-M. Kim(KBSI), A.Y. Borisevich(ORNL), S.J. Pennycook(ORNL), S.M. Yang(SNU), T.W. Noh(SNU), A. Gruverman(U. Nebraska), X.G. Li(USTC), E.Y. Tsymbal(U. Nebraska), Q. Li(PSU)

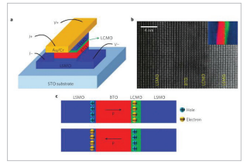
Abstract

For the first time, well-designed ferroelectric oxide tunnel junction device demonstrates the potential to improve the functioning of non-silicon-based electronic devices, such as those used in certain kinds of non-volatile information storage and processing. Thanks to the polarization induced charged phase transition called the tunnelling electroresistance effect, it is found that binary-state resistance difference is enhanced by up to 10,000%. Atomic resolution transmission electron microscopy combined with electron energy loss spectroscopy was employed to uncover physical origin of the peculiar phenomenon at the interface.

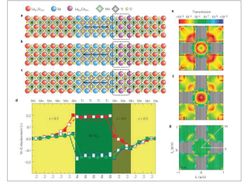
Expected Contribution to Science & Technology

Non-silicon materials that use enhanced tunneling-electroresistance-effect technology may be many years away from being available in personal computers and cell phones. However, this research is a next step toward demonstrating the feasibility of this technology. For example, a new generation of non-volatile multi level data processing and storage would be possible with the combined memory of MRAM and ferroelectric RAM (fRAM) or logic operation.

Image



Device geometry, atomic structure, and polarization-induced charge accumulation model



Results of density functional calculations

Representative Research Publications in Year 2013

04

High performance organic transistor for nano device

Hionsuck Baik(corresponding author), Seoul Center

Title

Novel polymer nanowire crystals of diketopyrrolopyrrole-based copolymer with excellent charge transport properties (IF : 14.829)

Journal

Advanced Materials (2013. 8. 14.)

Representative Scientific Instruments Used

Field Emission Transmission Electron Microscope (FETEM)

Authors

Ji Ho Kim(Korea University), Dae Hee Lee(Korea University), Da Seul Yang(Korea University), Dong Uk Heo(Korea University), Kyung, Hwan Kim(Korea University), Jicheol Shin(Korea University), Hyun-Ji Kim(KIST), Kyung-Youl Baek(KIST), Kwangyeol Lee(Korea University), Hionsuck Baik(KBSI),* Min Ju Cho(Korea University),* and DongHoon Choi*(Korea University)

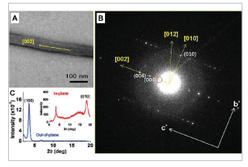
Abstract

We successfully fabricated PNWs with a large aspect ratio using PDTTDPP. It was surprising that the PNW made of PDTTDPP showed an SC nature and that the $\pi-\pi$ stacking direction was perpendicular to the direction of the longitudinal axis of the wire. Combining the results of GI-XRD and TEM-SAED, the SC-PNW was found to have possible orthorhombic lattice unit cell whose lattice constants are a ≈ 19.2 Å, b ≈ 3.7 Å, and c ≈ 21.2 Å. A maximal hole mobility of ≈ 7.0 $cm^2 V^{-1}s^{-1}$ was achieved for FET devices fabricated from an SC-PNW, which had a fairly large channel length (L = 15.9μm). This mobility value was almost one order of magnitude higher than that of the TFT devices employing the same polymer. This would ultimately enable the observation of the intrinsic properties of PDTTDPP.

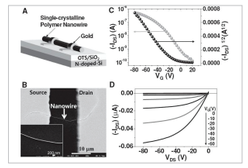
Expected Contribution to Science & Technology

The single-crystal polymer whose chains are oriented same direction has an advantage for charge carrier transport. It will be great help to fabricate future electronic and photoelectric device using excellent polymer semiconductor.

Image



A) TEM image of an isolated single nanowire made of PDTTDPP. B) SAED patterns of a PNW obtained perpendicular to the long axis of the PNW. C) One-dimensional out-of plane and in-plane profile of an annealed film on an n-octyltrichlorosilane- SiO_2/Si substrate obtained from GI-XRD.



A) Structure of an FET device based on a SC-PNW. B) SEM image of an SC-PNW FET device. C,D) Transfer (V_{DS} =-80 V) and output curves of the SC-PNW FET device.

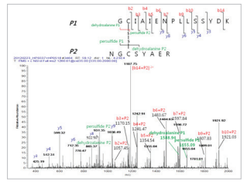
Representative Research Publications in Year 2013

05

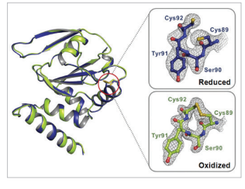
Structural and functional characterizations of HP0377, a thioredoxin-fold protein from Helicobacter pylori

Jin Young Kim(co-author), Division of Mass Spectrometry Research

Image



MS/MS spectra of peptide GCIAIENPLLSSYDK - NGCSYAER. The spectrum shows fragmentation characteristics of disulfide linkage including cycsteine persulfide(+32 Da, P1+32, P2+32 Da) and dehydroalanine (-34 Da, P1-32, P2-34 Da)



Structural comparisons of reduced HP0377 with partially oxidized HP0377 and reduced E. coli DsbC

Title

Structural and functional characterizations of HP0377, a thioredoxin-fold protein from Helicobacter pylori (IF : 12.6)

Journal

Acta Crystallographica Section D (2013. 5. 1.)

Representative Scientific Instruments Used

7 T-FT/ICR-MS(7 T Fourier Transform Ion Cyclotron Resonance Mass Spectrometer)

Authors

J. Y. Yoon(SNU), J. Kim(SNU), D. R. An(SNU), S. J. Lee(SNU), H. S. Kim(SNU), H. N. Im(SNU), H.-J. Yoon, J(SNU). Y. Kim(KBSI), S.-J. Kim(MNU), B. W. Han(SNU) and S. W. Suh(SNU)

Abstract

Crystal structures of HP0377 have been determined in both reduced and partially oxidized states, which are highly similar to each other. In the study, for understanding the role of HP0377, which is a thioredoxin-fold protein, mass spectrometry analysis exactly proved that it can form a covalent complex with HP0518, a putative L,D-transpeptidase with a catalytic cysteine residue, via a disulfide bond.

Expected Contribution to Science & Technology

1. MS based protein structure study
2. Functional proteomics
3. Post-translational modification proteomics

Representative Research Publications in Year 2013

06

Cytocompatible nanoencapsulation of individual Chlorella cells to improve the cellular thermal tolerance

Kyung-Bok Lee (co-author), Division of Life Sciences Research

Title

Bioinspired, cytocompatible mineralization of silica-titania composites : thermoprotective nanoshell formation for individual chlorella cells (IF : 13.734)

Journal

Angewandte Chemie-International Edition (2013. 11. 18.)

Representative Scientific Instruments Used

Confocal Microscope & Transmission Electron Microscope (TEM)

Authors

E.H. Ko(KAIST), Y. Yoon(KAIST), J.H. Park(KAIST), S.H. Yang(KNUE), D. Hong(KAIST), K.-B. Lee(KBSI), H.K. Shon(KRISS), T.G. Lee(KRISS), I.S. Choi(KAIST)

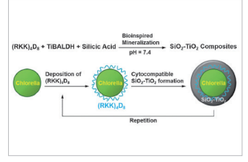
Abstract

A bioinspired approach was successfully applied to the formation of SiO_2-TiO_2 composites by using an $(RKK)_4D_8$ peptide. The cytocompatible process made it possible to encapsulate individual Chlorella cells within a SiO_2-TiO_2 shell with high cell viability (87%). The encapsulated Chlorella showed an almost threefold increase in their thermo-tolerance after 2h at 45℃.

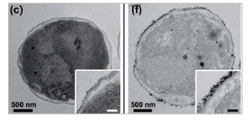
Expected Contribution to Science & Technology

Considering that many eggs are protected by their outermost inorganic shells and biological metabolism is controlled tightly by layered organic inorganic shells, we believe that the formation of artificial inorganic shells would be a promising approach for the protection of cells from external stressors. In addition, the combination of biological and abiological inorganic materials also would increase the number of tools available for the manipulation of the artificial shells.

Image



Scheme for formation of SiO_2-TiO_2 composites and for nano-encapsulation of individual Chlorella cells within the SiO_2-TiO_2 composite shell



TEM micrographs of native chlorella and SiO_2-TiO_2 coated chlorella cell

Representative Research Publications in Year 2013

07

CW/Pulsed EPR studies on the metal ion coordination of an amyloid beta peptide relevant to Alzheimer's disease

Sun Hee Kim(corresponding author), Division of Materials Science Research

Title

34 GHz Pulsed ENDOR characterization of the copper coordination of an amyloid beta peptide relevant to Alzheimer's disease (IF : 13.734)

Journal

Angewandte Chemie-International Edition (2013. 1. 21.)

Representative Scientific Instruments Used

CW/Pulse EPR System

Authors

Donghun Kim (KBSI), Nam Hee Kim (KBSI), Sun Hee Kim (KBSI)

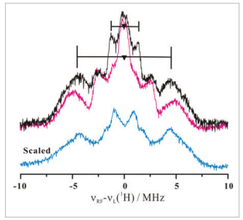
Abstract

It has been proposed that the redox-active copper ions are involved in the amyloid fibrilization relevant to Alzheimer's disease. Thus, elucidating the structure of the copper-amyloid peptide is crucial to understand the mechanism of this amyloid fibrilization at the molecular level. In this work, CW/pulsed EPR spectroscopy was employed to determine the coordination environment of copper ion in amyloid peptide.

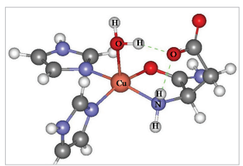
Expected Contribution to Science & Technology

Alzheimer's disease afflicts more than 26 million people worldwide. However, there have been no drugs and therapeutics to cure Alzheimer's disease. The knowledge of the coordination environment of copper ion to amyloid peptide is very important for the rational design of therapeutic agents for Alzheimer's disease. Thus, our result will provide a framework for the development of the therapeutic agents for Alzheimer's disease.

Image



^{1}H/^{2}D pulsed ENDOR spectra of Cu-Amyloid peptide in H_2O and in D_2O.



The structure of the active site of Cu-amyloid peptide by EPR spectroscopy.

Representative Research Publications in Year 2013

08

Hydrogen-induced morphotropic phase transformation of single-crystalline vanadium dioxide nanobeams

Woong-Ki Hong(1st author, corresponding author), Jeonju Center

Title

Hydrogen-Induced morphotropic phase transformation of single-crystalline vanadium dioxide nanobeams (IF : 13.025)

Journal

Nano Letters (2013. 3. 4.)

Representative Scientific Instruments Used

Transmission Electron Microscope (TEM), Raman spectroscopy

Authors

Woong-Ki Hong(KBSI), Jong Bae Park (KBSI), Jongwon Yoon (GIST), Bong-Joong Kim (GIST), Jung Inn Sohn (Cambridge), Young Boo Lee (KBSI), Tae-Sung Bae (KBSI), Sung-Jin Chang (KBSI), Yun Suk Huh (KBSI), Byoungchul Son (KBSI), Eric A. Stach (BNL), Takhee Lee (SNU), and Mark E. Welland (Cambridge)

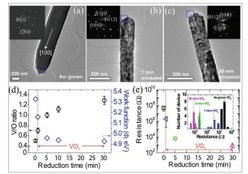
Abstract

We report a morphotropic phase transformation in vanadium dioxide (VO_2) nanobeams. Structural analyses show that the annealed VO_2 nanobeams are hexagonal-close-packed structures with roughened surfaces at room temperature, unlike as-grown VO_2 nanobeams with the monoclinic structure and with clean surfaces. Quantitative chemical examination reveals that the hydrogen significantly reduces oxygen in the nanobeams with characteristic nonlinear reduction kinetics which depend on the annealing time. Surprisingly, the work function and the electrical resistance of the reduced nanobeams follow a similar trend to the compositional variation due mainly to the oxygen-deficiencyrelated defects formed at the roughened surfaces. The electronic transport characteristics indicate that the reduced nanobeams are metallic over a large range of temperatures. Our results demonstrate the interplay between oxygen deficiency and structural/electronic phase transitions, with implications for engineering electronic properties in vanadium oxide systems.

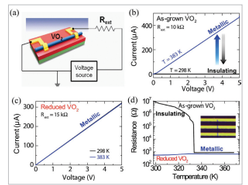
Expected Contribution to Science & Technology

VO_2, a strongly correlated oxide, has attracted significant attention because of a variety of possible applications based on its ultrafast MIT. Accordingly, many efforts have been made to understand the significant influences of stoichiometry, interfacial stress, external strain, and doping on the metal-insulator phase transition of VO_2. Our study will enhance the understanding of the complex phase transitions of vanadium oxides and thereby will provide a foundation for engineering diversity and desirable properties for a wide range of technological applications.

Image



TEM images and electron diffraction patterns of VO_2 nanobeams



Electrical properties of VO_2 nanobeams

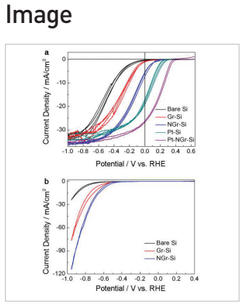
Representative Research Publications in Year 2013

09

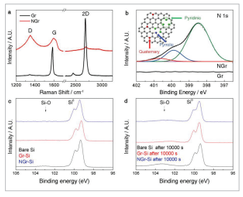
Development of the Graphene-based catalysts for hydrogen production

Jung-Hye Seo, Jouhahn Lee(co-author), Division of Materials Science Research

Image



Cyclic Voltammetry (CV) of graphene (Gr), N_2-plasma-treated Gr (NGr), Pt, and Pt with NGr on a Si electrode.



(a) Raman spectra and
(b) High resolution XPS spectra of N 1s peak of Gr and NGr.
(c) Before the chronoamperometry test and (d) after the chronoamperometry test at 0 V vs.

Title

N-doped monolayer graphene catalyst on silicon photocathode for hydrogen production
(IF : 11.653)

Journal

Energy & Environmental Science (2013. 9. 1.)

Representative Scientific Instruments Used

X-ray / UV Photoelectron Spectrometer (XPS/UPS)

Authors

Junghyun An(SNU), Jinyeon Hwang(SNU), Jung-Hye Seo(KBSI), Jouhahn Lee(KBSI), Kye Yeop Kim(SNU), Joohee Lee(SNU), Seungwu Han(SNU), Byung Hee Hong(SNU)*, Ki Tae Nam(SNU)*

Abstract

Carbon-based catalysts have been attracting attention in renewable energy technologies due to the low cost and high stability, but their insufficient activity is still a challenging issue. Here, we suggest that monolayer graphene can be used as a catalyst for solar-driven hydrogen evolution reaction on Si-photocathodes, and its catalytic activity is boosted by plasma treatment in N_2-ambient. The plasma treatment induces abundant defects and the incorporation of nitrogen atoms in the graphene structure, which can act as catalytic sites on graphene. The monolayer graphene containing nitrogen impurities exhibits a remarkable increase in the exchange current density and leads to a significant anodic shift of the onset of photocurrent from the Si-photocathode. Additionally, monolayer graphene shows the passivation effect that suppresses the surface oxidation of Si, thus enabling the operation of the Si-photocathode in neutral water. This study shows that graphene itself can be applied to a photoelectrochemical system as a catalyst with high activity and chemical stability.

Expected Contribution to Science & Technology

We expect that a catalyst graphene will open a way for mass production of hydrogen using low-cost, high efficiency catalyst by obtaining photoelectrochemical efficiency to replace the conventional platinum/silicon systems.

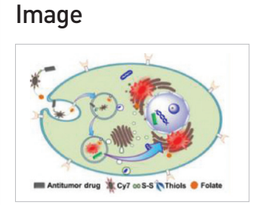
Representative Research Publications in Year 2013

10

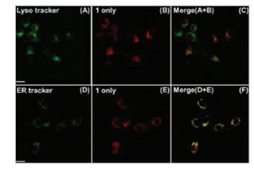
Folate-based near-infrared fluorescent theranostic gemcitabine delivery

Kwan Soo Hong(corresponding author), Division of Magnetic Resonance Research

Image



Schematic illustration of DDS bearing Cy7 dye 1 (Scheme 1) as an NIR-based reporter



Confocal laser fluorescence microscopy images of KB cells with prodrug 1 and Lyso-Sensor Blue DND-167 or ERtracker Red.

Title

Folate-based near-infrared fluorescent theranostic gemcitabine delivery
(IF : 10.677)

Journal

JACS (2013. 7. 18.)

Representative Scientific Instruments Used

Delta Vision Real Time

Authors

Zhigang Yang(KU), Jae Hong Lee(KU), Hyun Mi Jeon(KHU), Ji Hye Han(KU), Nayoung Park(KU), Yanxia He(KU), Hyunseung Lee(KBSI), Chulhun Kang(KHU), Jong Seung Kim(KU)

Abstract

A series of heptamethine cyanine derivatives bearing a carbamate ethyl disulfide group and gemcitabine, an anticancer drug, was newly synthesized. Their disulfide bonds are readily cleaved by various thiols including glutathione, to result in a subsequent decomposition of the carbamate into amine followed by release of the active gemcitabine, which can be monitored by the fluorescence changes. In the biological experiment, prodrug 1 is preferentially up-taken by folate-positive KB cells over folatenegative A549 cells via receptor-mediated endocytosis to release gemcitabine causing cell death and to emit fluorescence in endoplasmic reticulum. Moreover, it is selectively accumulated in the KB cells which were treated to mice by dorsal subcutaneous injection.

Expected Contribution to Science & Technology

This drug delivery system is a new theranostic agent, wherein both therapeutic effect and drug uptake can be easily monitored at the subcellular level, by in vivo and in vitro fluorescence imaging.

Representative Research Publications in Year 2013

11

Development of analytical technique for detection of adult stem cells using protein biomarker and bio-imaging technique

Yang Hoon Huh(1st author), Division of Electron Microscopic Research

Title

Higher 5-hydroxymethylcytosine identifies immortal DNA strand chromosomes in asymmetrically self-renewing distributed stem cells (IF : 9.737)

Journal

Proceedings of the National Academy of Science of the United States of America (2013. 10. 15.)

Representative Scientific Instruments Used

High Voltage Electron Microscope (HVEM)

Authors

Yang Hoon Huh (KBSI), Justin Cohen (Adult Stem Cell Technology Center), James L. Sherley (Adult Stem Cell Technology Center)

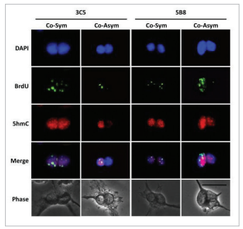
Abstract

Distributed stem cells (DSCs), which continuously divide asymmetrically to replenish mature tissue cells, adopt a special form of mitotic chromosome segregation. Chromosome segregation is non-random instead of random. DSCs cosegregate the set of sister chromosomes with the older of the two template DNA strands used for semiconservative DNA replecation during the preceding S phase. Neither the responsible molecular mechanisms nor the cellular function of nonrandom segregation are known. Here, we report evidence that immortal strand chromosomes have a higher level of cytosine 5-hydroxymethylation than mortal chromosomes, which contain the younger DNA template strands. We propose that asymmetric chromosomal 5-hydroxymethylation is a key element of a cellular mechanism by which DSCs distinguish older DNA template strands from younger one.

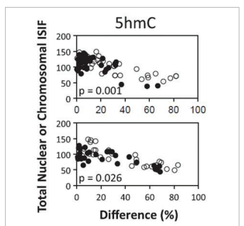
Expected Contribution to Science & Technology

We expect that the analytical method for adult stem cell detection developed in this research will be very beneficial for related researches such as the isolation and large scale culture of adult stem cells, the prevention mechanism of cell ageing, and the detection of cancer in early stage.

Image



Higher 5hmc content marks immortal DNA chromosome in DSCs



Quantitative analysis of the pattern of asymmetric 5hmc chromosomal content

Representative Research Publications in Year 2013

12

Petrogenesis and U-Pb zircon chronology of adakitic porphyries within the Kop Ultramafic Massif (Eastern Pontides Orogenic Belt, NE Turkey)

Keewook Yi(co-author), Division of Earth and Environmental Science Research

Title

Petrogenesis and U-Pb zircon chronology of adakitic porphyries within the Kop Ultramafic Massif (Eastern Pontides Orogenic Belt, NE Turkey) (IF : 6.659)

Journal

Gondwana Research (2013. 1. 10.)

Representative Scientific Instruments Used

High Resolution Secondary Ion Mass Spectrometer (HR-SIMS / SHRIMP)

Authors

Yener Eyuboglu (KTU), Francis O. Dudas (MIT), M. Santosh (China Univ. Geosci.), Keewook Yi (KBSI), Sanghoon Kwon(Yonsei Univ.), Enver Akaryali (Gumushane Univ.)

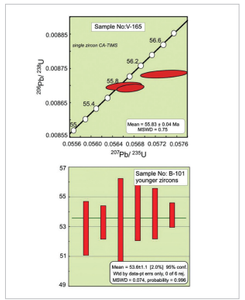
Abstract

High-silica adakites intrude the Kop ultramafic massif in the eastern Pontide orogenic belt of NE Turkey. U-Pb dating of zircons from two intrusions yields ages between 52 and 59 Ma. The best-constrained crystallization age is 55.83±0.04 Ma, indicating that these are the oldest adakitic rocks of the eastern Pontides. Modeled bulk distribution coefficients indicate that the adakites were generated as silicic magmas, and are not derived by fractional crystallization from basaltic or andesitic parental melts. Sr, Nd, and Pb isotopic data indicate at least three isotopically distinct sources, one of which is depleted mantle. These adakites are unique among the late Cretaceous and Cenozoic igneous rocks of the eastern Pontides in having a large proportion of the depleted mantle component. The prominent role of the depleted mantle in their petrogenesis suggests that the adakites may be related to a slab window in a south-directed subduction zone.

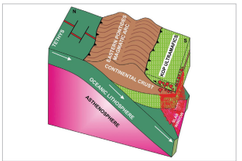
Expected Contribution to Science & Technology

Better understanding of tectonics of NE Turkey, which has a quite complicated geological history, is quite important. This study can be good example that precise in-situ U-Pb age determination and geochemistry is able to reveal the evolution path of crust and mantle in the past.

Image



SHRIMP age data from zircon of adakite NE Turkwy.



Conceptual block diagram of slab window in the subduction zone of NE Turkey at 55Ma

Research Projects in 2013

Main Projects

Project	Title	SubTitle	Principal researcher	Research fund (Unit: million won)
General Mission-oriented R&D Projects	Operation & Joint Utilization of Advanced Equipment	Support of analytical research	Young Ho Chung	5,350
		Operation of advanced multipurpose mass spectrometers	Kyung-Hoon Kwon	1,250
		Operation of sensitive high resolution ion microprobe	Jeongmin Kim	1,150
		Establishment management of analytical system for national disaster response	Kwang-Sik Lee	1,500
		Establishment and operation of Western Seoul Center	Chi-Yong Eom	1,000
	Operation & Research of fusion imaging equipment	Operation of High Voltage Electron Microscope (HVEM)	Jin Gyu Kim	1,210
		Operation of Magnetic Resonance equipment	Kwan Soo Hong	1,600
		Installation and Utilization of Human MRI Research System	Gyunggoo Cho	3,800
		Installation and Utilization of Super Bio-HVEM	Jin Gyu Kim	1,900
	Development of high-tech equipment & Analytical technology	Technology support of research equipment	Jeong Min Lee	327
		Development & Operation of high-precision thermal-imaging microscope system	Jeong Min Lee	600
		Installation of small and medium accelerators utilizing the ECR Ion	Mi-Sook Won	1,450
		Development & research of analytical technology	Seungil Kim	2,950
		Identification of drug-binding proteins using in vivo imaging technology	Kwan Soo Hong	3,000
	Installation of Research Facilities and Equipment	Installation of research equipment	Kwang-Sik Lee	5,718
		Establishment of joint-use equipment for degenerative disease research	Won Jin Moon	850
		Operation support of platform technology and construction of analytical instruments for fusion science	Hye On Yoon	1,500
		Development of multi-disciplinary In-situ analytical system for nano technology and related science	Dong Lak Kim	1,850
	Promotion of Research Facilities & Equipment	National Research Facilities & Equipment Center operation program	Kyungman Yoo	1,550
		Joint Utilization Support of Expensive Special Research Equipment	Kyungman Yoo	600
Creative R&D Projects	Strengthening Future Research Competence	Strategic research for future	Jongsung Jin	1,480
		Creative basic research	Eunkyoung Ryu	1,860

In-house Projects

Project	SubTitle	Principal researcher	Research fund (Unit: million won)
Development & Research of Analytical technology	Development of Animal MRI techniques for brain disease treatment monitoring	Chaejoon Cheong	88
	Elucidation of metabolic pathway and biomarker using metabolic profiling	Geum Sook Hwang	244
	Study on characterization and fabrication of Bio-inspired functional composites	Her song	104
	Unfolded Protein Response(UPR) signaling analysis technology based on spectroscopy	Jong Bok Seo	69
	Study on major depression using In Vivo bioluminescence and fluorescence imaging	Won Jin Moon	56
	Protein-Protein interaction structure analysis and design of inhibitor	Hae Kap Cheong	303
	Study of amyloid peptide fibrillation in Alzheimer °Øs disease using EPR system	Sun Hee Kim	144
	Development of cryogenic scanned probe Tera Hz MRI nanoscope	Sang Gap Lee	220
	Development of original technology for Bio-analysis of the mechanism of infectious disease	Seungil Kim	264
	Developing correlative fusion techniques of Bio-imaging using High Voltage Electron Microscope	Jae Kyung Hyun	240
	Identification of a mechanism of tumor metabolism based on fusion technology	Hyeon Man Baek	192
	Metaproteome analysis for elucidating oil degradation pathway	Young Ho Chung	96
	The development of inhibitors targeting Polo-box-domain of polo-like kinase 1 and its structural analysis using NMR/X-ray	Jeong kyu Bang	289
	The development and application of nuclear magnetic resonance analysis techniques for electrochemical reaction sand ion behavior research	Oc Hee Han	192
	Software development for MRI application	Hyeon Man Baek	36
Seed type National Agenda Project	Development of scientific forensic technologies using cutting-edge high-tech analytical equipment	Jong Soon Choi	190
	Research of resistant material and cultural environment for plants using polyphenol metabolomics	Jongsung Jin	130
	Development of high Sensitivity Portable Mass Spectrometer	Hyun Sik Kim	144
	Development of isotope technology for country-of-origin or authenticity discrimination for foods	Kwang-Sik Lee	122
	Development of country-of-origin or authenticity discrimination techniques for foods	Geum Sook Hwang	70
	Hirerarchically nano structured materials for developing environmental remediation technology	Ha Jin Lee	109
Development of auxiliary systems	Mass Spectrometry based disease screening for improving the quality of life	Jin Young Kim	91
	Development of cryogenic high-sensitive analysis and detection equipment	Yeon Suk Choi	144
	Development of sample orientation navigator for 3D EM imaging	Jin Gyu Kim	96
	Microfabricated comprehensive 2-Dimensional chromatographic chips	Sang Goo Kim	144
	Development of wet-cell holder auxiliary technology wet-cell holder	Yoon Jung Kim	96

Research Projects in 2013

In-house Projects

Project	SubTitle	Principal researcher	Research fund (Unit: million won)
International Research Collaboration Project	Development of diagnosis technology using PET	Eunkyoung Ryu	86
	Development of high efficient energy storage based on 3D macroporous graphene film	Jin Bae Lee	96
	Geochemical study of basaltic soils along a Hawaiian chronosequence: Understanding change of the Critical zone	Jong Sik Ryu	86
Support for Collaborations between KBSI Universities	Identification and functional study of novel Wnt signaling-associated kinases	Gun Hwa Kim	67
	Study of functions of Ets1 genes and disease mechanisms using fusion of genome design technology and zebra fish generation	Seung Hae Kwon	52
	Development of trace element distribution imaging of geological samples	Chan Soo Park	57
	Study of physical properties on Cu_2ZnSnS_4 thin film solar cell by using pulsed laser deposition	Jong Seong Bae	57
	Tectonics and origin of mesozoic granitoids in South Korea	Kee Wook Yi	67
	Identification of the proteome changes in learning and memory	Young mok Park	67
	Navigation of plant immune system and research of mechanisms of control parameters	Myung Hee Nam	67
	Development of high-throughput quantitative N-glycan analysis system	Young Hwan Kim	67
	Development of high sensitive porous-carbon-based electrode for biosensor	Tae Sung Bae	61
	Synthesis of nanomaterials on graphene or atomic layered material as a substrate and their characterizations in atomic level	Hwanuk Guim	61
	Time-dependent 31P NMR study on GTP hydrolysis in taxol-stabilized microtubules	Younkee Paik	61
Support for Young Scientists	Biocompatible Nano-medicine-based Osteoporosis-control study	Kyeong Soon Park	67
	Study of functional structure of mass spectrometry based-RBC membrane protein	Joweph Kwon	60
	Study of change in major greenhouse gas emissioncharacteristics in forests and agricultural soils caused by artificial nitrogen influx	Dong Ho Lee	52
	Real-time observation and nanoscale analysis of low-dimensional nanostructures and their oroperties-coupling behaviors by mechanical strain	Woong-Ki Hong	52
	Analysis of electron transport characteristics of functional electron spin devices	Seung Young Park	69
	High resolution structural analysis of virus capsids using cryo-electron microscopy	Jae Kyung Hyun	67
	Development of cryogen-free MgB_2 superconducting magnet system for ECR ion source	Seyong Choi	67
	Study on the chemical state analysis using high spatial resolution STEM-EELS	Hionsuck Baik	57
	Obesity reduce by the stimulation of brown adipocyte	Young Wook Cho	57
	NGFI-B and Btg2 are bi-functional proteins ; Two different organs through nuclear and mitochondria	Jaeil Park	57
	Understanding the growth mechanism and selective functionalization of high-quality graphene	Cheolho Jeon	57
	Characterization and development of Ru and RuO_2 thin film by atomic layer deposition	Tae Eun Hong	57
	Construction of nano-particles for disease diagnosis and therapy using nano-imaging and analytical system	Jin Kyu Rhee	57
	Evaluation of ion beam irradiated extreme materials using HVEM	Jonghan Won	48

Commissioned Projects

Project Title	Principal researcher	Period	Research fund (Unit: million won)	Partner
Collaborative research by the Graduate School of Analytical Science and Technology	Youngmok Park	09.4.1~14.2.28	14,000	Ministry of Education and Science Technology
Project for the youth's science activity Utilizing state-of-the-art equipment	Jaeyun Kang	04.1.1~ongoing	9,500	Ministry of Education and Science Technology
Project for setup and operation of the high-technology components & materials research center	Euhduck Jung	04.10.1~ongoing	20,487	Ministry of Knowledge Economy
Development of national research facilities and equipment information service for management	Dongwoo Kim	06.1.1~ongoing	7,694	National science & technology commission
Development of scientific forensic technologies using cutting-edge high-tech analytical equipment	Kwang-Sik Lee	10.12.15~16.12.31	4,730	Korea Research Council of Fundamental Science and Technology
Characterization of novel proteins and metabolites of marine bacteria & archea using proteomic platform technology	Seung Il Kim	07.1.1~13.12.31	1,540	Ministry of Oceans and Fisheries
Study of safety management of PCB sin food	Jung Joo Seo	12.1.1~16.11.30	400	Ministry of Health and Welfare(MW)
3 T MRI SAR measurement experiment	Jee Hyun Cho	13.2.1~13.10.31	60	Korea Research Institute of Standards and Science
Development of ultra-precision machining technology for infrared opto-mechanics	Ki Soo Chang	11.12.15~14.10.14	450	Korea Research Council of Fundamental Science and Technology
Sample injection part and electronic system development of high sensitivity portable mass spectrometry	Seung Yong Kim	13.1.1~13.12.31	100	Bioneer corporation
Statistics of material flow by metal	Jae Sik Yoon	13.1.1~13.12.31	47	Ministry of Knowledge Economy
Characterization and basic design of CO_2 capture facilities for assessment of CO_2 storage formation	Kee Wook Yi	12.1.1~13.12.31	210	Ministry of Knowledge Economy
Publication of white paper about the operation of specialized school agency	Youngmok Park	13.3.1~13.6.30	18	Ministry of Education and Science Technology
Rare metal materials research using quantum design method	Yangsoo Kim	12.12.10~13.10.9	70	POSCO
The distribution mapping of lead isotope in the Korean peninsula	Youn Joong Jeong	13.3.15~13.11.29	57	Cultural Heritage Administration
The support program for the advancement of National Research Facilities and Equipment	Kyungman Yoo	10.2.2~ongoing	6,500	Ministry of Science, ICT and Future Planning
Development of method to assess fluorine level in soil and waste and protocol for contaminated site monitoring	Hye On Yoon	12.4.1~15.3.31	415	Ministry of Environment
High magnetic field cryo-probestation technology	Seung Young Park	12.4.1~15.3.30	105	MS Tech
Analysis of facilities and equipment subject to feasibility examination of National Research and Development Project in Second Half of 2012	Kyungman Yoo	13.4.15~13.6.30	16	Ministry of Strategy and Finance
Chemical & biological detection research	Myoung Choul Choi	13.1.1~16.12.31	171	Agency for Defense Development
Yuseong-gu science mentor for youth	Jaeyun Kang	13.4.15~13.10.31	11	Yuseoung District

Research Projects in 2013

Commissioned Projects

Project Title	Principal researcher	Period	Research fund (Unit: million won)	Partner
Technical development for discrimination of herbal medicine using metabolome analysis	Geum Sook Hwang	13.4.1~13.11.30	70	Korea Institute of oriental medicine
Advanced algorithm development for analysis of MR spectroscopy	Hyeon Man Baek	13.4.20~14.2.19	80	Samsung Electronics Co.,Ltd.
Genomic study of non-culturable microorganisms in food and human	Seong Woon Roh	13.1.1~17.12.31	400	Korea Food Research Institute
MALDI-TOF for the diagnosis of BRCA mutation and genitourinary infection pathogen	Myoung Choul Choi	10.12.1~15.11.30	500	Ministry of Knowledge Economy
Obtain of MRI image sbyusing 4.7 T Bruker MRI equipment	Chul Hyun LEE	13.4.15~13.10.15	20	Samsung Electronics Co.,Ltd.
Leakage of hazardous chemicals in groundwater and the establishment of management system for contaminated soil spread monitoring	Hye On Yoon	13.4.1~16.3.31	600	Ministry of Environment
Study on the factors affecting lithium adsorbent capacity and the controls of physicochemical process in marine environments	Hye On Yoon	10.4.1~14.3.31	510	Ministry of Land, Transport and Maritime Affairs
Investigation of the 3D bioactive structure of anticancer drug epothilones using ^{2}H and ^{19}F REDOR NMR spectroscopy	Younkee Paik	11.5.1~16.4.30	171	MINISTRY OF EDUCATION
Smart nanoporous materials for stimuli-responsive controlled release	Weon Sik Chae	11.5.1~14.4.30	172	MINISTRY OF EDUCATION
Multi-sensors for heavy metals and retreatment system of refractory organic matrix	Janghee Yoon	11.8.1~14.4.30	732	Ministry of Environment
Research of repeat protein production and molecular structure	Hae Kap Cheong	09.3.1~14.2.28	675	Ministry of Education and Science Technology
Development of spin device measurement	Seung Young Park	11.7.15~17.2.28	798	Ministry of Education and Science Technology
Operation of Junior Doctor (2013)	Jaeyun Kang	13.5.1~13.10.31	273	Daejeon Metropolitan city
Development of energy storage materials based on hollow nanostructured transition metal oxide	Jin Bae Lee	13.6.1~16.5.31	135	MINISTRY OF EDUCATION
A development of in-situ multi-disciplinary characterization system for oxide electronics using ultrafast phase transitions	Woong-Ki Hong	13.6.1~16.5.31	135	MINISTRY OF EDUCATION
Development of high resolution infrared optical system and LIT Modules	Kye Sung Lee	12.7.1~17.6.30	2,000	Korea Research Council for Industrial Science and Technology
Convergence research center program for mass spectrometry based clinical diagnostic analysis	JongShinYoo	09.7.10~14.6.30	21,815	Ministry of Science, ICT and Future Planning
Project for excellent technology navigation and transfer	Jong Seong Bae	13.6.1~13.12.31	8	Ministry of Trade, Industry and Energy
High resolution MRM-MS based plasma protein qunatitation using peptide antibody	Jin Young Kim	13.6.1~17.5.31	348	Ministry of Science, ICT and Future Planning
Study of structural properties and electron transfer mechanism in organic/inorganic hybrid device interfaces	Jouhahn Lee	09.7.1~14.6.30	580	Ministry of Science, ICT and Future Planning
Analysis using HVEM to identify high resolution electron crystallography of membrane protein in structural biology using electron microscopy	Hyonam Park (supported by Jae Kyung Hyun)	12.9.1~15.2.28	180	Ministry of Science, ICT and Future Planning

Commissioned Projects

Project Title	Principal researcher	Period	Research fund (Unit: million won)	Partner
Studies the physical and chemical properties of Water-soluble organic carbon component in atmospheric dust	Joo Ae Kim (supported by Hye On Yoon)	12.9.1~15.2.28	180	Ministry of Science, ICT and Future Planning
Development of property measurement, control and instrumentation in high magnetic field and cryogenic environment	Yoonah Lee (supported by Dong Lak Kim)	12.9.1~15.2.28	180	Ministry of Science, ICT and Future Planning
Technology detection and transfer (2013)	Jungek Goo	13.6.1~14.4.30	19	Ministry of Science, ICT and Future Planning
Fabrication and characterization of functional photonic crystal materials	Myung Jin Lee (supported by Weon Sik Chae)	12.9.1~15.2.28	180	Ministry of Science, ICT and Future Planning
Analysis of marine biology in microalgae	Se-eul Oh (supported by Dae Kyung Kim)	12.12.1~15.2.28	67	Ministry of Science, ICT and Future Planning
Culture of microalgae and development of new potential materials	Narae Lim (supported by Dae Kyung Kim)	12.12.1~15.2.28	66	Ministry of Science, ICT and Future Planning
Development of NMR based metabonomics/chemometrics for diagnosis and treatment of chronic kidney disease	Geum Sook Hwang	10.6.30~15.6.29	749	Ministry of Science, ICT and Future Planning
Strengthening TLP competence for KBSI	Byung Sang Hwang	13.5.1~16.4.30	450	Ministry of Trade, Industry and Energy
Development of antibody characterization platform technologies for antibody-biobetter (development of antibody characterization-based technology for antibody biobetter)	Hyun Sik Kim	11.6.1~16.5.31	742	Ministry of Trade, Industry and Energy
Research equipment engineer training project	Kyungman Yoo	12.7.1~23.7.31	10,192	Ministry of Science, ICT and Future Planning
A semi-metal p-MRAM technology using spin-orbit coupling	Seung Young Park	13.6.1~18.5.31	125	Ministry of Commerce, Industry and Energy
Development of CO_2 storage facility monitoring technology and its application to sites	Dong Ho Lee	12.6.1~20.5.31	6,121	Ministry of Science, ICT and Future Planning
Magnetic nanoparticles for spintronicand biomedical apllications	Hae Jin Kim	13.7.1~15.6.30	100	Ministry of Science, ICT and Future Planning
Development of testing methods of chlorinated naphthale neandchlorinated paraffins in food	Jung Joo Seo	13.7.1~14.5.31	120	Ministry of Food and Drug Safety
Distribution survey of natural radioactive substances in soil	Jeong Hee Han	13.6.12~13.12.6	65	Ministry of Environment
Autonomous cooling technology at cryogenic temperature	Yeon Suk Choi	13.7.29~15.7.28	200	Korea Research Council of Fundamental Science and Technology
Analysis method of protein pharmaceuticals characteristics	Hyun Sik Kim	13.8.1~14.7.31	30	aprogen coporation
The molecular identity investigation of the membrane proteins using omics technology	Yeonju Kwak (supported by Youngho Chung)	12.9.1~13.8.31	120	Ministry of Science, ICT and Future Planning
Core technology development for 28 GHz superconducting ECR ion source system	Mi-Sook Won	13.8.1~14.2.28	250	Ministry of Science, ICT and Future Planning
Design of triplet cryostat for LTS quadrupole magnet	Yeon Suk Choi	13.8.1~14.2.28	70	Ministry of Science, ICT and Future Planning
Multi-photon biomedical imaging using biocompatible nanoparticles	Seung-Hae Kwon	13.5.1~13.12.31	100	Institute for Basic Science
Analysis of facilities and equipment subject to feasibility examination of national research and development project in first half of 2013	Kyungman Yoo	13.8.22~13.11.13	18	Ministry of Strategy and Finance

Research Projects in 2013

Commissioned Projects

Project Title	Principal researcher	Period	Research fund (Unit: million won)	Partner
Metabolic profiling studies for prediction and management of the metabolic syndrome	Geum Sook Hwang	13.9.1~ 18.8.31	475	Ministry of Science, ICT and Future Planning
Development of multiple diagnostic and therapeutic technology in cardiovascular disease using fusion research of metabolomics and bio-imaging	Geum Sook Hwang	12.7.27~18.7.26	12,000	Korea Research Council of Fundamental Science and Technology
Development of pathogenesis and diagnosis of heart failure using metabolomics	Youngsik Hong (supported by Kwan Soo Hong)	12.9.1~17.8.31	750	MINISTRY OF EDUCATION
Isolation and bioprospecting of novel species of archaea from extreme environments	Seong Woon Roh	12.9.1~15.8.31	163	MINISTRY OF EDUCATION
Study on immune cell infiltration by in vivo MRI in animal autoimmune myocarditis	Kwan Soo Hong	11.9.1~14.8.31	597	Ministry of Science, ICT and Future Planning
Research of resistant material and cultural environment for plants using polyphenol matabolomics	Jongsung Jin	11.7.1~14.6.30	1,714	Ministry of Trade, Industry and Energy
Technical development of cryo-specimen fixation for biological molecules	Hyun Suk Jung	13.9.17~19.2.28	825	Ministry of Science, ICT and Future Planning
Support for education of research equipment	Jeong Min Lee	13.8.1~23.7.31	2,278	Ministry of Science, ICT and Future Planning
Assessment of the effect of LRRK2 inhibitors using electron microscope in animal model of parkinson's disease	Hee Seok Kweon	13.10.17~16.10.16	300	Ministry of Science, ICT and Future Planning
Protein network analysis of hydrogen production of *Thermococcus onurineus* NA1 using proteomics	Young Ho Chung	09.7.1~14.6.30	350	Ministry of Land, Transport and Maritime Affairs
Development of high resolution the thermal imager for temperature measurement	Kye Sung Lee	13.6.1~15.5.31	160	Ministry of Trade, Industry and Energy
Analysis of degradation mechanism and improvement of durability in PEMFC	Seokhoon Lee	11.9.1~21.8.31	970	Ministry of Trade, Industry and Energy
Diagnosis of myocarditis using magnetic nanoparticle contrast agent-based MRI	Kwan Soo Hong	11.11.1~14.10.31	240	Ministry of Health and Welfare(MW)
Collaborative research network for multiple functionalization and organization of two-dimensional atomic thin films	Woong-Ki Hong	13.11.11~14.7.10	8	Korea Research Council of Fundamental Science and Technology
Analysis of the toxicity and bio-distribution of targeted protein nanoparticles	Jee Hyun Cho	13.10.15~14.10.14	60	Korea Research Council of Fundamental Science and Technology
Development of low power consumption half-metal spin materials	Seung Young Park	13.6.1~18.5.31	125	Ministry of Trade, Industry and Energy
NBIT based kinase signaling control	Young Ho Chung	12.7.27~18.7.26	2,400	Korea Research Council of Fundamental Science and Technology
Development of a rapid biosensor system to detect human noroviruses	Joweph Kwon	13.12.16~15.12.15	2,460	Korea Research Council of Fundamental Science and Technology
Development of high sensitivity portable toxic gas detection equipment	Hyun Sik Kim	13.12.16~15.12.15	2,800	Korea Research Council of Fundamental Science and Technology
Anti-obesity drug development by the enhance of fat burning in brown adipose tissue	Young Wook Cho	13.12.12~14.6.11	30	Korea Research Council of Fundamental Science and Technology

Installation, Upgrades of Advanced Research Equipment in 2013

	Equipment	Division
Equipment Installed * Standard: installation fee over 100 mill. won	Numeric aberration scanning transmittance electron microscope	Division of Electron Microscopic Research
	TOF-SIMS (Time of flight secondary ion mass spectrometry)	Busan Center
	700 MHz NMR Spectrometer	Division of Magnetic Resonance Research
	FT-ICR (Fourier Transform Ion Cyclotron Resonance Mass Sectrometer) cart upgrade	Division of Mass Spectrometry Research
	SIRMS (Stable isotope ratio mass spectrometer)	Division of Earth and Environmental Science Research
	MALDI Hybrid Tandem mass spectrometer	Division of Mass Spectrometry Research
	High-speed mass spectrometer	Division of Mass Spectrometry Research
	WD-XRF (Wavelength dispersive X-ray fluorescence spectrometer)	Gangneung Center
	400 MHz NMR spectrometer	Division of Magnetic Resonance Research
	Beam diagnostic system for LEBT	Busan Center
	Individual ventilated cage system	Gwangju Center
	MALDI TOF/TOF MS (Matrix-assisted laser desorption/ionization time of flight mass spectrometry)	Seoul Center
	SIRMS (Stable isotope ratio mass spectrometer)	Division of Earth and Environmental Science Research
	ICP-MS (Inductively coupled plasma mass spectrometer)	Division of Earth and Environmental Science Research
	MALDI Imaging sample preparation system	Seoul Center
	EPR Spectrometer	Jeju Center
	Ultracentrifuge system	Division of Life Sciences Research
	OSL (Optically stimulated luminescence)	Division of Earth and Environmental Science Research
	Multi-Angle light scattering system	Division of Magnetic Resonance Research
	Power supply for high-field magnet	Division of Materials Science Research
	Mid-IR Camera	Center for Analytical Instrumentation Development
	Pulse shaping system	Seoul Center
	PSS (Protein sequencing system)	Division of Life Sciences Research
	Electromagnet system for LEBT-High precision power supply system	Busan Center
	Protein synthesizer	Division of Magnetic Resonance Research
	TOF/TOF upgrade system	Seoul Center
	SIMS (Secondary ion mass spectrometry) control system	Busan Center
	Spectrum camera CCD set	Chuncheon Center
	Amino acid composition analysis system	Seoul Center
	Multi channel gas proportional counter	Division of Earth and Environmental Science Research
Performance Upgrades * Standard: upgrade fee over 50 mill. won	FT-ICR (Fourier Transform Ion Cyclotron Resonance Mass Sectrometer) cart upgrade	Division of Mass Spectrometry Research
	Power supply for high-field magnet	Division of Materials Science Research
	SIMS (Secondary ion mass spectrometry) control system	Busan Center
	Spectrum camera CCD set	Chuncheon Center
	Multi channel gas proportional counter	Division of Earth and Environmental Science Research
	DESI (Desorption electrospray ionization)	Division of Mass Spectrometry Research
	Intensified CCD detector	Gwangju Center
	Precon	Division of Earth and Environmental Science Research
	High-speed mass spectrometer	Division of Mass Spectrometry Research
	Super-Sensitive detector upgrade of laser confocal scanning	Gwangju Center
	UV-Micro raman spectrometer	Gwangju Center

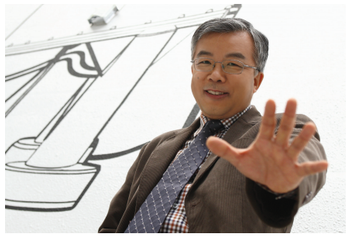
I am challenging the largest project since KBSI's establishment

'The Best KBSI Scientist' award of KBSI is to honor the best employee who devotes to raise KBSI's reputation with a creative and outstanding outcome in a year. It is Dr. Kwan-Soo Hong, the Director of Division of Magnetic Resonance Research, who is named for 2013. Dr. Hong has planned establishment of 'National Particle Imaging Center', the largest project since KBSI's inception and has been pushing forward with it while improving institute's prestige with his research achievements in bio-medical imaging research field.

Dr. Kwan-Soo Hong
Director, Division of Magnetic Resonance Research

Q1. Please say a few words on having won the award

A. First of all, thanks to all the KBSI employees. I feel this award is too much for me, even though I have long coveted this chance. I start to feel obliged to contribute more than ever. Actually, I have been conscious of my own importance because my recent paper was not bad and government selected my plan for "National Particle Imaging Center" as a nominee for feasibility study and evaluation. But this award seems like an opportunity for me to get back to the basic and cultivate my ability again. This award means a lot to me, receiving congratulations from all the colleagues, in terms of its aspects requiring sincere supports of many people to be honored.



Q2. Please introduce briefly your research field

A. I received my PhD in the field of analysis on solid materials using solid NMR but I changed it into Bio MRI field when I was spending 2 years for post doctorate study in USA. Looking back on it now, that was not a bad idea. It wasn't easy for me to get into the new field, of which a simple paper was hard to read at first, but, on the other hand, it was a big pleasure to experience new world and find a new way for my life. Gradually, research went well and I could have joint research partners. My study is generally about how to identify progress of disease using imaging equipment so that the disease can be cured. After verification by cellular experiment using bio-marker and animal test, my study goes to identify the possibility of clinical feasibility test. This point is where I look for new contrast medium applicable to clinical feasibility test and expected to have economic value.

Q3. What's your next research plan?

A. I do have 2 accents in research. First, I want to learn and understand all diseases by using imaging equipment to track biomechanical motion of major immune cells involved vitally in immunization diseases. Second, I want to develop new contrast medium for MR/NIR/PET to target protein(or peptid) uniquely related to a disease cell, which are applicable to clinical test. Cooperation between industry, academic and research institutes, and hospital on bio-fusional-imaging technology, graft on nanotechnology and biotechnology, will lead KBSI to be a center for particle imaging research.

Q4. Your project was selected as a nominee for feasibility study and evaluation by the government in 2013. Please introduce your achievement and next plan.

A. Establishment of "National Particle Imaging Center" requires 286 billion won, in detail, 190 billion won for installing imaging equipment, 18 billion won for developing imaging equipment and 76 billion won for construction, land and operation. Feasibility study and evaluation is going on now. If we break whole project process down into 3 steps, first one is a selection of nominees for feasibility study and evaluation. Second one is a completion of feasibility study and evaluation. The final step is to secure a budget for the project. We're currently in the middle of the second step, expecting the successful completion of the feasibility study and evaluation, the result which will be announced at the end of May. Then the Ministry of Science, ICT and Technology will examine it in June or July. Final step will be extended to the Ministry of Strategy and Finance and the Congress. This project will be the largest project in KBSI's history as the amount of purchasing equipment is larger than that of whole equipment possessed by KBSI.

Q5. What's the most meaningful achievement in your life as a scientist?

A. I believe my most outstanding achievement is "Noninvasive assessment of myocardial inflammation by cardiovascular magnetic resonance in a rat model of experimental autoimmune myocarditis. *Circulation* 2012, 125(21), 2603-2612[IF=15.202]", published in *Circulation* in 2012, as a result of over 10 years of my research on bio-imaging field. It marked a new era in my research, as a result, that I gained self-confidence as a researcher. I think that achievement was a beginning of this award.

Q6. You were nominated two times as the person who brought honor to our country by Biological Research Information Center(BRIC), at first with your development of technique for early diagnosis of Myocarditis in May 2012, and next with your development of drug delivery technique in July 2013. How do you feel?

A. I was introduced as a person who brought honor to our country twice. It was for a paper in *Circulation* 2012(IF= 15.202, 2012, 125(21), 2603-2612) at first. And this time, it was for a paper in *J Am Chem Soc*(IF= 10.677, 2013, 135(31), 11657-11662). A research of 2012 was about MRI technique, jointly developed by Seoul St. Mary's Hospital and Harvard School of Medicine, to diagnose early Myocarditis which is one of the main causes of sudden death of young people or chronic heart failure while next one in 2013 is about a synthesis of fluorescence anticancer drug targeting a specific cancer cell and development of new drug carrier from cellular experiment and bio-imaging experiment. They mean a lot to me as the aspect of the new beginning of bio-tracking imaging technology for immune cells and theranostics in which I am currently interested.

KBSI Annual Report 2013

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With KBSI

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