NIMS NOW International

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Feature on collaboration promotion:

“The true value of materials is in their use”

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– Promoting collaboration with companies to return research results to society through practical application –

Collaboration with other organizations having technologies not available to NIMS is an important measure for achieving greater research results by combining each one’s specialty areas. NIMS has been actively promoting collaboration with universities, public research institutes, private companies, and the number of such collaborations reached over 350 in FY2007. As one of NIMS missions, it is particularly important to collaborate with private companies which are actually producing and using materials for the dissemination of research results and promotion of their applications. Here we introduce various collaboration activities with private companies now being promoted by the Collaboration-Promotion Office to utilize research results for the benefit of society.

Kensaku Murakawa
General Manager
Collaboration-Promotion Office
Planning Division

Collaboration activities

Collaboration activities at NIMS are grouped into several types, including supply of samples, technical consultations, joint research, and entrusted research. Collaborations start from various reasons, we hold NIMS Forums, NIMS Evening Seminars, and participate to a diverse range of technical exhibitions in order to create opportunities to communicate our research results and technological potentials to private companies. Then, we match the needs of companies found during these events with the seeds of NIMS, and turn them into concrete collaboration through in-depth discussions at private seminars.

Sample supply

- Sample supply of NIMS-developed new materials to companies with a view to developing joint research, etc.

Technical consultations

- Prior study before stepping up to joint research, licensing, etc.
- Technical consultations and instructions based on NIMS’ fundamental research

Funded joint research

- Joint research aimed at practical application, with funds provided by companies
- NIMS undertakes fundamental research and companies perform application research.

Entrusted research

- NIMS undertakes research at the request of companies, etc.

▶ NIMS Forum

Comprehensive research results in all research fields are presented at annual NIMS Forum for publicizing the details of ongoing research at NIMS and their latest achievements. NIMS Forum consists of oral sessions (oral presentations) introducing research results and poster sessions focusing on technology transfers. Through lectures on hot research topics and exhibitions of sophisticated devices and technologies, a wide variety of research having high potential for practical application are introduced in detail. We also provide a section for cousultation where NIMS researchers are available to answer specific questions from participants. The report for the FY2008 NIMS Forum held in October is shown on pages 10 and 11 of this newsletter.

▶ NIMS Evening Seminar

Aimed at introducing NIMS research to people from other organizations including industry, NIMS evening seminars are held monthly under various themes. NIMS researchers specializing in these fields directly explain the outlines of their research. The seminar opens to everybody who is interested and there are many cases that have developed into private seminars or joint research as a result of encounters at these seminars.

NIMS Evening Seminar

Starting April of 2009, the seminar will more focus on fostering engineers and introduce science and technologies at NIMS research field more understandable for attendees. Anyone who is interested is welcome to these seminars.

Titles of NIMS Evening Seminars

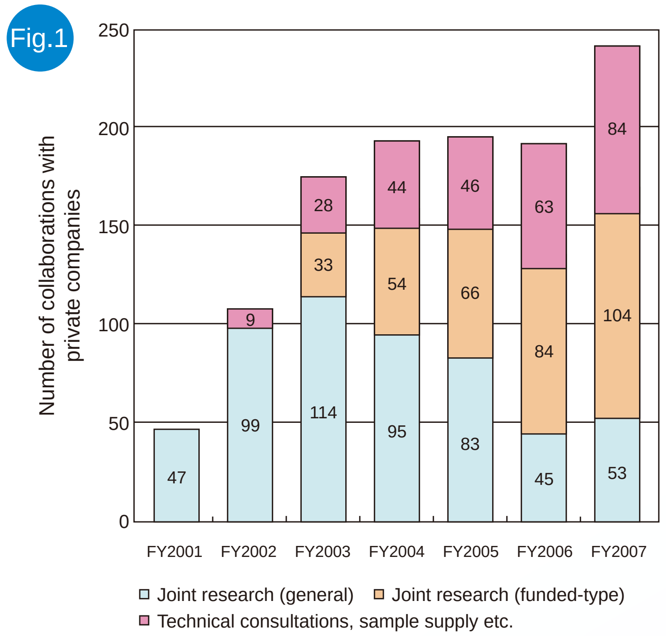
56th	New developments in thin film materials
57th	Research into coating and composite materials at NIMS
58th	Introduction of research at the Computational Materials Science Center
59th	Research into glass, lamellar compounds, and joining technologies at the Advanced Nano Materials Laboratory
60th	Introduction of research at the Innovative Materials Engineering Laboratory
61st	A-Ultra supercritical for reducing CO_2 and solving energy problems: R&D of heat-resistant steel at NIMS
62nd	Towards the integration of nano functional structures
63rd	Supporting exploratory research into materials －from creation to analysis and evaluation
64th	Forefront of nano architectonics －innovative materials explored by young and energetic researchers
65th	Recent developments in superconductive metals
66th	Advanced research into organic devices at NIMS

▶ Private Seminar

NIMS and a company exchange information on mutual “seeds” and “needs” to search for approaches to collaboration under non-disclosure agreements at the private seminars. So far, This seminars have been held over 40 times with approximately 20 companies, and have resulted in the establishment of collaborations including joint and entrusted research with specific themes.

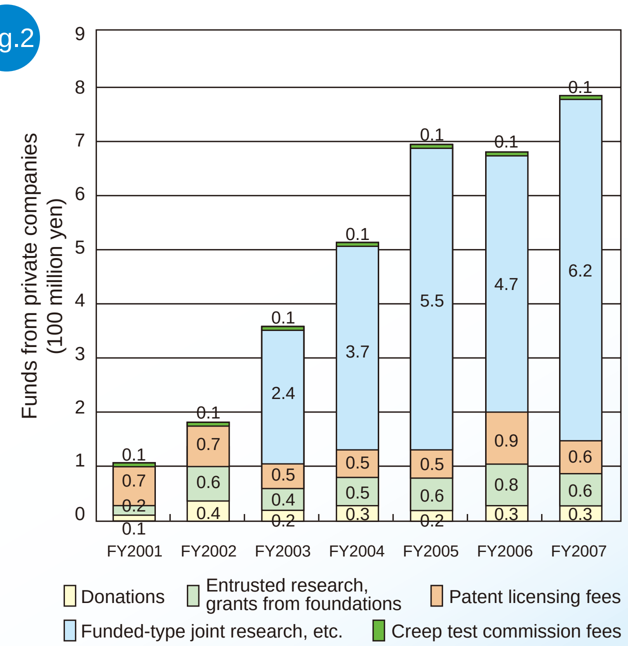
Owing to these seminars, the number of collaborations with private companies is increasing year by year (**Fig. 1**), and in particular the number of funded-type research is rising significantly. **Fig. 2** shows the amount of funds NIMS obtained from private companies, which is also growing year by year. NIMS considers these increases in funds as indications that industry is keenly interested in the research results and technological potentials of NIMS and that it believes that investments of funds into NIMS research is worthwhile.

Fig.1



Number of collaborations with private companies

Fig.2



Funds from private companies

Establishment of NIMS-industry collaborative research centers and laboratories

Some of these collaborations have established new organizations as joint research within NIMS to achieve greater results in an efficient manner.

The Rolls-Royce Centre of Excellence for Aerospace Materials was jointly established in 2006 by the NIMS High Temperature Materials Center and Rolls Royce in order to develop ultra-high temperature materials for jet engines (mainly materials used in the highest temperature areas in gas turbines). Research is now under way seeking practical application to jet engines.

The NIMS-Leica Bio-Imaging Laboratory was established at the NIMS Center for Nanotechnology Network in October 2007 with donations from Leica Microsystems. With the intention to provide bio-imaging and observation technologies using sophisticated microscopes and devices including state-of-the-art confocal laser microscopes to researchers at universities and companies across the country, fulltime staff members are engaged in high-level technical support and joint research.

The NIMS-TOYOTA Materials Center of Excellence for Sustainable Mobility, which was established in July, 2008, is conducting research aimed at elucidating the mechanisms of fundamental phenomena and developing generic technology necessary for creating next-generation automotive materials. Research will cover simulation, characterization (analysis, evaluation) and fabrication (synthesis of materials) across a full spectrum from microscopic (atomic orders) to macroscopic sizes. Starting from research into next-generation all-solid state lithium ion secondary batteries for automobile use, the development of which is urgently needed from the viewpoint of environmental and energy demands, the scope of research will be expanded to other environmental and energy-related materials.

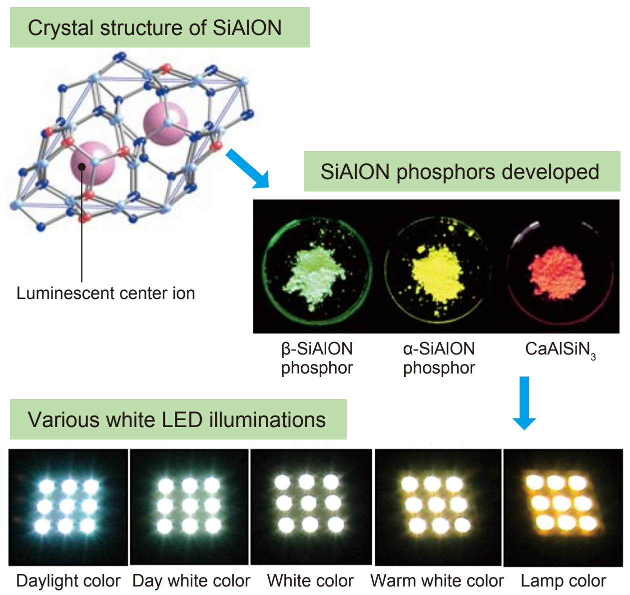
Practical application of research results

Some of the research results obtained from these collaborations are actually being used in society. **Table 1** shows a list of materials and technologies which have been put into practical use since the days of the National Research Institute for Metals and the National Institute for Research in Inorganic Materials, the predecessors of today's NIMS.

Table 1

Material	Application
Ultrafine metal powder	Conductivity, powder metallurgy, sliding
V_3Ga, Nb_3Sn	Electric transmission cables, magnets
Magnetic fluid	Vacuum shielding, hard disks
Molybdenum single crystals	Laser mirrors
Ni-base superalloy design software	Development of Ni-base superalloys for gas turbine blades
Mn-base damping alloys	Springs, high damping steel
Ultrafine metal powder	Catalysts, electronic devices, etc.
Shape-memory alloys	Sensors, healthcare equipment, etc.
Bi-system superconducting materials	Electric transmission cables, magnets
Cu-Ag alloys	Electric transmission cables, magnets
Titanate fibers	Substitute materials for asbestos, plastic-reinforcing materials, additives for brake linings
Titanium oxide nanosheets	Photocatalysts, etc.
Sintered silicon carbide	Corrosion-resistant mechanical seals, etc.
Gas-pressure sintering technology	Turbochargers, etc.
Diamond thin films	Cutting tools, heat dissipating boards
Sintered diamond	Cutting tools
X-ray guide tubes	Scanning x-ray analytical microscopes
LaB_6 single crystals	Electron emission sources for electron guns in electron microscopes, etc.
Production technology for single crystals such as lithium niobate	Materials for laser wavelength conversion, etc.
Ce-doped yttrium ion garnet single crystals	Optical isolators

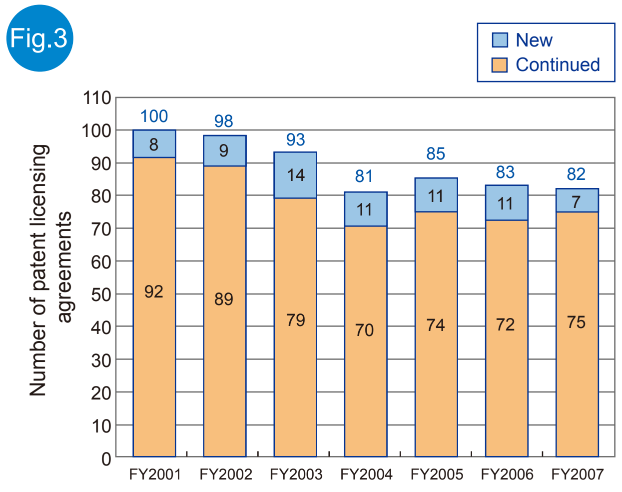
Recently, expectations have been growing with regard to the practical application of NIMS-developed SiAlON phosphor to liquid crystal displays for flat panel televisions and white LEDs for lighting. It was developed as a result of cooperation between NIMS, materials manufacturers, and device/assembly makers. Aiming at practical application, other forms of collaboration are also being concluded with industry, including vertical collaboration from upstream to downstream and horizontal collaboration in the same fields, so as to distribute research results for wider utilization.



Development of high luminance and high efficiency SiAlON phosphors

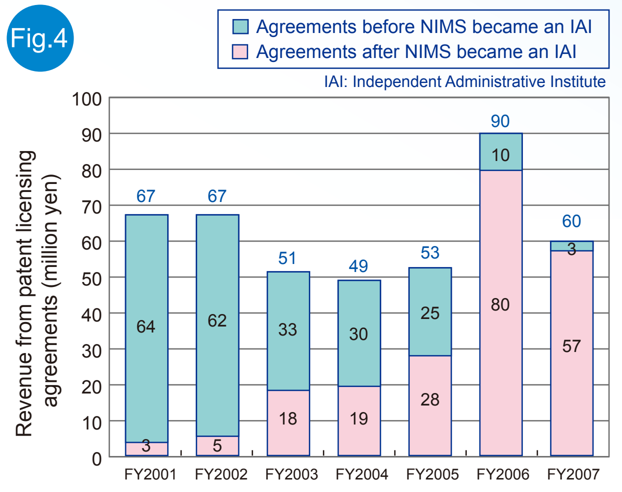
The results of these collaboration activities also appear in the form of patent licensing agreements. **Fig. 3 and 4** show patent licensing agreement numbers and revenues from these agreements, respectively. The number of patent licensing agreements is approximately 80 per year and the revenue from these agreements reaches 50~60 million yen per year. In terms of revenue, NIMS is ranked among the top 10 universities and public research institutes in Japan. NIMS will continue to communicate its technologies to industry and promote technological transfers on a broad basis.

Fig.3



Number of patent licensing agreements

Fig.4



Revenue from patent licensing agreements

► Venture companies started from NIMS

Five venture companies have started out from NIMS. They are doing business based on research results obtained at NIMS, and NIMS researches are proactively involved in their business activities. NIMS is providing various forms of support to these companies including patent licensing and the lending of facilities and equipment. It is our hope that they will grow into full-fledged companies and work to promote the practical application of NIMS research results.

OXIDE Corp. (Established on Oct.18, 2000)
Manufacture and sale of optoelectronics materials

SWING Ltd. (Established on May 20, 2003)
Manufacture and sale of single crystals for holograms, wavelength conversion devices, etc.

Materials Design Technology Co., Ltd. (Established on Sep. 12, 2003)
Development, sale, and maintenance of software related to materials thermodynamics database and other materials science applications, and related consulting and support

Probe Workshop Inc. (Established on Aug. 22, 2006)
Design, manufacture, and sale of magnetic resonance detectors and related consulting

Comet, Inc. (Established on Dec. 26, 2007)
Development, production, and sale of new functional materials based on combinatorial technology, and the manufacture and sale of combinatorial material production equipment

"The true value of materials is in their use"

We are promoting collaboration mainly with domestic companies, but inquiries regarding collaboration from overseas companies have also been increasing sharply in the last few years. Although special attention is necessary in order to prevent possible technology drains from our country, NIMS is looking to promote collaboration with overseas companies in the event collaborative partners cannot be found in Japan. This is because materials have value only when practically applied, and collaboration with overseas companies can potentially lead to global benefits which include benefits for Japan.

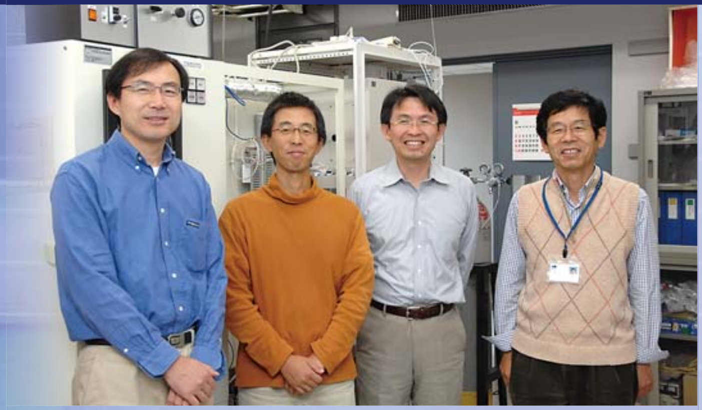
As its guiding concept shows, NIMS research is steered towards "Nanotechnology driven materials science for sustainability", and the most important form of returning research results to society and contributing to innovation is to put materials generated from research into practical use.

To make our research results widely available in society, we will continue to promote our collaboration activities based on the motto "The true value of materials is in their use".

Development of Ni_3Al Intermetallic Foil Catalyst for Use in Hydrogen Production

Intermetallic Catalyst Group, Fuel Cell Materials Center

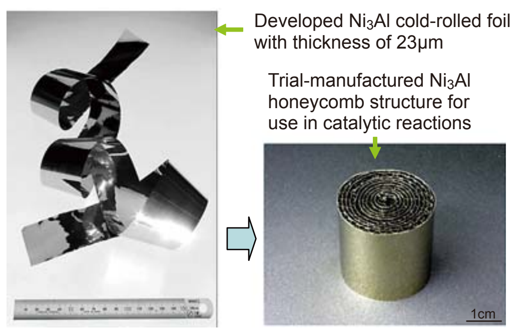
Group Leader
Ya Xu, Masahiko Demura, Anpang Tsai, Toshiyuki Hirano



The development of compact, high efficiency, low cost hydrogen production systems is an urgent issue for practical application of fuel cells. Hydrogen is produced from fuels such as natural gas, methanol, etc. by a reforming reaction. The microreactor has attracted attention as a new fuel reforming system. The microreactor is a device in which a chemical reaction and production of the target substance takes place in microchannels with a width of several μm to several 100μm, and features excellent heat transfer, mass transfer, and diffusion. At present, high temperature microreactors in which a noble metal catalyst such as platinum (Pt), rhodium (Rh), or ruthenium (Ru) is coated on a stainless steel foil have been developed. However, with the noble metals, high cost and shortages of resources are problems, while stainless steel foils have inadequate heat resistance and poor adhesion with the catalyst. To solve these problems, we developed an Ni_3Al intermetallic foil which has excellent characteristics in terms of both catalytic properties and heat resistance properties.

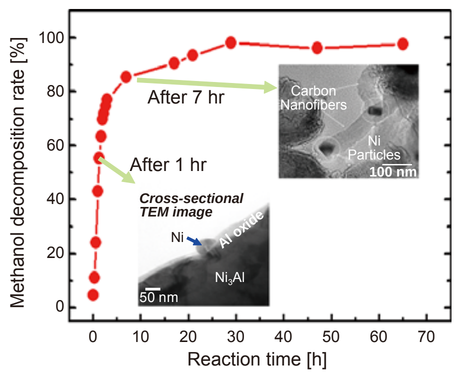
Ni_3Al intermetallic cold-rolled foil is an outstanding heat-resistant foil material which was developed for the first time by NIMS, and is a promising candidate as a high temperature microreactor container material. **Fig. 1** shows the developed Ni_3Al foil with a thickness of 23μm, and a honeycomb structure for use in the catalytic reaction which was trial-manufactured using this material. Recently, it has been found that Ni_3Al foil shows high catalytic activity and selectivity in reactions in which hydrogen is produced from methanol and methane. The curve in **Fig. 2** shows the change in the percentage of methanol which reacts relative to the total methanol supplied to the system (methanol decomposition rate) when the methanol decomposition reaction ($CH_3OH \Leftrightarrow 2H_2 + CO$) is performed on the surface of the Ni_3Al foil. It can be understood that the methanol decomposition rate increases rapidly in the initial reaction period. Furthermore, as shown in the photos in **Fig. 2**, the catalytic properties of the foil are manifest because, in the initial reaction period, the Al in the Ni_3Al is oxidized selectively and active nickel (Ni) microparticles are formed at the foil surface, and then, as the reaction proceeds, a surface nanostructure forms, which consists of carbon nanofibers (CNF) that function as a carrier for the Ni microparticles. It was also found that the catalytic properties of this material can be further improved by acid and alkali surface treatment of the Ni_3Al foil. This improvement is realized because the Al atoms in the Ni_3Al are selectively eluted as a result of the surface treatment, forming a porous structure in which Ni microparticles are densely dispersed at the foil surface. In this porous structure, pores with diameters of 10-100nm are formed with high density at the surface. At present, we are engaged in research to further improve the catalytic properties of the Ni_3Al intermetallic foil using two techniques, namely, optimization of surface treatment and control of the microstructure. Our aims are (1) establishment of a technology for imparting a catalytic function to flat metallic foils and (2) realization of intermetallic foil catalysts for hydrogen production which do not require noble metals and possess both a catalytic function and heat-resistant structure properties.

Fig.1



Developed Ni_3Al intermetallic foil and a prototype of a honeycomb structure using this material.

Fig.2



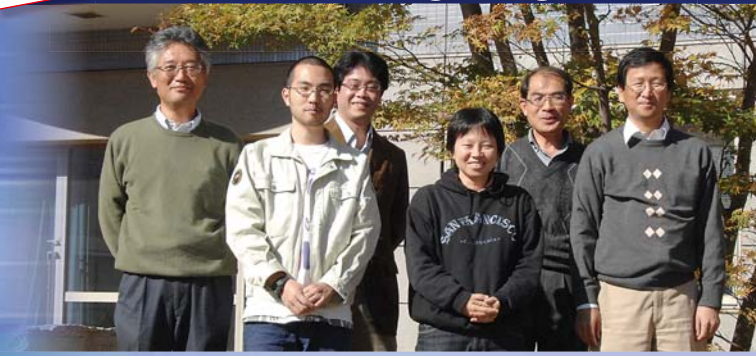
Time dependency of methanol decomposition rate of Ni_3Al foil at 793K.

Research Highlights

Development of CPP-GMR Device Using Half-Metal

Magnetic Materials Group
Spintronics Group†
Magnetic Materials Center
University of Tsukuba Graduate School††

Group Leader
Takao Furubayashi, Hiroaki Sukegawa†, Koichiro Inomata†
Managing Director
Kota Kodama††, Yukiko Takahashi, Kazuhiro Hono



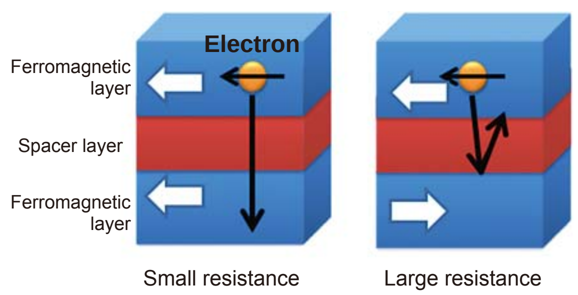
The giant magnetoresistance (GMR) effect, which was discovered simultaneously and independently by Peter Grünberg and Albert Fert in 1988, was applied to the read heads*1 of hard disk drives, dramatically improving recording density. Grünberg and Fert received the 2007 Nobel Prize in Physics for this discovery. GMR is a phenomenon that occurs when a metallic thin film with a thickness of several nanometers or less is inserted as a spacer between two ferromagnetic thin layers, and the electrical resistance of the thin film changes greatly depending on whether the direction of magnetization of the two magnetic bodies is mutually parallel or anti-parallel. This change is referred to as the magnetoresistance ratio. How to obtain a large magnetoresistance ratio has become a problem for achieving further increases in recording density.

To overcome this problem, we carried out research using a full-Heusler alloy, which is a half-metal, in the ferromagnetic layers, focusing on a GMR device of the type in which the electrical current flows perpendicular to the film surface (Current-Perpendicular-to-Plane GMR: CPP-GMR). Although electrons have either up or down spin,*2 only electrons with one spin orientation, up-spin electrons for example, carry electrical conduction in half-metals. As shown in **Fig. 1**, when the magnetization of the ferromagnetic layers is aligned, a current flows easily, but when the magnetization is oriented in opposite directions, flow of the current is difficult, and as a result, large GMR can be expected. Full-Heusler alloys can be expressed by the composition X_2YZ, which has a regular atomic arrangement termed an $L2_1$ structure. Theoretically and experimentally, several combinations of metals are considered to be half-metals. Up to the present, we have obtained a magnetoresistance ratio of 8.5% at room temperature and 30% at cryogenic temperature (**Fig. 2**) using a Co_2MnSi full-Heusler alloy in the ferromagnetic layers and Cu as the spacer between these two layers. The value at cryogenic temperature (6K) is the largest which has been obtained to date with a GMR device. However, this is still inadequate. To enable actual use in heads, it must be possible to obtain a value on this order at room temperature. One reason why it is not possible to obtain an adequate magnetoresistance ratio at room temperature is thought to be because the atomic arrangement of full-Heusler alloys is not ordered with sufficient regularity in actual thin films. In the future, our aim is to realize a larger magnetoresistance ratio by innovation in the thin film manufacturing conditions and to apply the developed material practically to read heads.

*1 Device that senses a magnetic field producing a pattern of magnetization which has been written as information on a hard disk, and converts this to an electrical signal.

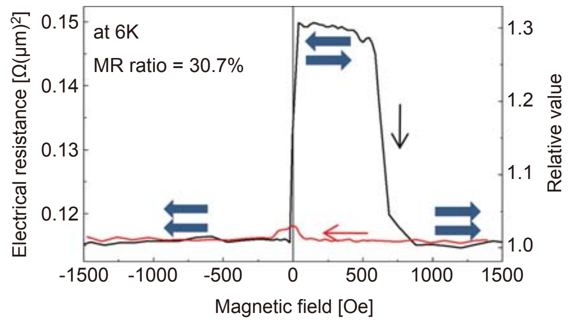
*2 A basic property possessed by electrons. Individual electrons behave like small magnets and, spin determines their orientation.

Fig.1



Schematic diagram of GMR.

Fig.2



Magnetoresistance properties of device using full-Heusler alloy Co_2MnSi.

Cluster

Introduction of Interdisciplinary Cluster

Corrosion

The Corrosion Cluster was started by 12 members who are engaged in research related to corrosion and corrosion protection in the Materials Reliability Center, Structural Metals Center, Composites and Coatings Center, Fuel Cell Materials Center, Biomaterials Center, and Innovative Materials Engineering Laboratory. The aims of this Cluster are to solve the corrosion-related problems which we confront in each area of project research and to activate the research of individual researchers by combining the knowledge of the corrosion experts in these respective fields.

Corrosion occurs in various kinds of environments accompanied by diverse modes (delayed fracture,*1 crevice corrosion,*2 stress corrosion cracking,*3 corrosion fatigue,*4 etc.). In spite of the fact that hydrogen and hydrogen ions play a key role in such corrosion degradation, a detailed discussion of their role has not been possible because the methods of detecting and measuring hydrogen are extremely limited. In recent years, the Intense Research Group of the Innovative Materials Engineering Laboratory has proposed a revolutionary technology which makes it possible to measure the distribution of hydrogen in real time by measuring surface electric potential.*5 Therefore, focusing on that hydrogen and hydrogen measurement technology, the first objective of the Corrosion Cluster is to establish an infrastructure technology for theoretical life prediction in connection with corrosion degradation by clarifying the role of hydrogen and hydrogen ions in the corrosion reaction and degradation of materials (**Fig. 1**). To exchange information with research centers in other countries, including research trends in NIMS, a Corrosion Cluster Workshop was held on July 15, 2008. Invited experts from other countries included Prof. Scully of the University of Virginia (US), Dr. Wang of the Beijing University of Iron and Steel Technology (China), and Dr. Lublinska of Warsaw University of Technology (Poland).

Another objective of the Cluster is to create an atmospheric corrosion network in the Asian region. Joint exposure tests are already being carried out in various Asian nations*6 (**Fig. 2**). As exposure tests using carbon steel and an atmospheric corrosion monitor (ACM) type sensor with the National Metal and Materials Technology Center Thailand (MTEC) had been in progress for one year, NIMS-MTEC ACM Sensor Workshop was held to study its results on July 24, 2008. Also, on November 28, 2008, researchers from five other nations in the Asian region were invited to a workshop which was held to exchange information on atmospheric corrosion in the respective countries, and the results of research in China, Korea, Vietnam, Thailand, India, and Japan were reported. The Cluster will promote more activities to deepen exchanges in the future.

*1 Phenomenon in which the strength and toughness of metal materials are deteriorated by hydrogen from water environments, eventually resulting in cracking. This type of corrosion is called delayed fracture because brittle fracture occurs in a material under static stress after a certain period of time.

*2 Type of localized corrosion which occurs in the interior of narrow crevices where mass transfer with bulk environment is restricted.

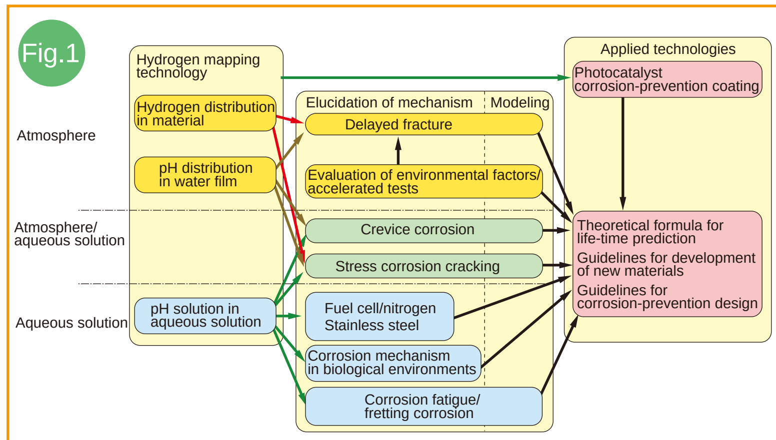
*3 Phenomenon in which cracking occurs, with a corroded area as its initiation site, due to the simultaneous action of corrosion and static stress.

*4 Fracture phenomenon which occurs due to the simultaneous action of corrosion and cyclical stress.

References:

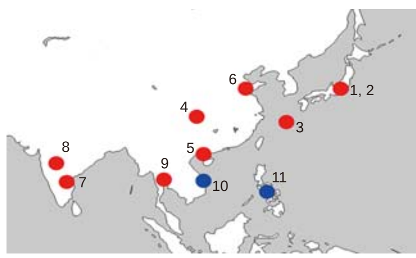
*5 NIMS NOW, Vol.8, No.7, p.7 *6 NIMS NOW, Vol.7, No.8, p.8

Fig.1



Cooperation of Cluster members aiming at understanding of corrosion phenomena, focusing on hydrogen, and establishment of a life prediction method.

Fig.2



Exposure sites in Asia
(Red: Tests currently in progress)
Japan: 1. Tsukuba, 2. Choshi, 3. Miyakojima
China: 4. Chongqing, 5. Hainan Island, 6. Quingdao
India: 7. Madras (coastline)
8. Anna University (inland at Madras)
Thailand: 9. Bangkok
(Blue: Installation scheduled)
10. Vietnam, 11. Philippines

FACE interview フェイス

The Organic Nanomaterials Center was launched in April 2006 as the first research center in NIMS handling organic/polymer materials. The Center is engaged in research on uniquely-shaped nanoscale organic materials including polymers, proteins, inorganic clusters, and other giant molecules. Organic and polymer materials have extremely large possibilities in materials science. In this FACE Interview, the Managing Director of the Center, Dr. Izumi Ichinose, discusses the development of research on nanoscale materials.

Dr. Izumi Ichinose
Managing Director, Organic Nanomaterials Center
JST-CREST Research Director

A "Back to Basics" Perspective on Creating New Materials is Key

First, I'd like to ask how the Organic Nanomaterials Center was established.

When I came to NIMS in 2003, there were virtually no researchers specializing in organic materials. A number of researchers were hired in the following three years, and I contributed greatly in recruiting excellent researchers during that time. I feel that many researchers at NIMS are more interested in materials that will be useful in some way in future, rather than research of the basis of materials. NIMS had a strategy of having young researchers in the organic/polymer field, so when the Organic Nanomaterials Center was launched, young and highly motivated researchers who also had forecast of practical applications to some extent, came together to form this unit.

Why do you think that you were appointed Managing Director?

I was involved in organic synthesis as a student, and later I did research on polymer thin films. In parallel with that, I also did research on thin films of metal oxides. I think I was selected as a kind of "binder of organic and inorganic researchers", because I had a background in polymers and was also familiar to a certain extent with inorganic materials and metals. My specialty is thin films, and I'm currently engaged in research on separation membranes, but in the center, display materials, and sensing materials are our core areas and we are also conducting research to find new properties and applications of fullerenes, supermolecules, etc. as new materials. In all cases, I feel that the perspective of actually creating new substances, and not simply creating new materials from existing substances, is essential.

What about the research environment?

When I came to NIMS, there was a strong atmosphere that the environment for basic research was more complete than that at universities. At NIMS, we create basic materials and investigate their properties, functions, and performance in order to take advantage of those materials. The only way to do this is to return to a basic level of physics, chemistry, and engineering. NIMS still has an atmosphere like a traditional university, where researcher had freedom and could do research in a deliberate manner. Because I hadn't thought that such bottom-up research was possible, it was my impression that the research environment was better than I'd expected. I still have that impression.

What do you mean by going back to basics?

For example, in my group, we're doing research on nano-separation membranes. In creating extremely thin films, we devised a manufacturing process which uses a soap film. When we investigated this soap film, we realized that the discussion of the forces acting on liquids in nanospaces, near-surface fluid dynamic properties, and related issues has a long history. When I wrote a paper, I cited references from the work of Robert Hooke and Isaac Newton in the 17th century. It might not be necessary to go that far back to basics, but science which is directly related to current nanotechnology is argued in work which is around 100 years old, and I think that many important issues for research remain to be explored there. Many nanomaterials appeared at the end of the 20th century, but with slight revisions in the theories of molecules and liquids proposed by our predecessors, I feel that we can find the seeds of new materials science.

What is your dream?

My dream is to seek a new physical chemistry in nanomaterials, and to make good use of the results obtained from that work in society, and particularly in environmental problems. Because this kind of research cannot be achieved without at least several top-level researchers, I want to work in an organization that has that kind of vitality. Rather than doing research that produces immediate results, at NIMS, I would like to do research which has depth and is not buried in history.

The 8th NIMS Forum

Advanced Materials Research and Technology Transfer

"The 8th NIMS Forum – Advanced Materials Research and Technology Transfer" was held at the Tokyo International Forum on October 29. In addition to the oral and poster sessions, "Mini lectures on research topics" focusing on advanced research and "Technical capabilities exhibition section" introducing the technologies and equipment which support research at NIMS, as new features of this year's event, created visitor's strong interest.

Oral Session

In the oral session, Coordinating Directors, Managing Directors, and Group Leaders from six research areas presented outlines of the contents of research in their respective centers.

Presenters from research centers

Key Nanotechnologies


Daisuke Fujita
Managing Director
Advanced Nano Characterization Center


Takahisa Ohno
Managing Director
Computational Materials Science Center


Kazuaki Sakoda
Managing Director
Quantum Dot Research Center


Naoki Kishimoto
Managing Director
Quantum Beam Center


Tomonobu Nakayama
Field Group Leader
MANA Nano System

Nanoscale Materials


Takayoshi Sasaki
Field Coordinator
MANA Nanoscale Materials


Izumi Ichinose
Managing Director
Organic Nanomaterials Center


Yoshio Sakka
Managing Director
Nano Ceramics Center

Materials Research for Environment and Energy


Kotobu Nagai
Coordinating Director
Materials Research for Environment and Energy


Hiroshi Harada
Managing Director
High Temperature Materials Center


Toshiyuki Mori
Deputy- Managing Director
Fuel Cell Materials Center


Takao Takeuchi
Group Leader
Superconducting Materials Center


Jinhua YE
Managing Director
Photocatalytic Materials Center


Kaneaki Tsuzaki
Managing Director
Structural Metals Center

Nanotech-driven Materials Research for Biotechnology


Yuji Miyahara
Managing Director
Biomaterials Center

Materials Research for Reliability and Safety


Yutaka Kagawa
Coordinating Director
Materials Research for Reliability and Safety


Toshio Ogata
Managing Director
Materials Reliability Center


Seiji Kuroda
Managing Director
Composites and Coatings Center


Akira Ishida
Group Leader
Sensor Materials Center

Nanotech-driven Materials Research for Information Technology


Yasuhiro Horiike
Coordinating Director

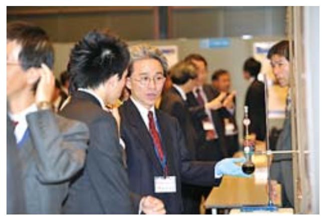

Toyohiro Chikyo
Managing Director
Advanced Electronic Materials Center


Naoki Ohashi
Managing Director
Optronic Materials Center


Kazuhiro Hono
Managing Director
Magnetic Materials Center

Poster Session

The poster session also attracted a large number of visitors. The session area was fully crowded with participants, and question-and-answer exchanges between visitors and NIMS researchers could be seen everywhere. Visitors showed a strong interest in the content and consulted with NIMS representatives on concrete cooperation in connection with several themes. These themes are expected to be advanced by joint research and other forms of cooperation in the future, leading to practical application.



Main Research Results

The presentations on main research results in the oral session consisted of the seven results with particularly strong topicality, as seen in press releases, etc., and all had large audiences.


1. Element-selective visualization of atomic arrangement
Koji Kimoto
Senior Researcher
Advanced Electron Microscopy Group
Advanced Nano Characterization Center


2. Multi-color electronic paper
Masayoshi Higuchi
MANA Independent Scientist
MANA


3. Solid-state lithium batteries
Kazunori Takada
Group Leader
Soft Ionics Group
Nanoscale Materials, MANA


4. Quasi-phase-matched nonlinear optical devices
Sunao Kurimura
Senior Researcher
Frequency Conversion Group
Optronic Materials Center


5. Biotransistor
Yuji Miyahara
Managing Director
Biomaterials Center


6. Diamond UV sensor
Yasuo Koide
Group Leader
Optical Sensor Group
Sensor Materials Center


7. Experimental studies of Polyamorphism
Osamu Mishima
NIMS Fellow

Mini Lectures on Research Topics

In the poster session, reports on six topics of advanced research with potential breakthroughs were presented as "Mini lectures on research topics," and had much attention in every topic.


1. Development of new oxide nanosheets-based phosphors
Tadashi Ozawa
MANA Scientist
Soft Chemistry Group
Nanoscale Materials, MANA


2. Development of advanced simulation method for nanoscale microstructure changes in practical materials
Toshiyuki Koyama
Senior Researcher
Particle Simulation & Thermodynamics Group
Computational Materials Science Center


3. Development of F-doped Core-free YAG Single Crystal as UV Optical Device
Kiyoshi Simamura
Group Leader
Frequency Conversion Group
Optronic Materials Center


4. Polymeric porous scaffolds prepared by an ice template method
Naoki Kawazoe
Researcher
Polymeric Biomaterial Group
Biomaterials Center


5. Development of a high-resolution AFM-nanoindentaion system
Nobuo Nagashima
Senior Researcher
Fatigue Group
Materials Reliability Center


6. Development of Ni_3Al intermetallic foil catalyst for use in hydrogen production
Ya Xu
Senior Researcher
Intermetallic Catalyst Group
Fuel Cell Materials Center

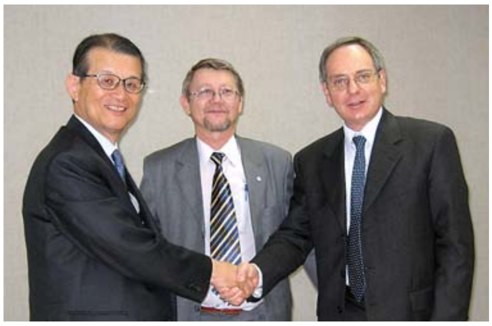
Technical Capabilities Exhibition

In the technical capabilities exhibition section, which was a new exhibition, the technologies and equipment which form the research infrastructure at NIMS were exhibited, beginning with an actual superconducting magnet for NMR, which had been cut so that visitors could view its cross section. This was an exhibition where the participants could actually see the technical capabilities of NIMS, and attracted a large number of persons.

More than 800 persons visited the 8th NIMS Forum, which was bustling throughout the day. NIMS will strive to make this exhibition an excellent opportunity for technology transfer in the future. We thank all visitors, and look forward to seeing you at the next NIMS Forum.

An Int'l Joint Graduate School Agreement with Budapest University

(Dec. 1, 2008) NIMS concluded an international joint graduate school agreement with Budapest University of Technology and Economics (BME), represented by Rector Magnificus, Prof. Gábor Péczeli, and Head of Doctoral Commission, Prof. György Mihály. BME is a prestigious Hungarian higher education institute founded in 1782, with three Nobel laureates Jenö Wigner (theoretical physics 1963), Dénes Gábor (Holography 1971) and György Oláh (carbonic chemistry 1994). Also involved in this agreement is the Institute for Technical Physics and Materials Science of the Hungarian Academy of Science (MFA) in Budapest, represented by Director Prof. István Bársony. The first graduate students of BME are expected to do research work at NIMS in 2009.


From left: Prof. Teruo Kishi, President of NIMS, Prof. István Bársony, Director of MFA, and Prof. György Mihály, Head of Doctoral Commission of BME.

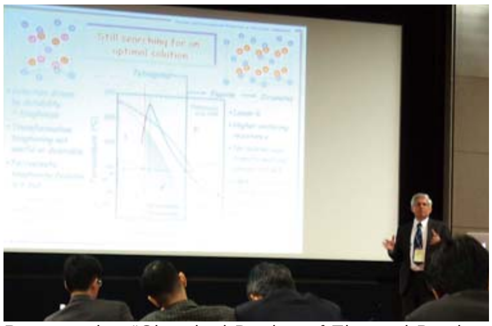
NIMS has already signed two very successful international joint graduate school agreements in Europe, with Charles University of Prague, Czech Republic (signed in February 2002) and with Warsaw University of Technology, Poland (signed in March 2005).

The 3rd Tsukuba International Coating Symposium

– Trends in Research and Development of Thermal Spraying and Particle Deposition Technologies and the Development of New Applications –

(Oct. 30-31, 2008) NIMS and the National Institute of Advanced Industrial Science and Technology (AIST) jointly held the Tsukuba International Coatings Symposium at AIST, Tsukuba. Coating researchers from the two institutes, as well as Japanese and international researchers attended this event.

In the wide technical field of coating, this symposium focused on particle deposition processes from the micron to the submicron order such as thermal spray coating, cold spray, aerosol deposition, etc. as its main topic. Keynote addresses by Prof. C. Levi of the University of California at Santa Barbara, who was the recipient of this year's NIMS Award, and Prof. C. Lee of Hanyang University in Korea, who is known for his research on cold spray, were followed by presentations and lively discussions on the development and application of coating technologies by NIMS, AIST, universities, and companies, including turbine makers and companies involved in various types of devices. The event was highly evaluated by the participants as thorough discussion of topics with high commonality was possible. The next Symposium in this series is scheduled for 2010.


Presentation "Chemical Design of Thermal Barrier Oxides" by Prof. C. Levi

MANA-EU Workshop on Atomic Network Compound

(Sep. 14-16, 2008) A MANA-EU Workshop on Atomic Network Compounds for New Energy Applications was held over a 3-day period September 14-16 at NIMS.

A total of 11 distinguished researchers were invited from six European countries (Germany, France, Switzerland, Austria, Slovakia,Ukraine), such as Prof. Yuri Grin (Max Planck Institute for Chemical Physics of Solids), Prof. Anke Weidenkaff (Empa – Swiss Federal Laboratories for Materials Testing and Research), Prof. Peter Rogl (University of Vienna), and Prof. Jean-Francoise Halet (CNRS, University of Rennes).


A scene at the workshop

Researchers made presentations on research of cluster or 2-dimensional net shapes compounds having atomic networks. The workshop brought important benefits for NIMS to obtain valuable knowledge of the importance and paths for utilizing the unique nature of atomic network compounds and functions as low thermal conductivity through group discussions and animated debate on research and development of energy materials based on novel concepts.

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