International Strategy Utilizing the Global Network

As open innovation has become a worldwide trend and the market is becoming increasingly global, there is a strong need for AIST to support the globalization of Japanese industry as an international open innovation hub. In this feature, the international strategy of AIST that contributes to the national benefit and AIST's efforts in the area of international cooperation using its global network are described with specific examples.

International strategy of AIST

The international strategy of AIST consists of the implementation of tripartite joint research together with Japanese corporations based on AIST's network of cooperation with overseas research institutes, promotion of international standardization, and fulfillment of missions set forth by the government, so as to support the global business operations of Japanese industry. As an international open innovation hub, AIST aims to support Japanese industry greatly enhance its competitiveness by pursuing this strategy.

AIST currently conducts joint research, exchanges of human resources, and exchanges of information with overseas institutes based on its global network. Using this network, AIST supports the global business of Japanese industry by implementing the tripartite joint research mentioned above through cooperation between AIST, Japanese corporations, and institutes in other countries. AIST is also actively promoting the international standardization of various technologies as a public institute, thereby supporting the efforts of Japanese industry to obtain global market share and enhance competitiveness. Furthermore, AIST is contributing to the fulfillment of the government's missions by promoting international cooperation to ensure stable supplies of mineral resources and to disseminate renewable energy.

These diverse forms of international cooperation are realized by our strong cooperation network with overseas institutes. AIST strategically signs memoranda of understanding (MOUs) on research cooperation with various overseas research institutes to establish a win-win network with these institutes for the promotion of joint research and exchanges of human resources and information. AIST dispatches its researchers to other countries, invites foreign researchers to Japan, and actively promotes interchanges of human resources with selected overseas research institutes, thus strengthening the foundations of its strong network of cooperation.

Methods of international cooperation to realize the international strategy and future prospects

As mentioned above, the international strategy of AIST is to support the global business operations of Japanese industry based on its global network with overseas institutes. The specific procedures are described below.

○ Joint R&D involving corporations through the use of AIST's overseas network

AIST has a cooperation network with major research institutes in various countries. Through tripartite joint research conducted by AIST, Japanese corporations, and institutes in other countries via our global network, we are working to support the acceleration of R&D activities of those Japanese corporations, the penetration of Japanese industry into the global market, and global business.

○ Joint R&D aimed at science and technology development with overseas institutes

There are a large number of research institutes with high R&D potential located in various countries around the world. AIST conducts joint R&D with these research institutes so as to realize AIST-created innovations and accelerate Japanese innovations in the relevant fields, thereby supporting innovations by Japanese industry.

○ International cooperation through international standardization

International standardization of important Japanese technologies such as solar power generation or biofuels ultimately supports Japanese industry's global market operations in these fields. AIST plays a key role as a public institute in leading efforts to realize the international standardization of various next-generation technologies, thus supporting the operations of Japanese corporations in the international market

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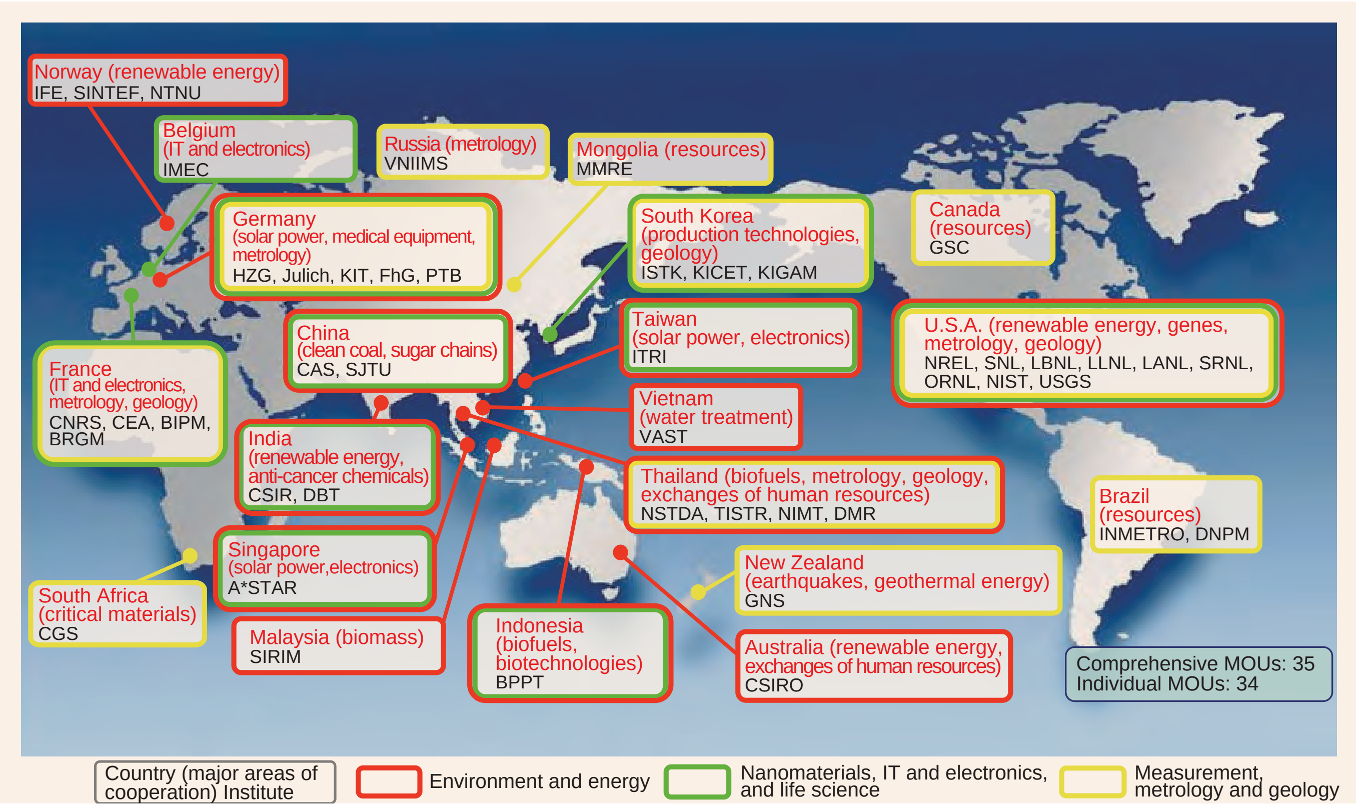

Major MOU signatories and areas of cooperation

and reinforcement of their industrial competitiveness.

◯ International cooperation to contribute to the government's missions

The important roles of the Japanese government in promoting Japanese industrial development include the provision of stable supplies of energy and mineral resources, dissemination of renewable energy, and support of Japanese corporations that have operations in other countries. AIST assists the global operations of Japanese industry by realizing various forms of international cooperation involving Japanese corporations to fulfill these government missions in its capacity as a public research institute.

Global network of AIST

At present, AIST has MOUs on comprehensive research cooperation with 35 institutes in 18 countries or regions to promote cooperation in multiple research areas. AIST also has MOUs with 34 institutes for cooperation in specific research areas. These agreements allow us to actualize systematic cooperation in various ways, as explained above. In Asia, our cooperation network covers China, South Korea, Taiwan, Thailand, India, Indonesia, Vietnam, and Singapore. In Europe, our network encompasses Germany, France, Belgium, Norway, and Finland. In the United States, we have a well-established cooperative relationship with research institutes under the U.S. Department of Energy (DOE). We also have a strong cooperation network in South Africa and Australia.

We are actively engaged in joint research and exchanges of human resources and information based on these MOUs with overseas institutes, and are deepening our mutual ties through our efforts in joint research and standardization utilizing each other's advantages. Through cooperative activities with Japanese corporations that are collaborating with us, we are making efforts to support the global business operations of Japanese industry.

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Joint R&D with Corporations Using the Overseas Network

Introduction

This article explains the specific efforts of AIST, using the network with overseas research institutes, to assist Japanese corporations in accelerating their R&D activities, penetrating world markets, and conducting global business operations.

Developing technology to produce transportation fuel from non-edible biomass in Thailand

Amid the soaring prices of crude oil and rising recognition of the importance of oil resource availability, it is an important issue not only for Japan but also the entire world to develop transportation fuel derived from non-edible biomass. There is a non-edible oil-yielding plant, *Jatropha curcas* (jatropha), that is resistant to drought, cultivable on barren land, and less likely to cause forest destruction. Considering these features, it is attracting a great deal of attention as a future potential raw material for transportation biofuel. AIST has advanced technological expertise in the field of transportation biofuels, including production of quality biodiesel fuel (BDF) from oil fractions and effective use of oil extract residues to enhance the overall efficiency of utilization of jatropha fruit.

Under these circumstances, AIST together with Thailand's National Science and Technology Development Agency (NSTDA) ,the Thailand Institute of Scientific and Technological Research (TISTR) and King Mongkut's University of Technology North Bangkok (KMUTNB) decided to conduct joint development of the fundamental technology to produce transportation fuel from non-edible biomass as part of the Science and Technology Research Partnership for Sustainable Development (SATREPS) being implemented by the Japan Science and Technology Agency and the Japan International Cooperation Agency (Fig. 1). In this joint project, high-

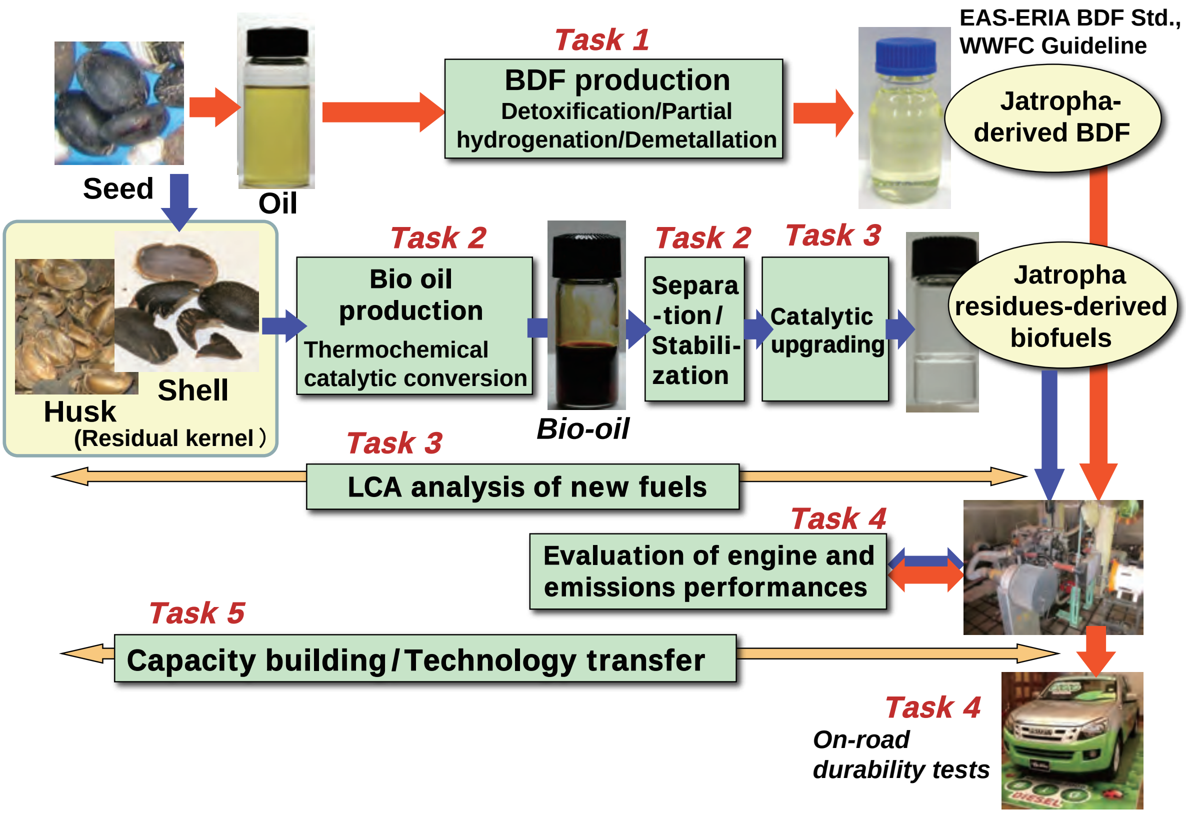

Fig. 1 AIST-Thailand joint development of technology to produce transportation fuel from non-edible biomass

quality BDF from non-edible jatropha is being produced in Thailand using AIST's technology. To verify its compatibility as an automobile fuel, a road durability test using actual vehicles fueled with the high-quality BDF was initiated in Thailand in November 2012 jointly with the Isuzu Motors' Thailand Group.

BDF jointly produced by AIST and the Thai institutes satisfies not only the level of quality recommended by the Economic Research Institute for ASEAN and East Asia (ERIA quality) under the East Asia Summit but also the guideline of the Worldwide Fuel Charter (WWFC). We will continue our efforts to develop industrial-scale manufacturing technology in the future. We also plan to promote and disseminate technologies not only to Thailand but also to the countries of East Asia for the production, quality assurance, and utilization of our BDF.

Developing natural rubber production technology in Indonesia

Natural rubber produced by a tropical tree, the Pará rubber tree, has excellent physical properties that cannot be reproduced by synthetic rubber. It is still an indispensable raw material for tire production, and demand is rapidly increasing as a result of the worldwide growth in vehicle ownership. It is, however, necessary to increase the production per unit of Pará rubber tree without expanding the area of land under cultivation, from the viewpoint of environmental protection. Conventional procedures have only involved classical selective breeding or empirical technical improvements, and an appropriate review based on scientific understanding has not so far been made.

Considering this status, AIST has established a framework for international joint research by three parties—AIST, the Indonesian Agency for the Assessment and Application of Technology (BPPT), and Bridgestone Corporation—and started technical development to support increased production of natural rubber.

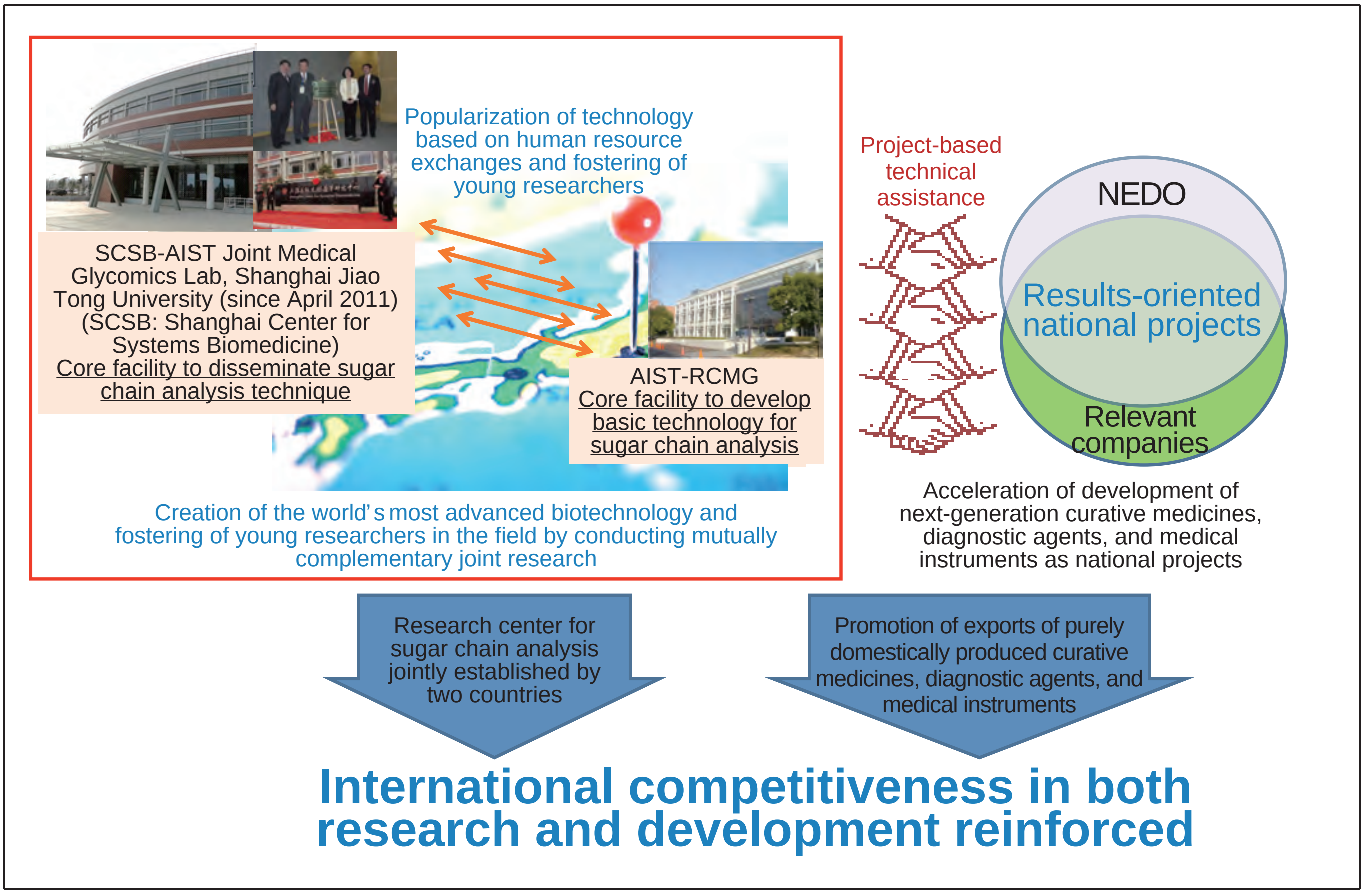

Fig. 2 Framework for the international joint project

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International Strategy Utilizing the Global Network

We are working closely with BPPT, a governmental agency of the world's second-largest natural rubber producing country, and the Biotech Center, one of the research institutes under BPPT. This system of close ties allows us to obtain information and research specimens related to or necessary for the cultivation and breeding of Pará rubber trees essential for the development of molecular breeding technology. In order to realize early application of the developed technology to production sites, we also have a collaborative framework with Bridgestone, which operates a rubber farming business in Indonesia.

Having started in 2011, this international joint research project is engaged in the development of DNA markers based on genome analysis, analysis of the formation mechanism of latex-producing cells (laticifers), clonal propagation technology, and genetic transformation technology.

Evaluating the effectiveness of a new liver disorder marker in China

Hepatitis virus infection is a global issue. China is one of the seriously affected countries, with more than 100 million people infected with this virus. It is hoped that technology to diagnose the disease be diffused to realize the earliest possible start of the appropriate treatment. Currently, FibroScan, a physical measuring device, and FibroTest, a serodiagnostic index, both developed by a French manufacturer, hold a large share of the market for quantification of hepatic fibrosis with hepatic fibrosis markers. These diagnostic methods, however, pose a large financial burden on patients. It is therefore an important issue not only for Japan but also the rest of the world to accelerate the dissemination of "the world's quickest, most inexpensive, and safest fibrosis quantification system."

The Research Center for Medical Glycoscience (RCMG) of AIST developed a leading-edge sugar chain analysis technique with 10 years' support from the New Energy and Industrial Technology Development Organization (NEDO) and created its own technique for developing diagnostic agents related to sugar chains as one of the culminations of these efforts. Particularly, RCMG completed development of a diagnostic kit that allows measurement of a hepatic fibrosis marker in 17 minutes, and a Japanese company applied for official approval for its production and sale. With this as a background, a laboratory was jointly established by AIST and Shanghai Jiao Tong University in the compound of the university in China in April 2011 to focus on research on sugar chains aiming at overseas expansion. A research theme applied for by this laboratory was adopted under the International S&T Cooperation Program of China in 2012. The laboratory provides an environment for the assessment of the diagnostic kit developed by AIST, with the serum of patients in China gathered by researchers of Shanghai Jiao Tong University being used for measurements to conduct ongoing evaluations of the effectiveness of the kit.

This international joint research project (Fig. 2) was realized based on the excellent performance of RCMG's glycoproteomics technology and the confirmed validity of "the quick, inexpensive and safe system" using the hepatic fibrosis marker.

The advanced technological capabilities of AIST have thus greatly supported overseas business operations of Japanese corporations.

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Joint Research and Development with Overseas Institutes for Scientific and Technological Development

Introduction

There are many research institutes with high R&D potential in the world. This article describes the specific efforts of AIST in creating AIST-originated innovations through joint R&D with these research institutes, thereby supporting innovations by Japanese industry in the relevant fields.

Developing robots with CNRS of France

In France, highly advanced studies are being conducted on the theoretical aspects of robot-related research. In particular, the National Center for Scientific Research (Le Centre national de la Recherche Scientifique: CNRS) is one of the leading institutes of research on artificial intelligence and applied mathematical theory. The Intelligent Systems Research Institute of AIST is also conducting advanced research of a globally excellent standard on robot implementation and control technology especially for humanoid robots. Win-win cooperation between AIST and CNRS is of pivotal significance in order to accelerate establishment of fundamental technologies for enhancement of the autonomy, adaptability, and interaction of robots.

Members of the AIST-CNRS JRL (Joint Robotics Laboratory), UMI3218/CRT

Recognizing this high potential for cooperation, AIST and CNRS signed an MOU in 2001. The two institutes set up together a dedicated organization to conduct international joint research based on the signed MOU, called the AIST-CNRS JRL (Joint Robotics Laboratory), UMI3218/CRT, in December 2008. After an external evaluation process, JRL started its second-term activities in December 2012. With respect to autonomy, we have established an off-line planning technology that enables a robot to move to a targeted position using whole-body motion while avoiding obstacles in a complicated environment. The developed method has also been extended to plan motions in contact with the environment and plural points and has been demonstrated using a humanoid robot. In the field of adaptability, we have developed a technology that enables a robot to move to a targeted position by avoiding obstacles in a changing environment, and validated it by implementing a humanoid that has capacity of adaptive walking path generation. Finally for interaction, our achievements include the realization of a teleoperation technology that enables a human and a robot to work in a coordinated manner using the visual and force sensing, and another technology that allows controlling a humanoid with brain signals.

CNRS-AIST JRL is continuously participating in external international projects including EU projects. Using the budget of those projects, postdoctoral researchers and doctoral students are employed by the French side and sent to AIST to conduct joint research. Many brilliant and highly motivated researchers from prestigious French schools such as École Polytechnique and École Normale Supérieure participate in the joint research at JRL. As a laboratory belonging to

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CNRS that is a highly reputed research institute, JRL offers them an opportunity to conduct research on advanced technologies at AIST. Foreign researchers from JRL are active at a number of research institutes including CNRS and various corporations, and we have maintained a cooperative relationship with those researchers. Mutual exchanges also take place, with six AIST researchers staying at CNRS on a medium- to long-term basis.

As explained above, the joint research conducted by AIST and CNRS and the establishment of JRL not only bring progress on fundamental technologies for robotics, but also accomplish a significant improvement of the research potential of AIST through the interaction with excellent human resources of CNRS. This synergy is expected to eventually make a noteworthy contribution to Japanese innovations in robot research.

Development of actuators with a Fraunhofer Institute

With the accelerating aging of society, there is a growing demand for medical and welfare equipment such as rehabilitation robots and silent pumps for medical applications, either for use in the home or to be fitted to the human body. These devices must ensure sufficient safety and operability in the environments in which they are used, while also realizing downsizing, weight-saving, and cost reduction. To achieve these objectives, an actuator is required that is light in weight, has excellent workability, and operates silently. One of the promising candidates for such an actuator is the electroactive polymer (EAP) actuator.

The Health Research Institute of AIST is engaged in the development of EAP actuators and their application to medical and welfare equipment, and boasts the world's top-class competitive edge in the development of nanocarbon polymer actuators. Practical application of such actuators, however, requires the upsizing of elements or device integration of actuators by layering as well as techniques for their systematization. The Fraunhofer Institute for Manufacturing Engineering and Automation (Fraunhofer-Institut für Produktionstechnik und Automatisierung: Fraunhofer IPA), located in Germany, is strong in the fields of process technology and systematization technology typically used for large-scale production. This institute had developed EAP by itself. Aware of the high performance of the EAP developed by AIST, Fraunhofer IPA withdrew from the development of fundamental technologies for EAP and decided to work with Japanese corporations centering on AIST to promote EAP development.

With this as a background, an MOU was concluded between AIST and Fraunhofer Gesellschaft in 2012. In April 2013, a joint research agreement on the development of EAP was signed between the two parties. Under this agreement, both parties will jointly develop technologies for the upsizing and layering of EAP actuator elements and related system technologies, whose development had been conducted by AIST, produce prototype extension actuators applicable to rehabilitation robots and silent pumps for medical use, and promote their industrial application. At present, AIST is studying the material composition of the element, while Fraunhofer IPA is working on upsizing and layering techniques. We intend to apply prototypes of medical and welfare devices produced by these joint research efforts and promote R&D for the commercialization of EAP devices with relevant manufacturers in Japan and overseas.

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International Cooperation in International Standardization

Introduction

The importance of international standardization began to be recognized particularly in the latter half of the 1990s. With the Agreement on Technical Barriers to Trade (TBT Agreement) administered by the World Trade Organization (WTO) coming into force, each WTO member country was obliged to base its domestic arbitrary or mandatory standards, when prepared, on the relevant international standards so that its domestic standards or conformity assessment procedures would not cause unnecessary trade barriers. Japan is also committed to this obligation, and its domestic standards, the Japanese Industrial Standards (JIS), have been modified to ensure consistency with the international standards.

The presence of a standard itself does not necessarily make it meaningful. A standard makes sense only when the relevant products or services are checked and proven to comply with it (conformity assessment). Similarly to international standardization, conformity assessment is becoming increasingly important as well.

This section describes the efforts of AIST in supporting the global operations of Japanese industry through assistance in the fields of standardization and conformity assessment activities, taking LED lamps and photocatalysts as specific cases. Although these supporting efforts are not necessarily made with AIST as the central figure, AIST’s advanced research results are incorporated in the major actions that constitute these efforts.

Comparison among international laboratories for LED lamp testing

LED lighting is characterized by higher conversion efficiency from electric power to light, power consumption lower than the traditional lighting such as incandescent lamp or fluorescent lamp with the same brightness, and longer operating life. Because of these advantages, LED lamps have rapidly spread and various LED products are on the market. However, some of LED lamps on the market did not have sufficient brightness and the brightness was lower than those mentioned in those performance indications. Hence, the Consumer Affairs Agency of Japan has directed the manufacturers and suppliers who shipped those LED lamps to correct their exaggerated performance indications, because consumer confusion could have been created.

One of the major causes of this problem is that the technology on which LED lamp is based is completely different from that of traditional lighting, and accordingly there are great differences from the traditional lighting such as, in the spectra, in the spatial distribution of light, and in the size or the shape of the light source. Furthermore there is also a wider variety of specifications among products. The above causes serious difficulty in evaluating LED lighting with high reliability using the traditional evaluation methods. Under these circumstances, AIST has been engaged in the research and development of an appropriate measurement standard for LED lamps that guarantees easier and higher reliable LED measurement. We plan to release this measurement standard in the near future.

Moreover, since the LED lamp products on market are measured by the manufacturers’ testing laboratories or third-party testing laboratories, it is very important to verify the introduced measurement methods and the measurement capabilities of these testing laboratories in order to improve the reliability of LED lamp performance indication. For verification, AIST took the initiative in conducting proficiency testing, in which participant laboratories measured the same LED lamps using the same measurement method (JIS) and AIST gathered objective data to verify the measurement capabilities of the laboratories. The results of the proficiency testing are being referred to in the accreditation conducted by the National Institute of Technology and Evaluation for verifying the measurement capabilities of the laboratories.

The LED lamps have also become popular around the world and some countries have introduced a system of marking and labeling to indicate their energy-saving performance. The criteria for testing, however, vary from country to country, and the approach to standardization or conformity assessment has not yet been unified.

It goes without saying that the current situation is not desirable for the global penetration of LED lamps. Consideration

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this situation, AIST participated in the IEA-4E SSL Annex, which is an international joint project of the International Energy Agency (IEA), and has prepared an internationally common measurement method and protocol for verifying the capabilities of the testing laboratories for LED lamp measurement throughout the world. This means that the measurement capabilities of testing laboratories can be compared based on the internationally common criteria. Any test results of LED lamp products which are provided by a laboratory verified by the common criteria, will then be able to be referred to as evidence for any performance certification, which is necessary for checking the products against the energy-saving labeling of each country. AIST is currently taking the initiative in conducting proficiency testing among Japanese participating laboratories according to the IEA-4E SSL Annex based criteria.

The expected outcome of these efforts is that LED lighting fixtures manufactured and tested in Japan will be certified as ecological products worldwide.

Actions for diffusion of photocatalysts

Photocatalyst is a relatively widely known term among the general public in Japan. A variety of products based on the reactions of photocatalysts, such as those with dirt-resistant or antibacterial features, are being sold. Titanium dioxide, well known as a photocatalyst, is a relatively inexpensive material that is also used as a pigment in products such as white paint. It is the rutile type of titanium dioxide that is used as a pigment, while the anatase type is used as a photocatalyst. Purchasers of these products cannot tell simply by looking at them whether or not they are really as effective as advertised. In this type of situation, products with and without actual effects tend to coexist.

Consumers who happen to buy an inferior product may come to doubt that the new technology that they embody is effective. Consequently, truly effective products may end up being poorly sold. If this occurs, the market for the new technology will not be established in a sound way.

Such inferior products should be eliminated. AIST has promoted the following strategy for standardization of photocatalytic products to verify effectiveness of the photocatalysts. First, the JIS specifying the method for evaluating the effectiveness of photocatalysts should be issued, and the specific JIS standard for each function of photocatalysts should be sequentially published. At the same time, the process of international standardization should be promoted. In Japan, certification marks are granted by an industrial organization based on the results of JIS-specified tests so as to differentiate products.

When a Japanese technology or national standardization is ahead of that of other countries, as in the case of photocatalysts, and is promoted to international standardization, the necessity of international standardization or the details of the technology may not be fully understood.

Appropriate measures are therefore being taken in cooperation with relevant countries to avoid such situations when promoting international standardization, including visits to specialists in Asia, Europe, and North America and the implementation of international round-robin tests with Asian countries and the European Committee for Standardization.

Test methods to verify the effectiveness of photocatalysts such as self-cleaning performance, air purification, water purification, and bacterial resistance have been established after going through these processes. In the future, the infrastructure necessary for the distribution of products in any country of the world will be able to be established by allowing the results of tests conducted in Japan or the results of Japanese institutional certification to be accepted in other countries (mutual approval).

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International Cooperation for Contribution to Government Missions

Introduction

This section introduces AIST's specific efforts in the area of international cooperation to contribute to the missions of the Japanese government, including the development of resources in India, Mongolia, and South Africa; cooperation with the U.S. Department of Energy in clean energy technologies; and metrology-related support for Japanese companies operating in Asia.

Cooperation with Mongolia and South Africa in the development of rare-earth resources

Rare-earth elements are used in various applications including catalysts, glass, ceramics, raw materials for fluorescent agents, and alloy additives. Among such applications, they are indispensable raw materials for neodymium magnets used in hybrid cars, electrical appliances, and industrial robots. At present, the supply of dysprosium, one of the rare-earth elements added to neodymium magnets, is particularly in danger. The Institute for Geo-Resources and Environment of AIST has conducted geological surveys in various parts of the world with an eye to developing new rare-earth resources. Since rare-earth elements form fluorides, it is logically expected that rare-earth resources will exist where a large volume of fluorite (CaF_2), the major naturally occurring form of fluoride, is found. The Institute for Geo-Resources and Environment has signed MOUs with the relevant government agencies of South Africa and Mongolia, the world's major countries with rich fluorite reserves or production, and conducted surveys on the potential of rare-earth resources in those countries.

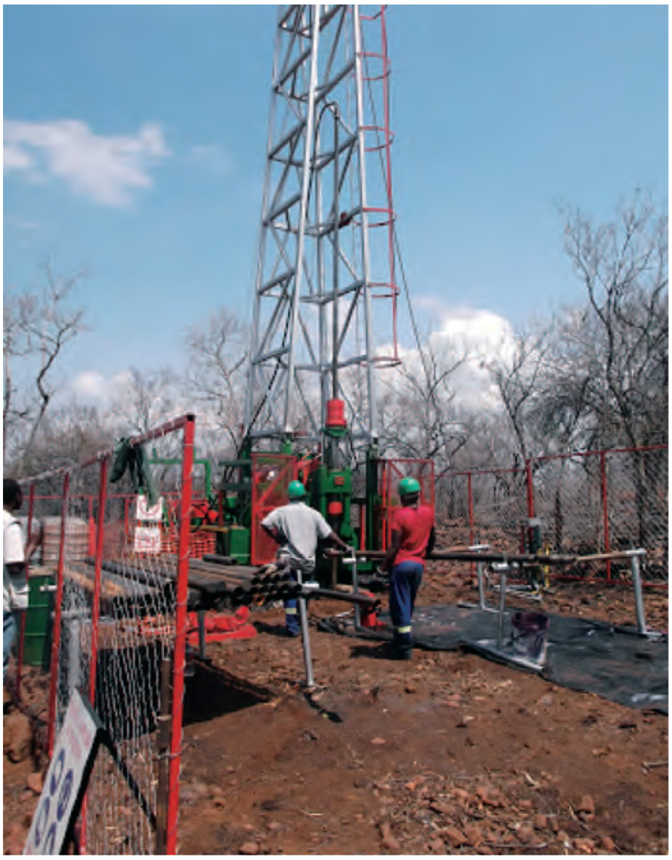

Fig. 1 Test-drilling survey in South Africa

In South Africa, we conducted a survey of fluorite deposits and prospects scattered over an area with a distribution of granite located at the center of the Bushveld Complex, famous for its production of platinum, based on an MOU signed between the Council for Geoscience, South Africa, and the Japan Oil, Gas and Metals National Corporation (JOGMEC), in 2007. Rare-earth minerals and rare-earth contents in the ores from these deposits were analyzed, and high concentrations of rare-earth elements containing a large volume of dysprosium were found in two of the deposits. Detailed surface geologic surveys identified one prospect as the most promising, and a test-drilling survey has been conducted there since 2012. (Fig. 1)

In Mongolia, a survey has been conducted for rare-earth deposits throughout the entire country based on an MOU related to mineral resources signed between the Mongolia's Ministry of Mineral Resources and Energy and JOGMEC in 2010. The survey found that

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the Haldzan Buregtei deposit in the Hovd area in western Mongolia is the largest in scale and that heavy rare-earth elements including dysprosium are abundant in the deposit. Since 2012, mineral and chemical analyses of core samples obtained from test drilling have been conducted jointly with a Mongolian company that owns the mining concession for the deposit so as to evaluate the tonnage and grade of the rare-earth reserves in the concession. At present, in addition to evaluations of the volume of rare-earth resources in these deposits, tests on the beneficiation of rare-earth minerals and extraction of rare-earth elements from the ore concentrates are being conducted using ore samples obtained from South Africa and Mongolia at a mineral beneficiation laboratory newly set up in AIST. Based on the results of these tests and analyses, a final evaluation of economic viability is planned so as to clarify the feasibility of resource development.

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Yasushi WATANABE

Technical cooperation with the U.S Department of Energy on clean energy

AIST signed an MOU with five research institutes under the U.S. Department of Energy (DOE), namely, the Los Alamos National Laboratory, Sandia National Laboratories, National Renewable Energy Laboratory, Lawrence Livermore National Laboratory, and Lawrence Berkeley National Laboratory, in 2009 to accelerate advanced technical development in the fields of energy and the environment through bilateral efforts, in line with the goal of realizing the early establishment of a low-carbon society. The conclusion of this agreement initiated exchanges of researchers and human resources. Joint research has been actively conducted since then, while also taking various forms of cooperation with other DOE laboratories into consideration.

In this joint research, research themes from which synergistic effects can be expected through the collaboration of both countries (including artificial photosynthesis, dye-sensitized solar cells, fuel cells, storage and transport of renewable energy, biofuels, and nanotechnology) are being identified based on the network of AIST and DOE laboratories. Furthermore, new projects related to renewable energy and other clean energy technologies involving cooperation with research institutes and corporations in other regions started in 2013 with Japan and the United States as the main participants, aiming at the realization of faster and more practical technical development. The results of this research on renewable energy are expected to be used and refined at AIST's Fukushima Renewable Energy Institute (Fig. 2), which is scheduled to open in April 2014.

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Fig. 2 AIST's Fukushima Renewable Energy Institute, scheduled to open in April 2014

Supporting measurement standards as a manufacturing infrastructure for Japanese companies expanding overseas

Many Japanese companies are currently expanding operations in Southeast Asian countries including Thailand, Indonesia, and Malaysia. A large number of manufacturing sites have already been established in these countries. All-out efforts are being made to ensure quality control by means of chemical analyses and measurements of varying physical engineering quantities such as length, dimensional form, electricity, and temperature in order to enhance product precision and safety.

In Thailand, an adequate metrological environment, such as a supply system of measurement standards or a traceability system, had not been established as a manufacturing infrastructure until more than 10 years ago. Japanese companies operating in Thailand prior to that time had to periodically send measuring devices used for quality control and the standards for these devices back to Japan for calibration. This time- and money-consuming process was a serious problem for them.

Under these circumstances, the Thai government set up the National Institute of Metrology (Thailand), (NIMT) in 1998, and AIST's National Metrology Institute of Japan (NMIJ) launched technical support including human resource development in Thailand, under a project with the Japan International Cooperation Agency, JICA-NIMT Project (2002-2008). Technical transfers of measurement standards covering 42 quantities have been completed through these efforts. Nowadays, NIMT is considered to be the most highly developed metrology institute in the Southeast Asian region in terms of quantity and quality. Many production sites of Japanese companies and affiliates in Thailand are provided with calibration services almost equivalent to those available in Japan by accredited laboratories in Thailand.

AIST intends to continue supporting the technical competency of Japanese companies operating in Southeast Asian countries through technical seminars while working together with NIMT, the Thailand Institute of Scientific and Technological Research (TISTR), and the Department of Science Service of Thailand's Ministry of Science and Technology (DSS). We also intend to support surrounding countries, Myanmar, Vietnam, Laos, and Cambodia in developing their metrology system, working in collaboration with Thailand as a hub of activity, thereby providing ongoing support to Japanese companies with widespread operations throughout Southeast Asia.

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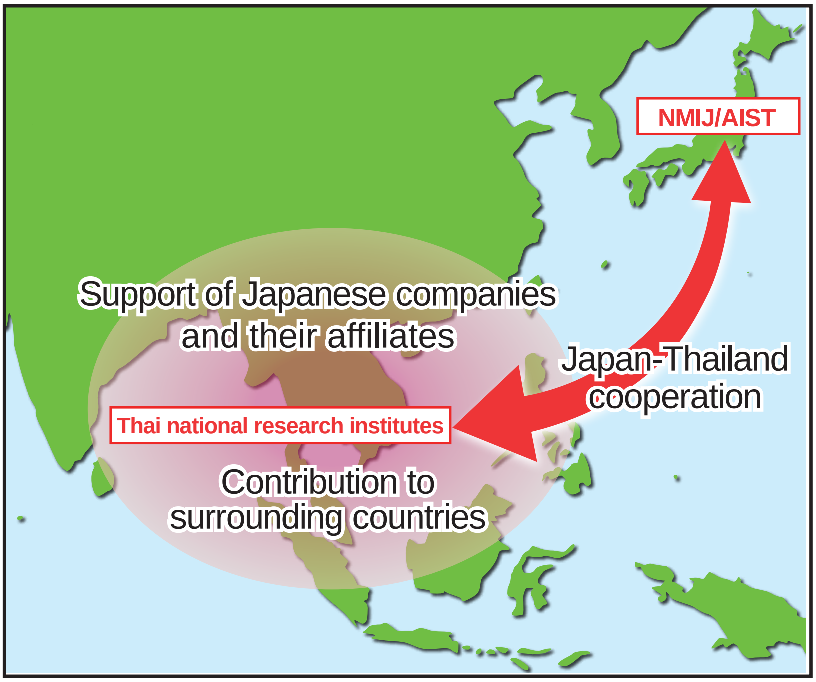

Measurement standards spreading in Southeast Asia through Japan-Thailand cooperation

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International Cooperation through the Establishment of TIA-nano – the International Research Base

The Tsukuba Innovation Arena for Nanotechnology (TIA-nano) is an international nanotechnology research and education base in Tsukuba, where the world's highest class research facilities and human resources in nanotechnology are accumulated. It was established by AIST, the National Institute for Materials Science (NIMS), the High Energy Accelerator Research Organization (KEK), the University of Tsukuba, and Japanese industry, with the support of the Cabinet Office, the Ministry of Education, Culture, Sports, Science and Technology, and the Ministry of Economy, Trade and Industry.

TIA-nano is expected to become an innovation engine not only of Japan but also of the world by its dedicated activities of R&D and human resource development in nanotechnology. A total of 26 projects have been conducted at TIA-nano, in which more than 100 companies in Japan and overseas have joined for collaboration.

As the core organization of TIA-nano, AIST has been widening and deepening its international network of research organizations, corporations, and universities around the world, and promoting joint research, exchanges of human resources, and research communications so as to create global values and to foster next-generation human resources.

Since 2010, AIST has been deepening cooperation with three major nanotechnology bases in the world, namely, IMEC in Belgium, MINATEC in France, and Albany Nanotech in the United States, and has been engaged in various joint activities including joint workshops and human resource exchanges. As a result of this cooperation, some numbers of joint research will be born in core research fields of TIA-nano. TIA-nano is also sponsoring international symposiums and summer schools and inviting world-renowned researchers as lecturers or speakers. Exchanges with the world's top-notch researchers and research institutes are thus being continuously promoted.

The TIA Collaboration Center located in AIST Tsukuba West started operation in June 2013 as a center for research and education activities of TIA-nano. With this as its core facility, TIA-nano plans to further enrich its functions as a globally valuable open innovation hub.

Manager,
Tsukuba Innovation Arena Planning Office
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Youichi SAKAKIBARA

TIA Collaboration Center, opened in June 2013