# NIMS NOW International

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# NIMS Management Advisory Council

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RIKEN Discovery Research Institute

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## Strengthening NIMS' Collaboration Network in Japan and Other Countries

On June 4, the 1st Meeting of the NIMS Management Advisory Council was held in the NIMS Tokyo Conference Room, and a number of knowledgeable persons from domestic institutions expressed their views on the management of NIMS. The following presents a portion of these opinions.

### Securing outstanding human resources

**Kishi:** We are making efforts to hire outstanding researchers, but conditions are far from satisfactory. Do you have any ideas about how we can gather high level people?

**Komiyama:** One is to look for human resources outside of Japan. We've decided to strengthen our collaboration by going into India, with a target date of April of next year. Of course, we also want to call out to other institutions, and not just the University of Tokyo. We've perhaps reached the stage where we must take this kind of organizational action.

**Kishi:** We're also promoting a plan to open a lab in India, with Bangalore in the southern part as a candidate area.

**Komiyama:** India is strong in materials research and has a high level, centering on Indian Institute of Technology (IIT), and it's friendly to Japan. What's more, India's population of 18 year olds is 20 million, which is 20 times larger than Japan's. For this reason, we must consider establishing bases in main cities such as Delhi, Bangalore, and others through collaboration.

**Kajiyama:** Recently, the University of California has been investing considerable financial resources in nanotech. Although this is divided into four divisions, we're collaborating with California NanoSystems Institute (CNSI), which was set up in UCLA. In the case of NIMS, since you're promoting nanotechnology research to such an extent, what do you think about collaboration here as well?

**Kishi:** The University of California has also attracted our attention, and we've had an approach from them as well. In particular, the University of California, Santa Barbara (UCSB) has been sounding us out about opening an office there, as they've completed nanotech-related facilities.

**Kajiyama:** Not only talk about collaboration, but also time to think is necessary in order to produce research results. There's no chance of serendipity when the pressure of miscellaneous work doesn't leave you any time to think.

**Kishi:** That's certainly true. Being too busy is a big problem, and you worry about what moves to make.

**Ikegami:** If researchers are allowed to do business-related work, they won't return to their research. You have to be careful, because if they once find out how interesting business meetings are, they won't be able to do their work without meetings.

**Inoue:** The average age of NIMS researchers is 45, and I had the impression that they do research from a longer-term perspective than at universities where researchers go out as their positions rise. This is a great strength that's not found in universities, and if it's possible to take advantage of it in the research aspect, by innovations in management methods and the personnel system, it can be a unique asset of NIMS and a point that distinguishes NIMS from other institutes. I think NIMS is producing such good results because it's structured to create new fields by a fusion of human resources in different fields.

**Kishi:** We've had some interesting early results in interdisciplinary research, but present reality is that things are definitely not progressing so simply. As you pointed out, the average age of our researchers is 45, and I think the fact that they can perform research in a more deliberate manner than in universities, which we call "long term stabilization," is a distinctive feature.

**Hirano:** I think you could promote short-term personnel exchanges between NIMS and universities more actively, and carry out research by transferring work to the most appropriate place for 3 years or 5 years. Because new hiring of outstanding people is extremely difficult, this would activate research.

### To an era that makes good use of shared facilities

**Hirano:** Recently, I think renovation of large-scale facilities has become very difficult, but what's the situation at NIMS?

**Kishi:** Because we've been dealing with individual project research, until now, we'd hardly considered purchasing shared facilities. However, we've listened to the requests for equipment from all our researchers, and there are items with a high degree of commonality, so we're currently conducting a review so as to introduce this equipment.

**Hirano:** Budgets are also gradually being cut at universities, and it's becoming difficult to purchase large-scale equipment independently. In such times, I hope that NIMS will construct facilities with distinctive features considering its responsibility as the core institute in Japan, and make it possible for educational and research institutes throughout Japan to share use of those facilities. In the case of large-scale equipment, I think that we are approaching a time when it will be necessary to construct facilities in a planned manner based on a review of conditions nationwide.

**Ikegami:** Researchers in America are good at shared use of facilities. They use facilities together with people in fields that would be inconceivable to us. In other words, because the time when facilities are available is limited, they use those facilities as intelligently as possible. If large numbers of foreign researchers are hired in the future, one method would be to make good use of their way of doing things.

**Kaya:** It's certainly true that Europe and the United States make full use of shared nanotech facilities and operate those facilities extremely well. For this reason, Japan must also create user facilities in well-developed research organizations.

**Ikegami:** Small budgets are a common problem throughout the world. Today, universities in Europe are beginning to say not R&D (research and development), but R&I, for innovation. Because public financing is not adequate for universities, it is necessary to raise funds from the private sector, which is why they're talking this way. Considering global trends, we have no choice but to learn from their way of doing things. In this sense, I think NIMS' alliance with Rolls Royce is a great step. I say this particularly because this is an area where materials patents are effective.

**Kaya:** While budgets are decreasing, on the other hand, good results are increasingly demanded. In other words, the challenge is that we must produce "quality rather than quantity." NIMS has reached the top class in materials research, but precisely because it's in the top class, how to enhance quality has become critical. For this, it will necessary to promote networking and cooperative work with research institutes in Japan and other countries even more than at present.

**Kishi:** Thank you for your valuable advice.

UCLA Geffen School of Medicine, U.S.A.
**Prof. André Nel**

# SPECIAL Interview

## Forefront Approach in Nanotoxicology

Nanotoxicology is a new science studying the potential adverse effects of nanomaterials on human health and the environment. With the large number of new nanomaterials becoming available, many with entirely new physicochemical properties, it is necessary to differentiate the harmful from the benign, and to avoid unexpected harmful interactions. Dr. André Nel, Professor of Medicine at UCLA's Geffen School of Medicine and Director of its Center for NanoSafety Research and Testing at the California NanoSystems Institute (CNSI), is at the forefront of the interdisciplinary study of nanomaterials and their effects. He spoke to NIMS NOW International while on a visit to Japan for the 15th NIMS Lecture in April.

"Ultimately," he said, "we need to be able to understand: are nanomaterials hazardous? And if so, how do they cause the hazard? We have to know how nanomaterials spread, through water, air, skin contact or direct delivery into the human body. Even if they're toxic, it doesn't mean they'll necessarily cause problems – they still need to enter the body at a sufficient dosage to cause injury."

Clearly, it's a huge task. Where to start? "Our Center's first priority is to create a classification system to rank materials as either potentially hazardous or potentially safe. What we especially want to avoid, if a significant toxicity does show up, is having a huge number of untested nanomaterials out there, and researchers scrambling desperately to test thousands of materials in response. And meanwhile, fear among workers, consumers and the public could place the entire industry at risk."

"If we use scientific principles to understand the nano/bio interface, we should be able to do high-throughput testing to classify materials into potentially dangerous and potentially safe categories, and then use that matrix to begin testing the potentially dangerous materials first. That way, we can focus our resources on the more labor- and cost-intensive studies."

For example, "studies of air pollution have taught us that the major mechanism of injury is the capacity of nanoparticles to induce the production of oxygen radicals and oxidative stress," he said. "So that will provide a predictive test and be the initial focus of our Center's research."

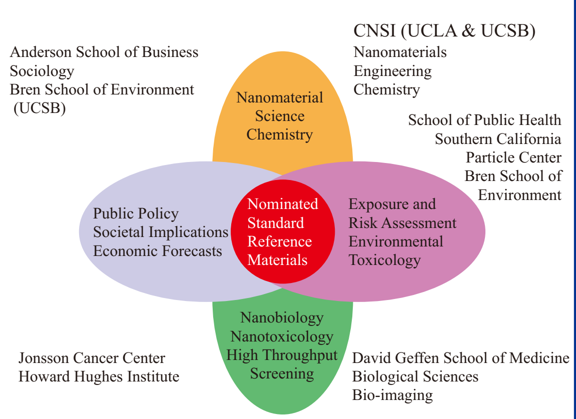
Future research could address how nanoparticles injure cell membranes or structures, such as mitochondria; cause unfolding or damage to proteins by surface adsorption; cause mutations in DNA; or create antigenic substances, leading to immune responses.

Despite all this dire talk of nanohazards, as a medical doctor Dr. Nel is excited about the potential of nanotechnology. "Our work will help us understand the nano/bio interface, and that will be the launch pad for a huge number of new nanomaterials that will be helpful as treatment delivery devices, sensors and so on. Even materials that turn out to be toxic could have very important roles in the development of new cancer chemotherapies, for example."

Collaboration will be crucial. "It will require integration at various levels – academia, government, companies and very importantly, the public." In order to promote this collaboration, Dr. Nel and colleagues have established a University of California Lead Campus Program for Nanotoxicology Research and Training* in which UC Campuses, government, industry and the public can participate in ensuring the safe development of nanotechnology in the State of California. This program, which has been funded by the state, will also provide a platform for collaboration with universities, government agencies and industries throughout the Pacific Rim to establish a rational approach to nanosafety.

NIMS's challenge, Dr. Nel said, is to bridge the gap between nanomaterials and biology. "We have to develop a creative process so that we can get outside the traditional boundaries of our disciplines and embrace the diversity of scientific concepts that will be required to make this new science mature."

*UC Lead Campus Program for Nanotoxicology Research and Training






# FACE interview フェイス

The 1st Asian Biomaterials Congress (1st ABMC) will be held at the Epochal Tsukuba International Congress Center (Tsukuba, Japan) over a 3-day period from December 6 to 8 of this year. We asked NIMS Fellow Tetsuya Tateishi, who is Chairperson of this event, to give us a brief outline of the Congress.

NIMS Fellow **Tetsuya Tateishi**
Director General
Biomaterials Center

## The first integrated congress of the ASBM and AISB will be held in Tsukuba

### Please tell us how this 1st ABMC came to be held.

Until now, two symposiums on biomaterials had been held in Asia. These were the ASBM (Asian Symposium on Biomedical Materials) and the AISB (Asian International Symposium on Biomaterials). The same researchers were attending the both conferences and making presentations on the similar research topics. Therefore, at ASBM7 and AISB5, which were held in 2006, there was a proposal to hold the conferences jointly in 2007. Agreement was reached, resulting in this 1st Asian Biomaterials Congress.

### What are the distinctive features of the ABMC?

In the 1990s, when these symposiums were first held, the focus was on metals, ceramics, plastics, and their composites, in other words, orthodox biomaterials. However, this changed around the year 2000, with application of substances of biological origin and appearance of technologies incorporating cellular material. In concrete terms, we've seen rapid progress in research on cell scaffolding materials which support regenerative medicine, and on tissue engineering which regenerates skin, cartilage, and other tissue.

### So this ABMC will also center on regenerative medicine and tissue engineering?

Because research had originally progressed based on the concept of scaffolding materials for cells, materials are extremely important. In this sense, this is a strong field for Japan. In particular, I think that our research on biomaterials in regenerative medicine, such as bioceramics, is on the world's top level.

### What kind of results can be expected in other areas?

As another feature of the Congress, results in the areas of evaluation techniques and standardization will be announced. Although a variety of materials are used in regenerative medicine, no standards exist for those materials. For example, regenerated tissue is created by planting cells in a cell matrix material, but in cases where porous materials are to be used, there are no numerical values for the appropriate porosity of the material. As another example, biodegradability is extremely important in regenerative medicine, but again, no standards exist. Although research on biomaterials is advancing, clinical application is still lagging behind. For this reason, we want to use this Congress to ensure that standards take root in Asia.

### What development do you foresee for this Congress in the future?

I think the Congress will be held every other year, but in any case, what's important is to create an association of the biomaterials societies in each country. This will be a topic at the upcoming Congress, and I expect that we might see the birth of an Association of Asian Biomaterials Societies. If we can set the stage for this, holding this Congress will be a significant event.

**Invitation to the 1st Asian Biomaterials Congress (ABMC) to be held December 6-8, 2007**

This Congress will be a gathering of leading researchers from throughout Asia, and will include presentations on recent results in a variety of topics from basic research on ceramics, metals, and polymer materials to clinical application, bionanotechnology, regenerative medicine, DDS, biomechanics, standardization, etc.

For details, please see: http://www.1stabmc.t.u-tokyo.ac.jp/

# Superconducting Materials Center

## Project for High Performance in Superconducting Materials by Nano Structural Control

Superconducting wire characterization device

Superconductivity has the potential to give birth to revolutionary technologies in a number of critical fields, including energy, environmental preservation and protection of resources, medicine and the life sciences, transportation, IT, and others. If these technologies utilizing superconductivity are realized, it is no exaggeration to say that almost all of the pending problems facing humankind can be solved, beginning with the problem of $CO_2$ emissions. In many cases, the success or failure of such superconducting technologies depends on whether an excellent superconducting wire and tape material can be developed or not. Therefore, in the Superconducting Materials Center, we are engaged in systematic, comprehensive research from basic to applied research, with the aim of establishing the foundation for producing high performance superconducting wires and tapes that can actually be used in these advanced fields. Concretely, we are devoting great effort to research and development of high performance wires and tapes with three superconducting materials which are expected to achieve practical application, these being bismuth-based high $T_c$ oxides, $MgB_2$, and $Nb_3Al$. Because advanced characterization techniques for wire and tape materials are also important for the development of high performance wires and tapes, in parallel with these efforts, we are also engaged in technical development for precise analysis and evaluation of the properties of these materials in the micro region including SQUID devices*. Moreover, the discovery of superconductors with properties superior to those of the above-mentioned three superconductors would clearly have an even greater technological and social impact. For this reason, the search for new superconductors of this type is also an objective of the Superconducting Materials Center. Concerning to the applications, various applications for high performance wires and tapes like those mentioned above are conceivable. One of the most promising applications is high-field superconducting magnet. Based on our actual results to date, the Superconducting Materials Center is engaged in the development of higher performance superconducting magnets.

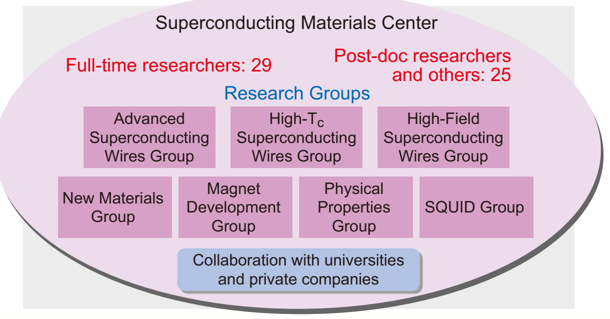
### Research Fields of the Superconducting Materials Center

(1) Development of high performance wires, tapes, and coils using high $T_c$ oxide superconductors and advanced metal superconductors (Advanced Superconducting Wires Group, High-$T_c$ Superconducting Wires Group, High-Field Superconducting Wires Group)
(2) Characterization of superconducting materials, synthesis of high quality superconducting materials, and development of new devices (Physical Properties Group)
(3) Development and application of SQUID devices (SQUID Group)
(4) Development and application of high-field superconducting magnets (Magnet Development Group)
(5) Search/development of new superconducting materials (New Materials Group)

In order to carry out these research and developments efficiently, the following seven research groups have been established, and coverage of a wide region of superconductivity, including structural analysis and characterization of superconductors, theoretical research on superconductivity, manufacture of long wires, tapes, and magnets, etc., is realized through close cooperation with other research units in NIMS, universities, and private companies.

*SQUID: Superconducting Quantum Interference Device; used in the measurement of extremely low magnetic fields.

For more details: http://www.nims.go.jp/smc/index_e.html




Organization of Superconducting Materials Center





# Development of High Sensitivity NMR (Nuclear Magnetic Resonance) Spectrometer

## - Aiming at Realizing the World's Highest Sensitivity -

High-$T_c$ Superconducting Wires Group, Superconducting Materials Center

Group Leader
Hitoshi Kitaguchi

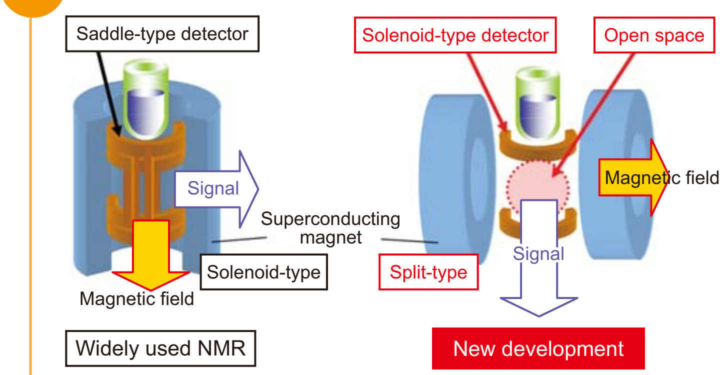
Nuclear magnetic resonance (NMR) analysis techniques are used in many research fields, beginning with 3-dimensional structural analysis of proteins, organic polymers, etc. For nearly the past 30 years, high performance in NMR devices has been achieved by realizing higher fields in the superconducting magnets used. In order to realize even higher performance, the Superconducting Materials Center is developing an NMR device using a composition and arrangement of detectors and magnetic fields different from those in the conventional method, aiming at a large improvement in signal detection efficiency, as a leading project (FY2003-2007) of the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT). **Figure 1** shows the key points of this project. High sensitivity can be expected with solenoid-type detectors, as this type can capture signals with higher efficiency than the saddle-type detectors which are widely used at present.

Furthermore, in order to use solenoid-type detectors, the direction of the detector coil axis (signal) and the direction of the field must be at a right angle (90°). The superconducting magnet must therefore be a splint-type which is divided to the right and left. In order to realize these features, advanced superconductivity technology (materials and magnets) is necessary. In the new method, an open space was created in the direction corresponding to the front and rear direction of the detector in **Fig. 1** by fabricating a split-type magnet. It is also expected to be possible to realize new analytical techniques by utilizing the large space in the center of this device.

To date, we have produced three prototype machines, and at present, two of these devices have operated smoothly for periods of more than a half-year, one being a high-field 600 MHz machine which aims at realizing high sensitivity and the other a 300 MHz machine for use in developing new applications (analytical techniques). **Figure 2** shows the history of sensitivity improvement in this project to date. We are currently working to improve sensitivity with the aim of realizing an S/N ratio (signal-to-noise ratio) of 10,000, which will substantially exceed the world's current highest level of 8,018.

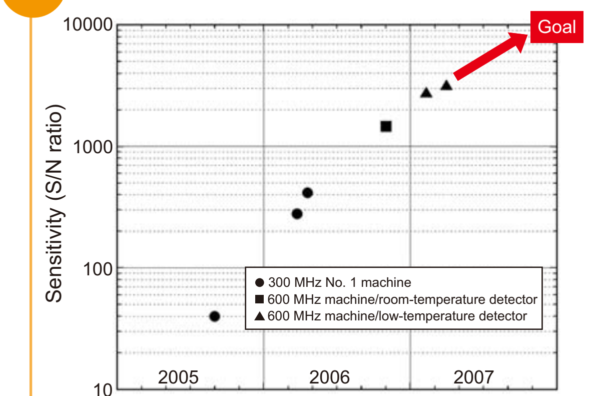
This project is being carried out with strong collaboration by NIMS, Hitachi, Ltd., Ehime University, Ibaraki University, and Kagoshima University, as well as cooperation from related research institutes and many outside experts. The aim of this project is to establish a new "made-in-Japan" technology. Realizing the world's highest sensitivity and creating new analytical techniques based on an original new Japanese method are expected to contribute to securing the world's highest level of development capabilities and competitiveness in a wide range of fields from basic research to industry, beginning with the fields of biotechnology and drug discovery.

Fig.1




Key points of new development (Measure by inserting a test tube containing protein solution from above into the center of the detector).

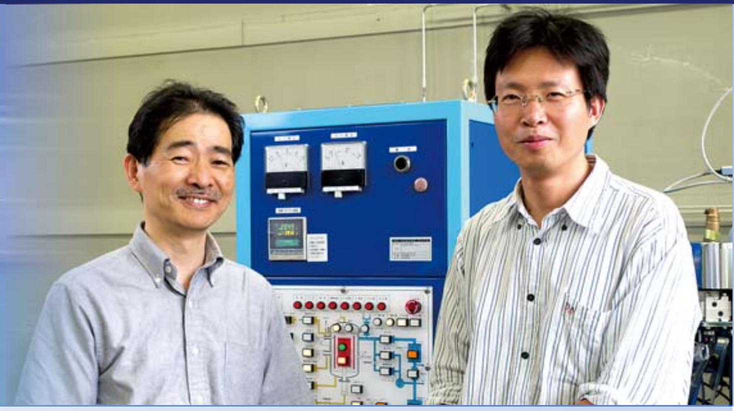
Fig.2




History of sensitivity improvement in this project to date and the project goal (world's current highest level is 8,018).

# Development of a New AlN Blue Phosphor for FEDs

Nitride Particle Group, Nano Ceramics Center



Group Leader
Naoto Hirosaki
Rong-Jun Xie

In the current generation of flat panel televisions, the liquid crystal and plasma types are the main stream. However, as a future technology, the field emission display (FED) method is continuing to advance toward practical application. In addition to achieving high contrast by self-emission, FEDs also promises fast response, and it is therefore expected to enable the realization of a flat panel television with image quality superior to that of CRTs. In this method, phosphors with high luminescence efficiency and excellent durability under electron beam irradiations are required.

The phosphor developed in this work is a phosphor which uses aluminum nitride (AlN) crystals as the host lattice. Due to their high thermal conductivity, AlN ceramics have been used conventionally as heat-dissipating substrates for ICs. However, when silicon and europium are doped into AlN crystals, we have found that this material becomes a phosphor which emits blue light under electron beam (EB) irradiations (see **Fig. 1**). The AlN: $Eu^{2+}$ phosphor is synthesized by firing the raw materials consisting of a mixture of $Si_3N_4$, AlN, and $Eu_2O_3$ powders at 2050 °C in a nitrogen atmosphere of 10 atm.

Yttrium-based oxides, which have long been known as blue phosphors for use with EB excitation, have a problem arising from their low durability although they possess high emission efficiency. The newly-developed phosphor shows little degradation of luminescence intensity, indicative of a phosphor with a long lifetime and high durability (see **Fig. 2**).

In cooperation with the electronics maker Futaba Corporation, an FED device was attempted by using the developed AlN:$Eu^{2+}$ phosphor. With the developed device, the reduction of luminescence intensity was less than 1/3 of that with the conventional product, demonstrating its excellent durability.

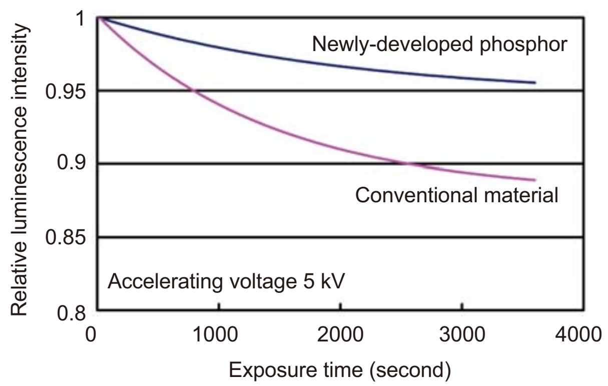
With the application of the blue phosphor developed in this research in FEDs, it will be able to produce displays with minimal long-term deterioration in image quality. As a result, flat panel televisions with high image quality using the FED method can be expected.

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

Fig.1

Newly-developed AlN blue phosphor.

Fig.2




Comparison of durability under electron beam irradiations. The AlN-based phosphor shows little degradation in luminescence intensity.





# Fullerene Nanobeam

## - A Micro-Spring Made from Fullerenes -

Fullerene Engineering Group,
Advanced Nano Materials Laboratory, NIMS
Graduate School of Pure and Applied Sciences, University of Tsukuba*

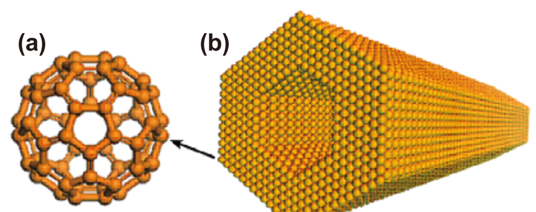
Group Leader Kun'ichi Miyazawa, Kazuma Saito*, Ryoei Kato*, Associate Professor Tokushi Kizuka*

Fullerenes are carbon molecules with closed cage structures. In particular, soccer-ball shaped $C_{60}$ is the best-known fullerene molecule (**Fig. 1(a)**). It has been reported that, under normal temperature/normal pressure, the $C_{60}$ molecule forms a crystalline semiconductor, i.e., a face-centered cubic (fcc) (density: 1.7 g/cm³) bonded by the van der Waals force, and its Young's modulus is approximately 20 GPa. In a range where Hooke's law holds, Young's modulus is a proportional constant ($=\sigma / \varepsilon$) between stress ($\sigma$) and strain ($\varepsilon$) under tension or compression applied to a rod of uniform diameter.

So far, numerous attempts have been made to apply $C_{60}$ to solar cells and transistors. Attempts to apply $C_{60}$ nanowhiskers ($C_{60}$NW) to field effect transistors (FETs) have also continued. $C_{60}$NW, a fine whisker-shaped crystal consisting of $C_{60}$, was discovered by our group in 2001. Now, this whisker-shaped crystal is called as 'fullerene nanowhisker' (FNW). FNW includes both hollow and non-hollow structures. In particular, the hollow FNW is called as 'fullerene nanotube' (FNT) (**Fig. 1(b)**). NIMS supplies samples of $C_{60}$ nanotubes ($C_{60}$NTs) as the NIMS standard testing material.

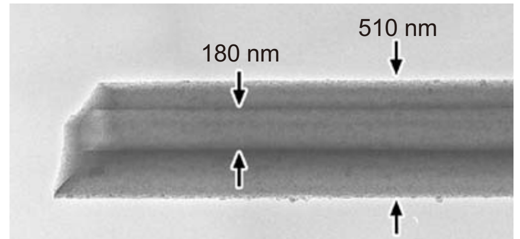
Since elastic bending of FNW to a small radius of curvature is possible, we can expect FNW to be applied to a lightweight semiconductor spring. Recently, an *in situ* transmission electron microscope at the University of Tsukuba with an internal atomic force microscope (AFM) device demonstrated that FNWs are harder than expected. **Figure 2** shows an observed image of a $C_{60}$NT (outer diameter: 510 nm, inner diameter: 180 nm) using the *in situ* TEM. **Figure 3** shows a bending process of the $C_{60}$NT seen in **Fig. 2** using a silicon cantilever tip inside the *in situ* TEM. From the measured applied force, it is found that the Young's modulus of $C_{60}$NT is 62-107 GPa. These values are 3-5 times larger than the modulus of the bulk $C_{60}$ crystals. Thus, it can be understood that the mechanical properties of $C_{60}$ crystals are dramatically improved by the change in shape to whisker. Cantilever beams are device elements for important micro electromechanical systems (MEMS), as used as AFM probes, micro-switches, etc. We are now searching for MEMS applications of fine, lightweight cantilever FNW beams (fullerene nanobeams).

Fig.1



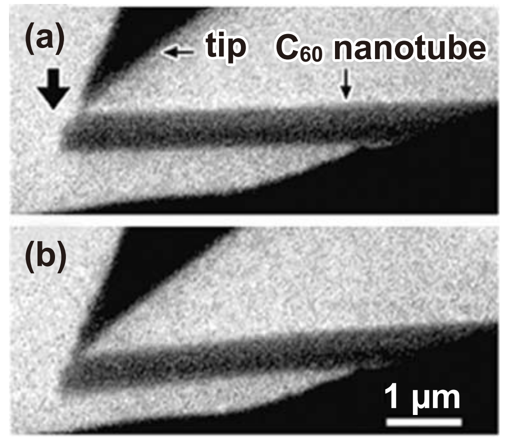

(a) $C_{60}$ (diameter: 0.71 nm) and (b) model of fullerene ($C_{60}$) nanotube ($C_{60}$NT).

Fig.2




Transmission electron microscopic image of $C_{60}$NT (reprinted from The Papers of Technical Meeting on Physical Sensor, IEE Japan, PHS-07-14).

Fig.3




Bending of $C_{60}$NT using silicon cantilever. (a) Before bending, (b) during bending (reprinted from The Papers of Technical Meeting on Physical Sensor, IEE Japan, PHS-07-14).

# NIMS Facilities and Equipments

In this part, we will introduce some of the facilities and equipments at NIMS.
The purpose of NIMS' Department of Materials Infrastructure is to create breakthroughs based on advanced materials characterization and fabrication techniques. One of the tasks is the development of infrastructure technologies, which include the world's highest level large-scale facilities and cutting-edge equipments, and which can be shared with outside researchers, including those at educational institutes and private-sector companies. Another task is to publish materials information which is necessary for expanded international use of new substances and materials, selection of optimum materials, etc. The High Voltage Electron Microscopy Station, which has been given a spot in this issue, aims at contributing to science and technology in harmony with society through the development of large scale and advanced equipments.

## High Voltage Electron Microscopy Station (HVEMS)

The High Voltage Electron Microscopy Station was established for the purpose of technical development and the joint use of various types of transmission electron microscopes (TEM), which are difficult to introduce at other research institutes, aiming at "electron microscopy for nanotechnology and the 21st century."

In technical development, our objectives are to develop dynamic observation techniques at the atomic and molecular levels, improve spatial resolution by correcting aberration, develop advanced spectroscopic characterization techniques, and conduct R&D on Lorenz electron microscopy and electron beam holography.

We are also promoting efficient researches by actively providing support in connection with the preparation of electron microscopy specimens, which are necessary in actual observation, and image analysis to analyze the observation results. (A part of this work is performed by the NIMS Nanotechnology Support Network.)

The following introduces some of the electron microscopes that are available to outside researchers as "user facilities." (The cover photo shows the dual ion beam interfaced in-situ high voltage electron microscope.)

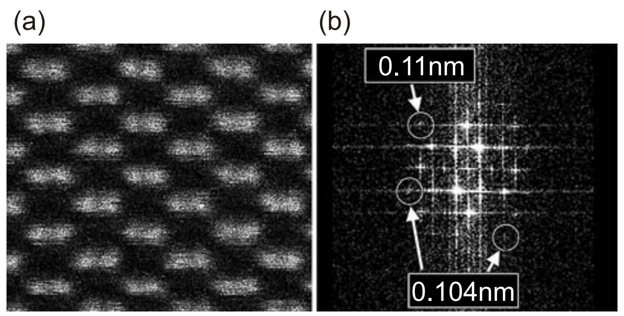
Managing Director
Department of Materials Infrastructure
Managing Director, HVEMS
**Kazuo Furuya**

## Ultra High Vacuum Spherical Aberration Corrected Scanning Transmission Electron Microscope (UHV-Cs-Corrected- STEM)

We developed an ultra high vacuum spherical aberration corrected scanning transmission electron microscope (UHV-Cs-Corrected-STEM) with an accelerating voltage of 200 kV, and are performing applied research on the analysis of advanced materials and nanomaterials using this device.

The newly developed spherical aberration corrector consists of 6 pole-lens in 2 stages, which form an asymmetrical magnetic field, and a 3-stage transfer lens. Cancelling the positive aberration of the objective lens has realized STEM resolution of 0.1 nm and also increased beam intensity by a maximum of more than 10 times. In order to prevent contamination by the strong converging beam, an ultra high vacuum is applied, in which the remaining gas in the device specimen chamber is reduced to the absolute minimum.

This device is continuing to produce impressive results in observation of semiconductor quantum structures, anomalous grain boundary structures, etc.




(a) and (b) show an HAADF-STEM image of Si<110> and its Fourier transform image. Resolution of approximately 0.1 nm has been achieved.

### [How to apply to use NIMS' "user facilities"]

Researchers at other institutes can apply to use NIMS' "user facilities" via the Web. First, you should register as a user and submit a user facilities research proposal. Proposals will be reviewed as required, and you will be notified of the results.

For more details, please visit: http://www.nims.go.jp/em_nims/ENG/





## Appointment of New Fellow

**Dr. Hiroyuki Sakaki**

(April 1, NIMS) -- Dr. Hiroyuki Sakaki, Vice President of the Toyota Technological Institute, was newly appointed as a NIMS Fellow.

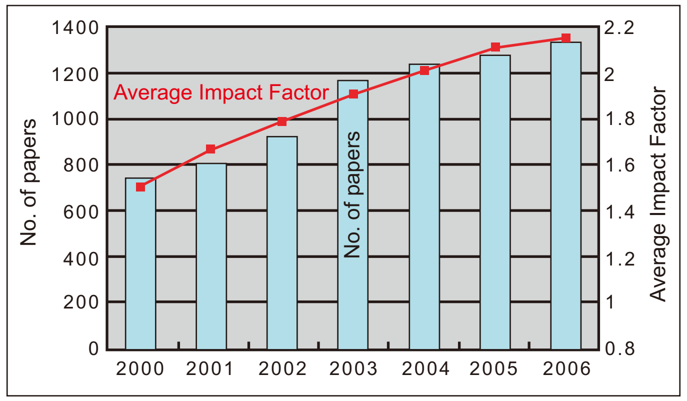
**Biography**

Dr. Sakaki received his Ph.D. in electronics from the University of Tokyo (UT) in 1973. He then joined UT, where he served as a professor both at the Institute of Industrial Science ('73-'07), and the Research Center for Advanced Science and Technology ('88-'98). Since 2007, he has been a Vice President of the Toyota Technological Institute.

## NIMS Surpasses 1300 Published Papers in 2006

In 2006, NIMS' researchers published 1,321 papers in scientific journals listed in Thomson Scientific's Essential Science Indicators (SCI papers). This was an increase of 1.8 times from the year 2000, immediately before NIMS became an Independent Administrative Institution (IAI). The average Impact Factor (IF) of the journals carrying NIMS' paper in 2006 was 2.17, which is more than 0.6 points higher than before NIMS became an IAI.

These facts show that NIMS' researchers are steadily producing research results, and at the same time, these achievements are being published in more influential journals.




Note: Analysis based on the Web of Science database provided by Thomson Scientific. The search was limited to "article" as the type of literature.

## Innovative Publications by NIMS

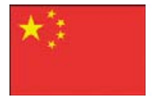
NIMS has served as the hub of all research in Japan related to materials science, while forging links with other countries and continuing our own research. As part of such activities, NIMS published "Materials Science Outlook 2005" in 2005. Now the second edition, "Materials Science Outlook 2006", is also available online (http://www.nims.go.jp/eng/news/outlook/).

Part I of the 2006 version outlines Japan's Third Science and Technology Basic Plan. Part II focuses on policies and research institutes for materials science in Asia. The book also offers an outlook on materials research in Part III, which consists of five sections devoted, respectively, to nanotechnologies, nanomaterials, materials for information technology, bio-nano materials and energy/environment.

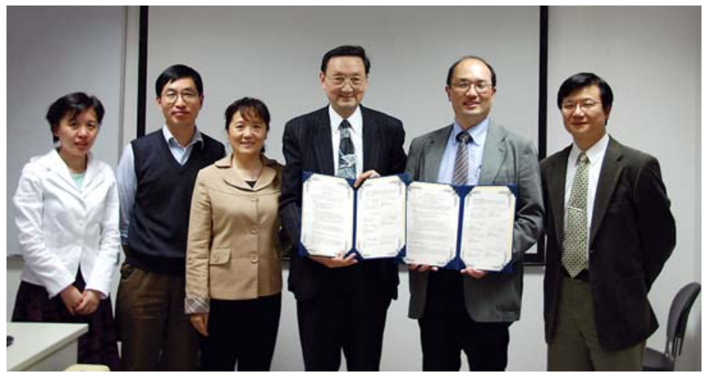
Also downloadable from the web page is "A Vision of Materials Science in the Year 2020" (http://www.nims.go.jp/eng/news/nims2020/), an excerpt of the "2020 NIMS Policy Paper" (in Japanese). We look forward to your visit.


Contact: Planning and Research Office  Email: Planning-Research@nims.go.jp

## NIMS Signs MOU with China's Nanjing University



(April 23, Nanjing) -- The NIMS Nano System Functionality Center (NSFC) signed a Memorandum of Understanding (MOU) for collaboration with the Research Institute of Superconductor Electronics (RISE), the Department of Electronic Science and Engineering (DESE) of Nanjing University, China. RISE is a leading institute in China in the high frequency applications of superconducting devices. NSFC and RISE plan exchanges of researchers and information on research, either on their own work or joint efforts between them, as well as other activities in the field of nano superconductor electronics, starting with joint research on terahertz devices and quantum computing utilizing Josephson junctions.



(From left) Prof. L. Kang, Prof. J. Chen, Prof. W. W. Xu (Chair, DESE), and Prof. P. H. Wu (Academician, Chinese Academy of Sciences, and Director, RISE), Dr. T. Hatano (Group Leader, NSFC), and Dr. H. B. Wang (Senior Researcher, NSFC).

## NIMS' President Kishi Receives Honorary Doctorate from Tampere University of Technology, Finland

(May 25, Finland) -- NIMS President, Prof. Teruo Kishi, was awarded an honorary doctorate by Tampere University of Technology in Finland. The honorary doctorate awarded by Tampere University is a prestigious degree which is given to those who have made outstanding achievements in research in the university or in scientific, artistic, or social fields. The award to Prof. Kishi recognized his many achievements in the fields of new materials development and materials evaluation and his contribution to the creation of a new global research network. Among those who also received honorary doctorates on the same occasion was Dr. Zhores Alferov of Russia, the Nobel Laureate in Physics in 2000.

President Kishi receiving his doctor's degree and traditional design "doctor's hat" at the award ceremony.

## Hello from NIMS

### Minasan Konnichiwa!

Matthieu Petit (France)
Post-doctoral Researcher (September 2006-present)
Advanced Device Materials Group, Advanced Electronic Materials Center

I am Matthieu Petit from France. I did my Ph.D. in solid-state physics at the Blaise Pascal University in Clermont-Ferrand, a city near the old volcanoes of the Massif Central. I work now at NIMS in the Advanced Device Materials Group, which is led by Dr. Toyohiro Chikyow, in the Advanced Electronic Materials Center. My main research interest lies in organic semiconductor thin films for field effect transistors. I work in collaboration with my host researcher, Dr. Yutaka Wakayama.

So why did I decided to go and work in Japan? Well, there are many reasons, as you can guess! As a teenager of the 90's, I used to watch animes (Japanese cartoons) on TV and played video games! That was my first contact with the culture of the Chrysanthemum Empire (Have I an *otaku*-that is, geek-background?!). Then I began my research activities in semiconductors, in which Japan is very strong. Eventually I went to Japan for the first time as a tourist in 2004. And I liked and felt good in this country! The idea of working in Japan appeared to me: a good balance between my professional activities and my wish to experience living in a very different culture than my own. This became a reality thanks to Prof. Vladimir Matolin, Head of the Department of Electronics and Vacuum Physics of Charles University in Prague, Czech Republic, who told me about NIMS.


[ With some of my colleagues in Nikko National Park (author: left) ]


[ In front of the Kamakura Daibutsu (Great Buddha), trying to find Enlightenment! ]

Thus, for almost one year I have been enjoying daily life in Tsukuba and Japan: good conditions of work, of course, but also shrines, earthquakes, miso soup, the crazy day- and nightlife of Tokyo, high-tech sushi restaurants (yeah, the ones with a conveyor belt!) and "onsen," the famous Japanese hot-spring baths, which should be an international thing promoted by the United Nations or World Health Organization in my opinion!! Last but not least, living in Tsukuba is a great opportunity to meet people from all over the world. A priceless chance to keep my mind opened!

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