NIMS NOW International

2007.Vol.5 No.10 October

SPECIAL Interview

Prof. Hideo Hosono

Frontier Collaborative Research Center (FCRC)
Materials and Structures Laboratory
Tokyo Institute of Technology

A Conception that Creates Novel Functions from Commonplace Materials

NIMS Project

NIMS Projects and Recent Achievements

Magnetic Materials Center

- The Search for Half-Metallic Heusler Alloy

Research Highlights

- Aiming at Practical Application of a Novel Nb_3Al Superconducting Wire
- Observation of Magnetic Domains in Spintronics Materials by Ultra-Low Temperature Lorentz Transmission Electron Microscopy

FACE フェイス interview

Usefulness to Society is the Final Goal of Researchers

Isao Nakatani, Research Fellow
Innovative Materials Engineering Laboratory

NIMS NOW International – AIST TODAY Joint Plan

NIMS–AIST Presidents Talk Shop

Hiroyuki Yoshikawa	President, National Institute of Advanced Industrial Science and Technology (AIST)
Teruo Kishi	President, National Institute for Materials Science (NIMS)
Akio Etori (Moderator)	Public Relations Advisor, AIST

A Penetrating Discussion of the Role of Independent Administrative Institutions

NIMS NOW International – AIST TODAY Joint Plan

NIMS–AIST Presidents Talk Shop

A Penetrating Discussion of the Role of Independent Administrative Institutions

- Hiroyuki Yoshikawa —— President, National Institute of Advanced Industrial Science and Technology (AIST)
- Teruo Kishi —— President, National Institute for Materials Science (NIMS)
- Akio Etori (Moderator) — Public Relations Advisor, AIST

What is an IAI? – Looking back on the establishment of AIST and NIMS.

Etori: We're now in the 7th year since the start of the Independent Administrative Institution (IAI) system. As the first Presidents of IAI research institutes which lead Japan in their respective fields, I know that you've both made tremendous efforts to reach the point where you're at today. I'd like to ask each of you about your largest impressions to date.

Profile

Hiroyuki Yoshikawa

Named first President of the National Institute of Advanced Industrial Science and Technology (AIST) in 2001. Chairman, Academic Advisory Board, Japan Society for the Promotion of Science. President of the University of Tokyo, 1993-1997. Became President of the Science Council of Japan and member of the Council for Science and Technology Policy in 1997. Has held numerous important posts in connection with engineering and industry, education, and academic policy. Dr. Yoshikawa's specialties are general design, robot engineering, and reliability engineering.

Yoshikawa: If we can say that AIST is one of Japan's leading research institutes, this was also true in the past. Our predecessor, the Agency of Industrial Science and Technology (former AIST), traces its origins to the Meiji Era, in the late 19th century, and played an extremely important role in Japan's transformation to a modern, industrial economy. This former AIST, which was part of the old Ministry of International Trade and Industry (MITI), underwent numerous reforms over the years, gradually changing with the times, and became an IAI in 2001. This historical flow was extremely fortunate. Although Japan had lagged behind in science and technology, industry, and engineering, the country suddenly transformed itself into a modern nation along Western lines by making research a matter of national policy, and introduced technology and accumulated research results.

After the Second World War, research diversified, but continued to advance under a structure in which the aims of research and the objectives of the government, corresponding to national policy, were completely identical. Under this system, researchers were independent and could carry out research which was consistent with national policy, while also enjoying considerable freedom in their search for new research ideas. In 2001, the IAI Law created a system under which not only researchers, but also research institutes, can conduct research independently. As a result, our national policy-oriented researchers have become true researchers in the international sense, and Japanese science and technology have gained international recognition.

At AIST, the organizational principle was also completely changed by restructuring a number of individual laboratories and integrating them into a single entity. Frankly speaking, the most basic organizational principle is that researchers must have autonomy. In a certain sense, this involves a contradiction. While researchers must have autonomy, they can't stay closed up in their own little world; at the same time, they also have to display their capabilities by cooperating, as a group, in work required by the nation. Actually understanding this together with our researchers was one particularly tough challenge when AIST was launched, but it was also the most enjoyable part of that experience.

Profile

Teruo Kishi

Named first President of NIMS in 2001. Director General of the NIMS Nanotechnology Support Network and the Chief Entire-Project Officer of the International Center for Materials Nanoarchitectonics (MANA). Vice President of the Science Council of Japan 2003-2005. Named President of the Japan Federation of Engineering Societies in 2007. Prof. Kishi's specialty is strength/nondestructive assessment of materials.

Etori: Prof. Kishi also came to an IAI from a university post and was involved in launching NIMS, which was formed by merging two large national laboratories. What was your largest concern at the time?

Kishi: The most important point was to define the real nature of an IAI. As a good point, we'd gained the freedom to act autonomously. On the other hand, however, in spite of the organizational changes, there was still a very strong feeling that all a researcher really had to do was to follow orders from above. The hardest part for many researchers was the fact that because they had freedom, they also had to take responsibility. So, one challenge in the first stage was to ensure that everyone shared the feeling that becoming an IAI was a positive move.

As you mentioned, NIMS was created by merging two national laboratories, the National Research Institute for Metals (NRIM) and the National Institute for Research in Inorganic Materials (NIRIM). The NRIM was originally a laboratory that was spun off from the Agency of Industrial Science and Technology. In contrast, the NIRIM was a new laboratory which was created by the former Science and Technology Agency, and therefore was oriented toward university-type academic research from the first. The different mentalities of these two labs were carried over into NIMS's Japanese name, which includes *busshitsu*, or substance, and *zairyo*, meaning material. Historically, in Japanese universities, the English word "material" had been translated as busshitsu in science departments and as zairyo in engineering schools. When NIMS was created, we adopted both words in our Japanese name. What to do about the difference in mentalities was a problem. Although this difference still exists today, I've now come to think that this difference is interesting. Even at the beginning, rather than seeing it as a problem, I think I actually found it interesting to face the new organization with its differences. I might add that, before NIMS, I was actually at AIST for three months. Because AIST was established in January 2001, I studied there for three months, then moved to NIMS when it was launched in April.

Etori: What was the most useful thing that you learned during those three months?

Kishi: How governmental administration and research share in a mutual partnership. NIMS is affiliated with the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and AIST, with the Ministry of Economy, Trade and Industry (METI; former MITI). Although there are some differences between these two ministries, the methods of completing assignments presented by these governmental organizations are extremely similar.

Etori: Since AIST was created by merging a large number of laboratories, wasn't there initially a feeling of being somewhat lost in the dark?

Profile

Akio Etori

Science journalist. Worked as a producer of science programming for Nihon Educational Television Co., Ltd. and TV Tokyo Corp. and as Editor-in-Chief of "Nikkei Science" before becoming Public Relations Advisor to AIST.

Yoshikawa: I wasn't the only one who felt that way. I think everybody was at a loss. Before AIST was actually launched, there was a great deal of discussion about how the institute should be designed, done mainly by younger people in their 40s. At the time, management people, such as lab directors and department heads, were not included in the discussions. If AIST was really going to become a valuable entity by fusing various industrial technologies, it had to discard the traditional concept of separate laboratories specialized in each field, which had been necessary in the Meiji Era. Therefore, we asked people with memories of the old days to step aside, and brought together these younger researchers to decide what research fields should be created.

When I came in April, AIST had 3000 researchers, and the map prepared when the organization was established included around 60 research units. In principle, the researchers themselves decided where they would be assigned. In other words, we created an organization because we had the people. Of course, the situation is different in a university. For example, in a school of science you have a physics department, a biology department, and so on, and, as specializations, you have areas like elementary particle science and astronomy. In other words, in a university, the organization comes first, and people are assigned to appropriate departments. Our organizational principle is completely the opposite. It is the major premise of AIST that the organization must evolve. The principle that we create an organization because we have people didn't end when AIST was established; we continue to act on this principle on a daily basis. If you do so, your organization will change. As I mentioned, we had about 60 units in 2001, but today there remains only one-third of the number of units with the original names. We took a free approach to the organization to facilitate the work of our researchers. We also carried out a review three and a half years after AIST was launched, and implemented major reforms to do away with anything that was still colored by the legacy of the former laboratories. In this, I believe that we've created an extremely effective organizational principle in the last six and a half years. As the reformed organization has progressively taken root, we've found that we're producing results at an impressive rate. Based on this, I believe that AIST has made excellent progress in building a consensus around this new system.

Etori: In the case of NIMS, could you comment on how you distinguish NIMS from universities?

Kishi: We keep our gaze fixed firmly on technical innovation, which is the "innovation" so frequently discussed today, we have constructed large-scale facilities and equipment, and we implement projects by independent groups. These points are all significantly different from the methods used in universities. NIMS is also different in the sense that we establish a Mid-Term Program and Mid-Term Targets, and to a certain extent, we carry out projects considering national policy. In true advanced research, there are many areas where we compete with universities, but we believe it is important that we "conduct research that universities are interested in, but don't have the capabilities to do."

The role of IAIs in linking research and industry.

Etori: I'd like to ask about the relationship between your institutes and industry and individual private companies.

Yoshikawa: AIST has only one framework for organization-building. This is what we call "Full Research." Full Research must necessarily include basic research which competes with university research. This is because research without new scientific discoveries at the basis of the technology can be done anywhere. There should be a group of people who do scientific research themselves and create technologies based on that research. There also can be researchers who can do joint research perfectly well with industry, and researchers who become involved in industry and launch venture companies. The research done by such researchers is integrated by those who perform a kind of basic research that AIST calls "Type 2 Basic Research." To explain our thinking, in Type 1 Basic Research, the goal is new discovery and elucidation. Type 2 Basic Research is research aimed at integrating and applying the knowledge in different fields in response to economic and social needs. Then, in Full Research, we create a large research organization to enable integration between researchers in general universities and people who are attempting to launch and run venture businesses on the basis of Type 2 Basic Research. This is beyond the capabilities of universities. Therefore, if a university establishes a collaborative relationship with AIST, this can provide a path from the university's research to industry through Full Research at AIST. From the viewpoint of this paradigm, our goal is to create a domestic network in cooperation with universities, rather than to distinguish ourselves from universities.

Etori: The general view is that NIMS is somewhat closer to basic research than AIST. However, I believe NIMS is also deeply committed to cooperation with industry, aren't you?

Kishi: Because our mission at NIMS is basic and generic/infrastructure technology research, we are required to disseminate the results of our research. Although applied research and industrial research are not included in our mission, our ties with industry have been extremely strong in recent years. For example, we hold "Evening Seminars" in a Tokyo Conference Room for technical exchanges with industry, and joint research has increased from basically zero when NIMS was established to around 200 projects at present. We've already reached a point where our research activities would be inconceivable without cooperation with industry.

The necessity of innovation that brings about social change.

Etori: Today, innovation has indeed become a national policy. I would like to ask how you understand innovation, and what direction your institutes take in this connection.

Kishi: Innovation in the broad sense has permeated NIMS to a very considerable degree. However, we have to ask how we can translate the results of our basic and generic/infrastructure technology research into something that will cause large changes in the society. I think we should ask how we can find directions, from materials, that can break down the barriers we face and bring about real change in social systems, not only in technology and not only in Japan, but in the world as a whole.

For example, the one material that NIMS would most like to develop is a room temperature superconductor. This is still distant dream and probably won't become a reality in the near future, but from the viewpoint of materials, a substance with this potential would represent the attainment of one innovation. The development of an economical room temperature superconductor would have a huge impact on problems related to energy, the environment, and resources, and on social and economic change. We're studying possible material-based approaches to this challenge, keeping in mind our dreams and the realistic problems we face. However, because this target is still a dream, we understand that we have to approach it gradually by building on the steps that lead up to it.

Etori: President Yoshikawa, you've said the innovation is only realized for the first time when its impact extends to reform in social systems.

Yoshikawa: I think that's right. If something doesn't have an effect on the mechanism by which wealth is created in society, I don't think it can be called innovation. Because simply creating something new isn't innovation, I think we should use a different definition from Schumpeter.

A good example would be the Grameen Bank ["Village Bank"] in Bangladesh, which was the brainchild of Professor Muhammad Yunus, who won the Nobel Peace Prize in 2006. When Prof. Yunus discovered that a loan equivalent to only US$27 was sufficient for the recovery of an impoverished family in Bangladesh, he realized that the economics he'd studied in the United States was inapplicable in certain societies, and established the bank based on the feeling that even small amounts of money can have a large impact. The recipients of these loans are limited to women. Those wishing to borrow money form a "solidarity group" of five people, and if only one of those persons starts a successful business, a second loan is offered. Conversely, if one member of the group becomes involved in some illegal business, all five members are responsible for repaying the loan. The recovery rate of loans under this system is 98%. Prof. Yunus and the banking system were awarded the Nobel Peace Prize for the bank's success in alleviating poverty. Although this system does not involve any kind of science or technology, it has already generated an unprecedented flow of wealth using a certain existing financial mechanism. I think this is truly the ultimate image of innovation.

Naturally, we're engaged in innovation through science and technology because the problems that we want to solve are not limited to poverty, but are problems which require technological solutions, such as global environmental problems. However, I also believe that we cannot solve the problems that we currently face if we don't change the mechanisms that exist today. Science up to the present day has been negligent, in that it's been simply producing knowledge and hasn't been actively accumulating methods of popularizing the inventions and discoveries it creates. For example, take environmental problems or agriculture problems. What should we do to begin working toward a realistic solution, even if only in incremental steps? We must take a step beyond the conventional innovation that equates changes with profit. Innovation should perhaps be the most important mission of people engaged in science and technology.

Etori: One role of the IAIs must be to expand the concept of innovation in this manner, and to actively propose methodologies for promoting this widely to the world.

Kishi: Japan has established a fairly complete science and technology policy. Beyond this, however, the country appears to be searching for ways to achieve innovation and reform in society and systems.

Yoshikawa: We're searching for ways, too. The creation of the method that we call Full Research was the result of intuition, but we researchers also agree among ourselves that Full Research may in fact be an innovation. I say this because Full Research is an extremely effective method for scientists and engineers in realizing innovation. As Dr. Etori said, because it's important that the world have a better knowledge not only of research outcomes, but also their direction, we are making a plan to put out a new journal.

Kishi: Although a large component of research at universities is carried out in accordance with professors' curiosity, it is desirable that the IAIs are strongly committed to innovation.

Yoshikawa: We should also be curious about innovation.

Etori: It's necessary to propose this in policy statements on science and technology, isn't it?

Yoshikawa: Yes. Type 1 Basic Research is research to discover new substances and materials. Without knowledge of the mechanical and electrical properties of those materials, as well as an understanding of the economic and social aspects, it is not possible to carry out Type 2 Basic Research to create a large number of materials of potential use and to judge whether they are actually suitable for devices. However, because Type 2 Basic Research does not result in published papers, the researcher's publishing productivity is poor. As a result, researchers don't want to do this kind of work. To remedy this situation, we're starting a new journal. We have several dozen candidate authors. For the present, we plan to start this in AIST, but we also want to receive papers from outside. No scientific society currently publishes papers of this type. Type 2 Basic Research necessarily covers a wide range of scientific disciplines and cannot be narrowed to any one field. The fact that fields are combined into hybrid or composite research is significant.

Kishi: The Type 1 Basic Research that you just mentioned is close to our *busshitsu* research, or advanced materials research, and Type 2 resembles our *zairyo* research, or materials engineering. However, without a skillful translation from the first type to the second, this work is meaningless. Moreover, interdisciplinary research between different fields becomes important in Type 2, but researchers involved in interdisciplinary studies undoubtedly have fewer chances to publish. Therefore, what's important is the evaluation within the IAI. We've made a variety of efforts in connection with individual evaluations, but it is extremely difficult to say what constitutes "results" in this case.

Training the human resources that industry wants.

Yoshikawa: We haven't reached a concrete agreement on this yet, but I'm considering the possibility of creating a school function in AIST. This would be a place for educating people who've completed doctorates. There are people who complain that the "10,000 Post-Doc Plan" (included in the First Science and Technology Basic Plan; FY1996-FY2000) increased unemployment, but without that plan, there would have been no Science and Technology Basic Plan. The fact that we're able to do effective research today is surely because we have post-docs. The post-docs who are ensuring the continuity of frontline research are one of the treasures of Japan's intellectual industry. This shouldn't be treated as a reserve army of the unemployed. However, if it is really true that these people have no future, our research institutes have neglected their responsibilities. We need to reflect on this.

AIST employs several hundred post-docs. Some of these will go on to permanent posts, but the remainder, who are hired for individual projects, are employed under limited-term contracts. To ensure that these people also have real careers, we must produce human resources with a broad range of sensibilities that companies will want when they leave AIST. The problem is that graduate students receive doctorates in an extremely narrow field. We want people with narrow specializations to come to AIST and do Type 2 Basic Research so they can expand the range of their expertise. Because AIST does Full Research in more than 50 units, the limitations of specialized fields are relativized by participating in these, and the participants can acquire a variety of new knowledge. Assuming hypothetically that post-docs study with us for 3 to 5 years, they'll be able to contribute papers to the new journal as graduation theses. The people trained under these actual conditions naturally become even more capable researchers, and private companies should welcome them. Because company researchers are truly innovators, we want to train this kind of practical researchers. When this time comes, the 10,000 Post-Docs Plan will reach a successful conclusion.

Kishi: By the way, I have questions for Prof. Yoshikawa. One thing that I'm concerned about now is the researchers of the future. According to the "Rikei Hakusho (White Paper on Scientific Professions)," young people believe it's disadvantageous to go into science-related professions. It's generally thought that science and engineering professions are unpopular, but what's really unpopular is engineering. Considering the fact that engineering sense and motivation are extremely important elements for achievement in innovation, I'm very concerned about the unpopularity of engineering. I'd really like to hear your opinion on why young people feel that scientific professions are disadvantageous, and why engineering professions are unpopular. Also, I've been wondering recently about Japanese graduate schools in comparison with those in China and India, so I'd like to hear your thoughts on the current state of graduate schools in Japan. Could you comment on these three points?

Yoshikawa: The lack of interest in the sciences is a social problem. Small countries like Belgium and certain others are raising the salaries of people in the sciences as a matter of national policy, but the U.K., U.S.A., and Japan are failing. There is a reason for this. Essentially, it's a failure of science education. I can't explain it, but young people have a very keen sense of the future, which leads them to reject the sciences. They perhaps feel that it's useless to go into the sciences and simply work to increase knowledge. They may feel that what they produce will cause environmental destruction, and the gap between the rich and poor will go on expanding. They may not consciously realize this themselves, but as a result, they instinctively dislike the sciences. I highly respect the instincts of these young people.

So, how to solve this problem? I think the fact that we've come to do engineering as an application of science is a real mistake. It's imperative to create a discipline of "knowledge for the use of knowledge," that is, how knowledge should be used. The lack of a system that precisely describes the nature and mission of engineering is one cause of our present problems, so we need to remedy the situation in the future. I think this is also related to our autonomy.

Kishi: I see. And what should be done about our graduate schools?

Yoshikawa: Well, I think the tendency to use doctors as workers has intensified the problem. In some other countries, they're more careful about this. In comparison with Japan, there are far more people with a strong consciousness of their role as educators, and they're aware of their responsibilities with regard to the kind of human resources they're training for the next generation. I don't think Japanese university professors give very much thought to these issues.

Kishi: Since the IAIs are actually future employers for graduate school students, we need to clarify our opinions and present them to the universities, don't we?

Yoshikawa: I don't think we can expect anything from that. That's why I'm proposing an education system in AIST itself. It's difficult to ask much from today's Japanese universities. Budgets are shrinking, and there are also problems in the Education Rebuilding Council. In spite of the dedicated work of those in frontline jobs, the system itself has been neglected. In this sense, it's not a matter of "rebuilding"; the responsibility lies with the system itself. It's important to increase budgets for education, and to give the frontline the ability to make judgments so that professors with new ideas about education can succeed.

Etori: I think that what Prof. Yoshikawa just said is extremely important. I also feel that publicity regarding technology has been inadequate. We have to convey the feeling that technology is in fact the most enjoyable pursuit.

Finally, I'd like to ask you both if you have any advice for today's young people.

Yoshikawa: Rather than advice, I feel that I should offer an apology. Those of us who came of age during this country's high growth period were able to do extremely rewarding work, but there was a failure in education, in that this wasn't carried over to the next generation during the 1980s and 1990s. That is, we failed to nurture these young people. Hopefully, those involved in education will effectively reconstruct the system in the years to come. Therefore, I want young people to take a cool-headed, objective look at Japanese society and reach their own conclusions. Japan has excellent organizations and achievements, and I hope they will have the sensitivity to realize this.

Kishi: I believe that individuals must become stronger in various senses, and must have a sense of responsibility. I hope that researchers will enjoy both their work and their private lives. I say this because research will not advance without this spirit.

Etori: Thank you very much for sharing your opinions with us today.

(Translated by the NIMS Public Relations Office)

Magnetic Materials Center

Development of Advanced Magnetic Materials by Nanostructure Control

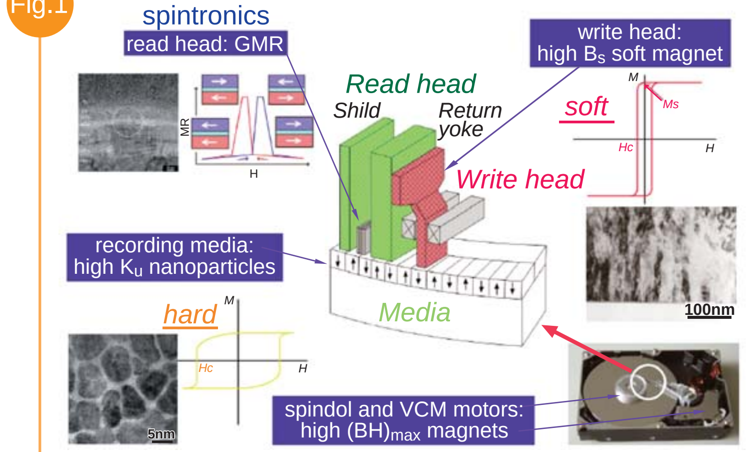
In order to realize a ubiquitous society, the development of magnetic recording systems and spintronics* devices will be necessary. The Magnetic Materials Center is developing the magnetic materials and spintronics materials that will be essential to this development. Recognizing the heightened importance of permanent magnetic materials in environment-friendly automobiles, the Center is also involved in the development of these materials, including the basic research supporting this work.

In terms of regular staff, the Magnetic Materials Center is the smallest center in NIMS. However, more than 20 post-docs and postgraduate students are engaged in research activities in the Center. This is also a research environment with a rich international flavor, as more than half of its members are from countries other than Japan, and English is used as a common language. Thus, young researchers and postgraduate students do research under a condition of “organized chaos.”

The materials which are the objects of research are thin films for use as high density magnetic recording media, gigantic magnetic resistance (GMR) devices for read heads, spintronics devices and their component materials envisioning applications such as magnetic random-access memory (MRAM), thin film permanent-magnet materials, and bulk magnetic materials. The Center is made up of three groups, the Magnetic Materials Group, Spintronics Group, and Nanostructure Analysis Group. These three groups carry out development of next-generation high performance magnetic materials and related basic research in close mutual cooperation.

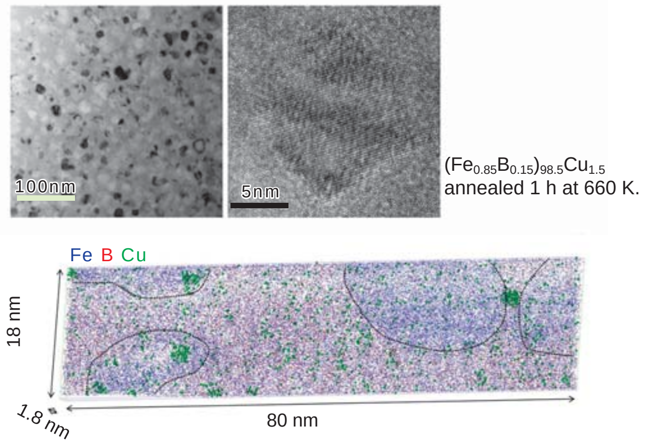
The Magnetic Materials Group is involved in the search for and development of all types of magnetic and spintronics materials used in magnetic data storage (**Fig. 1**), spintronics, and the energy/environment field. The Spintronics Group is engaged in the development of spintronics devices with the aim of application in MRAM, etc. The Nanostructure Analysis Group focuses on analytical research for material and device design guidelines by nanostructure analysis of magnetic materials, spintronics materials, and devices using these materials. To enable full and effective use of a unique analytical technique called three-dimensional atomic probe (3DAP) analysis, the group also performs nanoanalysis of various nanostructured metallic materials, such as nanocrystalline ultra-high strength alloys, magnesium alloys, metallic glasses, and others.

Fig.1



Magnetic materials used in magnetic recording.

Fig.2



Example of nanoanalysis by transmission electron microscope (TEM) (top)/3-dimensional atomic probe (3DAP)(bottom) of $(Fe_{0.85}B_{0.15})_{98.5}Cu_{1.5}$ high magnetic flux density nanocrystalline soft magnetic material (sample provided by Hitachi Metals, Ltd.), showing 3DAP observation (bottom) of the distribution of component atoms in the nanostructure (top) as observed by TEM. (The broken black lines in the lower figure correspond to the structure in the upper figure). In the 3DAP element map, the individual dots correspond to atoms. Thus, this technique enables direct observation of the Cu atoms (green) added to induce nanocrystallization. This type of analysis makes it possible to determine the effect of the added elements necessary for nanocrystallization.

*Spintronics: In conventional electronics, only the charge of electrons is controlled; however, spintronics uses devices in which both the charge and spin of the electrons are controlled.

For more details: http://www.nims.go.jp/apfim/

The Search for Half-Metallic Heusler Alloy

Magnetic Materials Group, Magnetic Materials Center

Managing Director
Yukiko Takahashi, Kazuhiro Hono, A. Rajanikanth

Electron possess both up spin and down spin. Half-metals are the materials in which spin up electrons are metallic and spin down electrons are semiconducting in nature. In such materials near the Fermi-level only spin up electrons exist, which means all the conduction electrons are completely polarized. These half-mettalic materials have attracted intense attention as key materials for realizing spintronic devices of all types, including giant magnetic resistance (GMR) devices for read heads in hard disk drive (HDD), tunnel magnetoresistive (TMR) devices for magnetoresistive random access memory (MRAM), spin injection from a metal to a semiconductor for field effect spin transistors (spin-FET), and others.

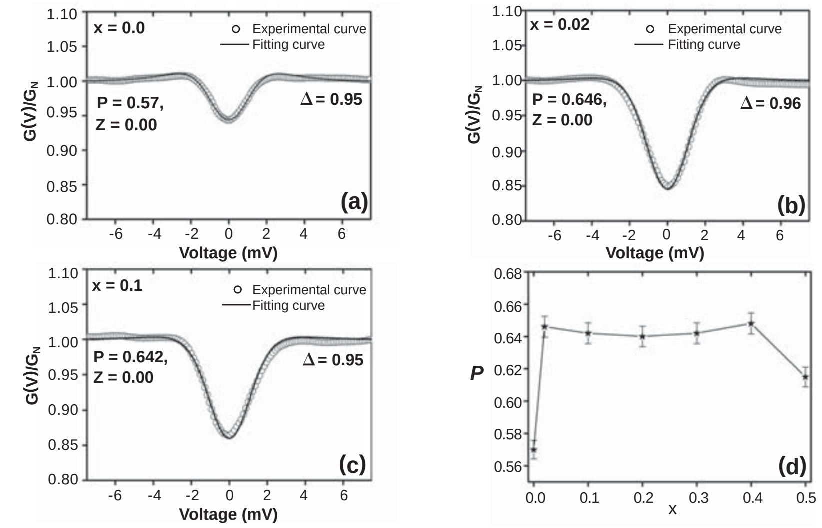
In searching for half-metals, experimental measurement of the spin polarization of the material itself by a quick and simple technique is necessary. Direct measurement of the spin polarization of ferromagnetic materials is possible using Andreev reflection, in which the conduction of electrons passing through contacts between a normal conductor and a superconductor increases to double that of the normal conduction when the voltage between the contacts is within the energy gap of a superconductor. In case of ideal ferromagnetic/superconductor junction the Andreev reflection is completely suppressed because at the Fermi level there are only up spin electrons which are not allowed into the superconductor. The amount of suppression in Andreev reflection depends on the intrinsic spin polarization of the material. We are employing this measurement technique in our search for half-metals.

The **figure** shows voltage vs conduction curves of $Co_2Cr_xFe_{1-x}Si$ Heusler alloy with various Cr concentrations *x*. The minimum at zero bias voltage indicates the suppression of Andreev reflection. Spin polarization is obtained by fitting with theoretical model. When the Fe in Co_2FeSi is substituted with only 2% of Cr, spin polarization increases rapidly, from 0.57 to 0.64, but shows a constant value with higher Cr substitution. These are the first experimental results measuring this kind of large change in spin polarization due to trace element addition, and demonstrate that the above-mentioned point contact Andreev reflection (PCAR) method is the optimum tool for quick and simple measurement of the spin polarization of various alloys with modified alloy compositions. This research has led to the discovery of high spin polarization alloys with excellent temperature resistance and material in which a comparatively high spin polarization can be obtained by addition of a fourth element to a Co-based Heusler alloy*. We are now using this technique to search for a near ideal half-metal with spin polarization exceeding 0.9, which we hope to discover in the near future.

*Heusler alloys: Ferromagnetic alloys having a regular $L2_1$ structure based on a BCC (body-centered cubic) structure.

For more details: http://www.nims.go.jp/apfim/

Fig.



Voltage/conduction curves of $Co_2Cr_xFe_{1-x}Si$ by the point contact Andreev reflection (PCAR) method (Fig. a, b, c) and the x dependence of spin polarization (Fig. d). (P: spin polarization, Z: interfacial scattering factor, Δ: superconducting gap)

Aiming at Practical Application of a Novel Nb_3Al Superconducting Wire

- Success in the Development of a High Speed Copper Plating Technique for Stabilization -

High Field Superconducting Wires Group,
Superconducting Materials Center

Akihiro Kikuchi (second from left) at the Fermilab

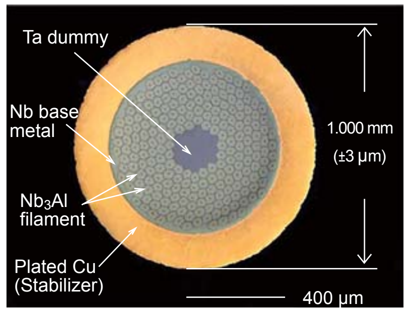
One barrier to the practical application of high performance stoichiometric Nb_3Al superconducting wires is the fact that high temperature heat treatment at approximately 2,000°C is necessary when synthesizing this material. About 10 years ago, NIMS researchers developed a heat treatment process for long wires called the RHQ (Rapid Heating and Quenching) process, in which resistance heating is controlled by applying a current directly to the material, and practical application was expected. However, in actual application to superconducting magnets, it is necessary to stabilize the superconducting state, which tends to become unstable due to disturbing factors such as thermal fluctuation. In general, pure copper, which is a good conductor, is used as the wire matrix in order to stabilize the superconducting wire, but when Nb_3Al wires are produced by the above-mentioned RHQ process, a Cu matrix cannot be used because the temperature during high temperature heating exceeds the melting point of Cu. This means that a composite with Cu must be formed on the wire after high temperature heating. Up to now, a process for rolling of cladding materials in which Cu foil was pasted on the material had been used, but destabilization was a concern, as numerous adhesion defects between the Cu and the Nb_3Al wire material were observed. As other problems, because only thin Cu foils could be used, composites with a high Cu content could not be produced, and applications were also limited due to the flat shape produced by rolling. For wider application, it is necessary to form a composite of high quality copper with high efficiency and satisfactory adhesion while also maintaining a round cross-sectional shape. This had been the second barrier to practical application.

Therefore, with technical cooperation from Hikifune Co., Ltd. (Japan), NIMS began development of a technology for high speed, heavy plating of copper based on electrolytic plating technology. Electrolytic plating is generally used to form thin films of less than 1 µm. However, for use with stabilization materials, a thickness that exceeds the common sense limit in conventional plating is necessary, and the process will not be practical if it does not achieve both high speed and high quality in the composite. In this research, we applied various improvements, resulting in the successful development of a technology for continuously plating copper to a thickness (150 µm) more than 150 times the conventional level at a high speed of 5 m/hr on a long (1 km) wire. Because this new process achieves unprecedented high plating efficiency, it is now possible to produce Cu composite wires at low cost. Where quality is concerned, because a high purity, high density structure is achieved, high electrical conductivity can be obtained down to extremely low temperatures. High dimensional accuracy was also realized at wire diameter ±3 µm (**Fig. 1**).

NIMS and the Fermi National Accelerator Laboratory (Fermilab) in the United States are carrying out joint research on the development of a new Rutherford cable for next-generation accelerators. A prototype of the world's first Nb_3Al Rutherford cable (**Fig. 2**) was produced using the Cu-stabilized Nb_3Al wire developed by NIMS. The cables used in accelerators are used under the most severe service conditions for superconducting cables. To realize a large capacity conductor, several dozen superconducting wires are bent into a rectangular shape and then compressed to form a band. However, the individual superconducting wires must show no deterioration in properties under this extreme plastic deformation. Furthermore, because of the unique field distribution of accelerator magnets, performance must be stable over a wide range from low to high fields. Thus, the establishment of a manufacturing process for Nb_3Al superconducting wires for accelerator conductors would heighten expectations for development to other applications such as nuclear fusion reactors.

For more details: http://www.nims.go.jp/smcMetal/

Fig.1



Cu-stablized composite Nb_3Al superconducting wire produced using the newly-developed high-sped plating technology. The Cu content comprises 50% of the total wire.

Fig.2

A Rutherford cable made by weaving together 27 Nb_3Al superconducting wires. The cable was compression molded to a high fill ratio of 87%, and is capable of carrying a large current of more than 25,000 A in liquid helium (4.2 K). The cable was trial-manufactured in the summer of 2007 in joint work with the Fermilab.

Observation of Magnetic Domains in Spintronics Materials by Ultra-Low Temperature Lorentz Transmission Electron Microscopy

Advanced Electron Microscope Group,
Advanced Nano Characterization Center

Group Leader
Yoshio Matsui, Xiuzhen Yu, Koji Kimoto, Toru Hara, Toru Asaka
(currently in U.S.A.)

Ferromagnets are made up of small magnets called "magnetic domains." The boundary between two magnetic domains is called a magnetic domain wall. Within one magnetic domain, the electron spins of the atoms are aligned in the same direction. Observation of magnetic domains and magnetic domain walls is impossible with a conventional electron microscope. For this, a specially-designed Lorentz transmission electron microscope is necessary.

Recent years have seen intensive research on so-called "spintronics," in which the electrical conduction of materials is controlled using the external field dependency of magnetism (spin state). Direct observation and control of the condition of spin alignment are particularly important issues. For example, in the layered perovskite-type manganite $La_{1.2}Sr_{1.8}Mn_2O_7$, which has attracted attention as a tunnel magnetoresistive (TMR) material, measurements of magnetization suggested that the spin alignment changes dramatically when manganese (Mn) is substituted with only a few percent of ruthenium (Ru). However, what changes actually take place in the condition of spin alignment, or so-called magnetic domains, between room temperature and ultra-low temperatures are not known in detail.

Therefore, focusing on the ferromagnet, in which 5% of the Mn content is substituted with Ru, we studied the temperature dependence of the magnetic domain structure using an ultra-low temperature Lorentz electron microscope (**Fig. 1**).

Figure 2a is an image of the magnetic domain walls at 20 K. The magnetic domain walls are shown by white or black lines and can be clearly understood. The color arrows show the direction of magnetization (in other words, the direction of spin alignment). When the temperature is increased to 80 K, the magnetic domain structure becomes simpler, as shown in **Fig. 2b**.

A detailed investigation of the temperature dependence of spin alignment by the authors revealed that it is possible to use temperature to control the direction of spin alignment. First, based on the magnetic domain wall images in **Fig. 2a** and **Fig. 2b**, the direction of magnetization was obtained by analyzing the change in the intensity of the electron wave propagation, with the results shown in the color maps in **Fig. 2c** and **Fig. 2d**. It was found that, at 20 K, the direction of magnetization in each magnetic domain is inclined in a complex manner, but as the temperature increases, the direction of magnetization gradually begins to align with the c axis (direction perpendicular to the layers of the layered structure), and at 80 K, the direction of magnetization is aligned with the c axis, forming anti-parallel domains (normally means 180 ° magnetic domains).

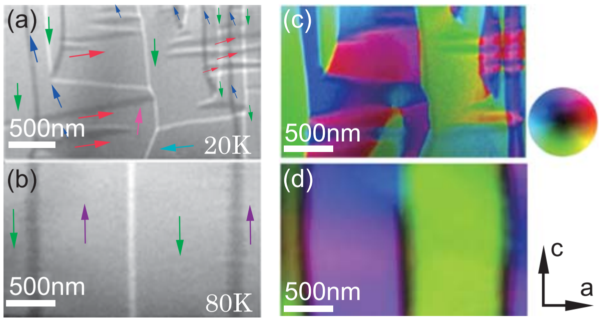
In this research, we succeeded in observing the temperature dependence of the magnetic domain structure in $La_{1.2}Sr_{1.8}(Mn_{0.95}Ru_{0.05})_2O_7$ by an ultra-low temperature Lorentz electron microscope. This result suggests the possibility that temperature can be used to control the direction of magnetization in this TMR material, that is, the direction of spin alignment. This finding is expected to contribute to the development of next-generation magnetic memory devices. Thus, direct observation of magnetic domains and magnetic domain walls by Lorentz electron microscopy is extremely significant in research and development in the field of spintronics. High expectations are placed on the future development of this technology.

For more details: http://www.nims.go.jp/AEMG/

Fig.1

Lorentz electron microscope.

Fig.2



Magnetic domain structure of $La_{1.2}Sr_{1.8}(Mn_{0.95}Ru_{0.05})_2O_7$. The color wheel in the images shows the magnetization direction at each point in addition to the arrows.

SPECIAL Interview

A Conception that Creates Novel Functions from Commonplace Materials

Textbooks inform us that cement is an electrical insulator. Prof. Hideo Hosono of the Tokyo Institute of Technology focuses his attention on unique research that overturns common sense as he searches for the hidden properties of materials. For example, although calcium aluminate (C12A7) is a cement constituent, he succeeded in passing a current through this material, and ultimately realized a calcium aluminate superconductor, by utilizing its nanostructure.

Prof. Hideo Hosono
Frontier Collaborative Research Center (FCRC)
Materials and Structures Laboratory
Tokyo Institute of Technology

Did you begin your research on calcium aluminate (C12A7) from JST's ERATO Program*?

I published my first paper on C12A7 in 1986, which was the same year as the discovery of high temperature superconductors. For five years, beginning in 1999, I was heavily involved in ERATO's "Hosono Transparent Electro-Active Materials Project" as the Project Leader. When this project was conceived, I selected the main topics from the research that I'd been doing and tried to develop the project centering on the most interesting of these. Among them, I was particularly intrigued by the C12A7 crystal, and took this up as a "hidden ball trick."

*ERATO: Exploratory Research for Advanced Technology.

Meaning everybody was caught off guard when this cement unexpectedly turned out to be a conductor?

C12A7 is essentially an insulator, but its crystal structure consists of three-dimensionally linked cage-shaped structures with an inner diameter of 0.4 nm. My idea was to combine these nanocages and active anions. Under normal conditions, these are unstable, but when they're introduced into a nanostructure, they become stable. This is because they become hydrogen minus ions, oxygen –1 valence ions, and also electrons. Hydrogen is normally a +1 ion, and oxygen is normally –2. For example, we discovered a new function in which platinum, which is normally stable, can be oxidized if 0– is introduced. We also realized the targeted superconductor by introducing electrons.

What points required particular attention?

We prepared three forms of the material, that is, single crystals, thin films, and sinters, or ceramics. We probably wouldn't have discovered such an interesting function if we'd only used powder.

Today, element strategy has become important, but rather than simply substituting substances with similar properties, I think that it is quite important to show how science can contribute to this problem. An approach that uses the essential nature of nanotechnology is necessary. Because Japan is poor in natural resources, nanotechnology must be responsible for breakthroughs in materials science. We have to ask about the purpose of nanotechnology. From this viewpoint, element strategy may be a "training hall for nanotechnology."

Where applications are concerned, TAOS* have attracted considerable attention, haven't they?

First, I presented the concept and actual examples of TAOS at the International Conference on Amorphous Semiconductors in 1995. Because there had been no ionic amorphous semiconductors up to that time, and the electron transport characteristics were completely different from those of existing amorphous semiconductors, I was proud of the novelty of this work. At the time, however, amorphous hydrogenated silicon was universally accepted, so absolutely nobody was interested. Nevertheless, we continued our research after this, and we created a thin film transistor (TFT) with field effect mobility of 10 $\text{cm}^2(\text{Vs})^{-1}$ using an amorphous thin film of an oxide of indium, gallium, and zinc, which is a TAOS material.

This was reported in the November 2004 issue of "Nature" as a high performance transparent transistor that can be produced at room temperature on plastic. For us, this was only realizing the work that we'd been doing for 10 years in an actual TFT, but at the time, flexible electronics had already become a hot topic, and this TAOS-TFT was adopted around the world almost instantly. At the same conference in August of this year, the number of presentations concerning amorphous nano-oxide semiconductors grew rapidly and accounted for 15% of the total.

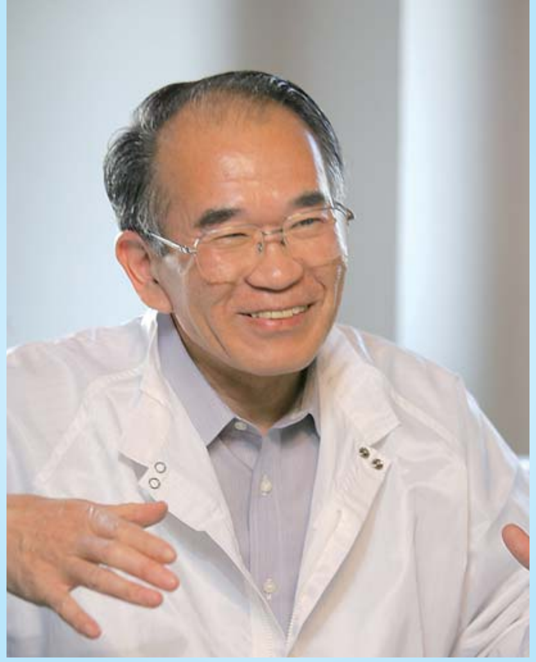
*TAOS: Transparent amorphous oxide semiconductors.

Finally, Prof. Hosono, what are your dreams for the future?

I would like to experience a change in my own outlook on things as a result of distinctively original research that nobody else has done. More concretely, I'd like to achieve the kind of scientific breakthrough that's carried in journals like "Nature" and "Science," and see that contribute to industrialization or to solving the problems facing the world today. I would also like to foster outstanding students with high aspiration in the process of doing this kind of pioneering research. If we could combine all of this, I think we'd have the ideal of university research.

FACE フェイス interview

Dr. Nakatani is the pioneer in microfabrication technology for magnetic materials. Patterned media have been an object of ongoing research for many years, and are now the focus of attention as next-generation recording media, with 600 Gbit/in^2 and ultimately 1 Tbit/in^2 considered within the range of this technology. Active research is now underway worldwide.
In 1970, Dr. Nakatani entered the National Research Institute for Metals (NRIM), which was one of NIMS's predecessor organizations. Although he reached retirement age last year, he is now continuing his research as a NIMS Research Fellow. He has developed numerous patented technologies based on his own original research. We asked him about the background that produced these research achievements and his hopes for the young researchers who will be responsible for the future.



Isao Nakatani, Research Fellow
Innovative Materials Engineering Laboratory

Usefulness to Society is the Final Goal of Researchers

Why did you begin work on microfabrication technology for magnetic materials?

The original motivation for this work was to create high density magnetic memory and patterned media for hard disks, and magnetic heads. Microfabrication technology is indispensable to create GMR and TRM, which are three-dimensional structures, and is also necessary in order to create devices using MRAM nonvolatile memory, like flash memory.

Concretely, what technologies are involved?

With silicon semiconductors, precise dry etching is possible using halogen gas plasma, but because magnetic materials are iron family transition metals or alloys, this isn't possible with magnetic materials. Therefore, I developed new techniques for etching using a plasma of carbon monoxide gas and ammonia gas, and also created etching equipment. NIMS owns the set of patents for this technology, from the basic patents to the defensive publications. This is the only technology of its kind at present, so our share is 100%.

I proposed patterned media for hard disks using microfabrication of magnets by this technique in 1989. In patterned media, magnetic nanoparticles with the same size are aligned along tracks on the surface of a hard disk. The read-write head follows this arrangement and records binary data on one magnetic nanoparticle. At the time, nobody was interested, but from around 2000, research on patterned media began worldwide as a technology that can overcome the limitations of perpendicular magnetic recording. This technology is expected to reach the market in 2009, and trial calculations show it has a market scale of ¥2 trillion.

Tell us about the creation of the device for manufacturing these nanoparticles.

Two years ago, a device which was created in this research was put into actual operation by industry. Naturally, I'll also be pleased if various discoveries are made and papers are written in the course of research, but the fact that this can be of use to society will give me great pleasure of a different kind.

You have done much of your research as a single individual. Did this give you some anxiety?

When I considered the history of audio recording, beginning with Thomas Edison, I had the slim hope that my research on patterned media wasn't in the wrong direction, but I also felt the anxiety that I had no colleagues doing the same kind of research. However, that's unavoidable if you're doing highly original research.

Do you have any advice for young researchers?

Research notebooks are extremely important for researchers, so please treat them carefully. No matter where you are or what time it is, when you open your notebook, that space becomes your laboratory. Where research topics are concerned, it is too late to start your research after grasping the present needs of society. For example, I hope that some of you will have the courage to propose recording media based on an entirely new concept as an alternative to the hard disk.

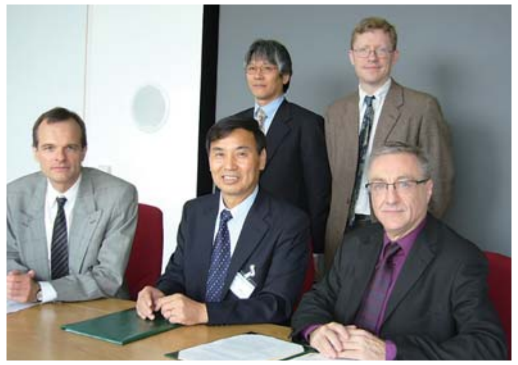
The final goal of researchers is to be of use to society and industry. We tend to forget this when we're in the middle of research, but at least once a year, I hope you'll ask yourselves why you're doing research. Science and technology, and research, are not for our own benefit, they're for the betterment of humankind. Without this mind, our efforts are virtually meaningless, regardless of the field.

Dr. Nakatani's research notebooks.

NIMS Signs an MOU with UCL, University College, London, U.K.

(July 4, U.K.) — The NIMS Organic Nanomaterials Center and International Center for Young Scientists (ICYS) signed a Memorandum of Understanding (MOU) with the London Centre for Nanotechnology (LCN), University College, London (UCL). LCN is an interdisciplinary research institute which was established jointly by UCL and Imperial College and is engaged in advanced research on nanoscience and nanotechnology. Founded in 1826, UCL was the first English university established after Oxford and Cambridge, the first to admit students regardless of race, class, religion or gender, and the first to provide systematic teaching of law, architecture and medicine. In the government most recent Research Assessment Exercise, 59 UCL departments achieved top ratings of 5* and 5, indicating research quality of international excellence. UCL is the fourth-ranked UK university in the 2006 league table of the top 500 world universities produced by the Shanghai Jiao Tong University. UCL has long had friendly ties with Japan, and is known as the school where the important historical figure Hirobumi Ito and recent Japanese Prime Minsiter Junichiro Koizumi studied. This MOU will accelerate research on organic nanomaterials, centering on quantum information processing platforms.

In the signing of this MOU, former ICYS Fellow Dr. David Bowler acted as the contact person in his capacity as a staff member of UCL and LCN. This relationship is expected to serve as a model case for the construction of an international network with the ICYS as the core organization.

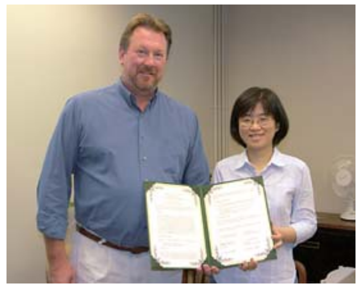

Front row, from left: Prof. Gabriel Aeppli (Director, LCN), Prof. Yoshio Bando (Director-General, ICYS), and Prof. Michael Worton (Vice-Provost for International Affairs, UCL).
Back row, from left: Dr. Kazushi Miki (Group Leader, Organic Nanomaterials Center), and Dr. David Bowler (Reader in Physics & PI in LCN).

NIMS Signs an MOU with Lawrence Berkeley National Laboratory, U.S.A.

(July 5) — The NIMS Quantum Beam Center signed a Memorandum of Understanding (MOU) on "Ion projection nanopatterning" with the Accelerator and Fusion Research Division (AFRD), Lawrence Berkeley National Laboratory (LBNL) in the United States.

NIMS and LBNL have conducted international collaboration in ion beam-based nanofabrication. Since August 2006, the two institutes have promoted more concrete activities, which include holding international conferences, workshops, discussing on instrumental issues and experiment plans, visits to relevant institutes, and so on. This MOU will strengthen the collaborative framework through mutual exchanges of researchers and information and other activities.


NIMS (from left): Dr. Yoshihiko Takeda (Senior Researcher, Ion Beam Group, Quantum Beam Center), Dr. Naoki Kishimoto (Managing Director, Quantum Beam Center), and Dr. Hiroshi Amekura (Senior Researcher, Ion Beam Group).


LBNL (from left): Dr. Stephen Gourley, Director, AFRD, and Dr. Qing Ji (Ion Beam Technology Group).

The 4th Japan-UK Nanotechnology Summer School Held

(July 29 – August 5, U.K.) — The 4th NIMS-IRC Nanotechnology Summer School was held at Cambridge University in the UK. The participants included 14 IRC students (University of Cambridge, University of London, University of Bristol) who are engaged in research at the IRC in Nanotechnology, and 14 students from NIMS (University of Tokyo, University of Tsukuba, Tokyo University of Science, Kitami Institute of Technology, Charles University (Czech Republic)), who were selected from NIMS and dispatched to the U.K.

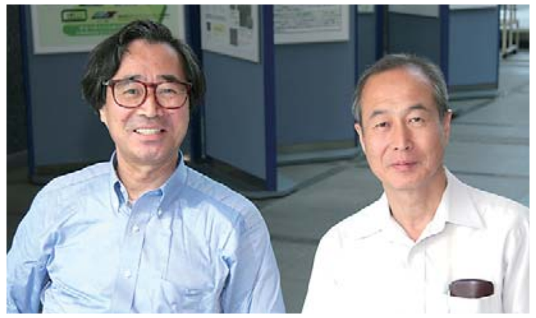
The school featured presentations and lively discussions on recent research results. The participating students deepened their knowledge of advanced nanotechnology, and also deepened their friendships through bowling, a soccer match, punting, and other leisure activities. The 5th Summer School is schedule to be held next summer at NIMS.


On the St. Johns College football ground at Cambridge University.

NIMS Fellows Receives the Japan Society of Applied Physics Fellow Commendation

(August 3, Tokyo) — Two NIMS Fellows, Dr. Masakazu Aono and Dr. Yasuhiro Horiike, were selected as recipients of the 1st Japan Society of Applied Physics Fellow Commendation. The award ceremony was held at a ceremony commemorating the 75th Anniversary of the publication of the Society's scientific journal "Oyo Buturi" (Applied Physics).

The awards to the two NIMS Fellows recognized their great contributions to the development of applied physics through ongoing activities in the Japan Society of Applied Physics (JSAP). Awards were also given to 84 other persons. The research achievements cited in connection with the awards to the NIMS Fellows were, for Dr. Aono, "Analysis of the structure and electronic state of solid surfaces and creation and measurement of the physical properties of nanostructures," and for Dr. Horiike, "Development of advanced micro-processing technologies and research on manifestation of new functions in devices." The JSAP has a history of 75 years and is an organization with more than 23,000 members. Its aims include encouragement of science through applied physics, contribution to society and industry by the development of technology, and contribution to education through mutual enlightenment and training of human resources.


Dr. Aono (left) and Dr. Horiike.

Cooperation Agreement with China's Xi'an Jiaotong University

(August 29, NIMS) — NIMS signed a cooperation agreement on a Joint Graduate School Program with Xi'an Jiaotong University (XJTU), China. The signing ceremony was held at NIMS with five representatives from XJTU in attendance, including Prof. Jianhua Wang, Chairman of the University Board, and Prof. Jun Sun, Head of the School of Materials Science & Engineering. One purpose of this agreement is to promote receiving of students from XJTU. After the ceremony, the Chinese delegation toured three labs in the NIMS Sengen Site and also visited Ninomiya House (JST International Residence for Researchers operated by the Japan International Science and Technology Exchange Center), where the students from XJTU are expected to stay.


Front row, left to right: Prof. Wang, Prof. Teruo Kishi (President, NIMS), back row, Ms. Shumei Ma (Clerk of the International Cooperation and Exchanges Department, XJTU), Ms. Li Liang (Vice Director of same Dept.), Dr. Masaki Kitagawa (Vice President, NIMS), Mr. Masahiro Takemura (Director General, NIMS International Affairs Office), Prof. Sun, Dr. Xiaobin Ren (Group Leader, NIMS), and Mr. Xiaobin Ma (Secretary of the Chairman of University Board, XJTU).

NIMS Senior Advisor Emeritus Honored as a Researcher Responsible for Advancement of Research Fronts in Japan

(September 19, Tokyo) — NIMS Senior Advisor Emeritus Prof. Hideomi Koinuma was honored as a researcher who has been a driving force in advanced research (research fronts) where dramatic development is expected at the scientific symposium "Honoring Excellence in Emerging Japanese Research Fronts" (sponsored by Thomson Scientific, with support of the Japan Science and Technology Agency).

"Research fronts" are not limited to main fields, but also include areas of advanced research which have attracted strong attention from other research fields, and therefore are selected by analyzing both the number of citations of published papers representing the field and "co-citation" in which multiple papers are cited simultaneously, based on the view that there is a strong mutual linkage in research fields which are the focus of scientific interest. The 1st award was held in 2004 and this was the 2nd award of its type. On this occasion, 10 research fronts were selected and 17 researchers were honored for their contributions in these fields. Prof. Koinuma, together with his co-researcher Dr. Tomoteru Fukumura (Senior Lecturer, Institute for Materials Research, Tohoku University; formerly NIMS Visiting Researcher), received the award "For their contribution to combinatorial discovery of room temperature ferromagnetism in diluted magnetic oxide semiconductors."

At the award ceremony: Prof Koinuma (middle) and Dr. Fukumura (left).

NIMS PoLyInfo Polymer Database Receives ORGATECHNO2007 Award

(July 19, Tokyo) – At ORGATECHNO 2007, which was the 3rd meeting of this exhibition/international conference on new organic polymer technologies, the NIMS Database Station's "PoLyInfo Polymer Database" received the ORGATECHNO2007 Award. The award ceremony was held at the Tokyo Big Sight International Exhibition Center.

The ORGATECHNO Award collects, from diverse fields, advanced materials/advanced application technologies with the potential to overturn conventional technologies from their foundations with the aim of achieving even higher levels in organic/polymer technologies.

PoLyInfo proposes a new concept of databases which is not limited to a simple database, but also includes functions that support polymer material design and thus make an important contribution to the creation of new materials. The ORGATECHNO Award recognized PoLyInfo for its major contribution to the development of the field based on a new approach different from the conventional thinking in the field of organic technology, including functions for estimation of the physical properties and structural modeling of unknown polymers not included in databases to date.

NIMS materials databases have a total of 31,337 registered users (as of August 31, 2007) from 7,879 organizations in 110 countries around the world. For details, please visit the NIMS materials database homepage at: http://mits.nims.go.jp/

NIMS Database Station members with people who have contributed to their work.

Hello from NIMS

Konnichiwa! My name is Agata Roguska, and I am a Ph.D. student at the Faculty of Materials Science and Engineering at Warsaw University of Technology in Poland. The area of my Ph.D. studies and interest within materials science is improving the biocompatibility of metallic biomaterials using various chemical and electrochemical surface modifications. I came to Tsukuba for a 6 month visit and joined NIMS as a Junior Researcher in the Biometal Group at the Biomaterials Center.

My friends and family back in Poland and foreign and Japanese colleagues I've met in Japan keep asking me the following two questions: "Do I like living in Japan?" and "How am I coping with life in Japan?"

I enjoyed most of the Japanese customs I have experienced, as they are genuine attempts to make life civilized. A meal is not started until all are served and a greeting is made to acknowledge the good food we are about to eat. People stand in line patiently waiting to board the train or bus, or even to cross the street. Not one but all staff in a store, bank, or business greets and says farewell to customers as they arrive and depart. But to be honest, these polite courtesies may sometimes hamper rather than enhance daily life. While flattering and enjoyable the first dozen times, it becomes annoying every time somebody enters the local bank, post office, or convenience store and is welcomed with the same patterned greeting from each staff member.

Agata Roguska (Warsaw University of Technology, Poland)
International Joint Graduate School Program
(March 2007-August 2007)
Biometal Group, Biomaterials Center

[At the top of Mt. Fuji]

It is sometimes perceived in Japan that Europeans are impolite because of our lack of knowledge of these countless behavioral requirements, and that our own culture is devoid of good manners. I have tried to explain to my Japanese colleagues that our manners are just subtler and can vary greatly depending on the given circumstances and situation. However, it is difficult to convey to them that there are only a few "must do's" in European society, and more "highly recommended" codes of behavior. Living in Japan might not be easy for Europeans, especially for a young man on his first long-term visit. But with support from all of my colleagues and coworkers, especially my host researcher Dr. Hiromoto, staying in Japan was surprisingly pleasant and interesting. Thank you all!

[At the NIMS Summer Festival with colleagues (author: left)]

National Institute for Materials Science
Visit NIMS NOW International Online!
http://www.nims.go.jp/eng/news/nimsnow/

To subscribe, contact:
Mr. Tomoaki Hyodo, Publisher
Public Relations Office, NIMS
1-2-1 Sengen, Tsukuba, Ibaraki, 305-0047 JAPAN
Phone: +81-29-859-2026, Fax: +81-29-859-2017
Email: inquiry@nims.go.jp