

KOREA BASIC SCIENCE INSTITUTE | 2012 annual report



www.kbsi.re.kr



Open World-class Institute, KBSI

KBSI Annual Report

Open world-class basic research institution analyzes creative paradigms with basic science!

Korea Basic Science Institute changes the future of creative economies with basic science.



Top 10 Achievements of KBSI in 2012

Disaster Analytical Science Research Center Established

- Analysis system built and operated to respond to national environmental disasters

Coherent Electric Field Characterization of Molecular Chirality in the Time Domain

- reaction dynamics and mechanisms in physics, chemistry and biology.
- Published in ChemicalSocietyReviews(IF=28.76,2012.6.29)
- 〈Han Ju Rhee's team, Seoul center〉

• Technique for Early Diagnosis of Myocarditis, One of the Heart Diseases

- Allows early diagnosis of myocarditis, one of the leading causes of sudden death in

• World's First Successful Measurement of Direct Methanol Fuel Cell-Reactions by "In Situ Nuclear Magnetic Resonance Spectroscopy"

environmental hazardous substances and advanced forensic science

"Missing Oxygen Atom" Analytical Technology Trough Electronic Microscope

- Published in NatureMaterials(IF=32.841,2012.8.19)

• Measurement of fuel cells insitu by originally developed "toroid cavity detector" • Published in Angewandte Chemie International Edition(IF=13.455, 2012. 4. 16)



• Structure of Metal Ions and Amyloid Peptide in Alzheimer's Disease Identified

- Binding structure of amyloid peptide and copper identified using EPR
- Provided essential foundation for development of Alzheimer's disease therapy
 Published in AngewandteChemie(IF=13.455,2012.12.3)
- \langle Sun Hee Kim's team, Division of Materials Scienceangle

• SOP for Membrane Proteome Analysis Technology Transfer

- Pre-treatment technology for membrane/cytoplasmic protein concentration for LC-MS/MS analysis and mass spectrometry
 <Jong Soon Choi's team, Division of Bio-science Research; Yosep kwon's
- team, Gwangju Center>
- Aspheric Ultra-Precision Machining Technology Transfer to Small and Medium-Sized Enterprises
- Surface polishing and accuracy measurement technology for aspheric optical components
- $\langle {\rm Geon} \; {\rm Hee} \; {\rm Kim} ' \, {\rm s} \; {\rm tem}, \; {\rm Division} \; {\rm of} \; {\rm Advanced} \; {\rm Equipment} \; {\rm Development} \rangle$

• Presidential Citation Received on the 45th Science Day

- Dr. Kwang Sik Lee and Hye On Yoon awarded
- Their contribution to national science technology development recognized
- Award ceremony held at the National Science Museum on April 20, 2012

12th Woman Scientist of the Year

- Dr. Mi Sook Won received the award.
- Her paper publication and research achievements and contribution to enhancing status of women scientists recognized
- Award ceremony held at Seoul Press Center on Nov. 30, 2012.





KBSI ANNUAL REPORT 2012

KOREA BASIC SCIENCE INSTITUTE ANNUAL REPORT 2012

- **10** President's Message
- 12 Present Status
- 20 2012 KBSI Navigation
- 24 Specialized High-Tech Research Support
 - Bio Science
 - Nano Science
 - Environmental Science
- 50 Installation/Operation of National Large-Scale Research Equipment
- 58 Advanced Analytical Science Research
- **68** Reinforcement/Promotion of National Basic Science Support Systems
- 82 Appendix



Open World-class Institute, KBSI

We will move forward to become an open world-class basic science research institute.

We will move forward to become an open world-class basic science research institute!

universities, businesses, and government research institutes.

We also spurred development of analysis equipment: the next-generation fusion in situ nano analysis system has been developed without a hitch and the research of 'high-precision thermal-imaging microscope' and "development of particle beam using ECR" has been nearing an end and their results will be published in the first and second half of 2013, respectively. We keep up with the "creative economy" era where new industries are created through development of analytical equipment highly dependent on imports. Analysis technology for national and social trouble-shooting has been developed to resolve problems such as national diseases, disasters, environment, and climate change using high-tech analysis science technology. We have developed "analysis technology for high-tech forensic science", "country-of-origin discrimination techniques for foods" and "bioimaging technology for early diagnosis of diseases", etc., to help realize people's happiness and safety. In terms of analysis specialist training, the Graduate School of Analytical Science and Technology (GRAST) produces analytical science specialists with Master's and Doctor's degree. We also lead in the creation of a new job called a research equipment experts through various programs such as research equipment user training, research equipment operator training, and research equipment engineer training projects; which involves Meister High School graduates.

KBSI is moving toward the vision of an "open world-class institute, KBSI" and making every effort to develop 'technology for people's happiness" that can be shared with all people.



It is no exaggeration to say new findings of modern science and technology mainly result from the development of new analytical equipment. Korea Basic Science Institute (KBSI) has secured world-class research equipment and professional analysis-supporting personnel and supported analyses and collaborations for researchers of

In 2012, KBSI achieved various results including analysis support, collaboration, analytical equipment development and analytical technology for national and social trouble-shooting, and the cultivation of professionals specializing in analyses.

As for analysis support, 132,049 samples were analyzed for 5,486 users and support for fusion analysis using different analytical devices for one sample has been especially increased. KBSI's high-quality analysis support resulted in 742 user publications, among which 639 publications were SCI papers accounting for as high as 86%.

As for collaboration, 535 papers were published through collaboration with domestic and overseas researchers. The papers on "development of high-resolution optical imaging technology using non-toxic nano particles" and 'development of oxygen vacancy using electronic microscope" were published in Nature Materials, a prominent journal.

President of KBSI Junflum change

History

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

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 people's safe lives

- Develop analytical technology for response to national disasters
- Develop analytical technology for safe food

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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 hightech 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

Researchers	Engineers	Administrators	Total
122	46	47	215

Equipment

	Head	Ochang					Local Cer	nters					
Category	quarter	s Center	Seoul	Busan	Daegu	Gwangju	Jeonju	Chun cheon	Sun cheon	Gang neung	Jeju	Western Seoul	Total
Equipment	142	108	76	43	33	44	24	16	9	12	9	-	516
Amount	46,145	45,273	20,514	14,515	9,395	12,470	8,200	5,249	2,546	3,390	2,577	-	170,278

Budget

Operating Revenue Category Government contribution 1. Basic fund 2. General R&D projects 3. Facilities and equipment 4. Loan payment and interests

Income

- 1. Public (government)
- 2. Private
- 3. Other R&D projects
- 4. Technology supports 5. Technical fees
- 6. Others

Total

(Dec. 31, 2012)

* President included in researchers category

(Unit : Million won)

(Unit : I	Million won)
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	Operating Expense				
Budget	Category	Budget			
67,270	Wages	15,284			
13,570	1.Research personnel	12,647			
39,495	2.Research support personnel	1,113			
1/, 205	3. Retirement reserves	1,054			
14,200	4. Others	470			
-	Direct research expenses	52,801			
	1. In-house projects	39,495			
19,572	2. Government/public projects	11,836			
14,421	3. Private projects	70			
, 100	4. Other R&D projects	-			
-	5. Technology supports	1,400			
4,386	Operating costs	4,352			
200	Facilities and equipment	14,205			
465	Others	200			
86,842	Total	86,842			



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.

Seoul Center

Metabolomics research Environmental analysis research Multidimensional laser spectroscopy research

Western Seoul Center Nano, bio, pharmaceutical fusion

Daedeok Headquarters

Biotechnology fusion research Proteomics research Electron microscopy research Nano materials research High field magnetic research Development of research equipment

Jeonju Center

Nano structural analysis and characterization research

Gwangju Center

Degenerative disease research

Suncheon Center New materials research Jeju Center



2012 KBSI Navigation



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

KBSI has built a nationwide research and analysis supporting network by utilizing Daedeok Headquarters, Ochang Center and ten local centers and also 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 2012 KBSI Navigation can be utilized to comprehensively understand various research and analysis service outcomes of KBSI in 2012 and guide the direction for future research and new projects

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

Publication by author type

[Unit : No. of papers]

[Unit : No. of papers]

1st Author 2012 Corresponding Author Co-author

Technology fee revenue

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20	2012	Domestic	Application	.,
29			Registration	44 1
10		Foreign	Application	
18			Registration	7
8				5
- 80				
27				
35				

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

Spečialzeď High-čech Robarch Support

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.

Bio Science

Nano Science

Environmental 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, Biotechnology fusion research includes comprehensive research ranging from 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.

Biotechnology Fusion Research

Biotechnology fusion research field, based on the advanced equipment and analytical technology in fields of cell biology and carbohydrate analysis, studied for pattern change and control mechanism of sugar, and proteinprotein interaction network based cell signaling pathways indicating weird properties according to human disease.

Main Research Activity

Using CUPID (Cell-based Un-/Identified Protein Interaction Discovery) system, we developed a target protein screening system for certain drugs. We also investigated the role of Cyp4a in the development of type 2 diabetes.

Representative Research Case

The role of Cyp4a in type 2 diabetes

By mass spectrometry, we found that CYP4A is highly up-regulated in db/db diabetic mice. Inhibition of CYP4A activity in db/db and high fat diet (HFD) mice using its specific inhibitor HET0016 dramatically reduced ER stress in the liver. The insulin resistance and apoptosis were also rescued by CYP4A inhibition in the db/db and HFD mice liver. In addition, inactivation of CYP4A improved the diabetic physiological phenomena, such as glucose tolerance, insulin secretion, and hepatic steatosis. These results show the importance of CYP4A in the remission of diabetes and of ER stress-induced insulin resistance and apoptosis and suggest that the reduction of CYP4A activity would be a therapeutic target against T2DM.

Major Achivements

Category	Achivem	ents		
Research Result	Publicatio 2 (SCI 2)	ns	Presentations Domestic 10 / Intern	
Analytical Methods	 Analysis of in vivo expression patterns of mi Xenopus Analysis of the role of drug candidates for ty 			
Projects	 Identification and functional study of novel W Cell-chip-based bio-mimetic protein networ Guideline for Analysis of N-glycans on recon Development of phosphoprotein interaction Development and application of real time dr NBIT based Kinase Signaling Control 			
Equipment	Installed	• Bio-LC • FCCS/LSM • HPLC • Fluouresce	1710,Carl Zeiss ence Cross-correlation	

Division of Life Science

Image

Effect of Cyp4a inhibitor HET0016 on diabetic pathophysiology in high fat diet mouse

Equipment

Bio-LC

Confocal Laser Scanning Microscope (CLSM 510)

Confocal Laser Scanning Microscope (CLSM 710-FCCS)

ANNUAL REPORT 2012

Proteomics Research

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

Division of Life Science

Cases Samples Analysis Service

Metabolomics The Metabolomics research field is discovering biomarkers for Research environmental stimulus

Image

Protein network analysis of hepatic insulin resistance. (A) insulin signaling, (B) lipid metabolism, (C) inflammation, and (D) ER stress. Red, upregulated protein; green, downregulated protein.

Equipment

MALDI-TOF-TOF/MS UltrafleXtreme

476 Protein Seguencer

Main Research Activity

High throughput screening and quantitative analysis of diabetes- and obesity-related hepatic membrane proteins and endoplasmic reticulum proteins were performed in the Korea Membrane Protein Initiative (K-MeP).

Representative Research Case

Proteomic and bioinformatic analysis of membrane proteome in type 2 diabetic mouse liver

We used proteomic and bioinformatic methodologies to identify novel hepatic membrane proteins that are related to the development of hepatic insulin resistance, steatosis, and T2DM. Using FT-ICR MS, we identified 95 significantly differentially expressed proteins in the membrane fraction of normal and T2DM db/db mouse liver. The newly identified proteins in T2DM should provide additional insight into the development and pathophysiology of hepatic steatosis and insulin resistance, and they may serve as useful diagnostic markers and/or therapeutic targets for these diseases.

Major Achivements

Category	Achivements				
Research Result	Publications	Presentations	Patents		
	38 (SCI 27)	Domestic 13 / Internation	onal 4 Application 4 / Registration 0		
Analytical Methods	 Analysis of ER p Development o Analysis of function 	proteome from liver in diabetes i f Streptococcus pneumoniae ON tional gene of epigenetic chang	model mice IV separation and purify protocol e		
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 Characterization of novel proteins and metabolites of marine bacteria & archea using proteomic platform technology Discovery and development of diagnotic marker using membrane vesicle proteins and secreted proteins Development of Advanced Forensic Science & Analytical Technologies Development of Advanced Forensic Science & Analytical Technologies				
Training of Equipment	 Proteomics stu Immuno-histoc model Movement of or 	dy for Diabete related protein hemistry using an obese mice rganism toward light	 Diversity of microorganism Gene analysis of microorganism Research of obesity and diabetes using cell and animal models 		
Equipment	Installed	UltrafleXtreme, Bruker LTQ Velos Thermo Tissue FAXS	Procise 492 CLC& ACTA purifier UPLC-LIFD Next Generation Sequencing		
	To Be Installed	•Antomatic high-speed cytome	etric sorter system		

Main Research Activity

Metabolic profiling technology was developed based on NMR spectroscopy and Mass spectrometry, and characteristic metabolites related asthma, alcoholic fatty liver, and chronic kidney disease were identified, providing as a biomarker for diagnosis.

Representative Research Case

Deveolpment of integrated metabolome and transcriptome profiling of kidney collecting duct cells to changes in extracellular osmolality Metabolome and transcriptome profiling were applied to investigate the effects of changes in extracellualar osmolality on the function of kidney collecting duct cells. Intergrated analysis of omics data was an effective way to understand the effects of extracellular osmolaity.

Major Achivements

Category	Achivemer	nts	
Research Result	Publications	s Presentations	
	15 (SCI 14)	Domestic 20 / Intern	
Analytical Methods	 Identification of unknown metabaolite based Metabolic profiling of liver induced by high fa Diseases-related metabolic study by using J Analysis of PBDEs Hydroxylated metabolite Establishment of analysis method of organi Establishment of analysis method of ginsen Metabolite profiling of alcoholic fatty acid liv 		
Projects	 Investigation Developmen Developmen Developmen fusion reserved Technical or Study of plate Study of size 	of biological pathway and biomarker of tof NMR based metabonomics/chemo ent of country-of-origin or authent ent of multiple diagnostic and ther earch of metabolomics and bio-im development for discrimination of ant disease responses using lipido gnaling network of GLIP1, a regula	
Training of Equipment	• Molecular	structure analysis using NMR	
Equipment	Installed	LC-MS-NMR HR-MAS NMR FT-NMR GC-MS TQ LC/MS/MS	

disease/therapy by profiling metabolites changed by genetic and/or

Seoul Center

Image

Integrated metabolome and transcritome profiling of kidney collecting duct cell to change in extracellular osmolality

[•] MS FT orbitrap LC-MS

- Ion Mobility Mass Spectrometer
- HPLC, Prep-HPLC
- UPLC QTOF MS

Equipment

On-line LC-MS-NMR system

GC-TOF-MS

UPLC-QTOF-MS

Magnetic Resonance Research

The research in macromolecular structure, interaction, and dynamics is carried out using NMR spectrometers.

Division of Magnetic Resonance Research

Image

Structural studies of the interaction of translesion synthesis polymerase to repair the DNÁ damage

Equipment

900 MHz Crvo NMR

800 MHz Crvo NMR

500 MHz Crvo NMR

Main Research Activity

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

Representative Research Case

Structural analysis of the interaction of DNA damage repair translesion synthesis polymerase

Human Rev1 TLS enzymes repair the damaged DNA, and identify the structure of information between the TLS enzymes can provide the foundation for future anticancer drug design.

Major Achivements

Category	Achivements				
Research Result	Publications	Presentations	Patents		
	29 (SCI 27)	Domestic 8 / International 21	Application 1 / Registration 2		
Analytical Methods	 Structural analysis of Arginase II Inhibitory Activity of Phenolic Compounds from Saururus chinensis using NMR Structural analysis of the domain disappears NORE1 using X-ray Structural analysis of the domain disappears MST2 using NMR and CD 				
Projects	 Optimization of NMR technologies for a high molecular weight protein NMR / X-ray fusion utilizing high-speed bio-molecular analysis technology advancement Use of technology in the field of protein re-design of high-field NMR 				
Training of Equipment	 Interesting biochemical experiments classroom What is the NMR? 				
Equipment Installed		900 MHz Cryo NMR, Avance II 900 800 MHz Cryo NMR, Avance 800 500 MHz Cryo NMR, Avance 500 400 MHz NMR, AVANCE III 400	• Auto-iTC • Macromolecular x-ray diffraction system, MicroMax-007HF R-AXIS IV+		
	To Be Installed				

Magnetic Resonance Imaging Research

600 MHz microimaging, animal 4.7 T/9.4 T MRI, PET/CT/SPECT and human 3 T MRI systems are used for measurement & analysis and joint research and methodology development.

Main Research Activity

For diagnosis and monitoring the treatment of disease, MR method development, MR imaging application research, PET tracer development, and fusion image research through MRI/PET/NIR fusion contrast agent development have been performed.

Representative Research Case

Development of dual-mode imaging agent for MRI and photoluminescence GdS:Eu3+ NPs showed the strong positive contrast effect to blood vessels and organs of mice as MR contrast agent, and confocal images of breast cancer cells as a photoluminescence probe. Their dual-mode imaging capability will allow target-oriented cellular imaging, as well as the resulting disease-specific MR imaging.

Major Achivements

Category	Achivements				
Research Result	Publications	Presentations	Patents		
	23 (SCI 22)	Domestic 8 / International 13	Application 3 / Registration 2		
Analytical Methods	 MEMRI method development for study of rat brain In vivo imaging of micro-sized inflammation sites using the magnetic nanoparticles Development of the tumor targeting radiotracer, 68Ga-NOTA-VEGF121 				
Projects	 Installation and utilization of human research MRI Brain research on the imaging fusion technology Development of the PET/MRI fusion imaging technology for the tumor targeting Investigation into the mechanism of tumor metabolism based on fusion method Development of the Brain activity measurement method 				
Fraining of Equipment	Understanding and practice of MRI equipment Remote laboratory experience program for young person				
Equipment	Installed 4	.7 T/9.4 T Amimal MRI 00 MHz/800 MHz microimaging System	• 3 T human MRI • Animal micro-PET/CT/SPECT		
	To Be Installed 7	T human MRI [2014]			

Image

(A) Detailed structure of europium-doped GdS (GdS:Eu3+) opto-magnetic nanoparticles (B) Relexivity of A and (C) T1-weighted MR images of a mouse before (top) and after (bottom) injection of A solution into a tail vein.

Equipment

Animal 4.7 T MRI

Animal 9.4 T MF

Animal micro PET/CT/SPECT

Mass Spectrometry Research

Scientists in the Division of Mass Spectrometry (MS) Research support research for drug discovery, diagnostic and therapeutic technology, and environmental science, using advanced mass spectrometers. The developers of world-class Fourier Transform Ion Cyclotron Resonance (FT-ICR) mass spectrometer participate in convergence science research Division of Mass Spectrometry Reserch

Disease Research

Degenerative By the 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 spinoffs in related R&D areas.

Image

A new combination MALDI matrix for small molecule analysis: application to imaging mass spectrometry for drugs and metabolites, Analyst, 137(24), 5757-5762 (2012) (Back Cover)

Equipment

MALDI Hybrid Tandem Mass Spectrometer

MAL DI Tandem Mass spectrometer

Hybrid FT-ETD Mass Spectrometer system

Main Research Activity

Many excellent publications and valuable patents were produced by the application of MS technology in the fields of biomarker discovery and validation, MS imaging of brain proteins and metabolites, characterization of protein drug, and mass spectrometry instrumentation; such as the devlopment of the electron capture dissociation gun.

Representative Research Case

Molecular Imaging for the Drug Delivery Process Analysis by Mass Spectrometry

We developed the mass spectrometry technique for molecular imaging of small molecules, such as drugs and metabolites which analyze the drug delivery or metabolism in collaboration with Konkuk University and KIST. It can accelerate the process of drug discovery.

Major Achivements

Category	Achivements					
Research Result	Publications	Presentations	Pa	atents		
	37 (SCI 35)	Domestic 20 / Interna	itional 19 Ap	plication 15 / Registration 14		
Analytical Methods	 The high sensitive mass detection method by the broadband Cryogenic Preamplifier Cooled by Circulating Liquid Nitrogen The analysis accuracy improved by ensuring linearity of the RF amplifier Separation Method for a Humira Antibody Drug Variant Disulfide Bonds Localization Method using ETD Experiments Protein Analysis Using an Online Monolithic Trypsin Immobilized Enzyme Reactor with Dual Tandem Mass Spectrometry Low abundant biomarker discovery in plasma using MALDI FT-ICR MS Characterization of gangliosides by using MALDI-TOF/TOF MS 					
Projects	Convergence Research Center Program for Mass Spectrometry based Clinical Diagnositic Analysis Clinical Trial of an Antibody Drug Enbrel to Treat the Inflammatory Disease A Study on Antiasthmatic Drug and Development of Effective Substances using OMC 2010 Development of Antibody Characterization Platform Technologies for Antibody-Biobetter Mechanism of oxidative stress in neurodegenerative disorders Improvement of neural induction from mesenchymal stem cells through combined omics analysis Development of proteomic method for stem cell biomarker discovery Development of the simple MALDI-TOF for the diagnosis of BRCA mutation and genitourinary infection pathogen					
Training of Equipment	• Education for th • How to identify p	e Glycoprotein Analysis Using proteins in our body?	Mass Spectrometer			
Equipment	Installed	ed .15T FT-ICR MS .MALDI/ESI Hybrid Tandem MS .lon Trap /7T FT-ICR MS .Bioinformation Data Server .Triple Quadrupole MS .Hybrid FT-ETD Mass Spectrometer .MALDI Imaging System (Orbitrap-Elite) .ESI-QTOF MS .Laser Microdissection System .High-speed Q-TOF Mass Spectrometer .2-dimensional gas chromatography / high resolution mass spectrometer sy				
	To Be Installed					

Main Research Activity

In 2012, the Animal Facility of Aging Science, which is specialized in the breeding of aged mice and rats in KBSI achieved success without cross-contamination and breeding technology for aged rodents. Also, a Super-Resolution TIRF microscope system will be installed to establish the foundation for enhancing research support in Nano-bio science.

Representative Research Case

Btg2 nuclear protein, expression and potential association in mitochondria The transcripts levels of Btq2 is highly increased by hormone treatment and expressed btq2 protein is localized with mitochondria. Mitochondrial Btg2 plays roles in suppression of proliferation and controlling ATP levels in differentiation cells.

Major Achivements

Category	Achivements			
Research Result	Publications	Presentations		
	9 (SCI 9)	Domestic 5/ Interr		
Analytical Methods	 Improvement of confocal Scanning Microsc Single molecule localization by Super resolu Measurement of Intact protein purification a Search a biomarker and application of flatfigure 			
Projects	• NGFI-B and Btg2 are bi-functional proteins; mitochondria • Functional membrane proteome structure a			
Fraining of Equipment	A basic principle of mass spectrometry and a Cellular and Nano-imaging using Laser Cor			
Equipment	Installed	• LCSM • online LC-NMR/MS • LC-MS/MS • Multi-TEM • AFAS		
	To Be Installed	Individually Ventialted Ca		

Gwangju Center

Image

Expression and Role of Btg2 in mitochondria

Equipment

Super-Resolution TIRF Microscope system

Individually Ventilated Cage System

Automatic Chemistry Analyzer

age System [2013]

ANNUAL REPORT 2012

02

32 | 33

Biological Imaging Research

The overall aim of our research is to use molecular imaging techniques to increase the understanding of disease biology and to assist in the development of therapeutic drugs.

Marine Biology Research

Research in biomedical manufacturing technology and environmentfriendly recovery with marine organisms are carried out.

Image

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

Main Research Activity

The production and application technology of biocompatible nanoparticles is applied to animal models for human diseases, including cancer, depression, and obesity. We perform highresolution imaging studies, cutting-edge equipment analysis, professional support and joint research for drug development, and disease onset research.

Chuncheon Center

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 Mn2+ dopants. The three photon process was successfully applied to high-resolution in vivo tumour-targeted imaging. The biocompatibility of ZnS nanocrystals offers great potential for clinical applications of three-photon imaging.

Major Achivements

Category	Achivements		
Research Result	Publications	Presentations	Patents
Analytical Methods Projects	 Intracellular ATP Assay of Live Cells Using PTD-Conjugated Luciferase Validity analysis of the weak bioluminescence signal in the early stages of metastatic cancer The measurement for the basal level of fluorescence signal from an animal administered fluorescent material Analysis method of TEM observation for conservation of intracellular ultra-structure A cooling stage techniques of FE-SEM for cell shape analysis method on the scaffold for tissue regeneration Targeted Evaluation Method for heparin-tagged drug for cancer therapy in vivo A living cell viability measurement using confocal microscopy Study on major depression using in vivo bioluminescence and fluorescence imaging Biocompatible Nano-medicine-based osteoporosis-control study Research for stimulating brown adinocyte to prevent obesity 		
Training of Equipment	EM(TEM/SEM) user training course Multi-photon CLSM user training course		
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 • Next Generation Sequencer [2013]		

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

Investigation into the antioxidant activity of marine Chlorella ellipsoidea Protein derived from marine Chlorella ellipsoidea was hydrolyzed using different proteases for the production of antioxidative peptide. The antioxidant activities of their hydrolysates were investigated. The purified peptide enhanced cell viability and reduced the proportion of apoptosis.

Major Achivements

ategory	Achivements		
Research Result	Publications	Presentations	Patents
	16 (SCI 15)	Domestic 4 / International 3	Application 2 / Registration 0
Analytical Aethods	 Preparation for electron microscopy of bacteria forming exopolysaccharide Optimization of observation of bacteria morphology using Scanning-TEM SCFA analysis from feces using SPME-GC-tandem-MS Method for Naringin measurement in feedstuff using liquid chromatograph-mass spectrometer (LC/MS) 		
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 		
raining of Equipment	Training of scanning transmission electron microscope Training of LC/MS system		
quipment	Installed	 Bio-LC LC/MS system Recycling HPLC Amino acid analzyer 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
	To Be Installed	Electron spin resonance [ESR] spectr	гозсору

Cases Samples Users Analysis Service

Jeju Center

Image

Phtographs of Chlorella ellipsoidea (A), Protective effect of the purified peptide on AAPH-induced oxidative damage in normal cells. (B), Proteictive effect of the puriried peptide aginst AAPHinduced apoptosis in normal cells (C).

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

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 Microcopy Research

The Division of Electron Microscopic Research is engaged in multinational collaborations through structural analysis of nano- and biomaterials, and aims to develop convergence imaging techniques using advanced electron microscopy.

Main Research Activity

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

Representative Research Case

Structural analysis of the protein complex involved in DNA replication Through 3D reconstruction of a SUMOylated PCNA protein complex, typical low molecular mass limit (~200kDa) for the structural analysis of biological specimen was overcome. The study revealed function-dependent structural changes of the protein complex involved in DNA replication, and made significant contributions towards understanding its molecular mechanism.

Major Achivements

Category	Achivements	
Research Result	Publications	Presentations
Analytical Methods	Specimen preparation method for TEM analy Analytical technique for localization of cellula image filtering, and 10 others	
Projects	 HVEM operation project Super Bio-HVEM installation and operation p Application of HVEM for correlative biological 	
Training of Equipment	•21 cases of public education programs and i	
Equipment	Installed	 High voltage electron mic Field emission-transmissio Energy filter-transmissio Bio-transmission electro Electron probe micro-ani High temperature x-ray of Environmental-scanning Focused ion beam, FIB
	To Be Installed	• FE-TEM [2013] • FE-SEM [2013]

Division of Electron Microscopic Research

Image

Srs2 binding-dependent structural changes of the protein complex that is involved in DNA replication

Equipment

Field Emssion-Transmission Electron Microscope

High Pressure Freezer

Grafix system

Nano **Materials** Research

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

Division of Materials Science

High Field Magenetic Research

environments

Image

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

Equipment

Complex Nano Spectroscope System

Solid state Nuclear Magnetic Resonance Spectroscopy

X-ray Photoelectron Spectroscopy

Main Research Activity

Scientists in the Division of Materials Science were able to synthesize the 3D macroporous carboncomposite materials and examine the elecrochemical performance. To develop the high-power and energy density electrodes, graphene oxide based metal oxide composites were fabricated and characterized with 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 selfassembly of ionic liquids led to the large surface area, mesopore structure, and fast ion and proton diffusion, resulting in nighly specific capacitance, high-rate capability, and long-term cycling stability.

Major Achivements

Category	Achivements		
Research Result	Publications	Presentations	Patents
	10 (SCI 5)	Domestic 10 / International 5	Application 3 / Registration 1
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 Organic-inorganic nanohybrid anode materials for high-power Li-ion battery Development of high-performance energy storage device based on 3D graphene-metal nanoparticle hybrid Fabrication of SERS active nanostructure and its application studies for low concentration analysis of protein 		
Training of Equipment	Complex Nano Spectroscope System 2,3-D Raman Spectroscopic imaing		
Equipment	Installed . (. E . E	Complex Nano Spectroscope System Electrochemical Analyzer system Bi-Potentiostat Liquid cell system for R	aman analysis

Main Research Activity

We carry out research for the application of magnetic tunnel junctions (MTJ). In particular, the performance enhancing technology of spin transfer torgue magnetic random access memory (STT-MRAM) devices is being investigated.

Representative Research Case

Developing the analysis technology of bias voltage and field for spin devices A study of 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, a computer program for automatic measurement was developed.

Major Achivements

Category	Achivements		
Research Result	Publications	Presentations	
	68 (SCI 64)	Domestic 37 / Inte	
Analytical Methods	Analysis of bias voltage and magnetic field d Raman spectroscopy and surface enhanced biological materials In-situ Raman spectroscopy for analysis of s		
Projects	 Development of spin device measurement The development of multi-disciplinary in situ an development of nanostructured materials fo Development of cryogenic scanned probe te Management of Division of Materials Science 		
Training of Equipment	• Korea-Japan Join superconducting r magnet. 15 partici	t Workshop on Supercond magnet design, winding, co ipants. during 9-14, July (6	
Equipment	Installed	 Physical Property Measu System, 16 T Magnetic Property Meas System, 7 T EPR System 	
	To Be Installed	• Glow Discharge Mass Sp	

Division of Materials Science

Image

Magnetoresistance curve dependency on the current bias

Patents

ernational 21 Application 22 / Registration 13

ependence for spin devices Raman scattering(SERS) imaging for anaylsis of

surfactants on polymer surfaces

nalytical system for nanotechnology and related science or Hydrogen storage era Hz MRI nanoscope

ducting Magnet : High magnetic field 7 T cooling by liquid Helium, test of the superconducting

days) rement · Complex Nano Optical Spectroscopy System •Magnetic Force Microscopy, MFM • 500 MHz Solid State FT-NMR 15 T High Magnetic Field System

pectrometer [2013]

Equipment

Cryogenic probestation(CSP)

Physical property measurement system (PPMS)

Magnetic property measurement system(MPMS)

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

44

High-Tech Materials & Components Research

Developed basic and applied technologies for regionally specialized materials and components industry and Li ion secondary batteries. Surface analysis supported research development of companies, universities, and research institutes by installing large-scale research instruments.

Image

-Ru -Al O Si

SIMS depth profile of RuAlO Film

Equipment

Angle Resolved X-ray Photoelectron Spectrometer

Auger Electron Spectrometer

Secondary Ion Mass Spectrometer

Main Research Activity

We optimized the deposition condition of ruthenium based ternary oxide as a diffusion barrier of copper inter-connector by using surface analysis instruments, and also conducted the research on the surface of oxide semiconductor and hybrid nanostructures for Li ion secondary batteries.

Representative Research Case

Development of Ru-based ternary oxide as a diffusion barrier for Cu interconnect

Ru-based ternary oxide, RuAlO, was successfully deposited by using atomic layer deposition. Compositions of RuAlO films were characterized by using SIMS, adopting the MCs⁺ cluster method. We expect that nano-crystalline RuAlO might be utilized as an alternative substitute to conventional diffusion barriers against Cu.

Major Achivements

Category	Achivements		
Research Result	Publications	Presentations	Patents
	44 (SCI 39)	Domestic 35 / International 3	Application 4 / Registration 3
Analytical Aethods	 Development of quantitative analysis method of chemical binding structure of PET film by using C1s peak fitting Development of non-destructive analysis method on the thickness measurement of HfO2 thin film Development of secondary imaging method of doping materials by using electron microscope Development of depth profile method of compound semiconductor solar cell by using pulsed RF-GDS 		
Projects	 Multi-sensors for Heavy Metals and Pretreatment System of Refractory Organic Matrix Study on nano-crystalline Ru-based Ternary thin films by atomic layer deposition 		
Fraining of Equipment	 •55 training courses including exploring surface structure using a microscope • The 5th surface analysis workshop 		
Equipment	Installed	Auger Electron Spectrometer Angle-Resolved X-ray Photoelectron Spectrometer	Secondary Ion Mass Spectrometer Glow Discharge Spectrometer Transmission Electron Microscope
	To Be Installed	High Resolution Field Emission Scanni	ng Electron Microscope [2013]

Main Research Activity

Scientists in the Division of High-Technology Materials studied the development of energy storage material for Li ion batteries.

Scientists in the Division of High-Technology Materials studied development of lead tap components using metal polymer bonded technology for Li ion battery.

Representative Research Case

Comparison of polarimetry and crown ether-based HPLC chiral stationary phase method to determine (L)-amino acid optical purity The HPLC-CSP method was very effective for determining the (L)-amino acid content and the optical purity. The other advantage is that the HPLC-CSP method requires amino acid samples of guite low concentration (as low as 1 lg/mL), whereas the pharmacopoeia method requires higher concentrations (20-110 mg/mL). - Food Chemistry 135 (2012) 343-347 -

Major Achivements

Category	Achivements		
Research Result	Publications	Presentations	
	42 (SCI 40)	Domestic 42 / Inte	
Analytical Methods	 LPG gas component analysis utilizing the He Development of metal impurity analysis using 		
Projects	 Establishment and management of High-To Development and applicartion of metal-org storage Study on plant's growing condition distinction metabolomics 		
Fraining of Equipment	Youth education s	support programs with adva	
Equipment	Installed	Inductively-Coupled Plas Microscopic FT-IR/Rama Nano Secondary Ion Mas Liquid-Chromatograph N Combustion Ion Chroma	
	To Be Installed	• Time of Flight Secondary	

Busan Center

Image

Representative chromatograms for the resolution of (+)-amino acids on the chiral stationary phase (CSP).

Patents ernational 4 Application 4 / Registration 3 ead-space GC/MSD ng the O⁻ ion of Nano SIMS echnology Materials Research Center (Busan) anic polymer combination technology as an energy on and resistive materials using polyphenol

vanced scientific instruments: 40 programs

sma Atomic Emission Spectrometer an Spectometer ss Spectrometer Mass Spectrometer atograph

Ion Mass Spectrometer [2013]

Equipment

Nano Secondary Ion Mass Spectrometer

Liquid Chromatography/ Mass Spectrometer

Inductively Coupled Plasma Atomic Emission Spectrometer

ANNUAL REPORT 2012

High-Tech **Functional 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 the chemical response tracking of materials with advanced functions.

Daegu Center

Nano Structure Analysis & Characterization Research

The Jeoniu center is performing research support and collaborations to improve nanoscience and nanotechnology. Our research area is specifically focused on the 'analysis and characterization of the nanomaterials and nano-structures'.

Image

Toroid Cavity Detectors for Investigating Fuel Cells In Situ by Nuclear Magnetic Resonance Spectroscopy

Equipment

FT-NMR(Nuclear Magnetic Resonance) Spectrometer

High Resolution Mass Spectrometer

Multi-purpose X-ray Diffractometer

Main Research Activity

In 2012, in situ nuclear magnetic resonance techniques were developed and applied to direct methanol fuel cells to improve the performance of fuel cells.

Representative Research Case

Investigation of the Direct Methanol Fuel Cell Reaction by In Situ Nuclear Magnetic Resonance Spectroscopy

Without disassembling the direct methanol (CH₃OH) fuel cells in operation, electrochemical reactions occurring in the fuel cells, and in the process of production of electricity, were successfully investigated by using a unique analytical method called "in situ nuclear magnetic resonance spectroscopy". The results laid the groundwork to accelerate the commercialization of fuel cells.

Major Achivements

Category	Achivements		
Research Result	Publications	Presentations	Patents
	34(SCI 33)	Domestic 6 / International 1	Application 0 / Registration 1
Analytical Aethods	 X-ray topography application by the PIXcel 2D detector A quantitative analytical method for the GTP hydrolysis of microtubules using 31P CPMAS NMR An analytical method for the local structure of Dion-Jacobson oxynitrides using 7Li MAS NMR An analytical method for the dynamics in crystals using solid-state NMR An analytical method of solid acid electrolyte by 31P magic angle spinning NMR technique 		
Projects	Study of NMR for Improvement of Performance in Fuel Cell 2H{19F} REDOR NMR spectroscopy for the 3D bioactive structure of epothilone anticancer drugs		
raining of Equipment	Youth education support programs with scientific instruments : 65 programs Advanced science experience, isolate experimental experience, etc.		
quipment	Installed	 600 MHz / 400 MHz / 200 MHz solid s 500 MHz FT-NMR Spectrometer X-ray / High Resolution X-ray / Multi-pur High Resolution Mass Spectrometer Ultra High Resolution Field Emission Field Emission Scanning Electron Mi 	tate FT-NMR Spectrometer pose X-ray/ Multi-Function X-ray Diffractomete I Scanning Electron Microscope icroscope
	To Be Installed	Field Emission Tandem Electron Mi 400 MHz solid state FT-NMR	icroscope

Main Research Activity

Interesting research activities performed in 2012 were the development of the nanostructure materials based on nanocarbon composites, low dimensional nanostructures, inorganic/organic interface research. and so on.

Representative Research Case

Sandwich-like graphene nanocomposites armed with nanoneedles Graphene nanocomposites armed with nanoneedles are fabricated by the synthesis of Au on graphene with iron oxide and SiO₂. This structure prevents aggregation and contamination of the graphene nanosheet as catalysts, and allows recycling, both of which enhanced catalytic ability.

Major Achivements

Category	Achivem	ents	
Research Result	Publicatio	ns ง	Presentations
Analytical	· Developr	J nent of pretre	Domestic 22/Interna
Methods	Malysis development of predeductive of single of year Malysis development of carburized samples of Development of measurement method of nan Development of fabrication and analysis meth Development of cathodoluminescence analysis Development of potential image of metal oxide		
Projects	 Development and application of carbon dioxid Study of structural properties and electron trainterfaces Development of analysis technic for nanostru- Development of quantitative analysis for DNA Study and applications of smart nanosutrucut Real-time observation and nanoscale analysis properties-coupling behaviors by mechanical 		
Training of Equipment	Youth Education Support Programs with Adva		
Equipment	Installed	 FE-EF-TEM Micro XPS 	• UHR FE-SE • FE-SEM

KOREA BASIC SCIENCE INSTITUTE

Jeonju Center

anced Scientific Instruments: 68 programs

ΞM

- PSA System Single Crystal XRD
 - AFM system

Image

A schematic for graphene nanocompsites armed with nanoneedles

Equipment

•

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

Micro X-ray photoelectron spectrometer (-XPS)

Ultra high resolution field emission scanning electron microscope (UHR FE-SEM)

New Materials Research

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

Suncheon Center

Nano **Materials** Imaging Research

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

Image

Development of new anode material to 500 charge-discharge cycle efficiency while not a big loss.

Equipment

High Resolution- Transmission Electron Microscope (HR-TEM)

Field-Emission Scanning Electron Microscope (FE-SEM)

X-ray Diffractometer (XRD)

Main Research Activity

Performing research on the new technology and manufacture of the advanced Li adsorbent. Developing new materials for high-capacity next generation anode materials for Li 2nd battery. Developing cathode materials using spent lithium batteries.

Representative Research Case

Developing metallic lithium from bay salt

We have reported the new anode material with high efficiency for Li 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.

Major Achivements

Equipment

Category	Achivements		
Research Result	Publications	Presentations	Patents
	15(SCI 14)	Domestic 4 /International 3	Application 5 / Registration 00
Projects	Development of Positive Electrode Materials using Spent Lithium Batteries		

Training of	Youth Education Support Programs with Advanced Scientific Instruments: 32 programs
Equipment	DSC/TGA maker traning FE-TEM maker traning

Installed . X-ray Diffractometer System Photoluminescence Mapping system · Field-Emission Scanning Electron Microscope Field Emission Transmision Electron Microscope X-ray Fluorescence Spectrometry Thermal Analyzer

Main Research Activity

New 3D multifunctional nanomaterials were developed, as well as research and applications on natural minerals in the Gangwon region performed by using various optical nano-imaging instruments.

Representative Research Case

Specific compositions and optical characteristics of natural colloid in the spring water in the Geumiin area

The spectroscopic characteristics and application methods of the floating colloid and its precipitation in the Geumjin area were investigated. The colloids exhibited specific spectroscopic properties, especially for visible and NIR regions, and showed relatively high photothermal conversion efficiency. New substitute materials were synthesized and all results of this work have been filed for a patent.

Major Achivements

Category	Achivem	ents
Research Result	Publicatio 6(SCI 5)	ns Presentations Domestic 2 /Internati
Projects	 Smart nanoporous materials for stimuli-responent Characterization of colloidal materials in Geur An international joint research for 3D dielectric Fundamental study on natural minerals as main results Functional control of nanoparticle-superlattice 	
Training of Equipment	 Advanced user training of electron microscop Advanced user training of optical nano-imagir 	
Equipment	Installed	 Field Emission Transmission elect Field Emission Scanning Electron Multi Purpose X-ray Diffractomete Time-resolved Fluorescence Conf FT-UV-VIS-IR Spectroscopic Imag Wavelength Dispersive X-ray Fluor

Cases Samples Analysis Service

Gangneung Center

Image

Images of Geumjin colloidal particle and synthesized substitute materials (left) and spectroscopic characteristics of Geumiin colloid (right)

Equipment

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

Field Emission Transmission Electror Microscope (FE-TEM)

Atomic Layer Deposition (ALD)

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

N

Age Determination Research

Environmental Research

Isotope Research

Isotope research is performed by using various advanced mass spectrometers for the analysis of trace elements and environmental isotopes of samples which are of environmental importance. The research is often in collaboration with researchers in the Earth and environmental science fields. Division of Earth and Environmental Science

Main Research Activity

Research was carried out for the identification of the geographical origin of food using isotopes and Pb-Pb dating methods for identifying the origin of archaeological artifacts.

Representative Research Case

Using stable isotope analysis to discriminate gasoline on the basis of its origin

The bulk and compound-specific isotopic compositions of gasoline produced by four oil companies in South Korea were investigated. This study showed that gasoline can be forensically discriminated according to the oil company responsible for its manufacture using stable isotope analysis combined with multivariate statistical analysis.

Major Achivements

Achivem	ents	
Publicatio	ns	Presentations
21(SCI 19)	Domestic 18 /Interna
Li isotope analysis using MC-ICP-MS cool pl. Simulational correction for the coincidence s Making glass standard materials for the ana Analysis of refractory elements in geological Ar isotope analysis using multi-collector Simultaneous stable isotope analysis using Provenance of archaeological remains using Tracing the geographic origin of Chinese cab The use of stable isotope analysis to discrimi Oxygen and Hydrogen isotope analysis for disc Simultaneous stable isotope analysis for disc Making geologic map for Pb isotope distribut		
Installed	 Multi-collect Plasma Ma Stable Isoto Natural Rad Quadrupolet Mass Spect 	tor Inductively Coupled ss Spectrometer pe Ratio Mass Spectror lioactivity Measurement S Inductively Coupled Pla rometer
	Achivem Publicatio 21(SCI 19 Li isotope Simulatio Making g Analysis (Ar isotop Simultan Provenar Tracing tl The use o Oxygen a Simultan Discrimir Making g Training p	Achivements Publications 21(SCI 19) Li isotope analysis usin Simulational correctior Making glass standard Analysis of refractory e Ar isotope analysis usir Simultaneous stable iso Provenance of archaeo Tracing the geographic The use of stable isotop Oxygen and Hydrogen i Simultaneous stable is Discriminating the geog Making geologic map fr Training programs for a Stable Isoto Natural Rad Quadrupole Mass Spect

Image

Linear discriminant analysis scatter plot of discriminant functions for gasoline samples produced by the four different oil companies analyzed

• Equipment

SIRM

MC-ICP-MS

TIM

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 is also comprised of experienced researchers from various fields of geological sciences.

Division of Earth and Environmental Science

Image

Concordia diagrams for zircons from the gabbro(a) and granite(b) in the Jangsari pluton.

Equipment

KRSI SHRIMI

Scanning Electron Microscope

Main Research Activity

• First Paleozoic granitoids in Korea revealed by SHRIMP geochronology • Two stage partial melting of Nepal Himalaya

Representative Research Case

First Paleozoic granitoids in Korea revealed by SHRIMP geochronology Using SHRIMP zircon U-Pb geochronology, it was found that Jangsari pluton in the Gyeongsang basin was emplaced in late Permain, which is the first report of Paleozoic pluton in the Korean peninsula. Also, nearby Yeongdeok pluton was revealed as Late Permian-to-Early Triassic adakitic rocks.

Major Achivements

Category	Achivements				
Research Result	Publications	Presentations	Patents		
	14(SCI 12)	Domestic 9 /International 4	Application 1 /Registration 0		
Analytical Methods	•Authenticity test of pottery using luminescence signals in quartz • Develpment of K-feldspar IRSL dating II • U-Pb dating of titanite using SHRIMP				
Projects	 Geology of CO2 storage facilities Chronology of Acheulean-type industries in Korea-Thailand-France: contributions of newly developed luminescence dating methods Age dating and experimental development for Quaternary faults and marine terrace sediments near NPP sites 				
Training of Equipment	Training programs for students and experts: 26 programs				
Equipment	Installed	Heavy mineral separation system High Resolution Secondary Ion Mass	Spectrometer		
	To Be Installed	Be Installed • Time-resolved OSL measurement system			

Research

Environmental The environmental analysis field emphasizes the use of chemical and structural analysis equipment such as ICP, XRF, and XRD. Target materials are soil, groundwater, ceramics, high molecular composite materials, metals, and even bio-samples. Particularly, fluorine The hazardous substances in the environment are focused to develop a novel analytical method for the application of real environmental materials. In addition, the hazardous substance research establishes systematic procedures for analyzing the types of hazardous target substance, experimental methods, type of exposure, and metabolomic mechanisms in the human body. Gangneung 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. Furthermore, Persistent Organic Pollutants, Endocrine Disrupters etc. are analyzed for specialized research support. As a national official test facility, we conduct the analysis of dioxins in food. Also efforts are being made for the development of analytical techniques by participating in the National Quality Control Programs.

Representative Research Case

Development of a rapid analysis technique for soil fluorine with consideration to iron content in the matrix

The wavelength dispersive X-ray fluorescence spectrometry, as a tool for rapid analysis technique, was applied to determine fluorine content in soil and the analytical strategy for compensating the iron interference was developed.

Major Achivements

Category	Achivements				
Research Result	Publicatior 14(SCI 12)	ns Presentations Domestic 13 /International 4	Patents Application 4 /Registration 0		
Analytical Methods	Analytical method of arsenic compounds in environmental media using HPLC-ICP-MS Separation of arsenic species using solid-phase extraction disc and hologen concentration analysis method Rapid detection method for fluorine using WD-XRF				
Projects	 Safety control of PCBs in food (Feb. 2012 - Dec. 11, 2013; KFDA; 80 million won; Jeong-Ji Suh) Study on the Factors Affecting Lithium Adsorbent Capacity and the Controls of Physicochemical Process in Marine Environments (Apr. 2012 - Mar. 2013; Ministry of Land, Infrastructure and Transport; 120 million won, Hye-On Yoon) Developing Analytical Method for Mercury and Arsenic Species (Jan. 2012 - Dec. 2012, Support for Collaborations between KBSI and Universities; 70 million won; Hye-On Yoon) Development of Method to Assess Fluorine Level in Soil and Waste and Protocol for contaminated Site Monitoring (Apr. 2012 - Mar. 2013; Ministry of Environment; 145 million won; Hye Yang) 				
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

Intensities of fluorescence emitted from blanks (without addition of F) with different elemental compositions of the base matrix (95% Fe203, Si02, and Al2O3, respectively) against 2 theta values of Bragg angle. Higher content of Fe was affected to fluorine intensity.

Equipment

•

High Performance Liquid Chromatography-Inductively Coupled Plasma Mass Spectrometer

Wavelength Dispersve X-ray Fluorescence Spectromete

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 is the driving force to become a worldclass research institute.

HVEM
FT-ICR MS
HF-NMR
HR-SIMS
Human 7 T MRI System
In situ Analytical System
Super Bio-HVEM

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 the development of infinitesimal materials.

Division of Electron Microscopic Research |

The sub-nano patterns and model for polymer films, and its structural analysis using HVEM-HREM and XRD

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 $(\pm 60^{\circ})$

Chemical signal detection with a high collection rate using the state-of-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 a remote control system

Major Applications

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

Investigation of molecular level ordering in Polymer

Structural analysis of polymeric materials have been cumbersome using a conventional transmission electron microscope with 100~300 kV accelerating voltage due to the electron energy damage. In this work, the structural analyses of polymer material (P2VP) were successfully carried out using the HVEM-HREM. This result demonstrates the potential of applying the HVEM for analysis of a nano-sized polymer device and the evaluation of its properties.

Characteristics of Equipment

> 5.000.000

APPI. LC/MS/MS

CAD. IRMPD

Major Applications

01	02	
	03	04

	초고문해는 대시에 잘랑끈로마일	동계 패턴 문석
상사는 조사		Ste oltr
Broke MA		RA.
Pooling / 부위범 801.01년 소년 전여		
사체 응배추출		방사능 감지 대사체 미커 발굴
88/유기용배용	- Internation -	
and a second s	12 By	
문해등 실망분식 📖		AD A 12 A 4 A 10

- 01 Development of high-throughput analytical method to determine molecular formulae of most phytochemicals in plants using ultra-high resolution mass spectrometry
- 02 Development of profiling method of phospholipids of intact cancer cell using ultra-high resolution mass spectrometry
- 03 Development of guantitative analysis of animal brain metabolites sensitive to radiation
- 04_Detection of peptide ions containing a heme group was detected from cytochrome C peptide by using UHR 15T FT-ICR MS.

Representative Research Case

Discovery of the novel natural molecules using UHR MS Profiles We conducted the following: high throughput multi-components discovery method development using acitivity and mass profiles; natural product analysis using a ultra-high resolution mass profile method; optimization of herbal medicine prescription using a high throughput multi-components discovery method; and radiation sensitive biomarker discovery using a ultra-high resolution mass profile method.

• The world's best mass resolution :

· Dual ion source : ESI/MALDI

· Applicable methods: MALDI Imaging, APCI,

Various MS/MS techniques: CID, ECD, IS-

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 the Ochang Center.

The profiles of proteome, metabolome, petroleome, and natural product materials are produced with the ultra-high resolution mass spectrometry.

[Installed in December 2007]

Division of Mass Spectrometry Research

Image

•

Optimization of herbal medicine prescription using a high throughput multi-components discovery method

High Field-Nuclear Magnetic Resonance

The 900 and 800MHz Nuclear magnetic resonance(NMR) spectrometers, and 4.7 and 9.4T Magnetic resonance imaging(MRI) animal scanners were installed in the Ochang campus as the core equipment for research in molecular structure determination. drug discovery, development of diagnosis and treatment technology. This research equipment is being operated as the national user facility in Korea.

Division of Magnetic Resonance Research

(A) Identification of the interdomain contact site of Hsp33(227-287) (red) and full-length Hsp33 (black). (B) Domain organization in the structures of Hsp33 from B. subtilis

Characteristics of Equipment

Major Applications

01 02

03 04

less samples.

900MHz & 800 MHz NMR : The 1H 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 ¹³C spectra can be taken with 1mg or

9.4 T and 4.7 T MRI : Animal MRI scanners with 21 cm

R

and 40 cm bore sizes respectively

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

Development of NMR techniques for giant biomolecular structure analysis

Hsp33 is a molecular weight of 33kDa, in the active state, it is a giant protein reaching 66kDa. Hsp33 activity changes according to the oxdation-reduction state and has a unique molecular mechanism of action in response to the metal binding and folding-unfolding phenomenon. Using a 900 MHz NMR, we analyzed protein NMR data of Hsp33 protein monomer (33kDa) and dimer (66kDa) and clarified the molecular mechanisms related to chaperon activity.

Characteristics of Equipment

- stable isotopes
- · Improved multi-collector for Pu isotopes
- SHRIMP II

Major Applications

Representative Research Case

Two-stage partial melting of Nepal Himalaya Using a high reoslution secondary ion mass spectrometer, disctinct patterns of Rare Earth Elements and the Oligocene and Miocene U-Pb age from the Himalayan zircon were revealed.

Reproducibility of U-Pb age determinations within 1% · Cs-gun and aluminum flight tube exclusively for

· Remote analysis and diagnostics

- 01_U-Pb age determination of monazite
- **02_**Oxygen isotope analysis of monazite
- **03** Distribution of plutonium isotope in the nuclide particle
- 04 Corrected magnesium isotopic ratios of standard minerals (spinel, melilite, beryl and olivine)

High Resolution-Secondary Ion Mass Spectrometer

The high resolution secondary ionization mass spectrometer (HR-SIMS), which measures the isotope ratio for minute areas of solid materials, has been installed and operated as the research equipment of a national user facility for age determination, stable isotope research, and nuclide analysis (open in September 2009)

Division of Earth and Evironmental Science

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Geological map of Himalaya (above) and T-t path of the High Himalayan Crystalline Sequence (below)

Human 7 T MRI System

Characteristics of Equipment

The Philips Achieva 7 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 the 3 T clinical system for reproducible results to support research needs.

Division of Magnetic Resonance Research

in situ Analytical System

Near ambient pressure XPS is an advanced tool to understand real world chemical processes, since we need to analyze them as they occur in the real world. It'll make us free from the pressure gap between a UHV tool and the real world.

Division of Analytical Science

- Superconductive Actively shielded compact 7 T magnet Actively shielded gradient system and 8 channels RF
- system
- Ultra-high resolution, enhanced fMRI, and spectroscopy

Major Applications

01 02 **01_**Ultra-high resolution brain MRI (image: NRI, Gachon, Korea)

02_Ultra-high resolution fMRI (image: MGH/MIT, Boston, USA)

Characteristics of Equipment

Electron spectrometer : exchangeable aperture, wideangle deceleration lens

- Differentially pumped electrostatic pre-lens at three stages
- Detectors : nine channeltron detectors arranged as a single block

Major Applications

01 02

01_In-situ analysis of catalytic reaction **02**_Study of liquids and their interfaces to solid materials

Characteristics of Equipment

- · Advanced cryo-EM function at cryogenic temperature (< 98° $_{K}$) for the structural analysis protein complexes
- Enhanced auto-high tilt function (±70°) for the 3D structure analysis
- \cdot Reinforced performance with STEM, in-column \mathcal{Q} -filter, and high resolution CCD camera (4kx4k)

Major Applications

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 leader in National User Research Equipment in nano-bio fusion research fields.

Deadeok Headquarters-Division of Electron Microscopic Research

- **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

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 New-Concept Nano Materials Utilization Technology
- Development of National Agenda-Solving Technology
- Development of Leading-Edge Analytical Equipment

Development of New-Concept Nano Materials Utilization Technology

Scientists in the Division of Materials Science are primarily focused on the development of nanostructured and organic/inorganic hybrid materials through molecular simulation and characterization for high performance green energy storage.

Division of Materials Science

Main Research Activity

A bottom-up self-assembly method created ionic liquid-Co(OH)2 hybrid material which showed rapid and reversible redox-based supercapacitive performance. DFT calculations were comprehensively investigated to elucidate the critical role of ionic liquids on the redox reaction.

Future Plans of Research

The synthesis of ionic liquid-based hybrids will generally apply to other transition metal oxides or hydroxides for the development of energy storage devices. Also, using DFT calculation will study the electrochemical reaction on interface of a transition metal oxide or hydroxide.

Image

01 Transmission electron microscope images of Co(OH)2 **02_**Electrochemical graph and optimized structure of ionic lquid/Co(OH)2

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.

Development of the integrated analysis technology for discriminating the geographical origin of various agricultural foods, which are currently being circulated in Korea, is being established.

Main Research Activity

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 clear distinction between Korean and Chinese Kimchi.

Future Plans of Research

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

Image

Development of National Agenda-Solving Technology

Division of Earth and Environmental Science

01_Determining the geographical origin of Chinese cabbages produced in Korea and China

02 Determining the geographical origin of Korean and Chinese Kimchi

01 Technology to Discriminate the Origin of Agricultural and Livestock Produce

02 **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 positron emmision tomography(PET).

Main Research Activity

Division of Manetic Resonance Research

After IV injection of homemade magneto-fluorescent nano-particles (MNPs) into myocarditis rat model, MR imaging showed that the inflammation sites were detected with higher sensitivity and specificity compared to current clinically-used methods.

Future Plans of Research

Novel multi-modal imaging probe platforms with specific targeting functions to immune cells will be developed, and used for the study on the immune cell infiltrations.

Image

03 Culture property preservation and analysis technology

To establish the scientific research for culture and technology exchange in Northeast Asia, we produce the base data of lead isotopes developed the analysis techniques on geoscience of ancient artifacts.

Division of Earth and Environmental Science

Main Research Activity

In 2012, we carried out the analysis of galena samples used in raw material for making bronze artifacts and researched the applicability of origin estimation using the distribution area of lead isotope ratios in the southern Korean peninsula.

Future Plans of Research

Future research will be developed the including analysis technique of cultural heritage, making the distribution mapping of lead isotope ratios in the Korea peninsula for origin estimation study of ancient bronze artifacts.

Image

01_Thermal Ionization Mass Spectrometer for lead isotope ratio analysis

02 The distribution map of Pb isotope ratio in southern Korea peninsula

Scene-applicable analytical techniques using biochemica developed for fast and accurate crime scene investigation.

Division o

Main Research Activity

Several post-mortem interval protein markers in model ar verified for application in forensic science fields.

Future Plans of Research

Biochip analysis kits using post-mortem interval markers diagnosis.

Image

The Center for Analytical Research in Disaster Sciences (CA state-of-the-art analytical techniques and infrastructure resolutions on national environmental disasters.

Main Research Activity

Upon establishment of the Center for Analytical Research in Disaster Science, the basic research in the three major areas began: infrastructure construction and technology development for "environmental radiation" and "environmental hazardous substance analysis" and "forensic analytical technology development" to support scientific investigation.

Future Plans of Research

To consolidate the 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

al forensic biomarkers are being f Earth and Environmental Science l nimal systems were identified and	04 Technology for Crime Scene Investigation
will be developed for on-site field	
 01_ Western blot analysis of glycogen synthase after post-mortern intervals in various tissues 02_ In vivo glycogen synthase expression pattern in psoas muscle by immunohistochemistry 	
RDS) was established based on the of KBSI to strengthen scientific	05 Analytical technology in disaster science

01_The Plate Hanging Ceremony of

CARDS (2012.03.14)

02_A public relations officer

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.

01 Femtosecond Multi-Dimensional Spectroscope

Scientists at the Seoul center are developing a variety of multi-dimensional and chiroptical spectroscopic methods that enable real-time measurements of ultrafast biological and chemical processes in a femtosecond time scale.

Seoul Center

Main Research Activity

Two-dimensional infrared (2DIR) spectroscopy has been used to elucidate the ultrafast rotational dynimics of amino acid derivatives, and an ultimately sensitive single-shot optical activity interferometry enabling chiral structure determinations has been developed.

Future Plans of Research

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

Image

01_ Development of single-shot optical activity interferometry **02_** Chemical exchange two-dimensional infrared (2DIR) spectroscopic investigations of (4S)-azidoproline

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

Main Research Activity

High resolution infrared optical lens and ultra-precision thermal imaging microscope systems were developed. Also, the precise temperature imaging and thermal analysis method of semiconductor devices and nano-bio samples were developed, as an application technology of the thermal imaging microscope.

Future Plans of Research

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

Image

Division of Instrument Development

01 Ultra-precision thermal imaging microscope system

- 02 Measured microscopic thermal images
- (a) PHE sensor (b)Micro-bolometer

02

High-Precision Thermal-Imaging Microscope System

03 Small and Medium Accelerators Utilizing the ECR Ion

It will be used in the study of a functional energy material, a treatment of material surface, an ion implantation, and a non-destructive analytical device by developing and building the heavy ion beam facility using the ECRIS (electron cyclotron resonance ion source), etc.

Busan Center

Main Research Activity

The core technologies of 28 GHz ECRIS including a vacuum chamber, a gyrotron, superconducting magnets were finished. The the design and fabrication of an LEBT (low energy beam transport) were also finished. The technical design of the RFQ (radio frequency quarduropole) has also progressed.

Future Plans of Research

The superconducting ECRIS and LEBT will be built and RFQ will be installed then the effective beam extraction of ECR ion source will be developed in 2013. The fabrication of RFQ following the technical design of RFQ and DTL will also be processed.

Image

01_ower supply for LEBT **02_**ECRIS-LEBT line

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

Main Research Activity

Performance tests of cryogen free 15 T superconducting magnet, 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 fields and low temperatures, and the installation of high current power supply, evaluation of superconducting wire and magnet, magnetic separation, material synthesis and crystal growth will be done.

Image

 01_ LHe Cryostat within HTS magnet installed on Cryogen Free 15 T Superconducting Magnet
 02_ Controll and Masurement System for 15 T Superconducting Magnet

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.

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 already been developed. We have published our new development of a small cold electron ionization source that has a dozen advantages over a 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 also be attempted.

Image

Division of Mass Spectrometry Research

01_A cold electron ionization source has been published in Analytical Chemistry.

02_A tiny mass spectrometer assembled with a cold electron gun, an ion trap, and an ion detector. 04

Conduction Cooling Type 15 T High Magnetic Field Material Research System

05 Portable mass spectroscopy

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.

^COperation of National Research Facilities & Equipment Center (NFEC)

Conline Research Service System

Coperating Graduate School of Analytical Science and Technology (GRAST)

Publishing of Journal of Analytical Science and Technology (JAST)

Reinforcing Industry-Institute Cooperation System

Public Understanding Program for Science & Technology

National · International Networks

Operation of National Research Facilities & Equipment Center

NFEC is established by the Framework Act on Science and Technology to provide systematic support for science 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 the equipment for strategic investment, promotion of co-utilization of research facilities, and the development of high-skilled manpower.

<u>on</u> Supports policymaking 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 2012, support was carried out for 17 policy-makings and 1 legislation of research facilities and equipment. Also, we laid the foundation for policy-making to cooperate with the government for research facilities and equipment by organizing and operating a supporting consultative group of government agencies of research facilities and equipment and the legislation task force of national research facilities and equipment.

Future Plans of Research

Supports policy establishment for strategic investment and effective management of research facilities and equipment.

Prepares legal basis for rNational Research Facilities and Equipment Management Manual J.

Image

O1_Agenda to Support Policy-Making
 O2_Agenda for the second consultative group of government agency of research facilities and equipment

Enhances the competitiveness of national S&T by establishing of the National Large Research Facilities Roadmap(NFRM) for constructing large research facilities systematically and strategically.

Main Research Activity

Established The Second National Large Research Facilities Roadmap_ proposing the selection, expansion, and co-utilization of 13 key Large Research Facilities.

Future Plans of Research

Prepares the general management system on a national level. Prepares laws and regulations to promote co-utilization of National Large Research Facilities.

Image

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 3.8 billion KRW through holding a deliberative council on the research facilities & equipment budget twice and enhanced the effective execution of the R&D budget by constantly forming the council for amendment (7 times), according to the changes of research environment.

Future Plans of Research

Enhanced the convenience of researchers through providing a standard format for in-advance research facility planning reports and plans to hold a deliberative council on research facilities and equipment regularly 5 times a year instead of holding it occasionally upon request.

Image

01_ 「The Second National Large Research Facilities Roadmap (NFRM)」

02_Public Hearing & NSTC agenda for National Large Research Facilities Roadmap (NFRM)

01_ 'Deliberative Council on research Facilities and Equipment Budget' and deliberation materials 02

Establishment of the National Large Research Facilities Roadmap(NFRM)

03

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

04 **Operation of National Research Facilities** and Equipment Management Service

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

Main Research Activity

Built 81,402 pieces of Database through an investigation of government-wide research facilities and equipment introduction state, and contributed to advisory activities through selected 907 equipment experts. Moreover, for the first time in the country it published The 2010 Investigation and Analysis of National Research Facilities and Equipment, which includes the status of investment and utilization of research facilities and equipment built through the government R&D project.

Future Plans of Research

Plans to upgrade NTIS National Research Facilities and Equipment Management Service through an enhancement of information quality, expansion of the database, and strengthening of personalized service.

Image

05 Education for high-tech research equipment and cultivation of equipment experts

Supports effective employment of research facilities and equipment by systematically training equipment experts who are exclusively in charge of its operation and management. Supports training of existing research facilities and equipment operating personnel through the

development and employment of an excellent education program fit according to his/her equipment and field.

Main Research Activity

Conducted The Research Equipment Engineer Training Project _ in order to cultivate equipment experts who are exclusively in charge of operation and management of research facilities and equipment. Conducted total of 27 regular user training (349 people) in order to enhance the capability of high-tech research equipment users. Also, it held the Second KBSI Imaging Equipment Education School to spread the employment know-how of imaging equipment.

Future Plans of Research

Develop theory and practice material for systematic training of research equipment. Expand regular user training program to 40 times a year, and hold the Third Imaging Equipment Education School to cultivate job-oriented equipment experts.

Image

01_ [Research Equipment Engineer Training Project] 02_ The poster of the second imaging equipment education school 03_Textbooks of the general user education

Support operation costs (employment and maintenace) to that own research equipment with values of 100 million we of the equipment

Main Research Activity

Supported 400 million won for 16 equipment in 2012 and the equipment to the public. Moreover, contributed to through publishing total of 175 domestic and foreign these

Future Plans of Research

The amount of support fees per research equipment effectiveness and satisfaction of operating high-cost resear

Image

RT Information NFEC 왕년종 1세운전(이제인진씨 : 연구철씨의 운영 및 교통활용을 지원하는 전달인력의 인간씨 지 1세운전(씨스씨 : 연구철씨의 유전(씨스북 위체 왕년집), 체용구제의 수전의 등 전원

Publish 'NFEC PRISM', which analyzes issues of local and and a survey of research facilities and equipment to provide

Main Research Activity

In 2012, povided a variety of information by publishing including 'Exclusively Utilize Standard of Research Facilit the concept and range of S&T infrastructure'

Future Plans of Research

Publish and expand the NFEC PRISM which will be usef based on user needs for the the policy of research facilities and equipment, and investment trends.

Image

o universities and research institutes on or more for promoting shared-use	<u>D6</u> Promote support program of high- cost and special
analyzed 23,189 samples by opening deriving excellent research results s and registering 9 patents.	research equipment
t will be expanded to improve the rch equipment.	
 01_ Assessment for selection of high-cost research equipment program 02_ PR Instructional Material 	
d international management systems e useful information of policy-making	07 Publication of the trend report for research facilities
a total of 17 NFEC PRISM reports, ties and Equipment', 'Understanding	and equipment
ul to researchers and policymakers,	

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 centers. On OCS' web service, to share their opinion for sample analysis, users can communicate with KBSI's operator via video conference systems. OCS' web service provides various fields of research support(data analysis(S/W), Q&A etc.)

Main Research Activity

In 2012, a total of 47 analysis machines were working under OCS. In the research support service area, 534 analysis cases were processed based on OCS. OCS Especially 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

Improving the intelligent OCS for the promotion of share-use of research facilities. Upgrading OCS's performance for R&D utilization improvement. Contributing to the public understanding of science & technology.

Image

01_ 2012 Korea Science Festival
02_ (science popularization)
03_ (Joint Research)
04_ (KBSI JIKS (Jakarta International Korean School))

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 2012, there were 24 faculties in GRAST, 12 researchers belonging to KBSI and 12 professors belonging to CNU. In the same year, 30 master's course and Ph.D course students entered GRAST and 24 students graduated. In order to cultivate students of executive ability in the field of analytical equipment, GRAST operates expert certification programs. So 8 students received a license in the field of electromicroscope, mass spectrometry and MRI etc.

Future Plans of Research

GRAST will gradually increase the number of expert certification programs from five fields to eight, grant more students a certification, and foster specialists required in the field of research and industry.

Image

01_ 2nd Grast International Workshop 02_2012 UICEXPO 03_GRAST Seminar 04_Practical examination of expert certification programs

Operating Graduate School of Science and Technology

Publising Journal of Analytical Science & Technology

JAST (Journal of Analytical Science & Technology) publishes creative research or application on the analytical principles, techniques, methods, procedures, and equipment in all their respects.

Division of Creative Policy

Main Research Activity

The Journal of Analytical Science and Technology (JAST) has been issued biannually (March, September) since 2010 with 17 peer-reviewed articles published in 2012. The online edition of the journal is available at www.jastmag.org, and it is an open-access journal.

Future Plans of Research

Staring 2013, JAST will work with Springer, a world-class publishing company, for the purpose of co-publication. JAST is to make good use of its brand value and professional editing skills to improve the quality of manuscripts. Furthermore JAST plans to invite well-known scientists to increase citations on JAST with Google online advertisement continuously.

Image

01_ JAST[Journal of Analytical Science and Technology
02_ JAST[Journal of Analytical Science and Technology We play a central role in facilitating efficient shared-use and collaborations of state-of-the-art research equipment based on Dadeok Headquarters, Ochang Center and ten local centers. We also promote various cooperation programs with universities, companies and other research institutes for an inclusive growth.

		Division of Creative Policy
Center	Specialized field	Regional innovation system (RIS)
Daedeok Headquarters	Electron microscopy, functional proteomics, high magnetic field physical property of materials, nanomaterials, development of research instruments	Biology, machinery, high frequency parts
Ochang center	Liquid magnetic resonance, organic mass spectrometry, isotope research	Bio fusion technology
Seoul Center	Metabolomics, multidimensional laser spectroscopy, organic/inorganic chemical analysis	Biology, IT, medicine & pharmacy
Busan Center	Fusion components and materials, thin film surface analysis	Machine components, LED
Daegu Center	Characteristic analysis of high-tech function materials	Electronic information equipment, automobile parts
Kwangju Center	Aging research, optical materials and property analysis	Optical industry, automobile parts
Jeonju Center	Nano structure & characterization assessment, development of nanocarbon-based materials	Machine components, automobile
Chuncheon Center	Biological imaging, disease imaging	Medical equipment, electronic beam
Suncheon Center	Nano information, new materials of rare metal, fine structure analysis	New materials, shipbuilding
Gangneung Center	Nano new materials	New materials
Jeju Center	Marine biology	Life, marine plants
Western Seoul Center	Nano, bio, pharmaceutical convergence	Biology, IT, medicine and pharmacy

Visiting support programs of the equipment used and the researchers to conduct collaborative research with other institutions belonging to the regular visits by the short-term, full-time study period as the Sonata, and to conduct the study visit is a system to support living expenses, etc.

Main Research Activity

Award announcement and selection of the second half of 2012, a total of fifteen people by the evaluation committee (thirteen people in Korea and abroad two people) a visiting researcher selected the best equipment utilization, and to conduct joint research stipends, round-trip airfare overseas residents, private research space, and has supported Ochang Center Guest House. Additionally, the visiting researchers select first and second half by evaluating the significance of the assigned research, research performance capacity, and overall contribution of the research accomplishment.

Future Plans of Research

The domestic institutional capacity to support visiting scientists to participate more openly with industry, academia, and related organizations to promote the strengthening and expanding the use of joint research and equipment to derive the best research studies, including environmental improvement plans to offer our full support ls.

Image

Reinforcing Industry-Institute Cooperation System

01_ Evaluation Committee held for selection of visiting researchers

 $\textbf{02}_\text{Research Room of visiting researchers}$

01 Visiting Researcher Support Program

Operate technical counselling center and membership program for small and medium companies

In order to strengthen technical competitiveness and settle difficulties of small and medium businesses, the counselling center was set up to consult technology and equipment repair by utilizing leading-edge equipment and professionals of KBSI. Furthermore, outstanding member companies are selected to give discount benefits (10%~50%) on charges for device usage.

Main Research Activity

In 2011, a total of 465 cases of analytical services of technical counselling for small and medium businesses were carried out. Also, in the case membership services, 46 discount members and 219 general members were selected to provide discounts for equipment use and various information.

Future Plans of Research

In the future, the service support system for small and medium businesses will be strengthened and will contribute to revitalizing consumer-directed joint utilization and research of high-tech equipment.

Image

03

Support technical innovation for small and medium companies

In order to enhance technical innovation capabilities and strengthen the competitiveness of small and medium businesses, a custom-built research development support is provided through utilizing a nationwide high-tech research support network and outstanding R&D resources.

Main Research Activity

In 2012, in order to support technology development of small and medium businesses, 9 research projects were performed with 11 small and medium businesses, such as Isol and Biobud, and Taesun by utilizing research equipment.

Future Plans of Research

In the future, R&D support will be performed to solve difficulties of small and medium businesses by utilizing the best research infrastructure and to create new technology and products of high value through joint utilization of research equipment.

Image

01_ Development of high resolution fault isolation technology for semiconductor failure analysis **02** A development on the mould and the

automatic injection moulding process technology for aspheric ophthalmic lenses

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.

Main Research Activity

In 2012, KBSI held X-Science and Junior Doctor as science and culture projects where a total of 22,997 teens, college students, teachers and others participated.

Program Operation Results

Category	Course	Number of program	Number of participants
X-Science	Experience	445	10,533
	Experiment	75	3,174
	Exploration	48	88
	STEAM related intensive Science Class for high school students	12	213
Junior Doctor		356	10,116
Yusung-gu Sc	ience Mentor	10	420
Honorary Aml	bassador for Science and Creativity	12	343
Total		987	24,887

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

National Research Facilities and Equipment Center

01 Science Class

02_ Remote experiment

Public Understanding Program for Science & Technology

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.

Daejeon : Incheon : Korea Polar Research Institute Korea Advanced Institute of Science & Technology [KAIST] KORDI Chungnam National University Gangneung : Seongnam : D. A. K Korea Hannam University Gangneung-Woniu National University University of Science&Technology [UST] Asan : Soonchunhyang University Chuncheon: High-tech Components and MaterialsCluster Council Kangwon National University Kangwon National University Hospital Korea Research Institute of Bioscienceand Biotechnology Daejeon Hightech Industry Promotion Seoul National Science Museum SungkyunkwanUniversity Cheongwon: Korea Institute of Geoscience and MineralResources Chungbuk Technopark Korea University Cheonan Daejeon Metropolitan City Hall Bibong Elementary School Hongik University Korea University of Technology Hanbat National University Seoul National University Education Hoseo University Mediscov Inc. Sejong University Cheonaiu : Bioneer Corp. Chungbuk Provincial Office LG Sangnam Library Foundation NPC Co., Ltd. Kwangwoon University Chungbuk University DaedeokNet Mine reclamation Corp. (MIRECO) Cheongwon : Osong Medical Innovation Foundation Korea Basic Science Institute Korea Foundation for Gonaiu : theAdvancement of Science & Kongju National University Creativity Gyeryong Mountain Natural History Museum National Institute of Scientific Geumsan : Pohang Accelerator Laboratory Investigation International Ginseng and Herb Research Institute Gyeongsangbukdo Institute ofScience Education SEM Technology Co.,Ltd Poongsan Corp. Daegu: Kyungpook National University Daegu Metropolitan City Hall Ewha Womens University Jeonju : Chonbuk National University Korea Conformity Laboratories Gwangju : Rusan Ahnse Law Offices Chosun University Dong-Eui University Gwangju Metropolitan City Hall Pusan National University Honam University Foundation of Busan Science and Technology Chonnam National University Changwon : Korea Electrotechnology Research Institute Sunchon : Suncheon National University Jeju National University Jeju Free International City Development Center

🍘 서울대학교	한 발 대 학 교		호남대학교 HONAM UNIVERSITY	충북테크노파크	💮 KNU उर्दे सार्थक
KOREA UNIVERSITY	* XNU 강원대학교		김구원 · · · · · · · · · · · · · · · · · · ·	Www.science.go.) 국립중앙과학 National Science Museu	출 · · · · · · · · · · · · · · · · · · ·
NFS 국립과악수사연구원	한국과학창의재단 Possifundfool to the Advectored Classes & Crand	다. (Nonday National UN	학교	SCH 6천왕대 5000 CH 5000 CH	학교 UNI HYANG Ing Finaders
계룡산자연사박물관 Gyeryongsian Natural History Museum		R 한국상명공학연구원	🔊 한국전기연구원	🏟 순천대학교	····· ·······························
ගි성균관대학교 SUNGKYUN KWAN UNIVERSITY	KNU 강원대학교병원	() LG 상남도서	관 🛞 호서대학급 Hoseo UNIVERSI	고 TY · · · · · · · · · · · · · · · · · · ·	패 STY HAN 한남대학교 Hannam Unniversity
(A) 제종대학교 SEJONG UNIVERSITY	한국기술교육대학교 REFELORMENT WITCHERED VIENCETTES		KAIST	🛞 홍익대학교	· 부산대학교 rusan national university
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International Network

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

Appendix

Representative Research Publications in Year 2012

Research Projects in 2012

Installation and Performance Upgrades of Advanced Equipment in 2012

Interview with The Best KBSI Scientist in Year 2012

Representative **Research Publications** in Year 2012

New TEM technique for probing oxygen vacancies in functional oxide materials

Young-Min Kim (1st author), Division of Electron Microscopic Research

Title

Probing oxygen vacancy concentration and homogeneity in solid-oxide-fuel-cell cathode materials on the subunit-cell level (IF : 32.841)

Journal

Nature Materials (2012. 8. 19)

Representative Scientific Instruments Used

Aberration-corrected Scanning Transmission Electron Microscope (STEM)

Authors

J. He(ORNL), M.D. Biegalski(ORNL), H. Ambaye(ORNL), V. Laute(ORNL), H.M. Christen(PRNL), S.T. Pantelides(ORNL), S.J. Pennycook(ORNL), S.V. Kalinin(ORNL), A.Y. Borisevich(ORNL)

Abstract

Lattice spacing profiling from aberrationcorrected STEM image

Example of oxygen vacancy mapping using new TEM technique

Knowing the position of missing oxygen atoms could be the key to cheaper solid oxide fuel cells with longer lifetimes. New microscopy research using aberration-corrected scanning transmission electron microscope is enabling scientists to map these vacancies at an atomic scale. As conducting oxygen ions move through the fuel cell, they travel through vacancies where oxygen atoms used to be. The distribution, arrangement and geometry of such oxygen vacancies in fuel cell materials are thought to affect the efficiency of the overall device. By providing a means to study vacancies at an atomic scale, this new TEM technique will help inform the development of improved fuel cell technologies in a systematic and deliberate fashion, in contrast to trial and error approaches.

Expected Contribution to Science & Technology

A big part of making a better fuel cell is to understand what the oxygen vacancies do inside the materials how fast they travel, how they order, how they interact with interfaces and defects. Now KBSI researcher probe invisible oxygen vacancies and this study will be of direct interest for the exploration of solid-oxide-fuel-cell materials and devices, as well as for understanding the general physics of oxide materials and interfaces.

Coherent electric field characterization of molecular chirality in the time domain

Hanju Rhee (1st author, corresponding author), Seoul center

Title

Coherent electric field characterization of molecular chirality in the time domain (IF: 28.76)

Journal Chemical Society Reviews (2012. 6. 29)

Representative Scientific Instruments Used

UV-visible femtosecond laser system

Authors

Intae Eom(KBSI), Sung-Hyun Ahn(KBSI), Minhaeng Cho(Korea Univ.)

Abstract

Optical activity spectroscopy is a useful and unique tool to characterize molecular handedness (chirality) and provide stereo-specific structural insight into chiral molecular systems. However, more extended applications with conventional approaches have been limited by the extremely weak signal problem. Recently, femtosecond laser-based wave interference methods have been developed to overcome such inherent limitations of conventional methods and allow direct characterizations of coherent chiroptical signals with ultimate sensitivity.

Expected Contribution to Science & Technology

Femtosecond electric field approach to chiroptical measurements promises to open new possibilities of transient electronic or vibrational optical activity measurements in the ultrafast time domain and will allow one to elucidate many fundamental reaction dynamics in physics, chemistry and biology.

Representative **Research Publications** in Year 2012

Image

Comparison between intensity (conventional) and electric field (OA-FID) approaches for chiroptical measurement

Femtosecond chiroptical measurements based on laser wave interference method

Diagnosis of myocarditis using noninvasive MRI

Representative Research Publications in Year 2012

Hyeyoung Moon (1st author) and Kwan Soo Hong (corresponding author), Division of MR research

Title

Noninvasive assessment of myocardial inflammation by cardiovascular magnetic resonance in a rat model of experimental autoimmune myocarditis (IF : 14.739)

Journal

Circulation (2012. 05. 29)

Representative Scientific Instruments Used

4.7 Teslar magnetic resonance imaging system (MRI)

Authors

Hyo Eun Park(CU), Jongeun Kang(KBSI), Hyunseoung Lee(KBSI), Chaejoon Cheong(KBSI), Yong Taik Lim(KBSI), Sang-Hyun Ihm(CU), Ki-Bae Seung(CU), Farouc A. Jaffer(HMS), Jagat Narula(MSSM), Kiyuk Chang(CU)

Abstract

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Quantitative correlation of MNP-CMR and histopathological findings

Head-to-head performance comparison between MNP-CMR and conventional CMR

The feasibility of cardiovascular magnetic resonance (CMR) imaging with magneto-fluorescent nanoparticles (MNPs) for detection of myocarditis and its effectiveness in discriminating inflammation grades were assessed in experimental autoimmune myocarditis (EAM) and control rats. Changes in contrast-to-noise ratio between pre- and post-MNP CMR were significantly greater in EAM rats (1.08±0.10 versus 0.48±0.20; P < 0.001). Compared with conventional CMR, MNP-CMR provided better image contrast (CNR change 8% versus 46%, P < 0.001) and detectability of focal myocardial inflammation. Notably, MNP-CMR successfully tracked the evolution of myocardial inflammation in the same EAM rats.

Expected Contribution to Science & Technology

This MNP-CMR approach could be an effective clinical application in monitoring the evolution of inflammation and response to an inflammatory therapy in myocarditis. Furthermore, MNP-CMR directly visualizes the inflammatory cellular infiltration in the myocardium, and therefore it could be utilized in the clinical trial of myocarditis diagnostic tools.

Observation of Methanol Behavior in Fuel Cells In Situ by Nuclear Magnetic Resonance Spectroscopy

Oc Hee Han (1st author, corresponding author), Daegu Center

Title

Observation of Methanol Behavior in Fuel Cells in situ by NMR Spectroscopy (IF : 13.455)

Journal

Angewandte Chemie International Edition (2012. 4. 16.)

Representative Scientific Instruments Used

200 MHz Solid-state NMR Spectrometer (200 MHz SS-NMR)

Authors

Kee Sung Han(KBSI), Chang Woo Shin(KBSI), Juhee Lee(KBSI), Seong-Soo Kim(KBSI), Myung Sup Um(KIST), Han-Ik Joh(KIST), Soo-Kil Kim(KIST), Heung Yong Ha(KIST)

Abstract

The chemical conversion of methanol in direct methanol fuel cells was followed in situ by nuclear magnetic resonance spectroscopy for the first time as far as we know. Comparing data of the methanol oxidation on Pt/C and PtRu/C anode catalysts allowed the role of Ru in both Faradaic and non-Faradaic reactions to be investigated. In both reactions, the presence of Ru increased methanol amounts completely oxidized.

Expected Contribution to Science & Technology

In situ nuclear magnetic resonance spectroscopy will be employed for developing fuel cell materials and system design with its ability to trace electrochemical reactions occurring in fuel cells. As a result, it will accelerate the commercialization of fuel cells.

Representative **Research Publications** in Year 2012

04

Image

Schemcatic of toroid cavity detector for investigation of fuel cells in situ by nuclear magnetic resonance spectroscopy

Spectra of the fuel cells using PtRu/C and Pt/C anode catalysts acquired in situ by nuclear magnetic resonance spectroscopy

Representative **Research Publications** in Year 2012

Enantioselective Synthesis of alpha-Alkyl-betaketoesters

Geum Sook Hwang (corresponding author), Seoul Center

Title

Enantioselective Synthesis of alpha-Alkyl-beta-ketoesters: Asymmetric Roskamp Reaction Catalyzed by an Oxazaborolidinium Ion (13.455)

Journal

Angewandte Chemie-International Edition (2012. 8. 1)

Representative Scientific Instruments Used 600MHz LC-MS-NMR System

Authors

Lizhu Gao(SKKU), Byung Chul Kang(SKKU), Do Hyun Ryu(SKKU)

Abstract

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lune e er e

⊖ (Tf)₂N

Structure of catalyst and transition state model

00	Zn(BH.).	он о
	CH ₂ Cl ₂ , -45 °C 86% yield	
ent-2 97% ee		6 sitophilate 90:10 dr, 97% ee

Synthesis of the natural pheromone sitophilate

A catalytic route toward chiral α -alkyl- β -ketoesters using the title reaction of α -alkyl diazoester with aldehydes has been developed. chiral α -alkyl- β -ketoesters were successfully synthesized in high yields and excellent enantioselectivities. This methodology was applied to a concise two-step synthesis of the natural pheromone sitophilate.

Expected Contribution to Science & Technology

This catalytic asymmetric method can be applied to the synthesis of various biologically active natural products and drug candidates. In addition, synthetic sitophilate would be used for ecofriendly pheromone trap.

Anisotropic Volume Expansion of Silicon during Lithium Insertion

Young Kyu Han (corresponding author), Division of Materials Science

Title

Anisotropic Volume Expansion of Crystalline Silicon during Electrochemical Lithium Insertion: An Atomic Level Rationale (IF=13.198)

Journal Nano Letters (2012. 9. 17)

Representative Scientific Instruments Used Materials calculation system

Authors Sung Chul Jung (KBSI), Jang Wook Choi(KAIST)

Abstract

By employing first-principles molecular dynamics simulations, herein, we report that the interfacial energy at the phase boundary of amorphous LixSi / crystalline Si plays a very critical role in lithium diffusion and thus volume expansion. While the interface formation turns out to be favorable at x =3.4 for all of the (100), (110), and (111) orientations, the interfacial energy for the (110) interface is the smallest, which is indeed linked to the preferential volume expansion along the $\langle 110 \rangle$ direction because the preferred (110) interface would promote lithiation behind the interface.

Expected Contribution to Science & Technology

Our atomic-level calculations enlighten the importance of the interfacial energy in the volume expansion of Si and offer an explanation for the previously unsolved perspective.

06

Representative **Research Publications** in Year 2012

Image

Volume expansion of Si along (110) direction

Si(100) surface that can bind many Li atoms

Representative **Research Publications** in Year 2012

Development of high efficient energy storage based on 3D macroporous graphene film

Bong Gill Choi (1st author), Division of Materials Science

Title

3D Macroporous Graphene Frameworks for Supercapacitors with High Energy and Power Densities, USA (IF : 11.421)

Journal ACSNano (2012. 4. 23)

Representative Scientific Instruments Used Cyclic voltammetry, Impedance spectroscopy, XPS, TEM

Authors

MinHo Yang(KBSI), Won Hi Hong(KAIST), Jang Wook Choi(KAIST), Yun Suk Huh(KBSI)

Image

2 m-porous graphene film

Ragone plot of the supercapacitor

Abstract

We demonstrate high-performance supercapacitors by building 3D macroporous structure that consists of graphene sheets. These 3D macroporous electrodes were fabricated by using embossing process based on polystyrene colloidal particles. Furthermore, for further capacitance boost, a thin layer of MnO2 was additionally deposited onto graphene film. The porous graphene structure with a large surface area facilitates fast ionic transport within the electrode while preserving decent electronic conductivity and thus endows MnO2/graphene composite electrodes with excellent electrochemical properties.

Expected Contribution to Science & Technology

Our 3D macroporous graphene film has superior electrochemical properties and should be readily applicable to other energy storage and conversion applications with high energy and power densities.

In vivo tumor imaging using polo-box domain of pololike kinase 1 targeted peptide

Sung Min Kim (1st author) and Eun Kyoung Ryu (corresponding author), Division of Magnetic Resonance Research

Title

In vivo tumor imaging using polo-box domain of polo-like kinase 1 targeted peptide (IF 7.404)

Journal Biomaterials (2012.10.01)

Representative Scientific Instruments Used microPET/CT/SPECT

Authors

Sun Mi Yoon, Na Eun Choi, Kwan Soo Hong, Ravichandran N. Murugan, GyungGoo Cho(KBSI)

Abstract

Polo-like kinase 1 (Plk1) is a regulator of cell cycle progression during mitosis; it is overexpressed in many different tumors and has been implicated as a potential antimitotic target. Plks are characterized by the presence of a highly conserved C-terminal polo-box domain (PBD) that is involved in regulating kinase activity. The phosphopeptide Pro-Leu-His-Ser-p-Thr (PLHSpT) is a potent selective inhibitor of the PBD of human plk1 that acts by inducing mitotic arrest and apoptotic cell death in cancer cells. We synthesized cRGDyK-S-S-CPLHSpT to exploit the drug delivery and molecular imaging using positron emission tomography (PET). The peptide was blocked dramatically proliferation of tumor in vitro and in vivo. It was attempted to develop and show a tumor PET image with the radiolabeled-peptide. Here we showed the peptide is promising not only as an anticancer drug, but also as a radioligand for tumor diagnosis with PET.

Expected Contribution to Science & Technology

We expect that our contribution will provide new insights into the design of Plk1 peptide inhibitors and have significant implications for anticancer therapy and tumor diagnosis.

Representative **Research Publications** in Year 2012

08

Image

Illustration of the translocalization pathway showing cRGDyK-S-S-CPLHSpT

PET images of the 68Ga-labed peptide administrated to tumor mice

Representative **Research Publications** in Year 2012

Crustal evolution of northeastern Yeongnam Massif, Korea, revealed by SHRIMP U-Pb zircon geochronology and geochemistry

Nam Hoon Kim (1st author) and Chang Sik Cheong (corresponding author). Division of Earth and Environmental Science

Title

Crustal evolution of northeastern Yeongnam Massif, Korea, revealed by SHRIMP U-Pb zircon geochronology and geochemistry (6.659)

Journal

Gondwana Research (2011, 10, 04)

Representative Scientific Instruments Used

Sensitive High Resolution Ion MicroProbe

Authors

Kye-Hun Park(PKNU), Jeongmin Kim(KBSI), Yong-Sun Song(PKNU)

Image

Geochemical features of Buncheon granite gneiss reflect subduction-related tectonic environment.

Abstract

SHRIMP zircon geochronology reveals that the northeastern Yeongnam Massif evolved from the deposition of metasedimentary rocks during 2.02~1.99 Ga through widespread granitic magmatism at ca. 1.99 Ga to metamorphism and concurrent intrusion of the leucogranite during ca. 1.89~1.84 Ga. The geochemical features of the granitoids reflect a subduction-related environment and derivation from recycled crustal source rocks containing residual plagioclase. The 1.99 Ga granitic magmatism of the northeastern Yeongnam Massif is not found in the Gyeonggi and Nangrim Massifs. All three Massifs, however, show a strong metamorphic imprint at ca. 1.85 Ga, possibly associated with the formation of the supercontinent Columbia.

Expected Contribution to Science & Technology

Our data tightly constrained age for the emplacement of granitoids and deposition of metasedimentary rocks and tectonic environment of granitoids in the northeastern Yeongnam Massif. This results will be used for an important clue to reveal the Precambrian crustal evolution of the Yeongnam and contrast to the Gyeonggi and Nangrim Massif as well as Chinese Cratons.

Sex difference in amygdala subregions

Hengjun J. Kim (1st author), Gyung Goo Cho (corresponding author). Division of MR Research

Title

Sex difference in amygdala subregions: Evidence from subregional shape analysis (5.9)

Journal

NeuroImage (2012.5.1.)

Representative Scientific Instruments Used MRI scanner

Authors

Namkug Kim, Seokjun Hong, Sehyun Kim, Kyungmo Park, Sabina Lim, Jung-Mi Park, Byungio Na, Younbyoung Chae, Jeongchan Lee, Sujung Yeo, Il-Hwan Choe, Seung-Yeon Cho

Abstract

We found the main effect of age in the subregions and the effect of sex in the superficial nucleus, which showed that men had a larger mean radius than women. We also found a sex age interaction in the centromedial nucleus. The radius of the centromedial nucleus in women showed a steeper decline with age.

Expected Contribution to Science & Technology diagnosis of psychiatric disorder

KOREA BASIC SCIENCE INSTITUTE

Representative **Research Publications** in Year 2012

10

Image

amygdala shape analysis pipeline

sex difference in amygdala subregions

Representative Research Publications in Year 2012

Identification of cancer biomarker candidate by ultrahigh-resolution mass spectrometry

Yeong Hee Ahn (1 $^{\rm st}$ author) and Jong Shin Yoo (corresponding author), Division of Mass Spectrometry

Title

Identification of low-abundance cancer biomarker candidate TIMP1 from serum with lectin fractionation and peptide affinity enrichment by ultrahigh-resolution mass spectrometry (IF : 5.856)

Journal

Analytical Chemistry (2012. 2. 7)

Representative Scientific Instruments Used

15T Fourier-Transform Ion Cyclotron Resonance Mass Spectrometer (FT-ICR-MS)

Authors

Abstract

Kwang Hoe Kim(KBSI), Park Min Shin(KBSI), Eun Sun Ji(KBSI), Hoguen Kim(Yousei Medical Center)

Image

Scheme for MS-based identification of cancer biomarker in human blood

Identification of cancer biomarker candidate by FT-ICR-MS

This study utilized matrix-assisted laser desorption/ionization (MALDI) Fourier transform ion cyclotron resonance (FT-ICR) mass spectrometry (MS) to investigate a proteotypic target peptide originating from the tissue inhibitor of metalloproteinase 1 (TIMP1) known to be aberrantly glycosylated in patients with colorectal cancer (CRC). This investigation used L-PHA lectin to compare fractionated aberrant protein glycoforms from both noncancerous control and CRC serum. Each lectin-captured fraction containing aberrant glycoforms of TIMP1 was digested by trypsin, resulting in the tryptic target peptide, surrogate of the serum glycoprotein TIMP1. The results in this study confirm that TIMP1 can be a potent colorectal cancer biomarker candidate.

Expected Contribution to Science & Technology

TIMP1 in human serum is a potent CRC biomarker candidate, demonstrating that ultrahighresolution MS can be a powerful tool toward identifying and verifying potential protein biomarker candidates.

Determining the geographical origin of Chinese cabbages produced in Korea and China

Yeon-Sik Bong (1st author) and Kwang-Sik Lee (corresponding author), Division of Earth and Environmental Science

Title

Determining the geographical origin of Chinese cabbages using multielement composition and strontium isotope ratio analyses (IF : 3.655)

Journal

Food Chemistry (2012. 12. 15.)

Representative Scientific Instruments Used ICP-AES, ICP-MS, TIMS

Authors

Woo-Jin Shin(KBSI), Mukesh Kumar Gautam(KBSI), Youn-Joong Jeong(KBSI), A-Reum Lee(GRAST), Chang-Soon Jang(Hankook Seed Co.), Yong-Pyo Lim(CNU), Gong-Soo Chung(CNU)

Abstract

Recently, the Korean market has seen many cases of Chinese cabbage (*Brassica rapa ssp. pekinensis*) that have been imported from China, yet are sold as a Korean product to illegally benefit from the price difference between the two products. This study aims to establish a method of distinguishing the geographical origin of Chinese cabbage. Chinese cabbages were subjected to multielement composition and strontium isotope ratio (⁸⁷Sr/⁸⁶Sr) analyses. The ⁸⁷Sr/⁸⁶Sr ratio differed, based on the geological characteristics of their district of production. In addition, the content of many elements differed between cabbages from Korea and China. In particular, the difference in the content of Sr and Ti alone and the combination of Sr, Ca, and Mg allowed us to distinguish relatively well between Korea and China as the country of origin.

Expected Contribution to Science & Technology

Our results could be applied to other agricultural food products for which the country of origin is becoming an issue. Also, an integrated classification system for discriminating the geographical origin of various foods will be developed.

Representative Research Publications in Year 2012

12

Image

Cross-plots of combined major elements belonging to the same group of the periodic table: (a) Sr vs. Mg/Ca (b) Sr vs. Ti

Determining the geographical origin of Chinese cabbages produced in Korea and China

Main Projects

Project	Title	Subtitle	Period	Principal researcher	Research fund (Unit: million won)
General	Joint Utilization	Support of Analytical Research		Youngho Chung	5,350
oriented	or Advanced Equipment	Operation of Advanced Multipurpose Mass Spectrometers		Kyunghoon Kwon	1,160
R&D		Operation of Sensitive High Resolution Ion Microprobe		Jeongmin Kim	1,200
Projects		Establishment Management of Analytical System for National Disaster Response		Kwangsik Lee	500
		Establishment and Operation of 2ndSeoulCenter		Kwangsik Lee	928
	Operation of fusion	Operation of High Voltage Electron Microscope (HVEM)		Jingyu Kim	1,108
	inaging equipment	Operation of Magnetic Resonance equipment		Kwansoo Hong	1,702
		Installation and Utilization of Human MRI Research System		Gyunggoo Cho	3,800
		Installation and Utilization of Super Bio-HVEM		Heeseok Kwon	1,900
	Development of high- tech equipment	Equipment Maintenance	12.1.1	Kyungjae Lee	327
		Upgrade of 15T FT-ICR MS Performance and Development of Analysis	~	Hyunsik Kim	140
		Development of High-Precision Thermal-Imaging Microscope System	12.12.31	Geonhee Kim	1,600
		Installation of Small and Medium Accelerators Utilizing the ECR Ion		Misook Won	1,450
	Installation and Promotion of Research Facilities and Equipment	Installation of Research Equipment		Kwangsik Lee	5,718
		Establishment of Joint-Use Equipment for Degenerative Disease Research		Wonjin Moon	850
		Development of Platform Technology and Construction of Analytical Instruments for Fusion Science		Jungju Seo	1,600
		National Research Facilities & Equipment Center Operation Program		Kyungman Yoo	1,550
		Joint Utilization Support of Expensive Special Research Equipment		Donwoo Kim	400
		Development of Multi-disciplinary In Situ Analytical System for Nanotechnology and Related Science		Yunsuk Huh	1,850
Creative R&D Projects	Strengthening Future Research	Strategic Research for Future		Kwansoo Hong	4,020
	Competence	Creative Basic Research		Kwangsik Lee	2,270

In-house Projects

Project	Title	Period	Principal investigator	Research fund (Unit: million won)
Institutional	Space-Time Studies of Characteristic Structures and Dynamics of Biomolecules		Hanjoo Rhee	400
Strategic	PET/MRI Fusion-Imaging Technology Targeted to Cancer Diseases		Kwansoo Hong	300
Research	Brain Research on the Imaging Fusion Technology		Chulhyun Lee	110
	Development of Animal MRI Techniques for Brain Disease Treatment Monitoring		Chaejoon Cheong	185
	Elucidation of Metabolic Pathway and Biomarker Using Metabolic Profiling	10 1 1	Geumsook Hwang	295
	Study on Characterization and Fabrication of Bio-inspired Functional Composites	12. 1. 1	Songwook Her	150
	Unfolded Protein Response (UPR) Signaling Analysis Technology Based on Spectroscopy		Jongbok Seo	80
	Study on Major Depression Using In Vivo Bioluminescence and Fluorescence Imaging	~	Wonjin Moon	100
	Protein-Protein Interaction Structure Analysis and Design of Inhibitor	10 10 01	Haekap Cheong	350
	Study of Amyloid Peptide Fibrillation in Alzheimer ^o Øs Disease Using EPR System	- IZ. IZ. 31	Sunhee Kim	150
	Development of Cryogenic Scanned Probe Tera Hz MRI Nanoscope		Sangkap Lee	300
	Construction of SSimulation Process for Screening of Electrode/Electrolyte Candidates of Secondary		Youngkyu Han	300
	Battery			
	Development of Original Technology for Bio-analysis of the Mechanism of Infectious Disease		Seungil Kim	275
International	$\label{eq:combination} Combination of Small Molecules Targeting Polo-BoxDomain (PBD) of Polo-likekinases 1 (PlK1) \ and \ an$		Jeonggyu Bang	150
Research	Development of Early Cancer Diagnosis Reagents and Markers			
Collaboration	International Joint Research for 3D Dielectric Functional Materials		Wonsik Choi	60
Project	Chronology of Acheulean-type Industries in Korea-Thailand-France: Contributions of Newly Developed	12 1 1	Junghun Choi	50
	Luminescence Dating Methods	~		
	Development of Diagnosis Technology Using PET	12. 12. 31	Eunkyung Yoo	90
	Development of Hybrid System to Improve Accuracy of K-feldspar IRSL dating II		Jongyun Kim	80
	Development of High Efficient Energy Storage Based on 3D Macroporous Graphene Film		Yunsuk Huh	100
	Study of HTS Insert Coil Analysis Technic for Ultra High Magnetic Field NMR		Dongrak Kim	70
Development	Developement of New High Efficient ECDgun Equipment for ultrahigh-resolution mass spectrometry	12 1 1	Myoungchoul Cho	i 180
ofauxiliary	Development of Micro PEP Chromatography Chip for Analysis of Trace Samples	~	Sanggoo Kim	95
systems	Development of Cryogenic High-Sensitive Analysis and Detection Equipment	12. 12. 31	Yeonsuk Choi	150
Seed type	Development of Scientific Forensic Technologies Using Cutting-edge High-tech Analytical Equipment	10 1 1	Jongsoon Choi	250
National Agenda	Research of Resistant Material and Cultural. Environment for Plants using Polyphenol Metabolomics	۱ <u>۲</u> . ۱. ۱ ~	Jongsung Jin	150
Project	Development of High Sensitivity Portable Mass Spectrometer	12. 12. 31	Hyunsik Kim	150

In-house Projects

Project	Title	Period	Principal investigator	Research fund (Unit: million won)
Seed type	Development of Isotope Technology for Country-of-origin or Authenticity Discrimination for Foods	12, 1, 1	Kwangsik Lee	130
National Agenda	Development of Country-of-origin or Authenticity Discrimination Techniques for Foods		Geumsook Hwang	j 70
Project	Development and Application of Real Time Drug Repositioning Technology	IZ. IZ. 31	Jiwon Lee	150
Frontier Research	Developing 3-Dimensional High Resolution Molecular Imaging Using HVEM	12. 1. 1~12. 12. 31	Hyunsuk Jung	44
Support for	Study on Nano-crystalline Ru-based Ternary Thin Films by Atomic Layer Deposition		Taeeun Hong	70
Collaborations	Study of Plant Disease Responses Using Lipidomic Profiling		Myunghee Nam	70
between KBSI	Developing Analytical Method for Mercury and Arsenic Species.		Hyeon Yoon	70
and	Development of High Efficiency Nano Structured LED		Jaesil Yoon	70
Universities	Development of Electrode Materials of Li Secondary Batteries Using Metal Oxide		Yangsoo Kim	70
	Culture of Microalgae and Development of New Potential Materials		Daekyung Kim	70
	Protein Analysis Using an Online Monolithic Trypsin Immobilized Enzyme Reactor with Dual Tandem	-	Geon Cho	70
	Mass Spectrometry	12. 1. 1 ~		
	Identification and Functional Study of novel Wnt Signaling-associated Kinases	12. 12. 31	Geonwha Kim	70
	Discovery of Mitochondria-targeted Necrosis-inducing Substances and Study of Mitochondrial		Youngwoo Suh	60
	Fragmentation Types			
	Study of Functions of Ets1 Genes and Disease Mechanisms Using Fusion of Genome Design Technolog	ĴУ	Seunghae Kwon	60
	and Zebra Fish Generation			
	Development of Trace Element Distribution Imaging of Geological Samples		Chansoo Park	60
	Study of Physical Properties on Cu2ZnSnS4ThinFilmSolarCellbyUsingPulsedLaserDeposition		Jongseong Bae	60
Support	Study and Applications of Smart Nanostructure Using Self-assembled Polymer		Hajin Lee	60
for Young	Mg Isotope Behavior and Fractionation Caused by Chemical Weathering		Jongsik Ryu	70
Scientists	Understanding the Structure and Stability of Ligand-Stabilized Metal Clusters		Youngkyu Han	25
	Fabrication of SERS Active Nanostructure and Its Application Studies for Low Concentration Analysis of		Yunsuk Huh	25
	Protein			
	Synthesis and Characterization of Hollow Nanostructures for Energy Storage	-	Jinbae Lee	25
	Biocompatible Nano-medicine-based Osteoporosis-Control Study	~ 12. 1. 1	Kyungsoon Park	70
	Study of Functional Structure of Mass Spectrometry based-RBC membrane protein	12. 12. 31	Yosep Kwon	70
	Study of Change in Major Greenhouse Gas Emission Characteristics in Forests and Agricultural Soils		Dongho Lee	61
	Caused by Artificial Nitrogen Influx			
	Real-time Observation and Nanoscale Analysis of Low-Dimensional Nanostructures and Their		Woonggi Hong	60
	Oroperties-Coupling Behaviors by Mechanical Strain			
	Analysis of Electron Transport Characteristics of Functional Electron Spin Devices		Seungyoung Park	60

Commissioned Projects

Project Title

Collaborative Research by the Graduate School of Analytical Science and Tec Project for the Youth's Science Activity Utilizing State-of-the-art Equipmen Study on Antiasthmatic Drug and Development of Effective Substances using OM Developing Exchange Program to Build a Solid Foundation of Global Networking on Cell Dynamics Development of Ultra Precision Optical Machining Technology Support of Advancement of Collaboration System of Research Facilities Equipment and Long-Term Plan Project for Setup and Operation of the High-technology Components & Materials Research Sample Injection Part and Electronic System Development of High Sensi Portable Mass Spectrometry Characterization of Novel Proteins and Metabolites of marine Bacteria & Archea Using Proteomic Platform Technology Development of Antifreezing Material Using Glyco Peptoid-Peptide Hybri Analysis of Facilities and Equipment Subject to Feasibility Examination of National Research and Development Project in Second Half of 2011 Development of Core Technology for Precise Specimen Movement Development of Scientific Forensic Technologies Using Cutting-edge Hig Analytical Equipment Development of National Research Facilities and Equipment Information Service for Joint Utilization Study of Safety Management of PBBs in Food Cell-chip-based Bio-mimetic Protein Network Express (Development of Sensitivity Imaging HSC Fusion Platform) Development of Nanostructured Materials for Hydrogen Storage (Develo of Nanostructured Materials for Hydrogen Storage) Development of Spin Device Measurement Statistics of Material Flow by Metal and Business Support Management Development of Pulse Sequence for Tissue Separation from Single Imag Production and Structure Determination of the Designed Repeat Protein Development of Nanoscale Scanned Probe Tera Hz Spin Imaging Micro Yuseong-gu Science Mentor for Youth MIR Physical Property of Contrast Materials for Development of contrast A Development of High Magnetic Field Cryogenic Probestation Operation of National Science and Technology Ambassador (2012) Analysis of Facilities and Equipment Subject to Feasibility Examination of National Research and Development Project in Second Half of 2011 Simultaneous Stable Isotope Analysis for Discriminating the Origin of Pollutants and Development of Method to Assess Fluorine Level in Soil and Waste and F for contaminated Site Monitoring Survey of Galena Deposits from South Korea and Basic Research of Pb

	Principal researcher	Period	Research fund (Unit: million won)	Partner
chnology	Youngmok Park	09.4.1~ongoing	11,000	National Research Foundation of Korea
nt	Sukkeon Hong	04.1.1~ongoing	8,800	Korea Foundation for the Advancement of Science and Creativity
IC 2010	Hyunsik Kim	10.8.1~13.11.30	375	Chungbuk Technopark
	Hyunsuk Jung	11.12.27~12.10.26	5 10	Korea Research Council of Fundamental Science & Technology
	Geonhee Kim	11.12.15~14.10.14	4 900	Korea Astronomy and Space Science Institute
and	Kyungman Yoo	11.12.1~12.2.10	45	Korea Institute of S&T Evaluation and Planning
Center	Euhduck Jung	04.10.1~ongoing	20,217	Busan Metropolitan City
itivity	Seungyong Kim	12.1.1~12.12.31	100	Bioneer Corp.
	Seungil Kim	07.1.1~13.12.31	1,580	Korea Institute of Ocean Science & Technology
ide	Jeongkyu Bang	11.1.1~12.12.31	100	Korea Polar Research Institute
	Kyungman Yoo	12.2.1~12.3.31	30	Korea Institute of S&T Evaluation and Planning
	Younjoong Kim	05.9.1~14.12.31	1,810	Korea Research Institute of Standard and science
gh-tech	Kwangsik Lee	10.12.15~16.12.31	4,730	Korea Research Institute of Standard and science
١	Donwoo Kim	06.1.1~ongoing	6,594	Korea Institute of Science and Technology Information
	Jungju Seo	12.1.1~16.11.30	400	Pohang University of Science and Technology
High	Soohyun Kim	10.7.1~16.2.29	5,500	National Research Foundation of Korea
opment	Haejin Kim	09.5.1~13.3.31	8,440	Hydrogen Energy R&D Center
	Seungyoung Park	11.7.15~17.2.28	817	Korea Advanced Institute of Science and Technology
	Jaesik Yoon	12.1.1~12.12.31	50	Korea Institute of Industrial Technology
ging	Chulhyun Lee	12.3.1~12.10.31	80	Samsung Advanced Institute of Technology
IS	Haekap Cheong	09.3.1~14.2.28	675	Korea Advanced Institute of Science and Technology
scope	Sanggap Lee	12.4.1~12.7.31	24	National Research Foundation of Korea
	Daewon Lee	12.4.1~12.10.31	11	Yuseong-gu Office
Agents	Jihyun Cho	12.3.1~12.12.31	10	Hanwah Chemicals
	Seongyoung Park	12.4.1~15.3.30	135	MSTech
	Daewon Lee	12.4.1~12.11.30	3	Korea Foundation for the Advancement of Science and Creativity
	Kyungman Yoo	12.4.1~12.6.30	30	Korea Institute of S&T Evaluation and Planning
Protocol	Jongsik Ryu	11.4.1~13.3.31	100	Kunsan National University
Protocol	Hyeon Yoon	12.4.1~15.3.31	445	Korea Environmental Industry and Technology Institute
sotopes	Yeonjoon Jung	12.4.18~12.11.30	151	National Research Institute of Cultural Heritage

ANNUAL REPORT 2012

Commissioned Projects

Project Title	Principal researcher	Period	Research fund (Unit: million won)	Partner
Analysis of Radioactive Metabolites Using Ultrahigh-resolution Mass Spectrometry	Kyunghoon Kwon	12.1.1~12.12.31	20	Korea Atomic Energy Research Institute
Technical Development for Discrimination of Herbal Medicine Using Metabolism Analysis	Geumsookk Hwang	12.3.1~12.11.30	70	Korea Institute of Oriental Medicine
Operation of Junior Doctor(2012)	Seokwon hong	12.5.1~12.10.31	350	Daejeon Metropolitan city
Multi-sensors for Heavy Metals and Pretreatment System of Refractory Organic Matrix	Janghee Yoon	11.8.1~14.4.30	845	Korea Advanced Institute of Science and Technolog
Smart Nanoporous Materials for Stimuli-Responsive Controlled Release	Weonsik Chae	11.5.1~14.4.30	172	National Research Foundation of Korea
2H{19F} REDOR NMR Spectroscopy for the 3D Bioactive Structure of Epothilone Anticancer Drugs	Yoongi Baek	11.5.1~16.4.30	171	National Research Foundation of Korea
Development of Solid NMR to Analyze Characteristics of Energy Density Electrodes	Deokyoung han	12.1.1~12.12.31	20	Korea Institute of Science and Technology
Mechanism of Oxidative Stress in Neurodegenerative Disorders	Youngmok Park	09.4.1~13.3.31	430	Korea University
Establishment and Operation of Jeju Center (at expenses of Jeju Province)	Daekyoung Kim	08.4.3~12.12.31	700	Jeju Special Self-Governing Province
Development and Synthesis of Nano (rod, wire, bulk)-type Photocatalysts for	Taeeun Hong	09.5.1~13.3.31	280	Pohang University of Science and Technology
MALDI-TOF for the Diagnosis of BRCA Mutation and Genitourinary Infection pathogen	Myoungchoul Choi	11.12.1~14.11.30	300	Korea Electronics Technology Institute
Development of Multiple Diagnostic and Therapeutic Technology in Cardiovascular	Geumsook Hwang	12.5.25~12.6.25	7	Korea Research Council of Fundamental
Disease Using Fusion Research of metabolomics and Bio-imaging	J			Science and Technology
Technology Detection and Transfer to Daedeok Innopolis (2012)	Jongsoon Choi	12.5.1~12.12.15	14	Daedeok Innopolis
Convergence Research Center Program for Mass Spectrometry based	Jongshin Yoo	09.7.10~14.6.30	22,088	Conversing Research Headquarters for Fronti
Clinical Diagnositic Analysis	-			Medical Instruments
Research of Systemic Analysis of Rare Metal Materials	Jaesik Yoon	12.6.14~12.10.30) 35	Korea Institute of Industrial Technology
Development of Antibody Characterization Platform Technologies for	Hyunsik Kim	11.6.1~16.5.31	1,398	Hannam University
Antibody-Biobetter (Development of Antibody Characterization-Based				
Technology for Antibody biobetter)				
Research of Resistant Material and Cultural Environment for Plants Using Polyphenol Metabolomics	JongsungJin	11.7.1~14.6.30	1,872	Busan Metropolitan City
Extension of Shelf Life of High Nickel Anode Material (Ni ≥0.6) at High Temperature (60°C)	Youngkyu Han	12.6.1~15.5.31	330	Korea Electronics Technology Institute
Development of Cosmetics for Sensitive Skin Using Human Heat Shock Protein (HSP90a)	Younguk Cho	12.7.1~13.6.30	48	Regeron
Characterization and Basic Design of CO2 Capture Facilities for Assessment	Kiwook Lee	12.1.1~13.12.31	230	Korea Institute of Geoscience and Mineral
The Support Program for the Advancement of National Recearch Eacilities and Equipment	Kyungman Yoo	10.2.2~ 계소	4,500	National Science & Technology Commission
Study of Structural Properties and Electron Transfer Mechanism	looban Lee	09.7.1~14.6.30	600	Korea Research Institute of Chemical Technolo
inOrganic/Inroganic Hybrid Device Interfaces	JOUIIAIT Lee	0,1,1,1,1,1,0,000	000	
Research of Manufacture in Second confection of Atom Isolated in Silicon Crystal in	Sanggap Lee	11.7.1~13.6.30	24	National Research Foundation of Korea
Cryogenic High Magnetic Field		10/1 1/201	/00	
Study on the Factors Affecting Lithium Adsorbent Capacity and the Controls of Physicochemical Process in Marine Environments	Hyeon Yoon	10.4.1~14.3.31	400	Korea Institute of Geoscience and Mineral Resourc
Development of NMR Based Metabonomics/Chemometrics for Diagnosis and Treatment of Chronic Kidney Disease	Geumsook Hwang	10.6.30~15.6.29	750	Kyungpook National University
Research Equipment Engineer Training Project	Kyungman Yoo	12.7.20~13.9.30	1,080	National Research Foundation of Korea
Development of CO2 Storage Facility Monitoring Technology and Its Application to sites	Kwangsik Lee	12.6.1~20.5.31	6,121	Korea Institute of Geoscience and Mineral Resourc
Development of High Resolution Infrared Optical System and LIT Modules	Geonhee Kim	12.7.1~17.6.30	2,000	Electronics and Telecommunications Research Institu
Research Network for Research and development of Secondary Batteries and Fuel Cell electrodes	Deokyoung Han	12.8.13~13.6.12	10	Korea Research Council of Fundamental Science and Technology

Commissioned Projects

Project Title	Principal researcher	Period	Research fund (Unit: million won)	Partner
Non-toxic Nanobio Obesity Therapy Based on bio-engineering, nanobio technology and particular imaging.	Younggok Cho	12.8.13~13.6.12	2 10	Korea Research Council of Fundamental Science and Technology
Fusion Research of Brain Cognitive Signals and Electronic Processing Technology	Sanggul kim	12.8.13~13.6.12	2 10	Korea Research Council of Fundamental Science and Technology
Development of Industrial Microorganism Using Integrated Omics	Yosep Kwon	12.8.13~13.6.12	2 10	Korea Research Council of Fundamental Science and Technology
Research of Multi-disciplinary Fusion Imaging for Development of Antiviral Treatment	Jaekyung Hun	12.8.13~13.6.12	2 10	Korea Research Council of Fundamental Science and Technology
Development of Lap-on-a-chip Multichannel Spectral Imaging System and Application Technology	Geonhee Kim	12.8.13~13.6.12	2 10	Korea Research Council of Fundamental Science and Technology
Development of new method for advanced Li adsorbent (Production of Seawater Li adsorbent and Assessment of Performance)	Yangsoo Kim	12.7.1~12.8.30	14	Institute of Industrial Science and Technology (POSCO)
Development of Multidiagnosis and Treatment Technology for Cardiovascular Diseases Through Metabolomics and Biomedical Imaging Fusion Research (Identification of Biomarkers and Development of Fusion Imaging Diagnostic Technology Based on Integrated Metabolite Research)	Geumsook Hwang	12.7.27~18.7.26	5 12	Korea Research Council of Fundamental. Science and Technology
Research of Conversion of Atmospheric Particles Through Multi-sensors for Heavy Metals and Pretreatment System of Refractory Organic Matrix	Jooae Kim (supported by Haeon Yoon)	12.9.1~13.6.30	60	Center for Women in Science, Engineering and Technology
Development of Property Measurement, Control and Instrumentation in High Magnetic Field and Cryogenic Environment	Yoonah Lee (supported by Dongrak Kim)	12.9.1~13.6.30	60	Center for Women in Science, Engineering and Technology
Development of nanostructured materials for hydrogen storage	Jinbae Lee	11.9.1~12.12.31	15	National Research Foundation of Korea
Mechanism of Marine Microorganism ^o Øs Adaptation to Environmental Stress Using Proteom in Bioscience	Yeonju Kwak (supported by Youngho Chung)	12.9.1~13.6.30	60	Center for Women in Science, Engineering and Technology
Functional Control of Nanoparticle-Superlattice Structures	Myeongjin Lee (supported by Wonsik Chae)	12.9.1~13.6.30	60	Center for Women in Science, Engineering and Technology
Analysis Using HVEM to Identify High Resolution Electron Crystallogarphy of Membrane Protein in Structural Biology Using Electron Microscopy	Hyonam Park (supported by Jaekyung Hyun)	12.9.1~13.6.30	60	Center for Women in Science, Engineering and Technology
Study on Immune Cell Infiltration by In Vivo MRI in Animal Autoimmune Myocarditis	Kwansoo Hong	11.9.1~14.8.31	597	National Research Foundation of Korea
NBIT based Kinase Signaling Control	Youngho Chung	12.7.27~18.7.26	2,400	Korea Institute of Science and Technology
Isolation and Bioprospecting of Novel Species of Archaea from $\ $ Extreme Environments	Seongmoon Noh	12.9.1~15.8.31	163	National Research Foundation of Korea
Development of Pathogenesis and Diagnosis of Heart Failure Using Metabolomics	Youngsik Hong (supported by Kwansoo Hong)	12.9.1~17.8.31	750	National Research Foundation of Korea
Protein Network Analysis of Hydrogen Production of Thermococcus onurineus NA1 using proteomics	Youngho Chung	12.7.1~13.6.30	100	Korea Institute of Marine Science&Technology Promotion
Analysis of Recycling Magnesium Ingot and Impurity with Different Processes	Jongseong Bae	11.7.1~13.6.30	40	Korea Institute of Industrial Technology
Peptide Nanoarchitecture: Paradigm Shift in Cancer Therapeutics	Seonhee Kim	11.8.1~13.7.31	130	Yonsei University
Development and Application of Carbon Dioxide Adsorb Using a state-of-the-art instruments	Hajin Lee	10.11.1~13.9.30	360	Korea Electric Power Research Institute
Development of Ultra-small Sensor Module for Uncooled Thermal Cameras	Kisoo Chang	11.9.1~13.8.31	245	Clairfixel
Separation Method for an Humira Antibody Drug Variant	Hyunsik Kim	12.11.1~13.10.3	31 10	Aprogen

Commissioned Projects

Project Title	Principal researcher	Period	Research fund (Unit: million won)	Partner
Analysis of Degradation Mechanism and Improvement of Durability in PEMFC	Seokhoon Lee	11.9.1~21.8.31	970	Korea Institute of Energy Technology Evaluation and Planning
Development of Organic-inorganic Nanohybrid Anode Materials for High-power Lition Battery	Youngkyu Han	10.9.30~16.9.29	2,880	National Research Foundation of Korea
Studies of Regulatory Mechanisms on the Extracellular Secretion of ARF Cytokine	Hyunsuk Jung	11.8.22~19.8.31	800	Korea University
Diagnosis of Myocarditis Using Magnetic Nanoparticle Contrast Agent-Based MRI	Kwansoo Hong	11.11.1~14.10.3	1 240	Korea Health Industry Development Institute
Development of Natural Ingredients for the Control of Obesity	Eunjung Bang	11.12.1~13.11.3	D 119	Unigen
Analysis of Marine Biology in Microalgae	Hyeyoung Yang (supported by Daekyung Kim)	12.12.1~13.6.30	18	CenterforWomen in Science, Engineering and Technology
Culture of Microalgae and Development of New Potential Materials	Narae Lim (supported by Daekyung Kim)	12.12.1~13.6.30	18	CenterforWomen in Science, Engineering and Technology
Study on Antiasthmatic Drug and Development of Effective Substances Using OMC 2010	Hyunsik Kim	10.8.1~13.11.30	375	Chungbuk Technopark
Development of Tube Fitting on the Purpose of the Semiconductor below the Amount of Gas Leakage, $1x10^{\circ}$ std.cc/sec.andSurfaceRoughness,0.08Ra(μ m)	Myeongkyu Hah	11.10.1~13.9.30	56	Dong Bang Tech. Co. Ltd.
Cooperative Network for R $$ & D of Nano Materials for Future High Technology	Woongki Hong	12.12.21~13.12.	20 12	Korea Research Council of Fundamental Science and Technology
Analysis of Aging Research Equipment Status in Research Institution and Study on Improvement	Kyungman Yoo	12.12.28~13.8.2	7 160	Korea Research Council of Fundamental Science and Technology
Strengthening TLO Competence for KBSI	Seunghee Lee	12.12.28~13.8.2	7 33	Korea Research Council of Fundamental. Science and Technology
Development of Parallel RF Coils for Cardiac MR Imaging	Chulheon Lee	11.6.1~13.5.31	295	Korea Association of Industry, Academy and Research Institute
Development on the Yield, Purification and Resue of Precursor for LED	Jaesik Yoon	11.7.1~13.6.30	217	Korea Technology & Information Promotion Agency for SMEs
Discovery and Development of Diagnostic Marker Using Membrane Vesicle Proteins and Secreted Proteins	Seungil Kim	12.6.25~14.6.24	290	Korea Technology & Information Promotion Agency for SMEs
Development for Surface Modification of Metal Electrode Terminals and Energy Cell Sealing Technology Through the Surface Analysis Technique	Euhduck Jung	12.6.25~14.6.24	229	Korea Technology & Information Promotion Agency for SMEs
Development of 0.1 µm Resolution Portable Protecting Film Thickness Gauge Using Magnetization Analysis	Seungyoung Park	12.6.25~14.6.24	200	Korea Technology & Information Promotion Agency for SMEs
Development of Continuous System for Reuse of Precursor for LED Using ICP- MS and NMR Analytical Equipment	Jaesik Yoon	12.6.25~14.6.24	249	Korea Technology & Information Promotion Agency for SMEs
Development of Composite Technology for Separation of High-Performance Magnetic Nano Absorbent-superconducting high magnetic field for Disposal of Livestock Wastewater	Gyehaeng Lee	12.6.25~14.6.24	300	Korea Technology & Information Promotion Agency for SMEs
Development of High Resolution Fault Isolation Technology for Semiconductor Failure Analysis	Kisoo Chang	12.6.25~14.6.24	274	Korea Technology & Information Promotion Agency for SMEs
Development of Natural Circulating Cooling-type Cryogenic Insert System for High Performance Analyzer	Yeonsuk Choi	12.6.25~14.6.24	260	Korea Technology & Information Promotion Agency for SMEs
Development of Large-sized Intelligent Anti-fungal, Angi-bacterial Microneedle Molding Technology Through Introduction of SPM-Raman-Confocal Analysis/Assessment	Yunsuk Huh	12.6.25~14.6.24	300	Korea Technology & Information Promotion Agency for SMEs
Development of a Secondary Battery CAN Parts Through the Chemical Bonds Between Lightweight Low Price Polymer and Metal	Euhduck Jung	12.6.1~14.5.31	100	Korea Association of Industry, Academy and Research Institute

Installation, Upgrades of Advanced Research Equipment in 2012

Equipment

* Standard: installation fee over 100 mill. won

Performance Upgrades * Standard: upgrade fee over 50 mill. won

Equipment Installed

	800MHz NMR Cryogenic Probe
	MALDI-TOF/TOFMS
	TOF-SIMS
	Multi Collector Noble Gas Isoto
	Wavelength Dispersive X-ray Fl
	Next Generation Genomic DNA
	SFC System
	Cryocooler System
	700MHz NMR Spectrometer
	Hybrid FT-ETD MS Analyzer
	UC-EF-TEM
	Isotope Ratiomass Spectromet
	Ultra-Centrifuge Systems
	High-speed Mass Spectromete
	ICP-AES
	MALDI Hybrid Tandem Mass S
	Ultra low-level liquid scintillation
	Protein Sequencing Systems
	Fluoresence Microscopic Body
	Magnet Power Supply
	Automated Isothermal Titration
	Exchanges Both the Compress
	Elemental Analyzer
	EDS for FE-TEM
	Upgrade of Raman Spectrosco
	Semiconductor Parameter Ana
	TEM Gun and Assessory for lor
	Automated Image Cytometry
	600 MHz NMR and Microimagi
	Cavity Ring-Down Spectroscop
	5mm HX-MAS Probe for 600M
	Detector Up-Grade of All Chan

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ead	Division of MR Research
	Seoul Center
	Busan Center
e Ratio Mass Spectrometer	Division of Earth and Environmental Science Research
prescence Spectrometer	Gangneung Center
Sequence Analyzing System	Division of Life Science Research
	Seoul Center
	Division of Materials Science Research
	Division of MR Research
	Division of Mass Spectrometry Research
	Division of Electron Microscopic Research
•	Division of Earth and Environmental Science Research
	Division of Life Science Research
	Division of Mass Spectrometry Research
	Division of Earth and Environmental Science Research
ectrometer	Division of Mass Spectrometry Research
counter	Division of Earth and Environmental Science Research
	Seoul Center
	Division of Life Science Research
	Division of Materials Science Research
Calorimeter	Division of MR Research
r and Cold Head	Division of Mass Spectrometry Research
	Seoul Center
	Gwangju Center
/	Jeonju Center
zer	Jeonju Center
Pump	Jeonju Center
	Division of Life Science Research
g System	Division of MR Research
	Division of Earth and Environmental Science Research
z SS NMR	Daegu Center
el Spectrum Laser Confocal Scanning Microscope	Gwangiu Center

Interview with The Best KBSI Scientist in Year 2012

Scientist Pursuing New Continuously Challenges!

Dr. Oc Hee Han, Division of Analytical Research, Daegu Center

Every year, the "KBSI Researcher of the Year Award" is given to recognize the commitment of an employee who has made innovative and outstanding research achievements throughout the year. Dr. Oc Hee Han was chosen as The Best KBSI Scientist in Year 2012 for development of analytical methods, including toroid cavity detectors, using various nuclear magnetic resonance (NMR) techniques to identify the correlation between the performance of fuel cells and electrochemical reactions occurring in the fuel cells.

Q1. How do you feel about receiving the "2012 KBSI Scientist of the Year Award"?

A. I am thankful for being the recipient of The Best KBSI Scientist Award in Year 2012. I regard the award as an encouraging message of "to be better in the near future". Because this is the best award in the institution, I feel the recognition of my research quality by my colleagues. Although I have received greater awards from the government and academic society many times, such as "Scientist & Engineer of This Month" from MIST, "Memorial Award of Jo Woong Lee" from KMRS, and "Women Scientist and Engineer of This Year" from MEST, this award is special to me because of my colleagues' recognition.

 \square

Q2. Can you give me a brief summary of the research you have carried out?

A. We have carried out the "development of nuclear magnetic resonance (NMR) methods" and "investigation of atomic level structures of functional materials". NMR can observe structures and dynamics at the same time. Using this advantage of NMR spectroscopy, we have developed the analytical methods to investigate energy conversion systems, such as fuel cells and batteries and their constituents since 1999. Among the results, the demonstration of the in situ technique using solidstate NMR spectroscopy, published last year, has provided a foundation for the development of better fuel cells.

Q3. What are your future research plans?

A. First of all, I will continue the research on electrochemistry using NMR spectroscopy. It is because more research is still demanded in the areas of energy conversion and storage systems (such as fuel cells, batteries, and super capacitors) and related materials. At the same time, this research area can be the basis for various interdisciplinary researches. When I feel that I have done enough, I might switch to "signaling

mechanisms in bio-systems" and/or "brain science". Signaling in bio-systems is done through chemical and electric pathways; it is related to electrochemistry. I have dreamed of publishing 2 papers satisfying my standard, but it has not come true, yet. Sooner or later my dream will come true.

Q4. Do you experience any difficulties or advantages as a female scientist?

A.I believe in individual ability/effort, but gender difference affects the quality of learning and research. It might be more difficult for female scientists to build up their identity by cultivating good female characters which have been regarded as traits to get rid of in male dominated societies. I myself had difficulty finding role models nearby since there have not been many female scientists in universities/ laboratories. Of course, there is a large difference among individuals, but in general, women tend to have a greater awareness of equality and conduct experiments more meticulously. They say women are more likely to be "transformational leaders" and I agree.

Q5. What are the most rewarding experiences and maior achievements as a scientist?

A.I would like to say the best achievement is "yet to come" since my research is going better and better for me. At the same time, I can tell myself "Well done, I am very proud of you!". I am also thankful to have a chance to lend my hands to junior researchers who seek advice from me.

¹⁾Transformational leader: This term was first used in 1978 by James MacGregor Burns, an American politician. It refers to a leader who is equipped with a strong sense of morality and gives his/her followers inspiration and motivation satisfying their high standards to make them willing to follow him/her. The opposite is a transactional leader who makes people complete their tasks by using sticks and carrots.

KBSI Annual Report 2011

Organizing Committee

Chairman	Jae Yun Kang (Director of Division of R&D Cooperation)		
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	Ji Hyen Cho (Division of MR Research)	Ochang Center	Magnetic resonance
	Jae Kyung Hyun Division of Electronic Microscopic Research)		Age determinating r KBSI Ochang Center, 804 I TEL: +82-43-240-5114
	Jeon Heon Choi Division of Earth and Environmental Science Research)	Seoul Center	Metabolomics, Envir
	Seung Yong Kim (Division of Mass Spectrometry Research)		TEL: +82-2-920-0700
	Gye Hang Lee (Division of Materials Science)	Busan Center	Surface physical pro
	Jong Bae Park (Jeonju Center)	Busan center	High Technology Compo
	Dong Woo Kim (Leader of NREC Equipment Utilization Team)		TEL: +82-51-974-6102
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KBSI A	nnual Report 2012	Gwangju Center	Degenerative diseas
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Date of Issue	e May 2012		
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