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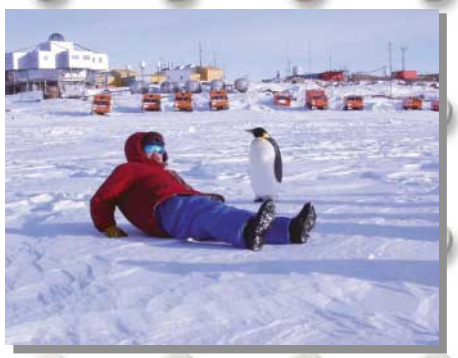

Topics

2002 AIST Showcase Symposium on Human Information Technology

National Institute of Advanced Industrial Science and Technology

●Research on volcanic ejecta and a survey of topographic features formed by the pyroclastic flow of Mt. Usu

Science Camp 2002

AIST Youth Education Program

AIST organized an event called "Science Camp" for high school and technical college students during this summer vacation. Fearing a decline of young people's interest in science and technology, AIST co-hosts this annual program with Japan Science Foundation and other national research institutes to arouse young people's academic curiosity in science and nurture future scientists.

The camp was held under seven themes and was held at four locations nationwide: Hokkaido, Tsukuba, Gifu and Aichi.

Taking advantage of AIST's potential to offer learning resources, the camp provides students with an opportunity to join a workshop according to their interests, meet the front-line researchers and witness their achievements. Furthermore, the science camp is characterized by its interactive learning method, by which the participants can acquire knowledge through "real life" experiences. The participants are granted a rare opportunity to meet with researchers and get coating directly from them. The program enables students to learn scientific perspectives and to appreciate the splendor of science by talking with researchers about their motivations to enter academe and their exciting research discoveries.

The camp receives participants

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from every region of the country. They form small groups based on the theme of their choice and attend a three-day, two-night program. During this camp, the students experience the excitement of bringing scientific theory into reality. They marvelled at the advancement of technology, power of nature and secrets of life.

The following is the themes proposed by AIST and the responsible research units.

- The legacy of volcano eruption
- Hands-on learning with ceramics
- Let's make a stirling engine model !
- Let's make hardware using a computer program
- Science of a *Xeno*pus laevis
- Key to the mystery of earth
- Japan's National Standard of Luminance

2002 AIST Showcase Symposium on Human Information Technology (HIT2002)

Toward a Further Evolution of AIST

At Santa Clara , June 11, 2002

AIST Technology Showcase Symposium Held in the U.S.

" 2002 AIST Showcase Symposium on Human Information Technology (HIT2002)" took place at Marriott Hotel, Santa Clara, California on June 11, 2002, co-sponsored by JETRO San Francisco and pl-x Inc.

The major objectives of the symposium were placed at: 1) introducing AIST, 2) exploring possibilities of technology transfer based on achievements of IT related researches and 3) promoting joint research projects. The symposium was a great success with approximately 200 participants, among them included product planning and development staff of local IT companies mostly from Silicon Valley, technology transfer consultants, university researchers and so on.

● Panel Discussion

Opening Session - Introduction of AIST and Calling for Research Consortium

● Dr. Naohiro Soga, Trustee of AIST

Dr. Soga firstly expressed his appreciation to the participants on behalf of AIST, and introduced the outline of the organization. He presented the objectives of the symposium, focusing on technology transfer and proposed the necessity of close collaboration between both business entities and academic organizations in Silicon Valley for the future development.

● Prof. Tetsuhiko Ikegami, Trustee of AIST

Prof. Ikegami argued that this symposium stemmed from various reformative movements in Japan: starting from a series of the structural reforms in Japan, reorganization of governmental agencies into independent administrative institutions, publication of "Science and Technology Basic Plan", establishment of the Council for Science and Technology Policy under Cabinet Office to on-going reforms of national universities. He also emphasized the importance of industry-academia-government collaboration in Japan. Secondly, he overviewed R&D projects currently in progress at AIST and expressed his wishes for the establishment of further cooperative relationships with the U.S. He closed his speech by underlying AIST's mission to pursue new courses for a public research institute aiming at pioneering the field of market-oriented R&D projects.

Panel Discussion Session Searching for the Possibility of New Research Collaboration

*** HIT (Human Information Technology)**

We lead our every day lives supported by a large number of computers without even being conscious of this. Even more computers will be integrated and merged into the future social system and we will take no notice to their existence. Here, we define HIT as an information technology to enable us to enjoy better amenities of life.

● Dr. Satoshi Kabasawa

● Prof. Edward A .Feigenbaum

● Prof. William F .Miller

- Technology Fusion between Japan and U.S.

● Dr. Satoshi Kabasawa, Moderator (Managing Director, Panasonic Digital Concepts Center)

IT is and will be a key technology of many industries. Considering the fact that mobile devices now material to our everyday life are becoming more dominant in the market, HIT is a significant technology in this field. In the midst of global competition, technical collaboration between US and Japan will be more important. AIST should play an intermediary role in this area .

● Prof. William F .Miller (Emeritus Professor , Stanford University)

Prof. Miller emphasized that many excellent researchers, entrepreneurs, investors and technical experts in Silicon Valley have been making contributions to the regional economy by their dense and flexible network of tight relationships and producing unique products. He suggested that IT including mobile networks, tools for productivity improvement, and applications for public use would make more progress. In his opinion, IT will be combined with biotechnology, and product merchandizing will make rapid progress in the field of nanotechnology. However, he also added that face-to-face communication is very important no matter how widespread the Internet becomes.

●Prof. Edward A .Feigenbaum (Professor, Stanford University)

Prof. Feigenbaum expected AIST to play a significant role to provide an insider's views to US researchers for the purpose of forming a human network. In addition, he indicated that it is a strong Japanese tradition to have a tendency to distinguish “we” and “they”, which should be taken into consideration for the successful US-Japan joint research projects. He also raised the most potential research fields for co-operative projects of both countries, including (1)Semantic Web, (2)Information Fusion for Anti- Terrorism, (3)Bio-Informatics and Medical Informatics, and (4)Digital Libraries.

●Dr. James Baker (President & CEO, FX Palo Alto Laboratory)

Dr. Baker emphasized that Silicon Valley was a very powerful hub of technological development where constant efforts to search for new business chances were being made. What are within the scope of their future R&D projects include Next Generation Internet, Biotechnology, Natural Language, Multimedia, Quantum Computing and more. He suggested that the demands on computing technology would shift from “speed, quality and economical efficiency” to “simplicity, usability and reliability” .

● Dr. Leonard Polizzotto (Vice President ,SRI International)

Dr. Polizzotto clarified that it was essential to upgrade the value of the customer's research achievements, so it would lead to the (1) creation of intellectual properties and commercialization, (2) recruitment/development of talented people, (3) revitalization of in-house communication, (4) acquiring market and customer information, and (5) increase in remuneration.

● Prof. Michikazu Aoi (Dean, Keio Business School)

Prof. Aoi appreciated the value of the symposium as the first attempt for AIST to assess its international stature and expressed his opinion that AIST should place more emphasis on international relationships for their management.

●Dr. Hideyuki Nakashima (Director, Cyber Assist Research Center, AIST)

Dr. Nakashima discussed the difference between the research collaborations implemented in the U. S. and those in Japan from his own experience and pointed out that collaboration toward a higher plane in the IT field would comprise of various phases of conflict, negotiation and coordination of the related parties.

Lectures about Japan-U.S. Research Collaboration

●Prof. Fu-Kuo Chang (Director, Smart Structure Research Center; Professor, Stanford University)

Prof. Chang said that IT was the technology to screen the vast amount of information to find the necessary and useful data. He outlined the profile of Smart Structure Research Center and the current research activities on Smart Structure technology as an example of Japan-US R&D collaboration.

● Prof. Richard B. Dasher (Director, US-Asia Technology Management Center, Stanford University)

● Dr. James Baker

● Dr. Leonard Polizzotto

● Prof. Michikazu Aoi

With an intimate knowledge about Japan and AIST, Prof. Dasher offered his advice on AIST's involvement in the joint R&D projects and the potential business partners. Furthermore, he referred to the possibility of an international research cooperation which would take advantage of the large-scale, highly advanced research infrastructure of AIST. He expressed his expectations toward "Technology Showcase" scheduled in the afternoon.

Luncheon Speech Session by a Leading Figure of Technology Transfer in the U.S.

● Dr. Robert Goldscheider (Chairman, The International Licensing Network, Inc.,)

Dr. R. Goldscheider, who is a prominent leader of technology transfer in the U.S., expressed his opinion that Japan had a high industrial and technological potentiality in spite of the severe economic recessions for the past 10 years, citing the past achievements of Japanese automobile and watch industries that quickly emerged into the world market, high level of education, diligence of blue-collar workers and so on. He analyzed that Japanese industries are not characterized by their own innovative inventions but their excellent production techniques to manufacture a high quality products based on the inventions introduced from abroad and the ability to distribute such products to the world. He also said that he and Lawyer R. Laurie were greatly impressed that AIST was abundant with excellent researchers when they visited AIST Tsukuba Center for three days in April of this year.

Presentations for "Technology Showcase on HIT"

With Business, Live demos and poster sessions at each booth.

Presentations were made on 10 different themes of HIT related technology transfer. Live demos and poster sessions were offered at exhibition booths throughout the day and rooms for business negotiations were also arranged for participants.

● Network Transferable Computer

Dr. Kuniyasu Suzaki (Senior Research Scientist, Information Technology Research Institute)

This is technology available in a Linux environment combining a virtual machine and hibernation, which saves the execution status of an operating system (OS) (OS snapshot). The OS current snapshot can be transferred to any computer or stored onto removal media such as CD-ROM for distribution. The procedures of the actual implementation of the system attracted a great amount of attention from the audience. There were many inquiries on the details of this technology at the booths.

● Interactive Information Retrieval Based on Semantic Structure

Dr. Koiti Hasida (Deputy Director, Cyber Assist Research Center)

This is an interactive information retrieval methodology which attains higher efficiency of search queries by giving hints to the user based on semantic structures. Active discussions on the related technologies were made at the booth including the relation with Semantic Web Project in the U.S.

● Real-time Gesture Recognition from Video Device

Dr. Ryuichi Oka (Visiting Research Scientist, Cyber Assist Research Center; Professor of Aizu University)

The presentation was on the system which allows the computer to recognize more than 30 different patterns of human gesture at real-time as "instructions", aiming at user-friendly interactive system with computer for easier computer operation.

● Volume Graphics(VG) Cluster - Highly Parallel Visual Computing System / Coloring Method for Multi-Spectral MRI Images

Dr. Shigeru Muraki (Head, Collaborative Research Team of Volume Graphics, Neuroscience Research Institute)

Cluster computing system technology enables the visualization of a large scale numeric simulation and real time image processing. Coloring method for MRI images is the

●Prof. Richard B. Dasher

● Dr. Robert Goldscheider

● Exhibition Booths

technology to correlate MRI images to color making use of independent component analysis.

● All-in-Focus Microscopic Camera for Micro-Manipulation

Dr. Kohtaro Ohba(Planning Officer, Planning Headquarters)

"All-in-focus camera" can capture images in focus at any distance without bringing the object into focus. The use of this camera facilitates the real time intuitive operation of a microscope.

● Ubiquitous Surface Tactile Sensor

Dr. Takanori Shibata (Senior Research Scientist, Intellectual Systems Institute)

A ubiquitous sensor can sense intensity of pressure, position of impact and so on through its flexible curved surface. For the application of this technology, a "healing" seal-type robot was developed for the purpose of realizing an emotional interaction between a robot and a human.

● Portable Manipulation Robot Technologies

Dr. Fuminori Saito (Research Scientist, Intellectual Systems Institute)

The presentation was on a robot useful as a tool in everyday life and capable of handling various shaped objects (Manipulation robot technology).

●Multi-Functional Myoelectric Prosthetic Hand System Using Evolvable Hardware

Dr. Tetsuya Higuchi (Team Leader, Advanced Semiconductor Research Center)

This is a multi-functional myoelectric prosthetic hand system that allows user to manipulate multiple movements of fingers by the use of an advanced chip developed in combination with artificial intelligence and latest LSI technology for myoelectric pattern identification.

● Ultrafast Circuits Using Block-Copolymerized Polyimides

Dr. Taro Itatani (Senior Research Scientist, Photonics Research Institute)

A block-copolymerized polyimide with micro-fabrication performance and low dielectric loss characteristics can be applied to an ultra-high-speed electric circuit with low noise emission.

A Step toward Further Development of AIST

In order to fulfill our mission, it is essential to generate AIST's name recognition both at home and abroad by actively publicizing the research achievements as well as introducing excellent researchers to the international community. One of the objectives of the symposium was placed as a search for future directions of AIST in order to establish a new model as a public research institute which boasts an abundant source of brainpower and technologies competitive in the world market.

This symposium was held at Silicon Valley under the theme of HIT and attracted many leaders in the fields of IT and technology transfer in the U.S. The success was partly due to the advantage of the venue, as Silicon Valley is certainly the center of the IT business in the U.S. All the opinions expressed during the symposium were indispensable for the researchers and research managers of AIST to promote international research collaboration. In addition, we welcomed the participation of entrepreneurs, technology transfer consultants and venture capitalists at the symposium. As a result, AIST could offer an opportunity for researchers to discuss with people at the center of the venture businesses - Silicon Valley. The researchers could learn much from this experience and gain confidence in their academic efforts.

This symposium greatly contributed to the establishment of a new network of international research collaboration and system for international technology transfer and joint researches. The next step will be awaited in anticipation of AIST's further development.

AIST Advisory Board Meeting 2002

Comprehensive Review of AIST Annual Performance by Worldwide Authorities

AIST Tokyo Waterfront Center, May 16, 2002

The AIST Advisory Board was set up as an Independent Administrative Institution (IAI) in April 2001 to conduct an annual review, by eminent scientists and authorities both from Japan and overseas, of all aspects of institute management. The first meeting was held at the AIST Tokyo Waterfront Center on May 16, 2002, with fifteen advisors in attendance, and was chaired by Makoto Morio, the president of Kyoto University. In the morning session, AIST President Yoshikawa first presented his management policy for AIST. Vice-President Hiraishi and Trustees Ikegami and Tanaka followed, and described the organization and its activities, its collaborations with the industrial sector and academia, and the evaluation system. The three research topics, correlation electron, glycoscience, and grid technology, were then presented by research unit directors Tokura, Jigami, and Sekiguchi. In the afternoon session, the members reviewed and discussed selected items: performance in the 2001 fiscal year, the roles of AIST as a public institute, and the future direction of the institute. The focus of the discussion was on the effect of new systems introduced as IAIs, i.e., the research unit organization created by unifying the former 15 institutes, the evaluation system for units and persons, and collaboration with the private sector. During the lunch break, a poster exhibition of 16 selected topics was held to help the advisors understand AIST activities. A laboratory tour of the Tsukuba Center was also provided on May 15 and 17. The result of the review and the opinions of the Board were summarized and released to the public as the Chairman's Summary.

Advisors at Meeting 2002 -Extract from Discussion in the Afternoon Session

Swan-Foo Boon, Managing Director, Agency for Science, Technology and Research, Singapore

--- I must start off by saying that I feel AIST is doing everything right. That's because we are doing exactly the same thing as Singapore. --- I think the more important issue is about the funding: who pays your salary? This will form the basis of where the AIST will go. In our case, if we have something of interest and the government isn't interested in it, we have to find external funding. Currently, about 20% of funds are coming from external organizations. ---

Seizo Miyata, President, Tokyo University of Agriculture & Technology

--- Compared with universities, I find that AIST's research is not so different in its individual themes, but different in its concept of "full research". It would take 15–20 years in a nightmare because of its trial-and error approach. To shorten the nightmare period and to reach the reality faster, you should hire many technicians. That would help make the national institute beneficial for the industry. ---

Hiroshi Kukimoto, Senior Managing Director, Toppan Printing Co. Ltd.

--- What AIST has gotten in moving to IAI is the increase in freedom of licensing of intellectual properties. First, I expect AIST to transfer the research output to industry and to promote development of venture enterprises. Second, we wish you to keep or improve the present three principles of licensing, i.e., no monopoly, no discrimination, and transfer with proper value. Even in the IAI status, AIST should avoid profit-making like a private corporation and should serve the public through licensing, taking into account that AIST is funded by the government to contribute to industrial progress. ---

Masuo Aizawa, President, Tokyo Institute of Technology

--- I feel the policy of "full research" that was presented by the president this morning is persuasive. But I wonder what structural measures were set up for realizing "full research". Do you do this based on structural measures



or on research themes? Is the present structure of three categories of research units suitable for full research? Who decides all of the themes, from what viewpoint, and who stops some of them along the way? ---

Hiroshi Komiyama, Professor, University of Tokyo

--- It would make little sense to differentiate the research done in public institutes, universities and private companies. I feel that you may do whatever you can do best with your capability. If we consider the role of IAI in this way, I tend to think that IAI should be responsible for the development and maintenance of infrastructure. The infrastructure is not limited to hardware but software as well. As well as standards of measurement, substances and geological survey, we should also note the accumulation of knowledge, which is increasing exponentially. IAIs like AIST will be the only organizations that can afford to do this. ---

Karen Brown, Deputy Director, National Institute of Standards and Technology, USA

--- I have some difficulty in trying to understand this. I read that AIST aims to make the dream become reality and to make the nightmare shorten. But is it for everything in the economy? Is it for infrastructure or for more focused areas? Is it to make spin-off ventures? What are the measures of success? These are all very different measures, and in some cases it needs to be measured over a long term. I have to admit, we in NIST also have a great difficulty in focusing. We are to focus on infrastructure; we are not to focus on new products and we are not to focus on new technology except as it relates to building the infrastructure, so it may be more limited. ---

Jean-Luc Clèent, Director of Int'l Affairs, Centre National de la Recherche Scientifique, France (on behalf of Geneviève Berger, Directrice Générale)

--- My organization, CNRS in France, is the biggest research center with twenty five thousand salaried persons and with a thousand laboratories connected with universities. If we identify our difference from universities, I think that we have more freedom than universities. We can set up new laboratories more easily and develop more contacts with industries. -----I would like to give you an example of this freedom. First was the increase in inter-disciplinary programs. We cover all fields of research, e.g., mathematics, biology and chemistry, and we can very quickly create an inter-disciplinary program. The second priority was to increase the transfer of technologies. We developed more collaboration with industries and created new small industries.---

Hans-Jürgen Warnecke, President, Fraunhofer-Gesellschaft, Germany

--- My main concern is whether AIST can achieve success in this configuration and in this mission. At first glance, it is a good idea to have Type-1, Type-2 and industrial research under the one roof because you will have a continuous flow, but you will spoil the criteria for evaluation because each of these research units need its own criteria to measure its effectiveness and efficiency. In Germany, we have three organizations. For basic research, we have the Max Planck Society. One hundred percent of funds are paid by the government and they do not care for applications. For long-range research for the benefit of society—for instance, environment and energy issues—we have the Helmholtz Society. For more short-term research, or contract research, including even big companies, we have the Fraunhofer Society. ---

Chang-Sun Hong, President, Korea Advanced Institute of Science and Technology, Korea

--- I am very pleased to be here to learn something about the courageous restructuring of AIST. In Korea, we have had similar discussions under IMF controls. I think the role of AIST must be different from the universities. As taxpayers, they will expect AIST to play some role in economic growth and human welfare. Especially this morning the management philosophy presented, is a very beautiful outline, but the next step is what the strategy of AIST is for this mission. --- In the case of our institute, 70% of the license fee will be given to inventors. ---

Minoru Morio, Vice Chairman and Director, SONY Corporation

--- I am speaking from the perspective of industry. The data are a little outdated, but from the year 2000, the amount of money that was given by Japanese industry to Japanese universities amounted to 70 billion Yen; but to overseas universities, it amounted to 150 billion Yen. What

overseas industries spent on Japanese universities was only 700 million Yen. These figures are not meant to indicate the research level of Japanese universities, but that the Japanese universities are not quite listening to what the Japanese industries need. There is not enough communication between academia and industry. This has long been a common belief among us industrial people. We see here one reason why this organization was turned into IAI. It is that the R&D should be more beneficial to the Japanese industries. ---

Tomoyo Nonaka, Journalist

--- AIST has spent one year to sum up all of the 15 institutes. You had to change the culture of the institute. It has been a year of "trial and error", seeking what to organize and how to manage. Rather than restructuring, re-engineering is a suitable word for these cases. I think AIST should have a more positive attitude towards being an IAI, not a negative one. When you talk about restructuring your organization in Japan, you tend to consider some kind of safety net first, but I'd like to think you may develop the possibility. ---

Hisashi Kobayashi, Professor, Princeton University

--- The Ministry of Education and Science is planning seriously how to develop a very strong, global-scaled COE in Japan. I don't think it's important to have a distinction between a university COE and a similar center to be established by AIST. Japanese university strength in terms of research is not comparable to some of the best universities in the United States. Here we have a chance for both AIST and the university community to work together, ideally to make a very competitive COE. So rather than making a separate mission and making the distinction between university and AIST, I'd like to see some cooperation and exchange of personnel and ideas to make some Japanese center visible on global scale. ---

Naomasa Nakajima, Professor, University of the Air

--- It is a great step forward that you made an evaluation of these fifty-something units. The evaluation result shows: Units that are still in the dream stage are given a high rating; those in the nightmare stage don't receive a high rating; those in the reality stage are given a high rating. I could be corrected, but I have that impression. That means that emphasis on Type-2 basic research is not clearly communicated to people outside. If you want to continue the external evaluation, you have to make this clear. Along with this, you should have internal evaluations as well. It is crucial that you should let them know your intentions. ---

Satoru Oya, Director and Chairman, Oyo Corporation

--- Today, science has been fragmented into many specialty areas. Accordingly, scientific societies have been broken down into many fragments. As a result, you can do in-depth study, but there is very little across-the-board coordination. To put science to good use for society, you need to reintegrate those fragmented disciplines. Now that AIST has been launched with integration of 15 different institutes, I hope that you will give your priority to a project where you can aggressively pursue interdisciplinary studies. ---

Makoto Nagao, President, Kyoto University, Chairman of the AIST Advisory Board

CHAIRMAN' S SUMMARY for MEETING 2002

(1)Mission and Planning

The AIST research policy focusing on the role of cross-linkage between the free and basic researches in the academia and the commercialization efforts in the industry, can be regarded as appropriate target-setting, for one of Independent Administrative Institutions established by the government, considering the achievement of three missions: i) To carry out difficult and long-term research tasks with which government itself should tackle; ii) To enhance industrial competitiveness and to create new industries based on advanced and innovative technologies; and iii) To consolidate the intellectual infrastructures for supporting industrial technology.

Unlike research works in academia based on researchers' non-binding thinking, AIST should first focus their efforts to select i) comprehensive, medium- to long-term development tasks in consideration of industrial and social needs, ii) large-scale projects difficult to be exercised by universities, or iii) researches integrating multi-disciplinary areas; then press those researches on with relevant specialists collected from within the Institute. In this way, augmented endeavor will be needed for dynamic management of AIST. With the previous organizations under MITI combined together, which had fifteen different missions, it is essential to make the identity of New AIST clearer, to enhance the sense of solidarity among staff members, to make efforts for carrying out efficient R&D works, and to contribute to the society through the development of advanced technology leading the world industry. Such a comprehensive and dynamic project management is of enormous importance.

For selecting specific research themes, it is crucial to resort to open process with high transparency, so that not only opinions from the AIST but also those from the industry and the society in general could be well reflected. In regard to the planning of medium- and long-term develop-

ments, strategic approaches and systems for their implementation should be investigated.

(2) Research Organization and Strategy

The merits of research organizations, including three categories of research units: research centers, research institutes/research divisions and research initiatives; and the graded allocation of research expenses cannot be assessed properly at this point after one year's experience only. Due to the short time of discussion, the Advisory Board failed to obtain detailed information on which of previous laboratories were merged to formulate each research unit, how researchers have been re-grouped, which of three missions have been given priority, and so on. Should any one be doing research works merely as an extension of those in the previous organization, without shaking up one's thinking to adapt to the new organization, the new environment and the clear targets, this had to be amended immediately.

The R&D strategy should be built up not by the mere compilation of an individual technology development, but on comprehensive footing to cover impacts of research results, if successfully commercialized, to individuals, societies and global environment. Such an approach can be realized only by the AIST where many research laboratories with diverse missions and specialties were integrated. Should positive R&D efforts be focused on specific problems which Japanese society must resolve, in addition to priority research areas, such as biotechnology, information technology and nanotechnology, where advanced countries in the world are competing vehemently, those efforts might result in leading-edge technologies which would lead other countries in the future.

While massive efforts directed to research collaborations among industrial, academic and government sectors can be appreciated, further striving may be needed for increasing substantial collaborations. Various methods including personal exchanges, joint researches, venture incubations have been strengthened; more substantially effective way should be sought.

It is also important to build up research environment where the equipment and facilities of state-of-the-art quality and highest possible grade are provided, and scientists and engineers of international class can proudly devote themselves to R&D works.

(3) Evaluation of Research Activity

The research works of an individual research unit are evaluated thoroughly by the external reviewers as a part of the internal evaluation. It is an easy-going way to assess research achievements by numerical factors, such as the number of papers, patents and other forcibly quantified expression, which should be avoided. While the numerical evaluation may be inevitable when comparing the performances among different research units, the numerical data should be interpreted with care, viewing from a number of different angles and giving weight to comments by world-eminent specialists. In case of personal evaluation, it will be necessary to avoid numerical assessment as much as possible depending upon the nature of respective researches. It is desirable to place emphasis on qualitative evaluation based on opinions from superiors and outside peers so as to boost researchers' morale. Disclosing the evaluation results as a rule will be beneficial to those evaluated, those to evaluate and the communities concerned.

The evaluation can be made based on the degree of accomplishments in reference to terms and milestones of the research schedule, as specified by the previously set up R&D plan. In evaluation, therefore, it is desirable to review not only the appropriateness of the R&D plan but also the degree of achievements. Then, it is critical to fix beforehand a "yardstick of evaluation" corresponding to the category of R&D plan.

(4) Conclusion

Generally speaking, it is of utmost importance to shake up researchers' thinking and to raise awareness about why previous laboratories were re-organized into an Independent Administrative Institution. It may be expected that if R&D works were carried out taking notice of the Board's comments given above, good accomplishments would become available by the end of the first Mid-Term.

It must be admitted that the Meeting of the AIST Advisory Board, 2002, failed to capture the actual status of AIST owing to the shortness of time, and the discussion lingered at the level of overview. From the next meeting on, the Board will hopefully provide in-depth assessment for focused items.

AIST RESEARCH HOT LINE

UPDATES FROM THE CUTTING EDGE

(July - Sep. 2002)

The abstracts of the recent research information appeared on the Vol.2 No.7-No.9 of "AIST Today" are introduced and classified by research area.
For inquiry about the full article, please contact the author directly.

Life Science & Technology

Systematic Clustering of a Large Superfamily Based on Sequence, Structure and Function

- Application to the TIM Barrel Glycosidase Superfamily -

Nozomi NAGANO
Computational Biology Research Center
e-mail:
n.nagano@aist.go.jp
AIST Today Vol. 2, No. 7 (2002) 16

To untangle the distant relationships between enzymes in a large superfamily, comprehensive sequence and structure analyses can be performed. By applying the analyses to the TIM barrel glycosidase superfamily, including 30 distinct sequence families, we generated four structural clusters (S1, S2, S3, and S4), as in Figure 1. By this analysis, we could find the evolutionary relationships between two distinct enzyme groups, β-amylase and so-called 4/7 superfamily enzymes, including endoglucanase. Moreover, by combining the multiple-alignment of the tertiary structures, the local structure analyses and sequence analyses such as PSI-BLAST, we could cluster these enzymes hierarchically, and suggested that the two distinct structural clusters, S1 and S2 are distantly related, as are S3 and S4, which have the common chemical functions, *N*-acetylated substrates (Figure 2).

Furthermore, this combined method is expected to be applicable to other large superfamilies and even to folds, which are at higher level of protein structures.

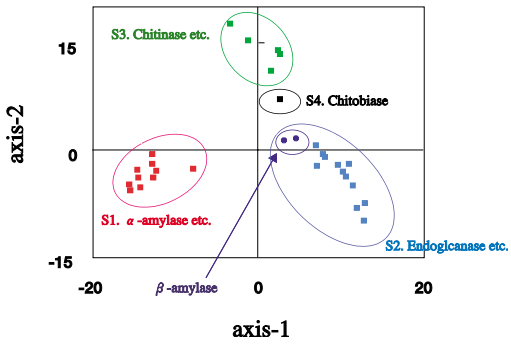
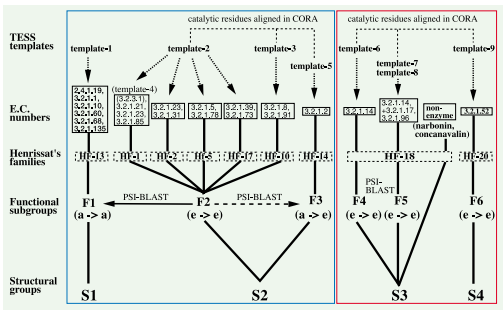


Fig.1 Clustering based on sequence identities: Multi-dimensional Scaling (MDS) plot of maximum sequence identities between 30 sequence families. The clusters are labeled with the names of the structural groups, α-amylase (S1), endoglucanase (S2), chitinase (S3) and chitobiase (S4). In the S2 group, the two β-amylases are indicated in circles, whilst the remainder is in squares.



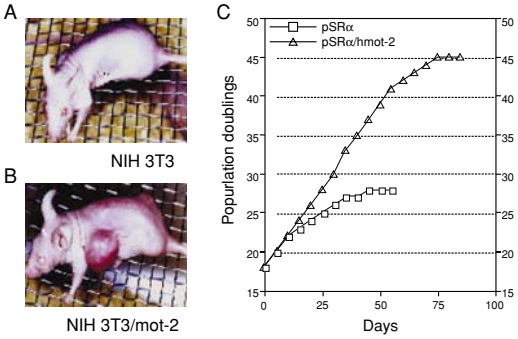
N-Acatylated substrastes

Fig.2 Hierarchic clustering of glycosidase superfamily

Mortalin in Cellular Senescence and Immortalization

Sunil Chandra KAUL
Research Center for Glycoscience
e-mail:
s-kaul@aist.go.jp
AIST Today Vol. 2, No. 7 (2002) 15

We have first cloned mortalin, a novel member of hsp 70 family of proteins and demonstrated that it is differentially distributed in cells with normal and immortal phenotypes. It is involved in pathways to cellular senescence and transformation. The mouse mot-1 cDNA that encodes cytoplasmically distributed protein caused cellular senescence in NIH 3T3 cells. In contrast, mot-2 cDNA encoding the perinuclear protein resulted in malignant transformation of NIH 3T3 (Figs. A & B) and lifespan extension of normal human fibroblasts (Fig. C). It was demonstrated that mot-2 interacts with p53 in cell cytoplasm and inactivates its function by nuclear exclusion mechanism. Other functions of mortalin include its chaperone activity, intracellular trafficking and mitochondrial import. These are expected to be mediated by its dynamic cellular localizations and its binding partners. Elucidation of such functional aspects of mortalin is extremely important to use it in biotechnology and tumor therapy.



(A) Nude mouse injected with control (NIH 3T3) cells did not result in tumor formation. (B) Tumor formation by NIH 3T3/mortalin (mot-2) transfectants. (C) In vitro population doublings of normal human lung fibroblasts transfected with empty vector (pSRα) and with human mortalin (pSRα/hmot-2) cDNAs.

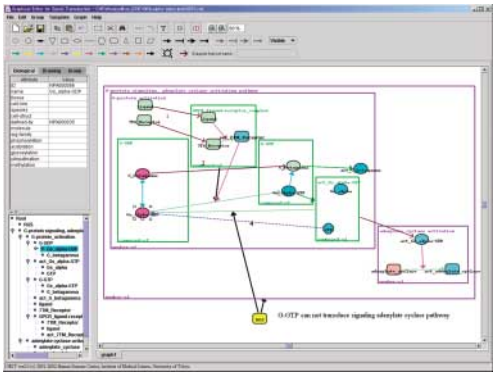
Representation of Biological Processes: Signal Transduction Pathway Database Development

Ken-ichiro FUKUDA
Computational Biology Research Center
e-mail:
fukuda-cbrc@aist.go.jp
AIST Today Vol. 2, No. 9 (2002) 19

Signal transduction pathways (STPs) explain the underlying mechanisms of various biological phenomena in terms of interactions of bio-processes and bio-molecules.

Since most of the knowledge is represented in the form of text by natural language, a knowledge representation model for STPs that is as readily processed by a computer as it is easily understood by humans is required.

A hierarchical and recursive data model that is able to handle the diversity of molecules and the hierarchical structure of bio-processes in pathways has been developed.



Screenshot of our pathway editor GEST

Neuronal Signals Related to Degree of Reward Expectancy in Anterior Cingulate

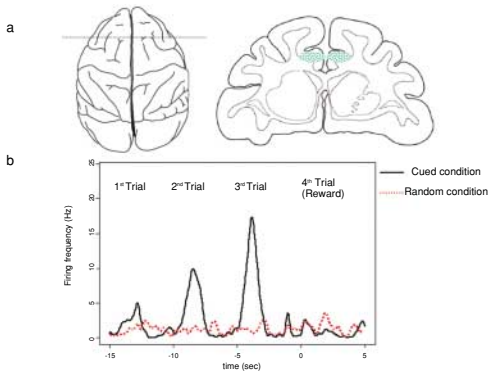
Munetaka SHIDARA
Neuroscience Research Institute
e-mail:
m.shidara@aist.go.jp
AIST Today Vol. 2, No. 8
(2002) 16

In our daily life, we make plans and act based on the motivation to reach a goal. During the course of the activity, we continually compare our current status against our expectation for reaching a goal, with expectation increasing over the course of the activity. This implies that there are neural signals underlying the increasing expectation.

We developed a task—a cued multitrial reward schedule task—to control level of motivation and investigate the degree of reward expectancy. In this task, monkeys can obtain rewards only after a series of trials had been correctly completed. When there was a cue to indicate how many correct performances were required for a reward, the monkeys made progressively fewer errors as the rewarded trial approached, indicating that the monkeys expectancy of an impending reward grew. For several reasons we hypothesized that the anterior cingulate of the medial frontal lobe (Fig. a) is a promising site for neuronal signals related to the degree of reward expectancy. We recorded single neuronal activity from the anterior cingulate while the monkey was performing the schedule task and discovered that the single neurons showed responses that were progressively increasing through the schedules as the reward expectancy increased (Fig. b, black line). Furthermore, the ordered neuronal response disappeared when the cue sequence was given at random so that the monkeys could not know how close their rewards were (Fig. b, red dotted line).

The knowledge gained through the research should contribute to uncovering the information processing in the brain relating to human motivation and plan-making. It should also lead to the understanding and improvement of the symptoms of those with obsessive-compulsive disorder and drug abuse, conditions characterized by the disturbances in motivation and reward expectancy.

A report of this research appeared in the May 31 issue of the *Science*.



a. Brain map of Rhesus monkey. Left: Dorsal view of whole brain. Right: Frontal section at the line indicated in the left fig. The area of anterior cingulate from which recording was done is shown by green shading.
b. Example of neuronal responses in the anterior cingulate when 4 correct trials were necessary to obtain rewards. black line: spike density plot of neuronal activity when there was a cue to indicate the proximity to the reward. red dotted line: spike density plot of the neuronal activity when the cue sequence was randomized.

Active Enzymes at Around 100ºC

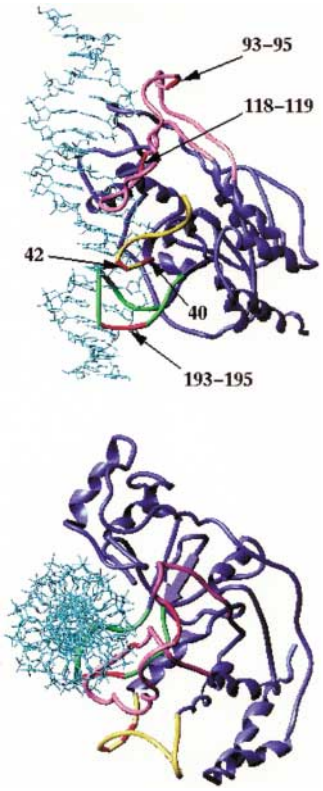
Ikuo MATSUI
Biological Information Research Center
e-mail:
ik-matsui@aist.go.jp
AIST Today Vol. 2, No. 9
(2002) 18

A hyperthermophilic archaeon *Pyrococcus horikoshii* was isolated from a hydrothermal vent in the Okinawa trough in the Pacific Ocean. It optimally grows at around 100ºC. The hyperthermophiles were expected to be good producers of thermostable enzymes active at around 100 ºC. The thermostable enzymes have considerable industrial potential by giving better yields under extreme operational conditions, since the enzymes show not only great stability but also enhanced activity in the presence of common protein denaturants such as heat, detergents, organic solvents, and proteolytic enzymes.

Moreover, hyperthermophilic archaea are

considered to be the prototype of eukaryote. Their DNA replication systems seem to be more simplified and stabilized, compared with the eukaryotic systems. Since the thermostable proteins are more suitable for the structure analysis due to their easy crystal formation than the mesophilic counterparts from eukaryote, the structural information will greatly contribute to comprehend the molecular mechanisms of DNA replication and repair systems effectively working in eukaryotic cells. The thermostable proteins involving DNA replication and repair are also useful as biological tools to develop new biotechnology.

Flap endonuclease-1 (FEN-1) has important roles in DNA replication, repair, and recombination. FEN-1 has dual activities such as 5' flap endonuclease and 5'-3' exonuclease. We have already reported the substrate specificity of FEN-1 from *P. horikoshii* (phFEN-1). Recently we succeeded to solve the molecular structure of a mutant phFEN-1 to a resolution of 3.1 Å. According to the molecular structure, 45 different mutants on one large loop and four small loops of phFEN-1 molecule were constructed and investigated their functions. Consequently, the substrate recognition mechanism of the molecule was elucidated in details as shown in Fig. 1. The facts will largely contribute to the structure/ function analysis of eukaryotic FEN-1s involving human counterpart.



The modeled complex of phFEN-1 with DNA. (A) The small loops 1 and 2, and the large loops are colored yellow, green, and pink, respectively. The numbers indicate the major DNA binding sites on the loops. DNA is colored light blue. (B) The side view of (A).

Information and Communication Technology

A Tele-operated Humanoid Robot Drives a Lift Truck!

New abilities of humanoid robot to realize proxy drives of a construction machine are developed. We use the tele-operated humanoid robot HRP-1S developed in Humanoid Robotics Project of METI of Japan. The proxy driving of an electric lift truck by HRP-1S was demonstrated at ROBODEX2002 as shown in the figure. It shows us that a humanoid robot can expand its capability by using machines designed for the human. The use of a tele-operated humanoid robot has a possibility to make all machines tele-operated without any modifications and do also incidental tasks instead of the human.

Teleoperated humanoid robot drives a lift truck

Kazuhito YOKOI
Intelligent Systems Institute
e-mail:
kazuhito.yokoi@aist.go.jp
AIST Today Vol. 2, No. 7 (2002) 8

Development of Common Software Platform on Parallel Computations for Discretized Numerical Schemes

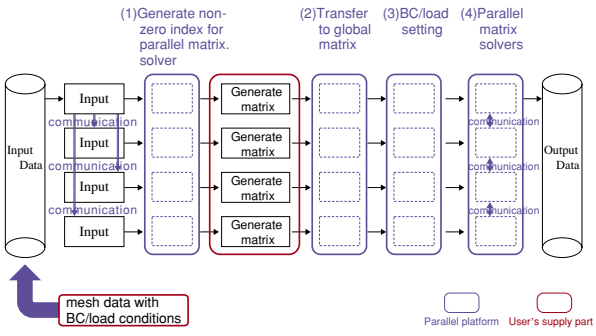
Akira TEZUKA
Research Institute for Computational Sciences
e-mail:
tezuka.akira@aist.go.jp
AIST Today Vol. 2, No. 8
(2002) 14

The Research Institute for Computational Science's Continuum Modeling Research Group at AIST and the Center for Computational Science and Engineering at FUJI Research Institute Corporation have developed a parallel software general platform for various numerical schemes such as finite element method, finite difference method, and finite volume method as well as other numerical schemes, to assist a smooth shift to parallel computational world for non-specialists in parallel computations, which only requires ordinary input data and the subroutine to construct his stiffness matrix. The source code and manual are released at the AIST website: http://www.aist.go.jp/infobase/pcp/index-en.html to general users with free of charge.

A major characteristic of this software platform is that it greatly assists users to parallelize his current numerical code in non-parallel computers with a high degree of parallel efficiency, regardless of any types of discretized numerical analysis technique used, and without advanced knowledge or experience in parallel computation required. Some parallel software such as PETSc, Aztec, GEOFEM, and ADVENTURE had been developed, however these are for professionals in parallel computations and not valid for the purpose above.

With this platform, users can enjoy large-scale, high-speed, parallel numerical computations in a few days, which may greatly activate computer-aided engineering (CAE) in industry. Because of severe competition in the worldwide business, most of the companies are trying to cut the cost in design section, by introducing commercial software developed mainly in the United States and Europe instead of original in-house numerical analysis software. However, "black box" use of commercial software results in the "death" of advanced technology in numerical simulation in this country, and too much dependency on imported software leads to lack of initiative on advanced fields and gives serious damages on industrial technology in Japan. By installing this platform to parallel computers, in-house numerical software can be easily enforced by parallel computations, and engineers can enjoy the advantages of vastly greater speed and scale in short developing time.

For the time being, more than 130 users enjoy parallel computations with our parallel platform. Both Japanese version and English version are available at the web site mentioned above. In near future, eigenvalue analysis matrix solvers and other functions will be added to meet further requirements from users. More demo programs are supposed to be added to this platform, hopefully by user's collaborations in part.



Data flow at parallel platform with 4CPUs

```
INCLUDE 'MPIF.H'                          : MPI include file
DIMENSION Aij(□), WORK(□), Bi(□), IDOMAIN(□)
CALL MPI_INIT(. . . )                     : MIP initialized
CALL MPI_COMM_RANK(. . . ,MYRANK,. . )    : Current processor
CALL MPI_COMM_SIZE(. . . , NPROC,. . )    : Number of processors
set IDOMAIN(I)                            : Partitioned data

CALL PCP_MKINDX                           : (1)Non-zero index gene.

DO  I=1,number of elements                : Stiff. matrix generation
    IF(IDOMAIN(I).EQ.MYRANK)THEN          : at each PE
      . . . . .
      Aij(□)=□                            : (User supplied part)

      CALL PCP_MKMATX                     : (2)Added to global mat.
    END IF
END DO

CALL PCP_MKBND0                           : (3)BC setting
CALL PCP_4FORCE                           : (3)Load setting

CALL PCP_IT4SLV(Aij,Bi,IDOMAIN,. . . ,WORK)  : (4)Parallel mat. solver

CALL MPI_FINALIZE(. . . )                 : MPI terminated
END
```

Modification pattern on FEM program

Protein Classification with Hidden Variables

Koji TSUDA
Computational Biology Research Center
e-mail:
koji.tsuda@aist.go.jp
AIST Today Vol. 2, No.8 (2002) 15

For using support vector machines (Fig. 2), a kernel function should be defined a priori. We propose a reasonable way of designing a kernel when objects are generated from latent variable models (e.g. HMM). First of all, a joint kernel is designed for complete variables (i.e. both visible and hidden). Then the hidden variables are marginalized out to give a marginalized kernel for visible variables. Although this framework can be applied to any object, we particularly derive several marginalized kernels useful for biological sequences (Fig. 1).

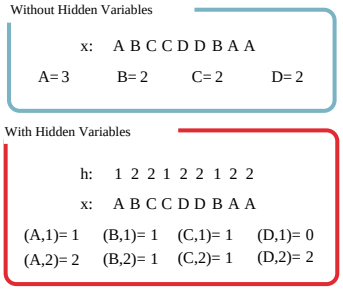


Fig.1 Feature Extraction with or without hidden variablesDioxide

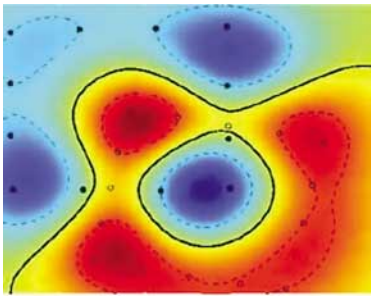


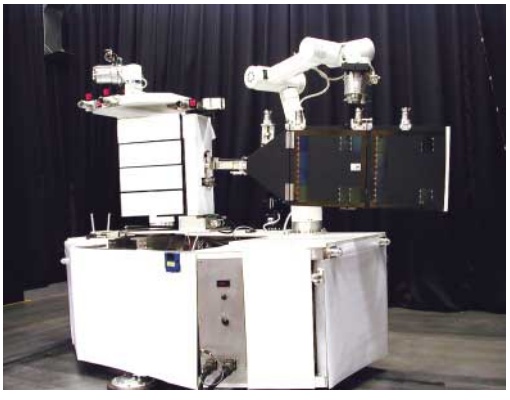
Fig.2 Partitioning a vector space with the support vector machines

Environmental Science & Technology

Development of a Space Maintenance Robot

Yoshitsugu TODA
Energy Electronics Institute
e-mail:toda-ys@aist.go.jp
AIST Today Vol. 2, No. 7 (2002) 7

The Space Maintenance Robot is a robotization of space system, which allows the assembly of several micro satellites in orbit, as well as the capture of orbiting satellites for diagnosis, maintenance and supply. Also, it is used for recovering and disposal of satellites at the end of the mission, helping the preservation of the space environment and contributing to the reliability and increasing life span of space infrastructure composed of micro satellites. This multifunctional space robot will provide care from the cradle to the grave for the satellite constellation.



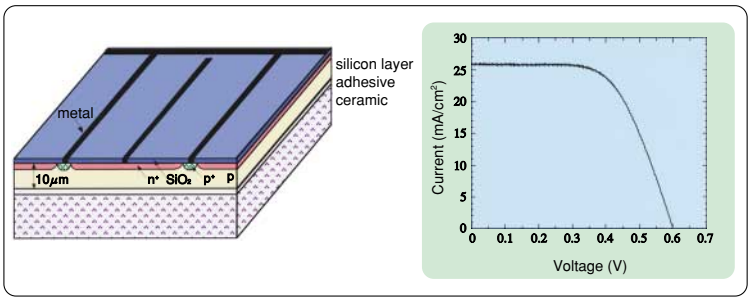
A Space Maintenance Robot on a Test Bed

Energy Science & Technology

Thin-film Silicon Solar Cells Using an Adhesive Bonding Technique

Hidetaka TAKATO
Energy Electronics Institute
e-mail:
h.takato@aist.go.jp
AIST Today Vol. 2, No. 7
(2002) 11

Thin-film silicon solar cells using an adhesive bonding technique have been investigated. A 10-µm-thick single-crystalline solar cell was fabricated by adhesive bonding of an alumina ceramic substrate, and the cell performance was estimated. The open circuit voltage, short circuit current and cell efficiency were 602 mV, 25.8 mA/cm^2 and 9.6%, respectively. Although the silicon layer of the cell is very thin, high open circuit voltage is obtained. The results indicate that the adhesive bonding technique is suitable for realizing high-efficiency thin-film cells.



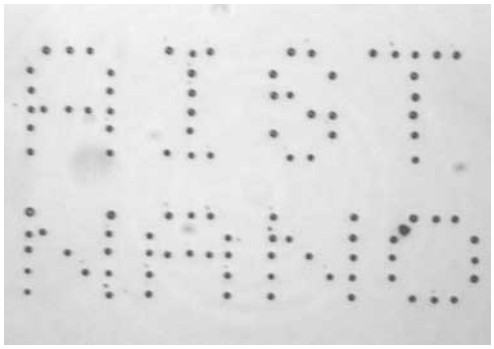
Schematic representation and current-voltage characteristic of the 10-µm-thick solar cell

Nanotechnology and Materials Science & Technology

Development of Ultrafine Ink-Jet Technology

Kazuhiro MURATA
Nanotechnology Research Institute
e-mail:
kazuhiro-murata@aist.go.jp
AIST Today Vol. 2, No. 7
(2002) 12

The ultrafine ink-jet technology developed makes it possible to dispense ultra fine dots with a size smaller than 1/1000 the volume size of dots produced by currently available technology. Printing of a few microns wide ultra fine wiring patterns of silver directly onto the substrate has been successfully carried out by using NanoPaste™ (Harima Chemical Co.), stable dispersion of superfine metal particles. This technology can be applied not only to surface mounting related technologies but also to innovative applications in other nanotechnology fields such as biotechnology, optical and ultrafine processing technologies.



A example of fine characters using sub-micrometer diameter dots (dot pitch 3-micrometer)

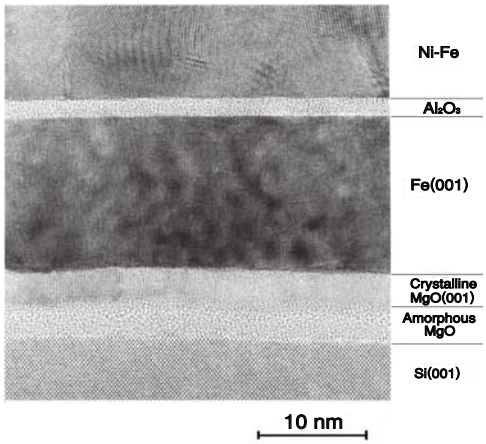
Development of High Performance Tunneling Magneto-resistive Devices

- Toward over G-bit M-RAMs -

Yoshishige SUZUKI
Nanoelectronics Research Institute
e-mail:
suzuki-y@aist.go.jp
AIST Today Vol. 2, No. 7 (2002) 13

Development of high performance tunneling magneto-resistive (TMR) devices is the key to realize Magneto-resistive RAMs over 1Gbit. The TMR devices with single crystalline magnetic electrodes enable significant enhancement of the TMR effect caused by the quantum size-effect.

We have developed TMR device with a single crystal Fe(001) electrode and by making it thin, as thin as several atomic layers, obtained significant enhancement of the TMR effect. The effect can be near 3 time lager than that for the thick Fe(001) electrode. We have also developed a process to make those high performance TMR devices on the LSI wafers. Picture shows TMR device grown on the SiO2 surface. Very flat interfaces and a highly oriented bottom electrode have been realized.

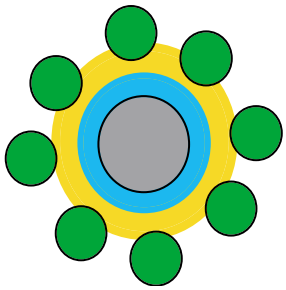


Cross sectional view of a tunneling magneto-resistive device grown on the SiO_2 surface. In the picture, Ni-Fe/Al_2O_3/Fe composes a tunnel junction

A Composite Particle Named "Magneto-Liposome" as a Drug Capsule

Hideo MATSUMURA
Life Electronics Laboratory & Photonics Research Institute
e-mail:
hideo-matsumura@aist.go.jp
AIST Today Vol. 2, No. 8 (2002) 8

A new type of composite particle is developed. It is consisted of a magnetic particle and several liposome particles and has a structure as shown in Fig. 1. Bi-molecular layered lipid-membrane liposome particles that can contain some pharmaceutical molecules in inner compartments are located around a magnetic particle, i.e., a silica-coated hematite through the binding properties of protein molecules. Because of its magnetic properties, we can control its location and hence will be able to supply pharmacy locally.

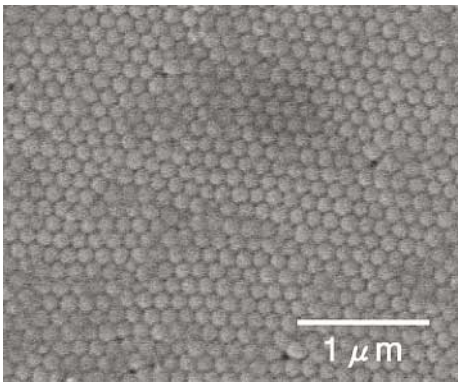


Schematic representation of magneto-liposome. Each region of the drawing shows a hematite particle (gray), a silica layer (light blue), a protein layer (yellow), or several liposome particles (green) from the center of the composite

Continuous Particle Self-Arrangement in a Long Micro-Capillary

Hideaki MAEDA
Micro-Space Chemistry Laboratory
e-mail:
maeda-h@aist.go.jp
AIST Today Vol. 2, No. 8
(2002) 9

A methodology has been set up to produce continuous particle arrangement in a long capillary. No additional drawing force is needed, the arrangement is a kind of self-assembly. Hexagonal arrangement can be obtained on the inner wall of a micro-capillary as shown in Fig.1, and thickness can be controlled from monolayer to multilayers. This type of particle arrangement was stable in both static and dynamic water and its vertical structure can be designed with layer by layer process. Using a patterning technology, it is also possible to control two- dimensional particle arrangement distribution. The structure produced by this method has extensive application in the microreactor field, such as catalyst utilizing its high surface area, separation utilizing uniform voids between the particles, and nano-device controlling three-dimensional structure.

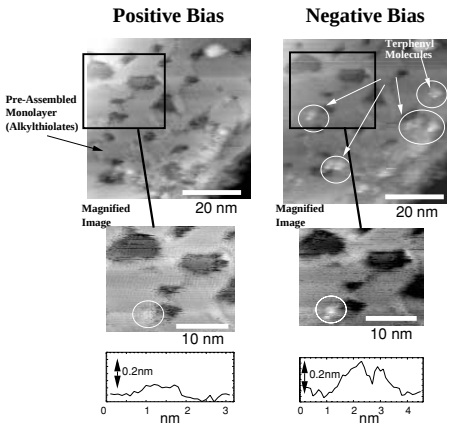


Particle arrangement on the inner wall of a micro-capillary

Direct Observation of Nanomolecular Motion by STM

Takao ISHIDA
Institute of Mechanical Systems Engineering
e-mail:
t-ishida@aist.go.jp
AIST Today Vol. 2, No. 8
(2002) 10

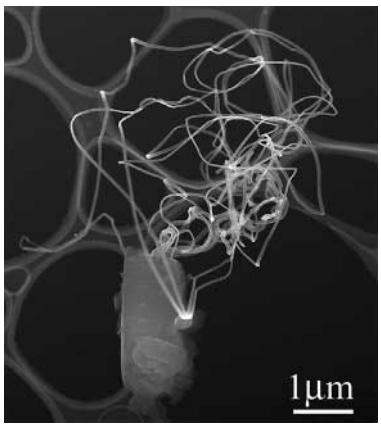
Nanoscale molecular motion induced by polarity change of the electric field was observed by Scanning tunneling microscopy(STM) when small amounts of mobile terphenyl molecules were embedded into pre-assembled dodecanethiol self-assembled monolayers (SAMs). At the positive tip bias, few of protrusions were observed. When the STM tip bias turned to negative, many protrusions appeared on the binary monolayer surface. The result demonstrated the single molecular mechanical device operation at the nanometer scale.



STM images of terphenyl molecules embedded into pre-assembled monolayer.Left; At the positive bias Right; at Negative bias

Preparation of Long Silver Nanowires with a High Aspect Ratio

We succeeded in preparing long silver nanowires with a markedly high aspect ratio using Ag^+-containing matrix by irradiation of controlled electron beam. A typical scanning electron micrograph is shown in Fig. The nanowire grew slowly like a spider spinning a thread and a long nanowire of *ca.* 40 nm in diameter and 115 μm in length on the micrograph was finally obtained. The aspect ratio of the wire reaches more than 2,000, which is, to our knowledge, the highest among the nano-order silver wires reported to date. A selected area electron diffraction (SAED) pattern in a part of the nanowire indicated that the nanowire was a silver metallic crystal with a face-centered cubic structure.

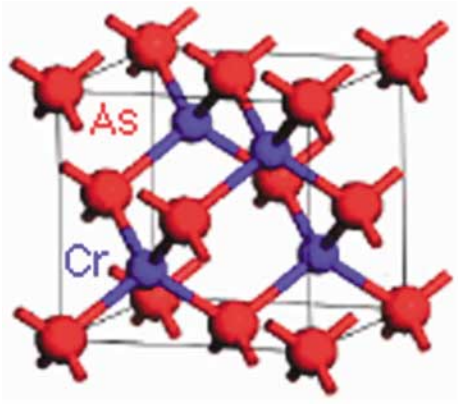


SEM micrograph of a silver nanowire

Yoji MAKITA
Institute for Marine Resources and Environment
e-mail:
y-makita@aist.go.jp
AIST Today Vol. 2, No. 8 (2002) 11

Material Design of Half-Metallic Ferromagnet and the Synthesis

The present status of the magnetoresistive device consisting of magnetic tunnel junctions has nearly reached the physical limit, due to the fact that the intrinsic spin-polarization of the ferromagnetic electrode is 50 % at most. We aim at the development of a 100% spin-polarization ferromagnetic material. The zinc-blende CrAs has been designed by *ab-initio* calculations and the calculation predicts the highly spin-polarized electronic band structure. We have succeeded in growing the zinc-blende CrAs thin films by molecular-beam epitaxy method. This is the first successful computational material design followed by the realization.



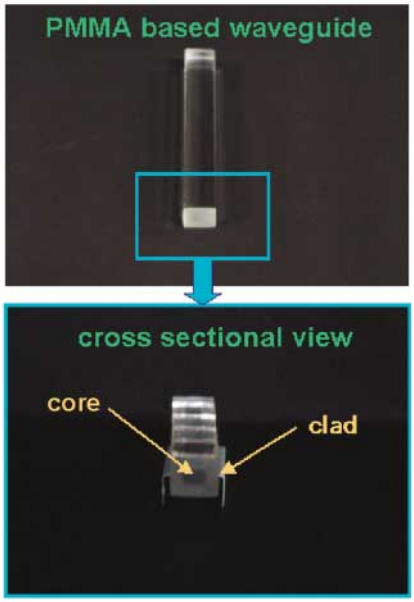
Schematic crystal structure of the zinc-blende CrAs designed by *ab initio* calculations

Hiroyuki AKINAGA
Nanotechnology Research Institute
e-mail:
akinaga.hiro@aist.go.jp
AIST Today Vol. 2, No. 9 (2002) 8

A Novel Fabrication Method of Optical Devices

Toshiko MIZOKURO
Photonics Research Institute
e-mail :
chem42@ni.aist.go.jp
AIST Today Vol. 2, No. 9
(2002) 11

Different kinds of novel fabrication methods of thin films using a vacuum technique are developed. One is the vapor transportation method of an organic compound with a high sublimation pressure, and the other is the direct injection of solution containing organic compounds into a vacuum chamber. Characteristics of the films made by the present methods are high quality: the films are free from residual solvent and film thickness is controllable below 100 nm. Moreover, a layer-by-layer structure with different kinds of organic compounds can be prepared. These methods are very important to fabricate organic optical devices such as polymer waveguides (Fig.) and organic memory media.



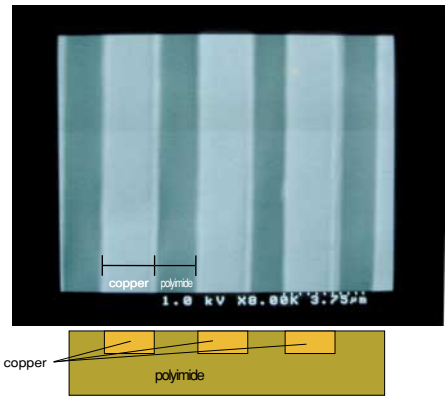
PMMA waveguide produced by the present method

Fabrication of Insulating Films by Electrodeposited Polyimide

Kazuhiko TOKORO
Nanoelectronics Research Institute
e-mail:
kazu-tokoro@aist.go.jp
AIST Today Vol. 2, No. 9
(2002) 9

For high performance electron device, packaging and interconnection with high-density fine wiring has been required. For this purpose, a realization of precise high-density integration such as microstrip lines, strip lines, and coaxial lines becomes essential.

The polyimide has good characteristics as insulating films such as low dielectric constant, high heart-resistance. It is suitable for the fine high-density wiring process. However, it is difficult to obtain sufficient coverage and uniformity on a large area by the conventional spin coating method. As a fabricating method of new polyimide film, a thin film preparation method by electrodeposition technique was examined using a colloidal polyimide solution.

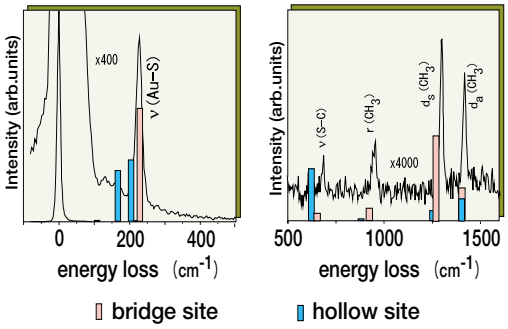


Scanning electron micrograph of polyimide insulating film and copper wiring

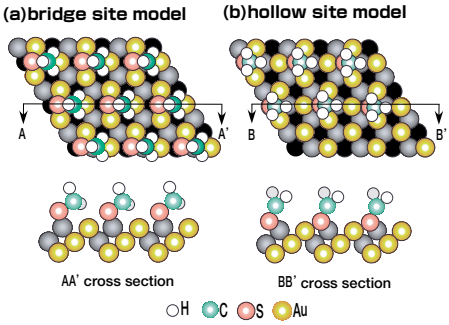
The Structure of Self-Assembled Monolayers

Hisakazu NOZOYE
Nanotechnology Research Institute
e-mail: h.nozoye@aist.go.jp
AIST Today Vol. 2, No. 9 (2002) 10

Determination of the structure of the self-assembled monolayer films has been the target of many researchers, however, many attempts have been failed because of the lack of effective analytical tools. The structure of self-assembled monolayer films has been determined, for the first time, by means of temperature programmed desorption (TPD), high resolution electron energy loss spectroscopy(HREELS) and density functional calculation (DFT). The location of the sulfur atom of the self-assembled monolayer films on the Au(111) surface is uniquely determined to be the bridge site although the hollow site has long been believed. The determination of the fundamental structure of the self-assembled monolayers accelerate the application of the self-assembled manslayer films to variety of fields.



The Au(111) surface is the closed packed structure which shows 6-fold symmetry as shown in figure 2. The adsorption site between three gold atoms is the hollow site and the adsorption site between two gold atoms is the bridge site



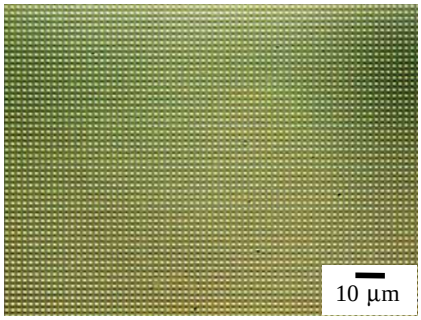
Gray colored balls in the cross section is gold atoms and hydrogen atoms which locate one atomic layer behind the cross section plane

Laser-Induced Materials Processing of Silica Glass

- Surface Microfabrication of 1 Micron-Sized Grid Array -

Ximing DING
Photoreaction Control Research Center
e-mail: ding-xm@aist.go.jp
AIST Today Vol. 2, No. 9 (2002) 12

Laser-induced backside wet etching of fused silica plates using aqueous solutions of a naphthalene derivative was performed upon KrF excimer laser irradiation at 248 nm. Well-defined line-and-space and grid micropatterns at 1 μm scale were fabricated without debris and microcracks formation around the etched area.



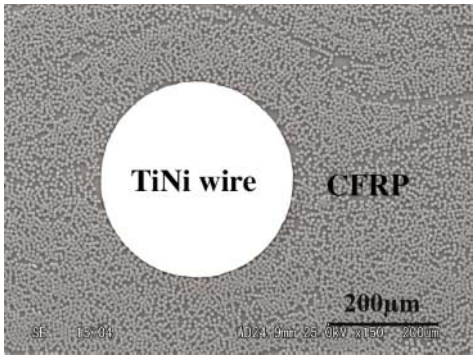
Confocal scanning laser micrograph of a grid array of 1 μm × 1 μm holes on the surface of a fused silica plate

Development of Shape Memory Alloy Smart Composites

- A New Method for Fabricating SMA Smart Polymer Matrix Composites -

Ya XU
Smart Structure Research Center
e-mail: ya-xu@aist.go.jp
AIST Today Vol. 2, No. 8 (2002) 12

Shape memory alloy (SMA) smart composites, in which SMA wires or plates are embedded in composites, are attracting much attention recently. However, one problem in the fabrication process is that the curing temperature of thermoset composites far exceeds the reverse transformation temperatures of TiNi SMA, and special fixture jigs have to be used during fabrication. This makes the fabrication process of SMA smart composites complicated and not suitable for practical application. We have developed a new, simple, and effective method to fabricate TiNi SMA smart composites. The method consists of using heavily cold-worked TiNi wires to increase the reverse transformation temperatures, and of using flash electrical heating of the TiNi wires after fabrication in order to avoid damaging of the matrix around wires. By proper cold working and subsequent electrical heating, the reverse transformation temperature (As) and recovery stress of TiNi alloys were well controlled, and the SMA smart composites were fabricated without using special fixture jigs.

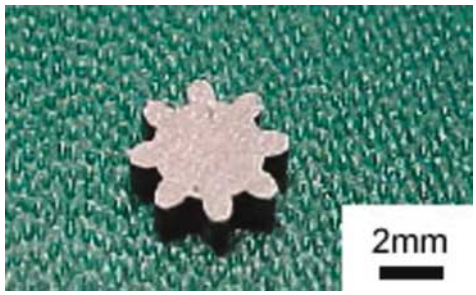


SEM image of the cross section of fabricated TINi/ CFRP smart composite

Bulk Amorphous Magnesium Alloy

Keizo KOBAYASHI
Institute for Structural and Engineering Materials
e-mail: kobayashi-keizo@aist.go.jp
AIST Today Vol. 2, No. 9 (2002) 13

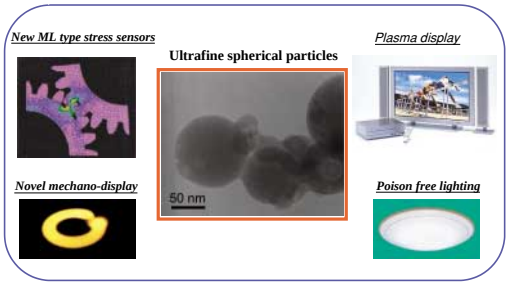
A new process was developed to prepare a new magnesium alloy with a high strength and corrosion resistance. Amorphous Mg-15at%Ni-10at%Si powder was synthesized by a mechanically alloying of elementary Mg, Ni and Si powders. The obtained powder showed a crystallization temperature of 573K. The amorphous powder was consolidated by a pulsed current sintering with a high pressure of 500MPa at 473K. The obtained bulk amorphous magnesium alloy showed a high compressive strength of 303MPa and a much higher corrosion resistance than a conventional one. The developed process enabled us to fabricate a bulk amorphous magnesium alloy with a commercial part of gear.



External appearance of bulk amorphous magnesium gear

Innovation of Strong Mechanoluminescence Materials and Their Application

We have successfully innovated high mechanoluminescence (ML) materials that can give intensive visible light emission during the application of mechanical stress, the luminescence intensity of which is linearly increased with the increase of the mechanical stress in the elastic region. By developing new manufacture processes, fine ML particles with high luminosity are controllable from a size of hundreds nanometer to micrometer. These strong ML materials are promising not only for novel application such as the new stress sensors and displays to visualize stress distribution in macro and micro-scale, but also for various potential applications such as poison-free lightings and high performance plasma displays.

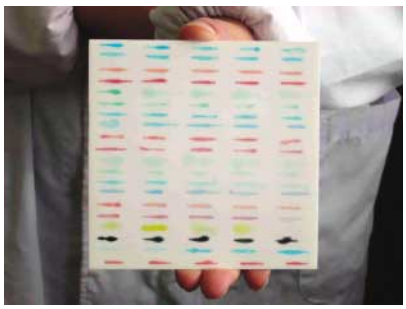


Applications of High Efficiency Phosphors

Chao-Nan XU
Institute for Structure and Engineering Materials
e-mail: cn-xu @aist.go.jp
AIST Today Vol. 2, No. 8 (2002) 13

High-Throughput Screening Technique of Thermoelectric Oxides

A high-throughput screening technique has been established for exploration of thermoelectric oxides. In this technique, 1000 samples can be prepared and evaluated their Seebeck coefficient a day. Moreover, consumed metal weight of one sample is a few 10 μg, which is smaller in the order of 10^{-5} times than the conventional technique. Using the new technique, a few n-type thermoelectric oxides have been found out.



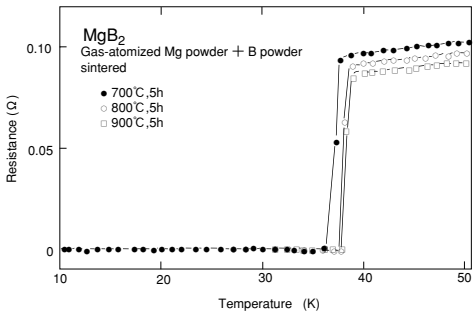
Combinatorial library on a ceramic plate

Ryoji FUNAHASHI
Special Division for Human Life Technology
e-mail:
funahashi-r@aist.go.jp
AIST Today Vol. 2, No. 9 (2002) 14

Development of Superconducting MgB_2 Tapes

The recent discovery of MgB_2 with a superconducting transition temperature Tc of 39K has much interest in various practical application such as cable. Since Mg is extremely volatile metal, powder metallurgical(PM) method is useful to produce a superconducting MgB_2.

We have succeeded in producing fine Mg powders with a diameter of below 100 μm by gas atomization. The atomized Mg powders mixed with B were heated at temperatures of 773K to 1173K and show a superconducting transition at 39K as shown in Fig. Moreover, the superconducting MgB_2 tapes were obtained by a powder - in-tube method using the powders



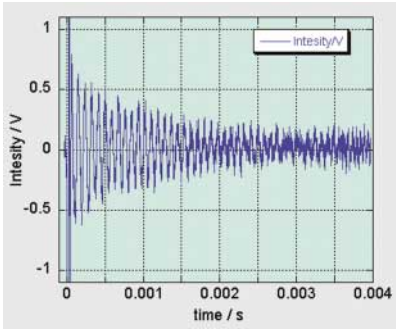
Change in electrical resistance of MgB_2 sintered at various temperatures as a function of temperature

Kunio MATSUZAKI
Institute of Mechanical Systems Engineering
e-mail:
k.matsuzaki@aist.go.jp
AIST Today Vol. 2, No. 9 (2002) 15

Development of Equipment for Continuous Flow Production of Spin-polarized Xenon Gas

Mineyuki HATTORI
Photonics Research Institute
e-mail :
mhattori@ni.aist.go.jp
AIST Today Vol. 2, No. 7
(2002) 9

The Photonics Research Institute, in cooperation with Toyoko Kagaku Co., Ltd. has succeeded in development of continuous flow-type equipment for spin-polarized xenon production based on the flow-type spin-polarized xenon production technology developed by AIST. This is the first equipment for continuous flow production of spin-polarized xenon, developed for practical use. This technology will lead to the development of medical equipment for instantaneous high precision diagnosis of the lung functions, and will represent a significant advance in technology for preventive diagnosis of brain infarction as it provides a highly accurate and fast imaging of the blood flow in the brain.

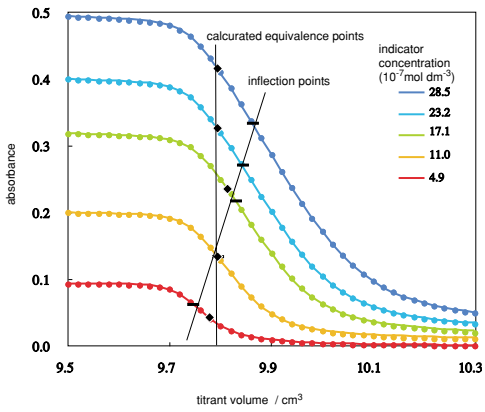


Continuous flow-type equipment for spin-polarized xenon production and NMR signal from spin-polarized xenon acquired by single pulse sequence

Accurate Determination of Cyanide Ions for Development of Standard Solution

Toshihiro SUZUKI
Metrology Institute of Japan
e-mail:
toshihiro.suzuki@aist.go.jp
AIST Today Vol. 2, No. 7
(2002) 17

In a nickel titration of cyanide ions using murexide as an indicator, an accurate equivalence point was determined by a nonlinear least-squares curve-fitting for a titration curve. This method was developed to establish a standard solution for cyanide ions. In a curve-fitting procedure, a theoretical titration curve was calculated, assuming that nickel ion formed only 1:4 complex with cyanide ions and formed only 1:1 complex with murexide. Results of the curve-fitting were reasonable at any pH and any indicator concentration studied.



Titration curves for nickel titration of cyanide ions

The Development of QCM Type Chloroorganic Compound Sensor

Ryuichi NAGANAWA
Institute for Environmental Management Technology
e-mail:
r.naganawa@aist.go.jp
AIST Today Vol. 2, No. 7 (2002) 10

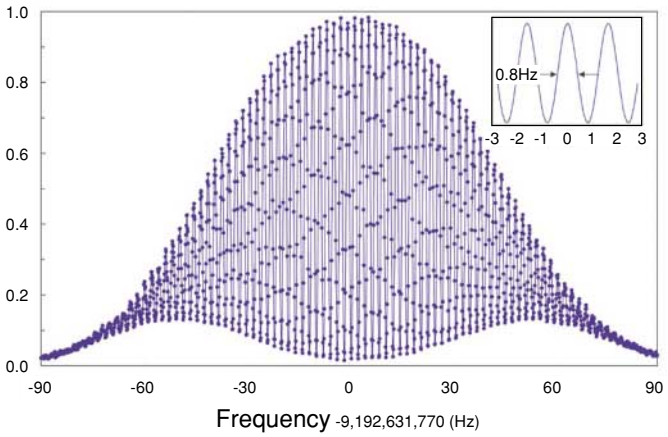
The simple and continuous monitoring method of volatile chloroorganic compounds using quartz crystal microbalance (QCM) was developed. The selectivity was improved, when the surface of the detector was covered by the lipid with the characteristic adsorption function. The reversible response which dealt with increase and decrease of the concentration was obtained. And this sensor has the wide dynamic range (0 to 1000 ppm). So, by using this method, the application to continuous monitoring and working environment measurement can be expected.

The appearance of quartz crystal microbalance and measurement cell

Cs Atomic Fountain Frequency Standards in NMIJ

Yasuhiro FUKUYAMA
Metrology Institute Japan
e-mail:
y.fukuyama@aist.go.jp
AIST Today Vol. 2, No. 8 (2002) 19

Using methods to cool and trap atoms with laser light, new frequency primary standards has been developed in NMIJ. This type of standards is called "atomic fountain" because cooled atoms motion looks like a fountain flow. We have obtained the Ramsey fringes with a linewidth of 0.8 Hz (fig.). Its linewidth is 100th smaller than that in former type of standards. It is expected that new type of standards achieve high stability and accuracy. And the short-term stability has been represented by $7\times10^{-13}\times\tau^{-1/2}$.



Ramsey fringes

Development of a Desktop Josephson Voltage Standard System with a Compact Refrigerator

Akira SHOJI
Nanoelectronics Research Institute
e-mail:a.shoji@aist.go.jp
AIST Today Vol. 2, No. 8 (2002) 18

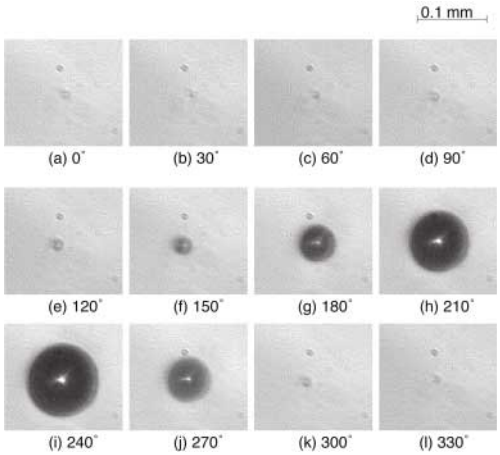
A prototype of a desktop Josephson voltage standard system with a compact refrigerator has been developed. The performance of the prototype system was evaluated by measuring current-voltage(*I*-*V*) characteristics for NbN/TiNx/NbN junction arrays cooled in the system supplied with a microwave(16 GHz). As a result, constant-voltage steps with amplitudes greater than 1 mA were observed on the *I*-*V* characteristics, indicating that the system was normally operated. The highest output voltage for the developed system is 1 V. We have a plan to increase it up to 10 V in near future.

A photograph of a desktop Josephson voltage standard system

Observation of a Cavitation Bubble

Teruyuki KOZUKA
Ceramics Research Institute
e-mail:
kozuka-t@aist.go.jp
AIST Today Vol. 2, No. 9 (2002) 16

A sonoluminescing single-bubble was illuminated using a stroboscope and its shadow images were captured with a synchronized CCD camera. Although it is possible to measure the bubble size using a light-scattering method with a photomultiplier tube (PMT), it is rather troublesome to arrange the optical axis precisely. The author suggests a new method that the optical system consists of a beam splitter inserted between a lens and the CCD camera, and a PMT mounted at the beam splitter. It is confirmed that this system is useful for the simultaneous observation of the bubble size, shape and translational motion.



The direct image of the bubble obtained by changing the phase of flash timing

Rotary Encoder High Precision Calibration System for Angle Standard

We developed the automatic calibration system for angle encoders. The system uses the Equal-Division-Averaged method that is one kind of the self-checking method. Both of the reference standard and the object angle encoders are calibrated at the same time against all encoders graduations within only one hour. The resolution and an uncertainty are 0.001 " and approximately ±0.05 ", respectively. This Equal-Division-Averaged method is hoped to become the national standard method for the calibration of angle encoders.

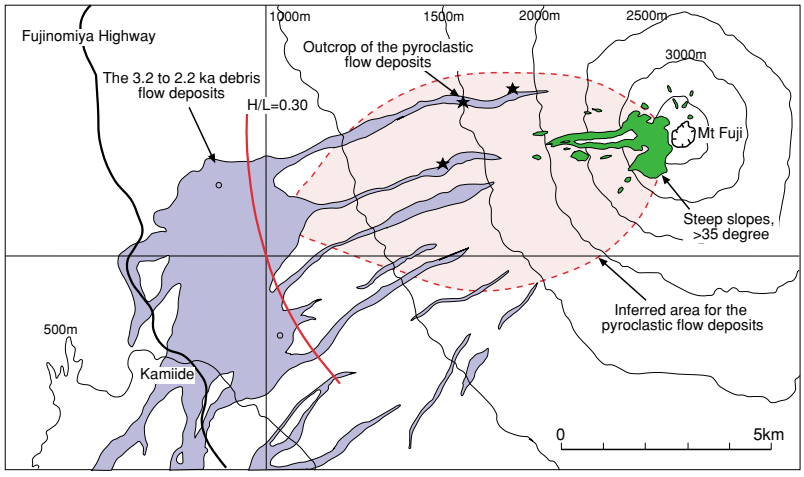
Automatic high precision calibration system for rotary encoder

Tsukasa WATANABE
Metrology Institute of Japan
e-mail :
t.watanabe@aist.go.jp
AIST Today Vol. 2, No. 9 (2002) 17

Geological Survey and Geoscience

Pyroclastic Flow Hazards at Fuji Volcano

Three basaltic pyroclastic flows were generated during the 3.2-ka, 2.9-ka, and 2.5-ka eruptions of Fuji volcano. These pyroclastic flows came down the west to southwest slopes, and generated lahar fans at the foot of the volcano. The ages of the pyroclastic flows correspond to the stage of explosive summit eruptions. Also, the pyroclastic flows only occurred at the steep summit slopes that exceed 34 degree in angle. So, the pyroclastic flows presumably resulted from avalanching of voluminous pyroclastic materials accumulated on the steeper slopes than the angle of repose.



Distribution of the pyroclastic flow deposits in the SW foot of Fuji volcano

Takahiro YAMAMOTO
Research Center for Deep Geological Environments
e-mail:
t-yamamoto@aist.go.jp
AIST Today Vol. 2, No. 8 (2002) 17

Report from the 43rd Japanese Antarctic Research Expedition / Wintering Team

Toshiaki Sakuraba, Planning Headquarters

Destination Antarctica !

On November 28th, 2001, we, the 43rd Antarctic Exploration Team boarded a flight from Narita to Perth, Australia.

We got on board an ice-breaking ship, the Shirase at Freemantle on the west coast of Australia on the following day. Immediately upon our arrival, we loaded fresh foods, inspected the survey and observation equipment, and attended a reception on board the ship. We started off on a journey toward the south from the quiet pier on December 3rd.

On the 2nd day of our journey by the time the boat reached more turbulent waters, we were already in a battle against seasickness and with a loss of appetite. We passed the 55 degrees South Latitude line on December 8th and encountered huge waves, which made our boat rock violently from side to side - 37 degrees on the port side and 32 degrees on the bow side. What discouraged us the most was the broken bottles of precious booze. All the same, the customary "Shirase College" was opened as usual and I was appointed as the President of the 43rd Shirase College.

Showa Station, Once Again

We finally arrived at the 1st helicopter port of Showa station at 16:07 on December 20th, 2001. This was my second visit to Antarctic.

The Shirase cast its anchor on an iceberg in the offing of the Showa station (LUTOU - HOLM BAY) on December 23rd.

We were supposed to share a summer camp with the Shirase support team until the relief of wintering team on 1st of February. During this period, we completed most of the construction work, shipments of goods and necessary transactions for taking over the exploration. The wind contained sand on the bare ground and occasional swirls of dust raised by vehicles made the Showa base look like a construction site in the mountains.

During the nightless period, we started our day at 6:00 in the morning and worked from 7:20 to 19:00 everyday. We were allowed to take a day off every 10 days.

Relief from the 42nd Wintering Team

A ceremony was held for the relief team on February 1st. The 43rd wintering team took over the task of the precedent team. All the members of the 43rd team moved from the summer camp to the residential building at the base. The days grew shorter, and we had a glimpse of a faint aurora.

On February 12th, the wintering team bid farewell to the last helicopter taking leave. It circled over the base a number of times and went off with several members of the 42nd team and the 43rd summer team who stayed behind to assist the wintering team. On the next day, a maximum wind velocity of 45.7m/sec was registered, an indication of the extreme conditions in the polar region. Starting from the first curfew issued from the 14th to 16th, we were occupied with handling a succession of commands. It was the first and precious experience for most of the team.

Showa station was buried with snow before long by the first blizzard on February 23rd followed by blizzards on March 3rd and 9th, lasting for 28 and 39 hours, respectively.

The passage of low-pressure systems brings blizzards and a rise in the temperature. The lowest temperature recorded after the start of our camp was - 29.3ºC, and this record was the fourth lowest temperature in recorded history. However, the temperature rose to +0.5ºC on the March 10th. We experienced unpredictable shifts of weather.

These spells of rough weather do break once in a while. The loveliness of a sunny day is breathtaking.

Enchanted by the Beauty of Nature

Under the sky full of stars, I awaited the moment of the celestial glow of aurora drawing a curtain over the stars, looking for the only constellation I know -Scorpion-. Wiping the sleep from my eyes, it was an ecstatic bliss to gaze up at the aurora in the sky after waiting patiently. It is the moment of joy for one who reached the southernmost land.

From around May 24th, the sun crepeds low over the horizon. It is known as the "rolling sun".

The records of sunrise and sunset finished on May 30th. The sun no longer peeped above the horizon.

The Mid-Winter Festival was held from June 20th to 23rd and happy greetings were exchanged with the Antarctic wintering bases of various countries. We also sent off our messages from the Showa station. Our "hand-made" festival went on 3 days, and nights. Although we did not have any ladies in our 43rd team, we were lucky enough to witness "girls" everywhere at the base during these days of great merry-making.

We had the sun above the horizon approximately for 4 hours in August. However, there are still restrictions on field activities. Therefore I have not yet had the good fortune to encounter penguins or seals. Let us wait and see!

Introduction of Newly Established Research Centers and a Laboratory

Research Center for Glycoscience

The inauguration of the Research Center for Glycoscience (RCG) on June 1, 2002 had been eagerly awaited by industry and academia. The center is an integrated research unit that covers a wide range of research fields related to both glycoscience and glycotechnology. It aspires to be an international leading research center for glycoscience. RCG is an organization with a limited life until 2008 and implementing the intensive research projects based an industry-academia-government collaboration, concentrating on 1) the analysis of human genes related to sugar chains, 2) the development of an automated sugar chain synthesizer and 3) a high-throughput analytical system for sugar chains.

Background and Outline of the Center

Over half of the proteins carry sugar-chains important elements that regulate proteins' functions. Glycoproteomics, the comprehensive analysis on the structure of proteins carrying sugar chains, is regarded as a key of the post-genome science. The study on complex carbohydrates including glycoproteins is one of the few biotechnology research fields where Japan has had an advantage over Europe and the U.S. Recently, related academic societies presented "Concept for Research Centers/Consortium for Glycoscience" to the government, in which AIST was expected to become a hub that takes a principal role to link academia and industry.

RCG has approximately 120 members comprising seven research teams, i.e., Glycobiosynthesis Team, Glycogene Function Team, Cell Regulation Analysis Team, Gene Dynamics Team, Applied Gene Technology Team, Glycostructrue Analysis Team and Glycochemosynthesis Team.

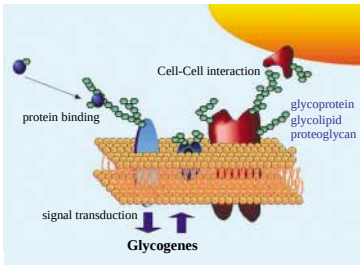
Research Subjects

Basic Research Subjects include: 1) isolation of a sugar chain synthetic gene of various living organisms and their functional analysis, 2) analysis of the tertiary structure of enzymes related to sugar chain synthesis and designing of specific inhibitors, 3) analysis on the sugar chain related genes of micro-organisms, plants and animals and their application, 4) development of synthesizing technology of useful sugar compounds such as glycoprotein and glycolipid using sugar chain related genes and 5) high-throughput analysis for a sugar chain structure including sugar chains of glycoprotein.

Applied technologies aiming at the creation of a new industrial field include: 1) development of diagnostic/treatment systems for cancer and infectious diseases, 2) real time analysis of a cell surface function and cell growth regulation and 3) development of systems and devices to synthesize, analyze and exploit sugar chains.

Future Prospects

RCG sets its specific targets as follows: 1) analysis of unidentified human sugar chain related genes (estimated at approximately 150 out of a total of 300 sugar chain related genes), 2) automated synthesis of any sugar chain using an appropriate glycosyltransferases, 3) development of a new technology on glycoproteomics using sugar chain recognition proteins (lectins), 4) analysis of in vivo receptor of sugar chains and 5) development of a diagnostic system applicable to various diseases.



Reorganization of Gene Discovery Research Center

As of July 1, 2002, the “Gene Discovery Research Center”, which was established on April 1, 2001, was reorganized. It created a new center, the Age Dimension Research Center, which inherited the major portion of the original center and a separate laboratory, the Gene Function Research Laboratory. The purpose of this reorganization was to transform the original research center that covered a wide spectrum of research areas, from mammalian biology to plant biology, into well focused research units. Researchers sharing similar research interests in each unit will be able to create better environments for strong synergy.

Age Dimension Research Center

Outline of the New Center

The mission of this new Center is to discover new knowledge that will lead to better health. Basic research will be

conducted with an emphasis on the time dimension of physiological systems and underlying regulatory mechanisms. In the post-genome sequence era in Japan and other countries, major efforts are now made into exciting new research fields such as bioinformatics, proteomics, individual's genome polymorphisms, regenerative medicine and gene therapy. Although these research activities are important, few scientists focus their serious research efforts on the role of time (age) on biological phenomena at the molecular level, which is an essential element of life. For a comprehensive understanding of many complex biological systems and homeostasis, we pay particular attention to this critical aspect and aim to determine the genetic and molecular mechanisms responsible for age-related regulation of genes, cells and physiological systems. The new knowledge that we uncover will be rapidly made available for use by industry for developing new valuable technologies, disease prevention and therapy as well as for drug development.

Research Themes

As the country's birthrate rapidly falls and the elderly population expands , the promotion of senior citizens' health has become an urgent issue and indispensable for creating a future productive society. At this center, we conduct our research on various biological phenomena with a unique view of analyzing the longitudinal time (age) dimension. We aim to contribute to the fundamental understanding of age-related regulatory mechanisms of genes and physiological systems such as aging and immunity as well as adult and geriatric diseases including cardiovascular diseases for which age is known to be a risk factor. We also will develop a new research paradigm, the Age Dimension Technology (ADT), which will help us to develop valuable technologies, effective and safe prevention/treatment methods as well as new drugs for such diseases.

Prospects for the Future

The purpose of this new center, therefore, is to conduct basic researches discovering principles and new knowledge of age-related genetic, molecular and cellular mechanisms of physiological systems and pathophysiological conditions and establish a new research paradigm. At the same time, we will proactively transfer our research achievements to developmental uses by industry. Through these activities, we will contribute to creating a healthy and active society in this country.

This center started with two research teams, Age Dimension and Cell Regulation. We intend to add two to three new teams in the near future.

Gene Function Research Laboratory

Outline of the Laboratory

Our mission is to identify new functional genes and elucidate their function systems. In the field of biotechnology where research outside Japan is prevailing, we propose a novel and unique approach in the basic research, which may develop technologies made for practical application.

Our research covers a wide range of subjects from basic to applied science including RNA chemistry, nanotechnology, structural biology, biological studies using both animal and plant cells as well as model animals. We will contribute to industry and clinical medicine by combining these basic and applied researches.

Our Goal and Activities

The results of basic researches in this field can be easily put into practice for both industrial and medical applications. Consequently, a research project with higher potential will directly give an impact on the society. We will pursue our research activities through two different approaches: i.e. "Basic Studies" and "Highly Interdisciplinary Studies". "Basic Studies" includes basic research projects on functional nucleic acid, cutting edge engineering, vector development, application of vectors to improve the efficiency in discovery of both human and animal functional genes and analysis of gene functions. Meanwhile, "Highly Interdisciplinary Studies" comprises of multiple areas centering on the discovery of new functional genes, which regulate diseases as well as other complex biological reactions such as the proliferation and cytokinesis of cancer cells and functions of central nerves.

Future Prospects

The laboratory aims at contributing to domestic industry in the field of life science through the active involvement in various consortiums with the academic community and industry both at home and abroad in co-operation with other AIST research centers.

Although GFRL is currently an organization with a limited life of 3 fiscal years, it is expected to be reorganized as a research center in the future.

Commemorative Seminar for the 120th Anniversary of the Foundation of Geological Survey of Japan

The Geological Survey of Japan marked its 120th anniversary this year.

In commemoration of this occasion, the "Commemorative seminar for the 120th Anniversary of Geological Survey of Japan" was held at the Meiji Memorial Hall in Tokyo on June 7, 2002.

Dr. Hiraishi, Vice President of AIST, made the opening speech followed by the congratulatory addresses from representatives of the Ministry of Economy, Trade and Industry as well as other related industrial and academic entities. Dr. J. Devine, Senior Science Advisor of U.S. Geological Survey, and Dr. Zhang Hongtao, Vice Director of Geological Survey of China, delivered commemoration speeches. Both speakers explained the present status of the geological survey of their countries, transition of their roles and their future tasks in the international community. They also expressed their expectations for Japanese contributions in this field. The Geological Survey of Japan introduced one of their recent research topics, the significance of scientific drilling at Mt. Unzen Volcano, Nagasaki prefecture.

Geological Survey of Japan

In April 2001, the National Institute of Advanced Industrial Science and Technology (AIST) was established as an Independent Administrative Organization by reorganizing 15 research institutes of the former Agency of Industrial Science and Technology in the Ministry of Economy, Trade and Industry (AIST/METI). It consists of 55 research units to work as the core of research and development, research support departments to facilitate efficient and effective activities on research and development, and administrative departments in charge of management. Five research units, two collaborative research teams in Hokkaido and Kansai and three research support departments are engaged in research activities on geological survey which had been conducted by the Geological Survey of Japan as a national research institute. Now all these units, collaborative teams and support departments relating to activities on geological survey are generally referred to as the “Geological Survey of Japan”.

For further information on the Geological Survey of Japan

Contact: Geoinformation Division, Secretariat of Geological Survey of Japan, AIST.

Tel:0298-61-3687, Fax:0298-61-3672, E-mail:secr@gsj.jp

URL:http//www.gsj.jp/HomePageJP.html

World's Largest "Super Clean Room" is Completed

"Super Clean Room" for the research consortium of Industry-Academia-Government was completed at AIST Tsukuba West at the end of March 2002.

The commemorative ceremony for the completion was held at the location on June 17, 2002.

In the presence of Mr. Yoshihisa Oshima, Vice Minister of Economy, Trade and Industry, Dr. Hiroyuki Yoshikawa, the President of AIST made his opening remarks followed by words of congratulations from guests. Dr. Masataka Hirose, the director of advanced Semiconductor Research Center, made an introductory presentation on "Semiconductor Research at AIST". After the ceremony, the guests attended a tour of the Super Clean Room and reception party.

The construction of this facility is financed by the Ministry of Economy, Trade and Industry. It boasts a 3,000 m^2 super clean room (class 3) and a 1500 m^2 clean room for research use (class 5). It is one of the largest clean rooms with research facilities in the world. Super Clean Room will be the center of three flagship R&D projects of the most advanced semicon-

ductor technology, that is: "Semiconductor MIRAI project", "HALCA project" and "ASUKA" project. "MIRAI" research project includes new materials, material processing, device technology and measurement technology for the next generation semiconductor technology, whereas the objective of "HALCA" project is the development of highly efficient and energy-saving manufacturing systems which accommodate a variety of types of products or production volume. "ASUKA project" aims at the development of new materials and total processing technology for the next generation of semiconductors.

Super Clean Room will be Japan's largest research center of Industry-Academia-Government collaboration where over 400 researchers will strive on the most advanced semiconductor R&D projects.

Floor Space	1300 m^2
Liquid Used	Kerosene, Light oil
Flow Rate	3 ～ 300 m^3/h
Pipe diameter	50 mm, 100 mm, 150 mm

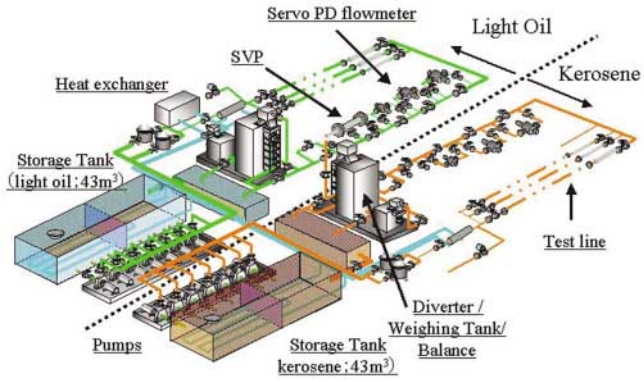
Primary Standard
1. Static and gravimetric method with flying start and stop
2. 10t, 1t balances, diverter, density meter

Uncertainty (k=2)
0.04% for volumetric flow rate,
0.03% for mass flow rate

Specifications of the primary standard

Successful Completion of Oil Flow Calibration Facility for Petroleum Tanks at AIST Tsukuba Center

- Aiming for the Highest Accuracy in the World -



Inside view of the facility

A new primary standard for hydrocarbon flow measurements has been made at the AIST Tsukuba center.

There had been no national standard for hydrocarbon flow measurements used at petroleum industrial complexes in Japan. As a result, flowmeter manufacturers and users have responsibility for the calibration by the standard flow rate. However, to comply with the requirement to set up a traceablity certification system based on international standards, a primary standard facility with a hydrocarbon flow that conforms to the measurement standards of international oil transactions was established.

The oil flow calibration facility is designed to calibrate hydrocarbon flowmeters in the flow rate range between 3 to 300 m^3/h with the expanded uncertainty less than 0.04 % for volumetric flow rates and 0.03 % for mass flow rates. Light oil and kerosene are used as the fluids. Each fluid has its own test line. This primary standard works based on static and gravimetric methods with flying start and stop so that the total mass pass through the flowmeter in a given time is measured by a diverter. Although the volumetric flow rate standard is fundamentally based on mass, time and density standards, it reduces the measurement uncertainty and meets contract conditions for calibration. A new diverter system developed by AIST was applied to minimize the uncertainty in the collection time of the hydrocarbon into the weighing tanks. The test lines' diameters for the flowmeters are 50, 100 and 150 mm. Two 43-m^3-storage tanks are used for the two lines to achieve a better stability of the liquid temperature.

At present, the detailed uncertainty and long-term stability for the facility has been estimated in order to achieve a traceable a system in 2005.

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AIST Tsukuba Central 3, 1-1-1 Umezono, Tsukuba, Ibaraki 305-8563, Japan
TEL: +81-298-61-4128 FAX: +81-298-61-4129 Email: prpub@m.aist.go.jp URL: http://www.aist.go.jp/