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Nobel Laureate in Physics 1986 / NIMS Fellow

Message from President

Aiming at Becoming the World's Preeminent Materials Research Institution with an Autonomous, Independent Spirit

Prof. Teruo Kishi

In the past year, NIMS launched its 2nd Mid-Term Program with two priority R&D regions, "Nanotechnology-driven advanced materials research" and "Advanced materials research for social needs." In this interview, NIMS' President, Prof. Teruo Kishi, discusses the Institute's goals for the second year of its new Mid-Term Program.

Making "serendipity" a keyword.

Nanotechnology Driven Materials Science for Sustainability: This is the concept of NIMS as we aim at becoming the world's preeminent materials research institution. Our goal is to create new materials by firmly promoting nanotech as an element technology. We intend to develop this in a wide range of research regions, including IT, biotechnology, and energy/environmental technologies. NIMS' mission is to contribute to building a sustainable society through these activities.

The recent adoption of the word "serendipity" in the creation of new materials is an extremely significant feature. Serendipity means "unexpectedly making important discoveries." By nature, this idea is hardly familiar in projects, but by daring to introduce this word, we have emphasized the interesting nature of materials research.

By incorporating organic materials and biotechnology as well as metals and ceramics in the creation of new materials, we are attempting to create boundary regions and interdisciplinary regions involving these various fields. We want to open up new fields which use the technology called nanotech by integrating various areas of materials science that have evolved in separation until now. In other words, in addition to the conventional image of fusing or integrating several kinds of materials, we are promoting research with the aim of creating materials that will result in true innovations, and by this, leading the world in materials science.

Building an effective system by analyzing the past and knowing ourselves.

In order to realize the kind of innovations which will lead the world, we must carefully consider how to make the existing systems function effectively and what direction we expect systems to take us in the future. When considering systems for promoting research, we must ultimately direct our efforts to the future by considering the past, knowing our own true capabilities, and determining what we should do in the present. Naturally, external evaluations of research are essential for this, but internal evaluations and self-evaluation are also necessary. It is extremely important to consider personnel hiring decisions and the creation of systems on this basis.

From the long-term perspective, "play" is also important for producing the maximum efficiency. This is germinal research, or what we call "exploratory" research. This is a research system for creating research that will lead to themes with the potential to become the "seeds" of research projects, and to the discovery of new principles and opening of new fields of science in the future, by grappling with challenging themes based on free concepts. We commit 10 % to 15 % of our total budget and 10 % to 15 % of our human resources to this kind of research.

Furthermore, as an Independent Administrative Institution, NIMS must also promote research which is differentiated from university research. In addition to pure fundamental research, we are also engaged in fundamental research with clearly-defined objectives. In particular, we have created facilities and equipment which universities don't have, as can be seen, for example, in our high magnetic field facilities, ultra-high voltage electron microscopes, and foundry facilities, among others, and we must therefore carry out research which is not possible at universities. Also, the fact that we can carry out research with some degree of long-term stability, without interruption in our operating subsidy, is a key point for producing major achievements.

The International Center for Young Scientists (ICYS) conducts activities from the viewpoints of training young researchers and internationalization. The ICYS, which is operated based on the "melting pot" concept, has developed the four "Ins," Independent, Interdisciplinary, Innovative, and International, as keywords. As a site where different scientific fields, cultures, and peoples come together through research, the ICYS carries out original research activities. Based on the successful progress of this program since its inception in 2003, we have decided to continue its activities as a new post-ICYS beginning in 2008.

A more clearly-defined role for NIMS in information circulation.

Cooperation with private companies is progressing smoothly through joint research, materials research platforms, and other NIMS' programs. For example, we hold an "Evening Seminar" for technical exchanges on alternate Fridays at NIMS' Tokyo Conference Room, and the number of participants from companies has increased steadily. The important point in this is "information circulation." By allowing us to input concrete information from companies, we expect to eliminate unfocused research. Our materials research platforms match "seeds" and "needs," and function as sites for research aimed at practical application. Through these forms of cooperation with private companies, we have discovered that what companies want from NIMS is fundamental and basic research and more specialized deep knowledge, expecting this to lead to the creation of new markets.

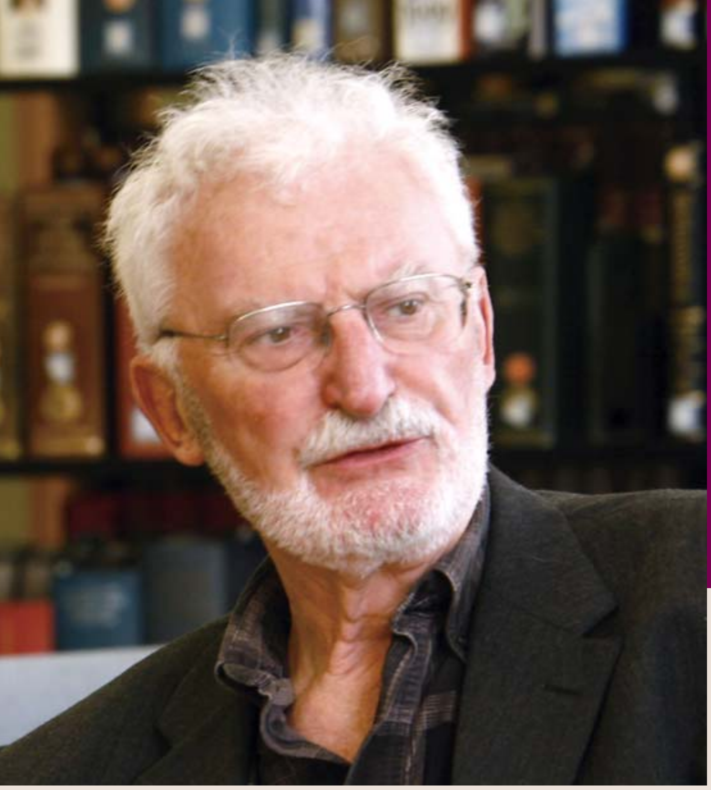
NIMS is also involved in a large number of international cooperative activities. A representative example of this is the "World Materials Research Institute Forum" for promoting advanced materials research and globalization in materials research. NIMS took the initiative in starting this Forum, which aims at strengthening research-related information exchanges and international collaboration jointly with the world's leading materials research institutes. The 1st Forum was held in June 2005 with 15 research institutes from Europe, North America, and Asia participating. The 2nd Forum will be held in Berlin in June of this year. In combination with this, we intend to hold a symposium to which we will invite young researchers from foreign countries. We also expect to start several working group activities, showing the increasingly important presence of this event.

As one of the world's core research institutes, it is NIMS' role to display leadership in materials science, beginning with these activities.

Profile

Teruo Kishi

As the first President of NIMS, Prof. Kishi is promoting a variety of innovations in research systems, evaluations, the operational aspect, etc., while also serving concurrently as the Director General of the NIMS Nanotechnology Support Network and member of the Basic Policy Research Committee of the Japanese government's Council for Science and Technology Policy. Prof. Kishi was also Vice President of the Science Council of Japan from 2003 to 2005. His professional field is strength/nondestructive evaluation of materials.



NIMS NOW International Renewal - A Commemorative Talk

"In Creating New Things, A Very Open Mind Is Important"

Heinrich Rohrer × Masakazu Aono

Nobel Laureate in Physics 1986 — NIMS Fellow

Profile

Heinrich Rohrer

Graduated from the Swiss Federal Institute of Technology (ETH), received his doctorate from ETH Zurich. After two post-doc years at Rutgers University, USA, he joined IBM's Zurich Laboratory and became an IBM Fellow. In 1979, Dr. Rohrer invented the scanning tunneling microscope (STM) with Gerd Binnig, and in 1986, he was awarded the Nobel Prize in Physics for this achievement.

Profile

Masakazu Aono

Completed his doctorate at the University of Tokyo, School of Engineering. In the course of his career, he worked as a Researcher and subsequently as Senior Researcher at the National Institute for Research in Inorganic Materials, Senior Researcher at RIKEN, Professor at Osaka University, Graduate School of Engineering, and Managing Director of the Nanomaterials Laboratory at NIMS. He is currently a NIMS Fellow and Managing Director of the Nano System Functionality Center.

Commemorating the Renewal, NIMS NOW International planned a talk between Nobel Laureate Dr. Heinrich Rohrer, who has given valuable advice to NIMS since the institute's creation, and NIMS Fellow Dr. Masakazu Aono. During a recent visit to NIMS, Dr. Rohrer presented a suggestive general lecture entitled "Science, for the Benefit of Mankind" and gave young researchers in the International Center for Young Scientists (ICYS) and NIMS Key Nanotechnologies Area opportunities for informal discussions. He also graciously responded to our request for this talk.

Young scientists with their unbiased minds give the thrust to new fields.

Aono: An international conference (ICN + T2006) commemorating the 25th anniversary of the invention of the scanning tunneling microscope (STM) was held recently in Switzerland, the birthplace of the STM, with well over 1000 persons in attendance. As one of the inventors of the STM, what was your impression of this historic conference?

Rohrer: The STM was a joint invention with Gerd Binnig. At that conference, I was mostly impressed by the large number of young scientists, and particular of the respectable portion of young women scientists. Women so far tended to avoid physics, technology domains, and engineering. It seems to me that the delicate but very challenging science and technology on the nm scale with its strong interdisciplinary component is more appealing to women than big and clumsy machines. It is the young scientists with their unbiased minds that give the thrust to creation. The youthful vitality at that international conference carries the promises for an exciting future.

Aono: The invention of the STM certainly triggered the development of nanoscience and technology. When you invented the STM, could you imagine the impact it would have?

Rohrer: Like always in science, first comes seeing and measuring, and then you can do something with it. There wasn't any biology before the optical microscope. And without the electron microscope, there wouldn't have been microelectronics. In the same sense, I expect that the invention of the STM would open the way to new fields. And I think it did so far, very well indeed.

For new development of nanotechnology, new fabrication techniques are important.

Aono: After the way was opened to nanotechnology, it passed through an initial stage and a fever stage and has now entered a third stage. What do you see for the future?

Rohrer: If nanotechnology is not 100 times more than what I think it'll be, it'll be too little. We simply cannot anticipate the real development, because it comes up through so many brains. Then of course there are the many fabulous technical challenges, and the developments depend on how fast we can master them. In materials science, which is NIMS' speciality, there is a great chance to create new technologies by creating new materials and vice versa, leading to novel nanoscale fabrication techniques.

Aono: So in that sense, in fabrication techniques, we have to use completely new methods.

Rohrer: That's right. The grand challenge for nano scale material science I consider growing with nm precision a given structure at a given place for a given function. Of course, local probe techniques are important for learning how to do it and to check what has been done, but they are in general not the production techniques. We have to do it by - how would I say? - controlled, or guided, self-organization. It's not just self-organization like nature does it.

Aono: It's often said that "nature is the best nanotechnology". For example, if we consider the human brain, the immensity of the nanotechnology used is overwhelming. However, if we think that it's constructed by DNA, and if we had an astronomically long time for trial-and-error, we could say that it's natural to arrive at this point. This means that it's not necessarily wise to try to realize functions like those of the brain by using other available parts, for example, transistors. In fact, it may be impossible. Available parts are being improved every day, but our aim should be to realize the highest things possible using those parts. It's also important to create new things which even biotechnology can't create.

Rohrer: You're correct. The true meaning of "nature is the best nanotechnology" is not to imitate nature, but to find inspiration by observing nature.

Aono: From that perspective, this highlights the need to actively develop completely new fabrication methods, in other words, methods of controlling substances and materials. For example, if it is possible to freely arrange soft, plastic nanosubstances in the spacings in a hard, unchanging matrix, and if those soft, plastic substance change depending on external signals, the environment, and their history, it will be possible to realize nanosystems with extremely interesting functions.

Researchers should be given freedom to pursue what they think is worthwhile.

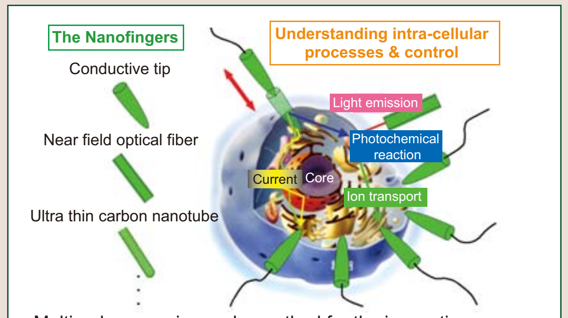
Aono: Finally, could you give us any suggestions for the future of NIMS?

Rohrer: Because NIMS is already engaged in a research at a high level, I think you can do the things that NIMS should do.

As an advice for young researchers: when you're creating new things, when you venture into new and unexplored territories, be aware that a lot simply happens and is not specifically planned or made to happen. Only a very open mind can notice and appreciate duly the unexpected. As Pasteur said: "chance favors the prepared mind". I think you have sufficient freedom in NIMS, to pursue what you think is worthwhile pursuing. It is important, that the young scientists get encouraging support and a helping hand here and there by their mentors; encouragement, not direction.

Finally, NIMS is engaged in a large number of leading-edge research projects in the field of nanotechnology. Speaking only of research that I know well, the atomic switch and the multiprobe instrument are pioneering technologies at the world level with very interesting potential. In particular, the extension of multitip STM to a multiprobe instrument with different types of local probes should become extremely important for nano-biomaterials and systems biology research, quite different from the original intention of the multitip STM. (See schematic diagram.) Novelty goes its own, unexpected ways.

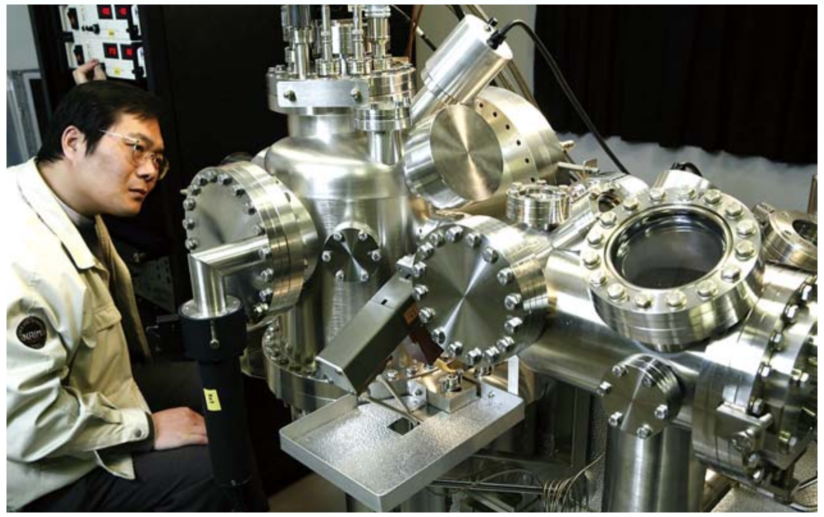
Aono: Your last comment is extremely encouraging. Thank you very much.



Multiprobe scanning probe method for the innovation of nanobiomaterial research.

High Temperature Materials Center

High Temperature Materials 21 Project



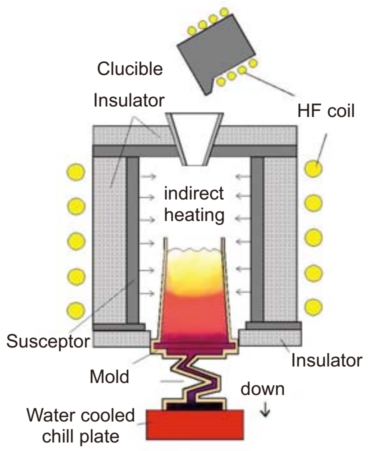
Condition of atomic-level microstructural analysis by Atom-probe Field Ion Microscope.

Using alloy design techniques based on theoretical/empirical property prediction and atomic-level microstructural analysis, the High Temperature Materials Center is engaged in the development of advanced high temperature materials such as high performance nickel (Ni) base single crystal superalloys, new coating systems, nickel-cobalt (Ni-Co) base forged alloys, platinum group metals (PGMs) base refractory superalloys, and others in order to realize large gas turbines for 1700 °C class ultra-high efficiency power generation, small gas turbines for high efficiency cogeneration systems, next-generation jet engines, etc. The Center is also carrying out dynamic/long-term property evaluation/analysis supposing actual environments, construction of virtual engine simulation program, and is endeavoring to contribute to CO_2 reduction and energy saving by applying research results to actual jet engines and power generating turbines through cooperation with other government ministries and companies in Japan and other countries.

The Rolls-Royce Centre of Excellence for Aerospace Materials at NIMS

In joint work with Rolls-Royce (RR), the High Temperature Materials Center is developing Ni-base single crystal superalloys with excellent temperature capabilities for use in the high temperature components (turbine blades) of jet engines for large civil aircrafts. The development target is an alloy with the world's highest temperature capability* of 1150 °C, which will be approximately 100 °C higher than that of the materials currently used. Research is being carried out with the aim of practical application in engines manufactured by Rolls-Royce in 2012. A calculation by Rolls-Royce showed that engine efficiency can be improved by 1 % if the temperature capability is increased by 40 °C. Assuming a Tokyo-New York round trip by the Boeing 787, which will go into service in the near future, this would reduce fuel consumption by approximately 500 liters, and thereby reduce CO_2 emissions by 2.5 tons.

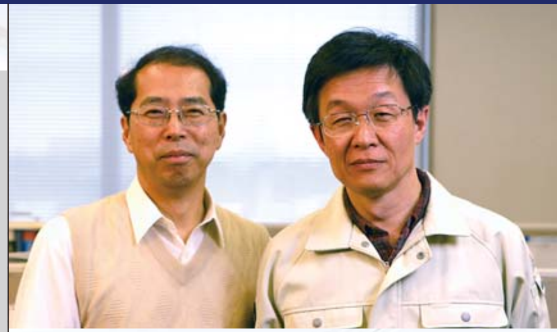
*Temperature capability is defined as the temperature at which creep rupture life at a stress of 137 MPa is 1000 hr.



Casting of a Ni-base single crystal alloy using a directionally solidified casting furnace. As shown at the right, after molten alloy is cast into a special mold in the vacuum furnace, a single crystal material is produced by the withdrawal method. Various types of test specimens have been prepared from this cast material.

Development of High Performance Nickel (Ni) Base Single Crystal Superalloy

- Development of Ni-Base Single Crystal Superalloy with Excellent Creep Strength and Thermo-Mechanical Fatigue Properties for Gas Turbines in Power Generation -

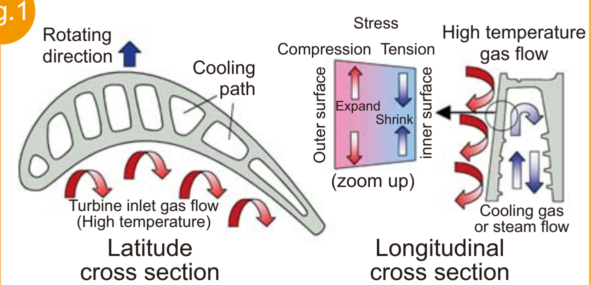


Managing Director
Masao Sakamoto, Hiroshi Harada

We are engaged in research and development on high performance Ni-base superalloys with the aim of realizing advanced jet engines and high efficiency land-base gas turbines for power generation. Among these, to date, as single crystal superalloys we have developed the TMS-162 alloy and TMS-196 alloy, which feature a combination of the world's highest creep strength and microstructural stability, by adding the platinum group element ruthenium (Ru). However, because land-base turbines are used in a repeated cycle of rated operation/stop over long periods of time, the material must possess not only creep strength, but also excellent fatigue properties under high temperature conditions (thermo-mechanical fatigue properties; see **Fig. 1**). Furthermore, because the turbine blade shape is larger and thicker than that in jet engines, it is also necessary to hold down the cost of the material.

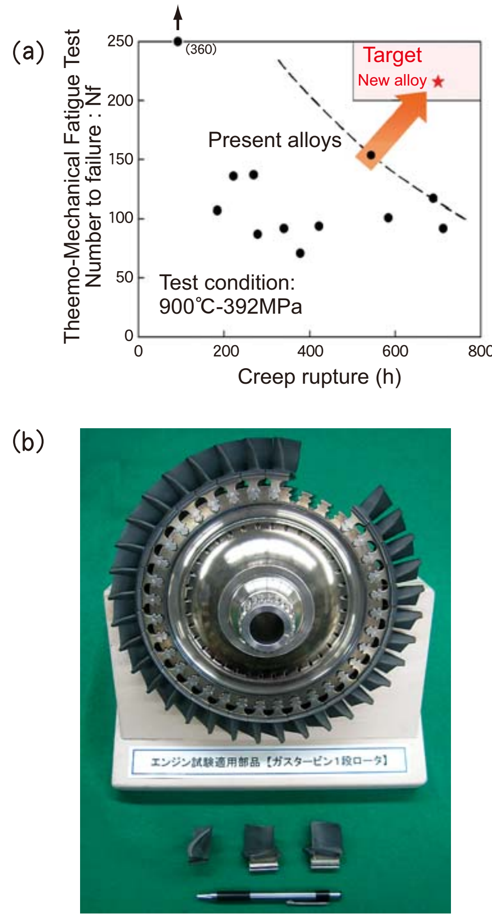
Therefore, in joint research with Mitsubishi Heavy Industries Ltd. and Kawasaki Heavy Industries Ltd., we are developing alloys which are suitable for large-scale 1700 °C class gas turbines for ultra-high efficiency combined-cycle power generation and small-scale turbines for cogeneration system. As a result, we have developed an alloy with both high creep strength and excellent thermo-mechanical fatigue properties, as shown in **Fig. 2(a)**. The creep rupture life and number of cycle to failure of this alloy exceed those of the conventional alloys now in practical use. In the development of an alloy for small-scale turbines for cogeneration system, we actually cast turbine blades as shown in **Fig.2(b)**, and after carrying out various element tests for practical application, installed these in a turbine rotor and successfully conducted an actual machine operation test. Based on these results, realization of high efficiency gas turbines for power generation is expected.

Fig.1



Schematic diagram of thermo-mechanical fatigue which occurs in a cooling turbine blade. Thermo-mechanical fatigue occurs due to repeated expansion/contraction of the turbine blade surface due to the difference in the temperature of the combustion gas and internal cooling during operation, cooling during stops, etc.

Fig.2



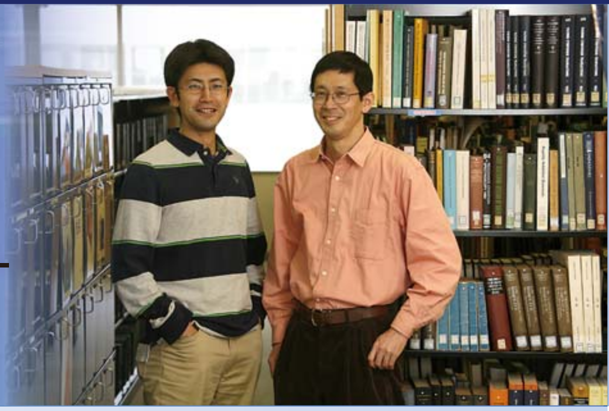
(a) shows the relationship between the creep rupture life and number of cycle to failure of various Ni-base superalloys under conditions of 900 °C and 392 MPa. Although these are severer than actual service conditions, the new alloy is superior to the conventional alloys in both creep properties and thermo-mechanical fatigue properties. (b) shows the turbine blades used in the actual machine test of a small-scale cogeneration turbine (bottom) and the appearance of the turbine rotor in which these blades were installed.

Development of Carbon Nanotubes with High Electrical Conductivity

- Application to Nanowiring and Transparent Electrodes -

Nano Frontier Materials Group, Nano System Functionality Center

Group Leader
Satoshi Ishii, Yoshihiko Takano



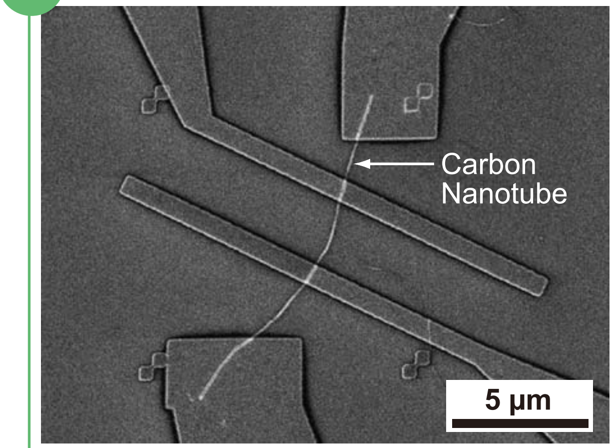
Beautiful diamond jewels, graphite used in pencil leads, soccer ball-shaped C_{60}, fullerenes, and carbon nanotubes (CNTs); they all consist of single element, carbon. Because CNTs have a fine straw shape with a diameter of less than one ten-thousandth of a millimeter and is light and strong, these novel properties make them potentially useful for a variety of applications in fields, such as nanowiring for future LSIs, and transparent electrodes. However, depending on the "handedness," or chirality, of CNTs, its properties differ greatly, for example, showing metal-like conductivity or the properties of a semiconductor. To date, attempts to control the chirality have not been successful.

In order to use CNTs for nanowiring and similar applications, high electrical conductivity independent of chirality is necessary. We have successfully fabricated boron-doped CNTs by a simple chemical vapor deposition method employing an electric furnace. Using electron beam lithography, four terminals were fabricated on a CNT and its electrical conductivity was measured (see **Fig. 1**). The results showed that the electrical conductivity of the CNTs at room temperature is one to two orders of magnitude higher than that of conventional multi-walled CNTs. Furthermore, it was also found that the CNTs retain its high electrical conductivity at down to extremely low temperatures (see **Fig. 2**).

Our group is conducting research on high electric conductivity and superconductivity that are found to occur when boron is added to diamond. Similarly, in CNTs, we assume that hole carriers are introduced into carbon when doped with boron, making it possible to obtain high electrical conductivity independent of the chirality of CNTs. In the future, superconductivity could also be found in boron-doped CNTs.

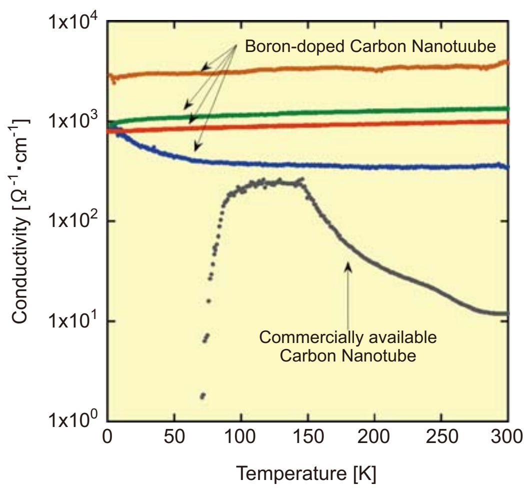
This new method has applications in a wide range of fields, including transparent electrodes and conductive films produced by adding CNTs to resins, nanowiring for future LSIs, CNT field effect transistors (FET), probes for scanning probe microscopes, electron emission devices, and fuel cells.

Fig.1



Scanning electron microscope image of a boron-doped CNT with a nanofabricated four terminals.

Fig.2



Temperature dependency of electrical conductivity.

Development of High Performance Photocatalyst-Coated Film

- Realizing a Corrosive Gas Decomposition Rate 30 Times Faster than the Conventional Technology -

Advanced Materials Research Group, Photocatalytic Materials Center

Managing Director
Defa Wang, Tetsuya Kako, Jinhua Ye

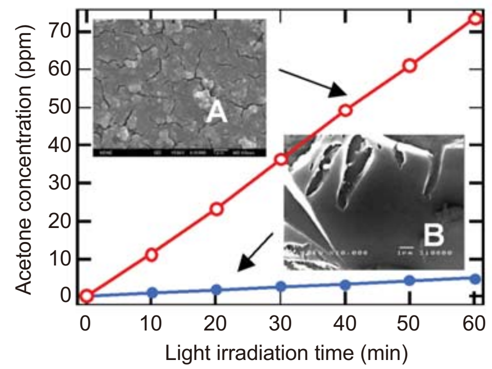
Titanium oxide photocatalysts are applied as environmental purification materials in a variety of products. In actuality, a titanium oxide photocatalyst is usually coated on the surface of a substrate of ceramic, glass, metal, or other materials in the purification devices for decomposition of harmful substances in the air.

In conventional titanium oxide photocatalytic filters, a slurry (a liquid dispersed with titanium oxide) mixed with a silica-based binder (a component which fixes the titanium oxide on the substrate surface) is coated on a porous ceramic material and fixed by heat treatment. However, for various reasons, the films produced by this process did not posses adequate photocatalytic activity. For example, in addition to the fact that a sufficient reaction surface area was not secured, light failed to reach the film interior, and the film contained heterogeneous silica compounds.

To solve these problems, we conducted a joint research on the development of new photocatalyst-coated films with Meidensha Corporation. First, we produced the films on glass plates in which the slurry and binder component were systematically adjusted, and investigated the crystallinity, surface morphology, film thickness, strength, and isopropyl alcohol (IPA) decomposition activity by the photocatalytic reaction of these films. **Fig. 1** shows a part of the results. The ordinate is the amount of acetone formed by decomposition of IPA. The formation rate with sample A is as much as 15 times faster than that with sample B. This result is attributable to the fact that, with sample A, numerous fine cracks are formed in the surface, as shown in the photograph (inset), and these increase the surface area that contributes to the reaction. As a further development based on these preliminary experimental results, micro-sized acrylic beads were introduced in a titanium-based binder component on an actual porous ceramic substrate. Because these beads are decomposed upon heat treatment, a coated film having a structure of micro-sized holes was obtained (**Fig. 2**). This resulted in a total increase in the amount of photoreaction due to a large increase in the effective surface area of the titanium oxide, and the penetration of light to the deep parts of these holes, etc. In a photocatalytic test for decomposition of hydrogen sulfide using the developed photocatalyst-coated film, a hydrogen sulfide decomposition rate more than 30 times faster than that of the conventional product was achieved.

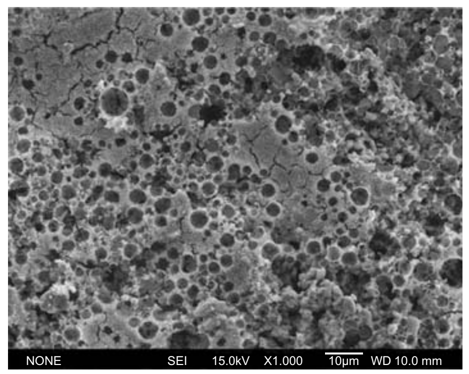
In addition to corrosive gases such as hydrogen sulfide, the photocatalytic filter developed in this research also enables highly efficient removal of various species of harmful molecules in the atmosphere, such as formaldehyde, sulfur dioxide, ammonia, nitric oxide, and the like. In the future, application to diverse types of air purification devices is expected.

Fig.1



Results of a preliminary experiment using a titanium oxide coated film with a controlled morphology. The properties of sample A, which is characterized by numerous fine cracks, are superior.

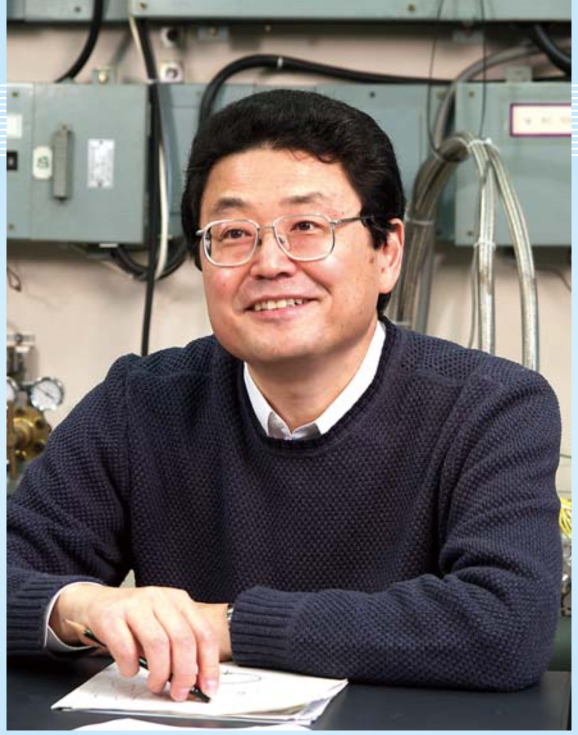
Fig.2



Surface SEM image of the photocatalyst-coated film fabricated by the new technique developed in this research. The baking temperature was 500 °C. A large number of micro-sized holes can be observed.

This feature introduces NIMS researchers and staff members who are engaged in outstanding research and original activities. This first "FACE" item presents an interview with Dr. Osamu Mishima, a NIMS researcher who received the Nishina Memorial Award in December of last year for "Experimental Research on Phase Transition and Polyamorphism in Water and Amorphous Ice."

The Answer is in Nature



Osamu Mishima, Senior Researcher

Special Subjects Group
Advanced Nano Materials Laboratory

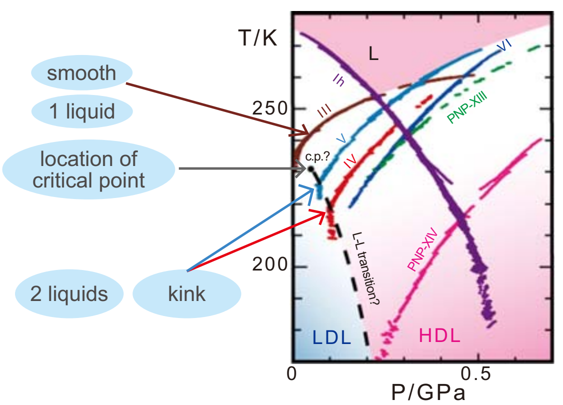
What led you to begin research on the liquid-liquid phase transition and critical point?

When I was a research associate at the National Research Council of Canada, I discovered that high density amorphous (HDA) ice forms if pressure is applied to ice at the temperature of liquid nitrogen, or 77 K (-196 °C), and HDA then changes to low density amorphous (LDA) ice if the pressure is decreased and the temperature is increased. This was the discovery of the HDA-LDA transition, and was work done around 1984.

What about your research on amorphous ice after returning to Japan?

After I joined the National Institute for Research in Inorganic Materials (now NIMS) in 1985, I wanted to clarify this phenomenon. Because this was important, I naturally wanted to do research on the subject, so I continued work on the amorphous phase transition. While I was involved in this, Peter H. Poole et al. at Boston University tried to elucidate the behavior of supercooled water at low temperatures around 228 K in simulation research. They advanced the hypothesis that, since the HDA-LDA transition exists, a liquid-liquid (L-L) phase transition between a high density liquid (HDL) and low density liquid (LDL) might exist in supercooled water and a critical point for the L-L transition might exist.

Melting curves of heavy-water ice



Mishima, PRL (2000)

Tell us about your experiments with water after Poole's hypothesis in 1992.

I performed experiments to investigate the critical point using melting curves for ice. As a result, I found that several of the melting curves for ice displayed breaks at the expected points on the L-L phase transition line. This is due to the difference between HDL and LDL. If this transition is discontinuous (the state changes suddenly), a critical point exists. This position was predicted experimentally. It is possible to classify the amorphous structure. In other words, this means that polyamorphism suggests an L-L phase transition and critical point.

These results were published in "Nature" in 1998, among other places.

The "mysteries of water" including the maximum density at 4 °C may virtually all be explained by the critical point. The theory of the critical point also shows good agreement with the experimental results. Quite recently, Mikhail A. Anisimov et al. at the University of Maryland published a paper presenting calculations for water using a scaling theory of the critical point. I also confirmed this, but I was extremely pleased by the agreement between the experimental results and physical theory.

This new science of liquids, the L-L critical point, would seem to open a variety of possibilities.

Until now, water was considered a mysterious liquid with anomalous properties. However, the cause of these mysteries, that is, the L-L critical point, is gradually being revealed. Nature may demonstrate whether a critical point exists or not if we perform repeated verification experiments. Because there are still areas where many unknowns exist, I'll continue to put a lot of effort into this in the future.

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

* Dr. Mishima also received the NIMS President's Award - Research Achievement Prize for FY2007.

Reorganization of NIMS' Organization

(April 1, NIMS) -- NIMS reorganized its organization in order to construct an operating system with greater mobility and strengthen its research base.

First, in the operational aspect, positions of Assistant to the President and Deputy Assistant to the President were established by type of work for long-term planning, human resources hiring/development, research resources, evaluation, and innovation as a system for carrying out work under the direct jurisdiction of the President. A Scientific Information Office was also created and is responsible for dissemination, collection, and analysis of information, including operation of the NIMS' materials portal site, publication of journals, and related work.

In the research division, a new "NIMS Nanotechnology Support Network" was established to handle a wide range of work including sharing of nanotechnology-related facilities/equipment with outside researchers and creation of networks.

Based on the new system, NIMS is carrying out advanced research so as to make an even greater contribution to society as Japan's core institute in materials research.

- President
  - Auditors
  - Advisory Board
  - Vice Presidents
  - Assistants/Deputy Assistants to the President
  - Fellows
  - Coordinating Directors
  - Audit Office
  - Secretary's Office
  - General Affairs Division
  - Integrated Strategy Office
  - Collaboration-Promotion Office
  - International Affairs Office
  - Public Relations Office
  - Scientific Information Office
  - Planning & Research Office
  - Human Resources Development Office
  - Information Technology Office
  - Centers
    - Key Nanotechnologies: Nano System Functionality Center; Advanced Nano Characterization Center; Computational Materials Science Center; Quantum Dot Research Center; Quantum Beam Center
    - Nanoscale Materials: Nanoscale Materials Center; Organic Nanomaterials Center; Nano Ceramics Center
    - Nanotech-driven Materials Research for Information Technology: Advanced Electronics Materials Center; Optronic Materials Center; Magnetic Materials Center
    - Nanotech-driven Materials Research for Biotechnology: Biomaterials Center
    - Materials Research for Environment and Energy: High Temperature Materials Center; Fuel Cell Materials Center; Superconducting Materials Center; Photocatalytic Materials Center; Structural Metals Center
    - Materials Research for Reliability and Safety: Material Reliability Center; Composites and Coating Center; Sensor Materials Center
  - Exploratory Research Laboratories: Advanced Nano Materials Laboratory; Innovative Materials Engineering Laboratory
  - Department of Materials Infrastructure: High Voltage Electron Microscopy Station; High Magnetic Field Station; Beam Line Station; Materials Data Sheet Station; Materials Database Station; Materials Manufacturing and Engineering Station; Materials Analysis Station
  - Interdisciplinary Cluster: Strategic Use of Elements; Social Acceptance of Nanotechnology; Corrosion; Non-Destructive Evaluation
  - Doctoral Program in Materials Science and Engineering
  - NIMS Nanotechnology Support Network
  - International Center for Young Scientists
  - The Rolls-Royce Centre of Excellence for Aerospace Materials

Research Cooperation Agreement with *BIO*KON, Germany

Dr. R. Bannasch, Coordinator, *BIO*KON (left), and Dr. N. Hosoda.

(March 27, Germany) -- The NIMS Advanced Nano Materials Laboratory signed a memorandum of understanding (MOU) on "Reversible Interconnection using biological Attachment" with The Bionics Competence Network (*BIO*KON) Center, Stuttgart, Germany. *BIO*KON hosts the 52 major players in the field of bionics and biomimetics in Germany. NIMS is the first *BIO*KON member from Japan. This agreement will accelerate research collaboration by exchange of researchers and information.

From left to right; Dr. E. Gorb, Senior Researcher, MPI, Dr. N. Hosoda, Senior Researcher, NIMS, Dr. S. Gorb, Leader, *BIO*KON, Dr. D.Voigt, Senior Researcher, MPI, and Ms. C. Miksch, Technician, MPI.

Hello from NIMS

The Country of Robots

Michal Reiter (Charles University in Prague, Czech Republic)
International Joint Graduate School Program
(October 2006 - October 2007)
Biosystem and Biomolecule Control Group
Biomaterials Center

Just one year ago, I made a decision to come to Japan. I had heard a lot about this nice high-tech Asian country before, but actually I have to say I was really surprised when I arrived. It is not easy to name something special; it is a lot of small details that makes the difference between my country and Japan. Everybody can mention such things as the different taste of food, eating with chopsticks, changing shoes everywhere, the absolutely different language and, for untrained people, the incomprehensible type of characters used in writing, namely, kanji, but I was prepared for these things.

As I am a scientist, maybe I should say the technological level of the equipment in laboratories is much higher than that what you can normally find in the Czech Republic. By the way, even if Japan is probably the top country in robots and technology, the term "*robot*" was invented by the Czech painter Josef Capek and coined by his brother Karel in his drama R. U. R.

[With students from Charles University and NIMS staff at Himeji Castle (author: third from right)]

On the other hand, I was not only surprised by Japan but also by the knowledge of the Japanese people about the Czech Republic. A large number of the people I have already met told me about their personal experiences with my country. Many people here know our capital city Praha (Prague), the symphonic poem by Smetana Vltava or famous Czech crystal or beer.

Japan is for my country a very important partner, which can easily be documented by the fact that during my stay in Japan I could meet our President Vaclav Klaus, several ministers, three or four rectors of Czech universities and other VIPs. I hope Czech and Japan can offer the best they have to each other.

[In Nara with a deer]

Online Questionnaire - We would like to hear from you! -

Starting with this issue, we have given NIMS NOW International a new look and contents to deliver more sophisticated and useful information to our readers. On this occasion, we are also beginning an online questionnaire to hear more from you. If you'd like to share your opinions, please visit the NIMS NOW International Online site at the following address.

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