MANA Progress Report

Facts and Achievements 2012

World Premier International (WPI) Research Center
International Center for
Materials Nanoarchitectonics (MANA)

National Institute for Materials Science (NIMS)

Preface

Masakazu Aono
MANA Director-General
NIMS

MANA was founded in October 2007 with the support of the World Premier International Research Center Initiative (WPI Program) of Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT). The WPI program aims "to build globally visible research centers that boast a very high research standard and outstanding research environment, sufficiently attractive to prompt frontline researchers from around the world to want to work in them." MANA has made considerable progress toward achieving this aim during the first five-year period of the WPI Program (2007-2011). This is made clear by the high praise MANA received in the WPI Program Committee's interim evaluation in 2011.

However, we, the scientists of MANA, are not satisfied with this accomplishment. We want to tackle even more challenging research during the next five years. The future challenges of MANA were discussed at MANA's 5th Anniversary Memorial Symposium held in the new WPI-MANA Building in October 2012.

For our readers' convenience, the MANA Progress Report consists of two booklets named "Facts and Achievement 2012" and "Research Digest 2012". This booklet, which is the part "Facts and Achievements 2012", serves as a summary to highlight the progress of the MANA project in 2012. The other booklet "Research Digest 2012" contains an overview of MANA research activities in the calendar year 2012.

Lastly, on behalf of MANA, I would like to ask you for your continued understanding and support to MANA.

MANA Progress Report
Facts and Achievements 2012

1. WPI Project Progress Report

In June 2012, MANA submitted a WPI Project Progress Report for Fiscal Year 2011 to the WPI Program Committee. The full report is published on the website of Japan Society for the Promotion of Science (JSPS) (see www.jsps.go.jp/english/e-toplevel/). The first page of the report "Summary of State of WPI Center Progress" is shown below.

Host Institution:	National Institute for Materials Science (NIMS)
Host Institution Head:	Sukekatsu Ushioda
Research Center:	International Center for materials Nanoarchitectonics (MANA)
Center Director:	Masakazu Aono

Summary of State of WPI Center Progress (MANA):

Research of the world's highest level:

The following selection from among our research accomplishments represents the vanguard of nanotechnology and materials science: A) Revolutionary nanomaterials created by "nanosheet technology", B) Novel "low-dimensional" superconductors, C) Nano-power generation/conversion/storage nanomaterials and systems, D) Boron nitride (BN) "white" nanotubes and nanosheets, E) Revolutionary nanodevices, F) Novel nanoscale characterization/analysis methods, G) Nano-life related materials research, H) Theoretical nanoscience. Although the research at MANA is conducted in the four research fields of Nano-Materials, Nano-System, Nano-Green and Nano-Bio, most of the foregoing research results from collaborative studies in two or three different research fields.

Fusion of various research fields:

In order to promote research fusion at MANA, we have set up funding programs such as our Grand Challenge Research Program and Inter-field Projects. The latter specifically aims to enhance the interaction between nano-bio and other fields, and theory and experimentation. MANA researchers are involved in eight of the 11 NIMS Inter Unit Seeds Development Research Grants of Fiscal Year 2011. To bring together researchers from different fields, MANA holds frequent seminars and a Grand Challenge Meeting once or twice a year. These meetings have proven to be highly beneficial in the fusion of various fields and in motivating young researchers to tackle new challenges.

Globalization:

The Center employs 206 researchers, of which 116 or 56% are foreign nationals. Despite the Great East Japan Earthquake and subsequent nuclear power plant incident, the percentage of foreign researchers has not changed. To strengthen Nano-bio programs, Prof. Francoise Winnik of the University of Montreal was appointed a Principal Investigator in April 2011. To promote the unique concept of nanoarchitectonics and raise MANA's profile, two special issues on MANA were published in Advanced Materials and Science and Technology of Advanced Materials, and MANA began announcing its research worldwide with the launch of its English newsletter the MANA Research Highlight.

Organizational reforms:

MANA's role in promoting some of the NIMS system reforms is clearly positioned in NIMS' third five-year plan. The item "building international networks and bases for international research" states that MANA's "experience in developing an international research environment and recruiting and training young researchers will be reflected in NIMS' internationalization efforts made as a whole."

The center's future development over the mid- to long term:

MANA was formally incorporated into one of the three priority R&D fields within NIMS' third five-year plan, and has become one of NIMS' research divisions. When the next five-year plan commences, MANA will continue to function as a core research division in charge of one of NIMS' strategic research fields and maintain the overall 200-strong body of researchers including between 80 and 90 of MANA's PIs, MANA Scientists and Independent Scientists. After the WPI funding period ends, MANA will receive operations subsidies from NIMS and its researchers will seek out external funding in order to maintain the Center's size and level of research activity.

2. WPI Program and MANA

The content of Section 2.1 is mainly based on information published on the website of Japan Society for the Promotion of Science (JSPS) in March 2013 (see www.jsps.go.jp/english/e-toplevel/).

2.1 World Premier International Research Center Initiative (WPI)

The World Premier International Research Center Initiative (WPI) was launched in 2007 by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in a drive to build within Japan "globally visible" research centers that boast a very high research standard and outstanding research environment, sufficiently attractive to prompt frontline researchers from around the world to want to work in them. These centers are given a high degree of autonomy, allowing them to virtually revolutionize conventional modes of research operation and administration in Japan.

Japan Society for the Promotion of Science (JSPS) is commissioned by MEXT to conduct the program's grant selection and project assessment processes and to perform other administrative functions.

● Outline of WPI Program

Competition for securing the world's finest brains has intensified over recent years. So that Japan may take a world lead by virtue of its strength in science and technology amidst this demanding environment, it needs to place itself within the global flow of outstanding human resources while creating open research platforms that attract such people from around the globe.

Given this perception, the World Premier International Research Center Initiative (WPI) provides concentrated support for projects implemented by Japanese universities and research institutes aimed at building top world-level research centers staffed by the highest caliber of core researchers. By achieving a very high research standard and providing an excellent research environment, these centers should possess a level of "global visibility" that attracts top researchers from around the world. They are given a high degree of autonomy, allowing them to virtually revolutionize conventional modes of research operation and administration in Japan.

Table 2-1: Content of WPI Program.

Targeted fields:	Fields of basic research
Funding period:	10-15 years
Project Funding:	Around ¥1.4 billion per year per center
WPI center staffing:	● 10-20 world-class principal investigators ● about 200 researchers and staffs ● at least 30% of the researchers from overseas
International-standard working and living environments:	● Strong leadership by center director ● Merit-based salary system ● Strong support functions for researchers ● English as the primary working language ● Housing and support for child education and daily living

The program is underscored by four main concepts:

- advancing leading edge research
- establishing international research environments,
- reforming research organizations, and
- creating interdisciplinary domains.

To realize them, the WPI centers advance research activities and create new disciplines under the strong leadership of their center director. The content of WPI program is summarized in Table 2-1.

Table 2-2: The 9 WPI Research Centers (as of January 1, 2013).

Host Institution	Center Name (Starting Date)	Center Director	Outline of the Center
Tohoku University	Advanced Institute for Materials Research (AIMR) (Oct 2007)	Motoko KOTANI	Establish a World-Leading Research Organization in Materials Science
The University of Tokyo	Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU) (Oct 2007)	Hitoshi MURAYAMA	Cross-Disciplinary Research Center for Addressing the Origin and Evolution of the Universe
Kyoto University	Institute for Integrated Cell-Material Sciences (iCeMS) (Oct 2007)	Susumu KITAGAWA	Creating a new field of integrated cell-material science in the mesoscopic domain
Osaka University	Immunology Frontier Research Center (IFReC) (Oct 2007)	Shizuo AKIRA	Observation of immune reaction - Unveiling dynamic networks of immunity -
National Institute for Materials Science	International Center for Materials Nanoarchitectonics (MANA) (Oct 2007)	Masakazu AONO	Materials Nanoarchitectonics - New paradigm of materials development -
Kyushu University	International Institute for Carbon-Neutral Energy Research(I^2CNER) (Dec 2010)	Petros SOFRONIS	The Grand Highway for a Carbon-Neutral Energy Fueled World
University of Tsukuba	International Institute for Integrative Sleep Medicine (IIIS) (Dec 2012)	Masashi YANAGISAWA	World-class institute for sleep medicine, aiming to solve the mechanism of sleep/wakefulness by conducting basic to clinical research
Tokyo Institute of Technology	Earth-Life Science Institute (ELSI) (Dec 2012)	Kei HIROSE	Globally-Advanced Interdisciplinary Research Hub for Exploring the Origins of Earth and Life
Nagoya University	Institute of Transformative Bio-Molecules (ITbM) (Dec 2012)	Kenichiro ITAMI	Changing the world with molecules: Synthetic Chemistry and Plant/Animal Biology

● **Selected WPI Programs**

The National Institute for Materials Science (NIMS) was one of the original five institutes selected for a WPI grant in 2007 and later in October of that year, established the International Center for Materials Nanoarchitectonics (MANA). A sixth WPI center was added in 2010 and 3 more WPI centers were selected in 2012. Table 2-2 summarizes the 9 WPI Research Centers with MANA being the only one not integrated into a university. Fig. 2-1 shows the distribution of the 9 WPI Research Centers on the 3 research fields Universe/Earth, Material/Energy and Life Science.

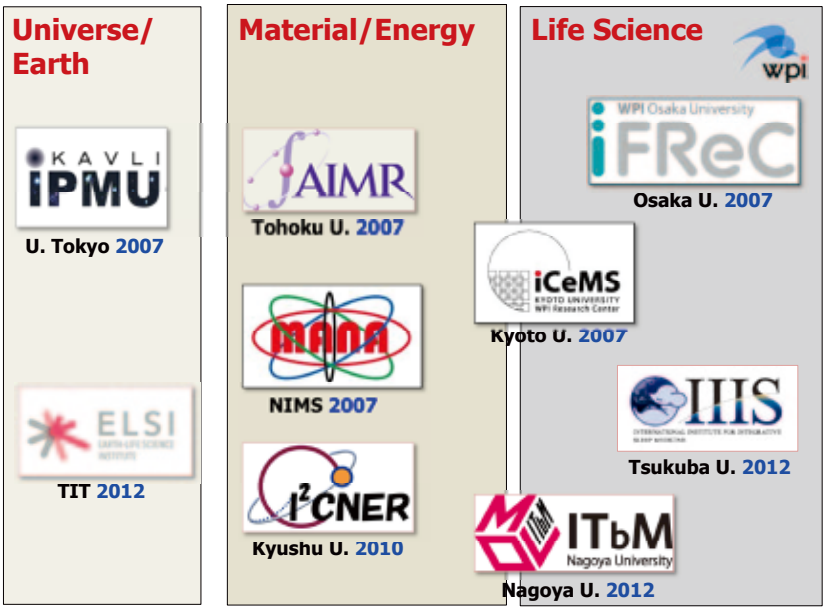


Fig. 2-1: Distribution of the 9 WPI Research Centers on the 3 different research fields Universe/Earth, Material/Energy and Life Science.

In 2011, the five WPI centers that were launched in October 2007 underwent an interim evaluation by the WPI program committee. MANA received a high score "A" and has entered the second term of operation in April 2012. The MANA Second-term Kickoff Meeting was held on May 7, 2012 (see Fig. 2-2). MANA Director-General Masakazu Aono gave a talk to all MANA staff in the auditorium of the new WPI-MANA Building. He presented the history of MANA over the past 5 years. Then he emphasized the importance of promoting research in the four research fields of MANA based on the concept of "Materials Nanoarchitectonics" and explained the outline of MANA's activities for the next 5 years.

Fig. 2-2: Participants of the MANA Second-term Kickoff Meeting in the auditorium of the new WPI-MANA Building.

2.2 Mission and Research Target of MANA

● **What is MANA?**

Materials nanoarchitectonics is a new research paradigm of materials development, which attempts to extract and use the ultimate functions of materials based on a profound understanding of the mutual interaction between individual nanostructures and arbitrary arrangement of those nanostructures.

● **Vision of MANA**

Oriented towards a better global future: Pioneering a new paradigm for nanotechnology in materials development.

● **Mission of MANA**

To achieve the goals of the WPI program, MANA aims to develop innovative materials by using nano-technology as a fundamental research center, especially for next-generation nano-science and technology. Its mission is summarized in the following four points:

- Challenge the development of ground-breaking new materials on the basis of materials nanoarchitectonics.
- Creating a "melting pot" where top-level researchers gather from around the world.
- Fostering and securing young scientists who have courage to battle with challenging research.
- Construction of a network of nanotechnology centers throughout the world.

● **Research Target of MANA**

When MANA was established in October 2007, a research organization was formed tailored to the five key technologies: "Controlled Self-Organization", "Chemical Nanomanipulation", "Field-induced Materials Control", "Atom/Molecule Novel Manipulation" and "Theoretical Modeling and Designing". The organization was reformed in October 2008 into four research fields: Nano-Materials, Nano-System, Nano-Green and Nano-Bio to make the research at MANA more explicit and clarify its missions. The five key technologies of nanoarchitectonics were converged into these four fields to promote fundamental studies on nanomaterials and nanosystem and clarify the direction of applications in environmental and life sciences, which will lead to new innovations. In October 2012, the Nano-Green Field was renamed to Nano-Power Field, and the Nano-Bio Field to Nano-Life Field. The research directions of MANA (as of October 1, 2012) are shown in Fig. 2-3. Research objectives four each field are as follows. MANA aims to become a unique hub of materials nano-science and nano-technology.

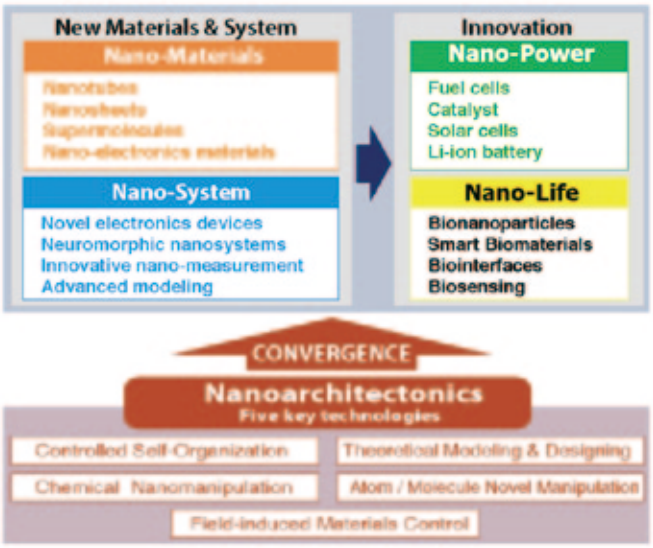


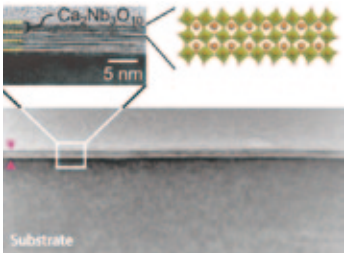
Fig. 2-3: Research Directions of MANA (as of October 1, 2012).

Nano-Materials Field

Designing Nanoscale Materials With New Properties and Unprecedented Functions

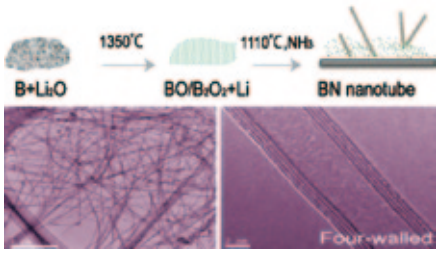
MANA is promoting research that explores new properties and functions intricately linked to nanoscale size and shape. This exploration covers a wide range of inorganic, metallic, and organic materials. Many new nanoscale materials are being created by utilizing unique synthetic techniques, involving soft-chemical, colloid chemical and supramolecular processes. The creation of nanoscale materials and the exploration of their applications have almost unlimited potential. Based on the concept of nanoarchitectonics, MANA is developing novel synthesis techniques to bring forth new materials and new processes that will spur innovation across a range of sectors including electronics, environment protection, and energy technology (see Fig. 2-4).

● Developing functional nanosheet films



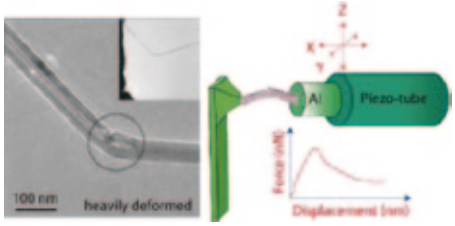
Cross-sectional TEM image of 3-layer film of $Ca_2Nb_3O_{10}$ nanosheet.

● Creating functional nanotubes and nanowires



High-purity synthesis of BN nanotubes (top) and their TEM images (bottom).

● Measuring nanoscale material properties



Mechanical properties of a BN nanotube measured inside TEM.

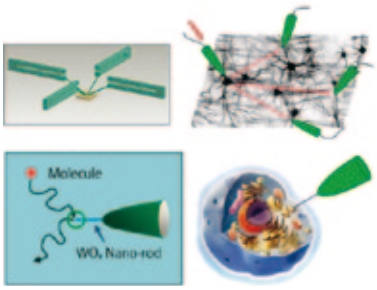
Fig. 2-4: Research Objectives of the Nano-Materials Field.

Nano-System Field

Revolutionary Functionality Realized Through Mutual Interactions of Nanoscale Functional Units

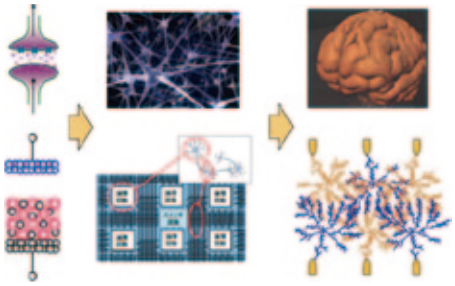
Our research activities encompass not only the discovery and exploration of nanoscale materials with a hitherto unknown functions, research also extends to the development of revolutionary functions that are created through mutual interactions of such nanoscale units. For this purpose, researchers investigate how nanoscale structures can produce novel linked functionalities on the basis of materials nanoarchitectonics. In the long run, such nano-systems have tremendous promise for various fields, but our research is focused on innovation in three areas, namely advanced information processing and communications, advanced environment sensing, and effective solar light application. The development of new nano-system evaluation methods and the new concepts of theoretical science also are important aspects that guide our work (see Fig. 2-5).

● Developing new nano-system evaluation methods



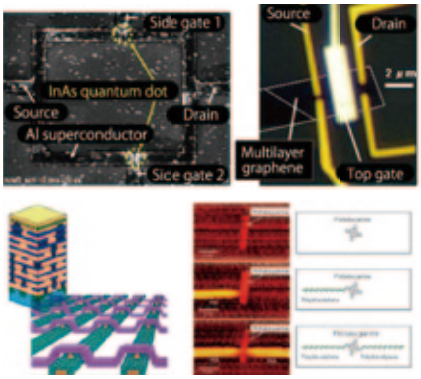
Development and application of AFM and STM with multiple probes (top) and of a single molecule sensing method with high spatial resolution (bottom).

● Towards a neural network type nano-system



Neural network type computing circuit realized directly on the materials level.

● Creating revolutionary nano-system devices



Top: Superconducting device (left) and Graphene device (right). Bottom: Integration of atomic switches (left) and Single-molecule device (right).

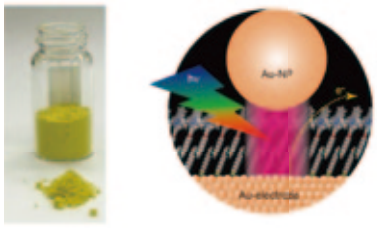
Fig. 2-5: Research Objectives of the Nano-System Field.

Nano-Power Field

Effective Conversion of Materials and Energy is Crucial to the Realization of a Sustainable Society

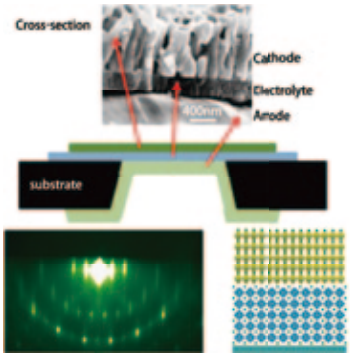
The biggest challenge facing humanity today is the move away from our dependence on energy that is derived from fossil fuels. Renewable energy is the key if we want to realize a sustainable society. Consequently, natural energy sources with the sun as the prime source must be converted with high efficiency into electricity and fuel. When storing, transporting, and retrieving energy through means such as secondary batteries and fuel cells, efficient transport of ions and electrons are required and controlled arrangement of atoms and molecules at interfaces is essential. The Nano-Power Field employs the concepts of surface nanoarchitectonics to directly control the nano structure on the atomic and molecular level. The research aims at illuminating and exploring methods and processes for interconversion between energy and matter with high efficiency (see Fig. 2-6).

● Capturing the energy of the sun



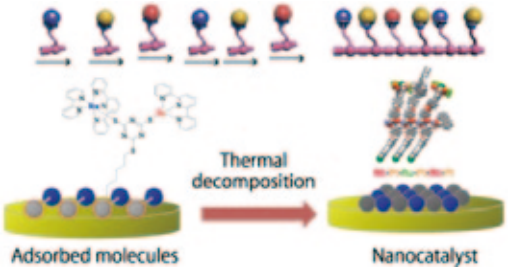
Left: Highly efficient photocatalyst for water oxidation responsive to visible light. Right: Enhancing photoelectric conversion efficiency through the use of nano gap light antenna effect.

● Efficient storage and use of energy



Top: Solid oxide fuel cell. Bottom: Highly oriented electrolyte for lithium ion battery.

● Programmed arrangement of atoms and molecules to form ultimate catalysts



Controlled arrangement of molecules and conversion to highly efficient catalyst.

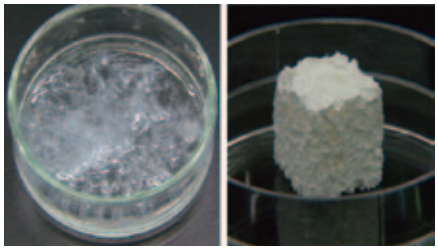
Fig. 2-6: Research Objectives of the Nano-Power Field.

Nano-Life Field

Innovative Medical Approaches May Draw on Nanoscale Biomaterial

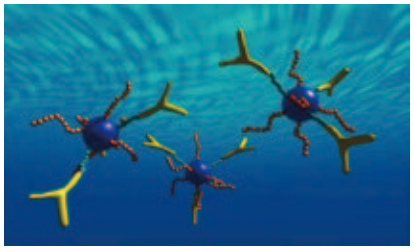
In the Nano-Life Field, enhancing the natural regenerative power of the human body is an important concept for treating diseases. The aim is to create materials suitable for "materials therapy", i.e. materials that sustainably elicit a regenerative and curative effect from the living tissue. Such materials designed and produced with nanoarchitectonics methods are expected to have an effectiveness that is comparable to conventional medicines. Drawing on the results of past research as inspiration, MANA is intensively working towards the development of such new nano-bio materials (see Fig. 2-7).

● Artificial bone made of oriented open-pore apatite



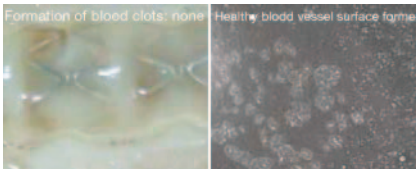
Left: Fiberized hydroxyapatite and collagen compound composite immediately after adjustment. Right: Hydroxyapatite and collagen compound composite made porous.

● Drug delivery system/smart biomaterial research



Conceptual image of intelligent particles with controlled nanostructure.

● Drug-eluting stent



Interior of blood vessel with drug-eluting stent currently under development. No blood clots are formed, and interior surface is smooth.

Fig. 2-7: Research Objectives of the Nano-Life Field.

3. MANA Organization, Management and Evaluation

3.1 Organization and Members

In order to realize the MANA concept, it is extremely important to establish efficient organizational operation. An overview of the MANA organization is shown in Fig. 3-1. The role of MANA members are explained in Table 3-1.

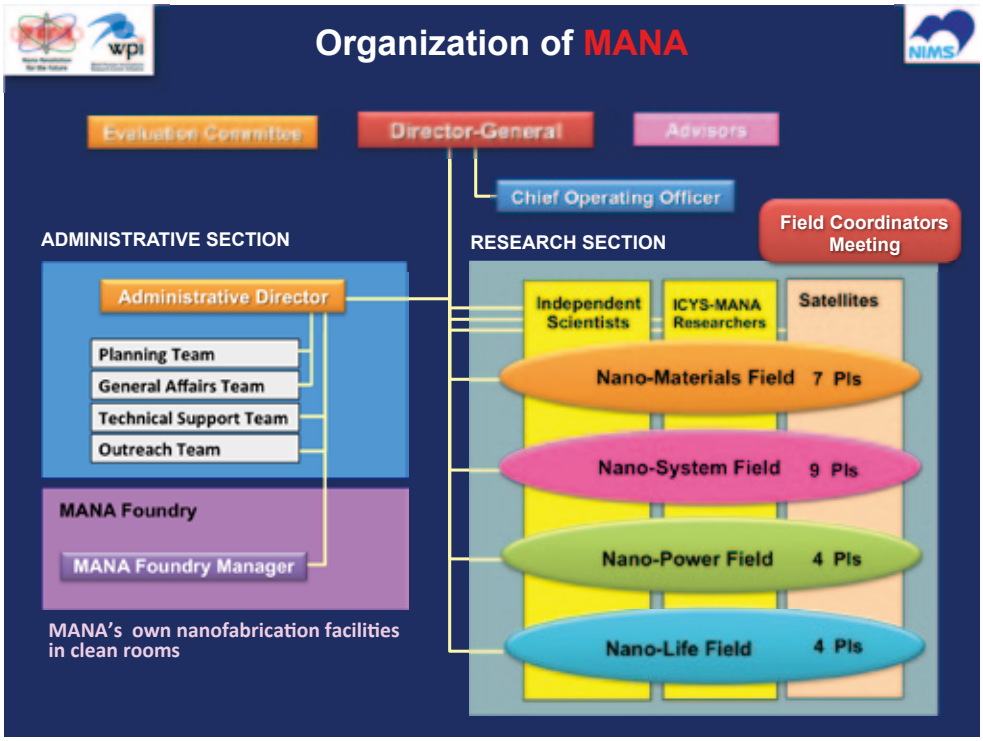


Fig. 3-1: Organization of MANA (as of January 1, 2013).

Table 3-1: MANA Members and Duties.

Director-General:	Center oversight.
Chief Operating Officer:	Assists the Director-General and supervises research.
Administrative Director:	Takes orders from the Director-General and supervises clerical and administrative duties.
Principal Investigators (PI):	Internationally known world top-class scientists who play leading roles in achieving MANA research targets and in fostering younger researchers through mentoring. Principal Investigators are selected from NIMS and other domestic and overseas institutes.
Group Leaders:	Group Leaders perform MANA research together with a Principal Investigator by heading an own group.
Associate Principal Investigator (API):	Promising young scientist, who is expected to perform his own research as almost comparable to a Principal Investigator.
MANA Scientists:	Researchers from NIMS who perform MANA research together with Principal Investigators.
MANA Independent Scientists:	Younger researchers from NIMS who work full-time at MANA and can perform their own research independently in the 3D system.
ICYS-MANA Researchers:	Postdoctoral fellows selected from all over the world by open recruitment. They perform their research independently while receiving advice from mentors and Principal Investigators.
MANA Research Associates:	Postdoctoral fellows working in a group of Principal Investigators or MANA Independent Scientists.
Graduate Students:	Doctor-course students at institutions affiliated with NIMS. They participate in research at MANA under the tutelage of Principal Investigators, MANA Scientists and Independent Researchers.
Research Support Staff:	Technicians that support research work.
Administrative Staff:	Staff that supports administrative duties.

As of January 1, 2013, MANA employs 222 staff (see Fig. 3-2). Of this number, 195 are researchers. There are 103 foreign researchers, or 52.8% of the total, and the 43 female researchers constitute 22.1% of the total. MANA has developed a multinational work force with foreigners from 26 different countries (see Fig. 3-3). Foreign and female researcher numbers have increased steadily, but given the size of the Center, we feel these are appropriate levels and will continue to maintain them going forward.

Appendix 8.1: MANA Top Management
Appendix 8.2: MANA Research Staff

Current as of January 1, 2013

Classification	Number		Foreigner	Female
Principal Investigator (NIMS)	16	24	4	1
Principal Investigator (Satellite)	8		5	1
MANA Scientist, Group Leader, Assoc. PI	57	171	6	8
Independent Scientist	12		2	0
ICYS-MANA Researcher (Postdoc)	9		7	2
MANA Research Associate (Postdoc)	41		37	15
JSPS Fellow (Postdoc)	11		9	2
Junior Researcher (Graduate Student)	41		33	14
Technical Staff	9	27	0	2
Administrative Staff	18		2	14
Total	222		105	59

Proportion of Foreign Researchers: 52.8% (103/195)
Proportion of Female Researchers: 22.1% (43/195)

Fig. 3-2: Workforce of MANA.

Current as of January 1, 2013

Region	Country	MANA PI	MANA Scientist	Indep. Scientist	ICYS-MANA Researcher	Research Associate	JSPS Fellow	Graduate Student	Staff	Total
Asia	China	2	3		5	17	4	19		50
	India					9	2	3		14
	Korea					1		3		4
	Hong Kong					2				2
	Indonesia							2		2
	Nepal		1							1
	Philippines								1	1
	Singapore					1				1
	Thailand					1				1
Oceania	Australia					1				1
	Fiji							1		1
Europe	Italia		1				1	1		3
	Russia	1		1		1				3
	U.K.	2	1							3
	Belgium					1	1			2
	France	1					1			2
	Czech					1				1
	Germany							1		1
	Poland					1				1
	Switzerland								1	1
Near East	Iran					1		1		2
	Jordan				1					1
Africa	Egypt							2		2
	Algeria				1					1
America	USA	2		1						3
	Canada	1								1
Total		9	6	2	7	37	9	33	2	105

Fig. 3-3: Foreign Staff of MANA.

3.2 Management

● Allocation of authority between NIMS and MANA

The NIMS president, as the responsible person of the host institute, supports the operation of the MANA center to the fullest extent, while respecting the authority of the MANA Director-General the operation of MANA. However, upon some situations such as receipt of any advice from the Steering Committee and NIMS Executive Board, the NIMS president reserves the right to take various additional measures necessary for the center operation including, for example, improvement of the experimental space and additional assignment of permanent NIMS researchers.

The Director-General of MANA has authority over the center's operation in general. He possesses the authority to allocate Center resources such as budget funds and space. This includes employment and renewal of contracts for researchers and administrative staff members of the MANA center, except for those who are enrolled in the main body of NIMS.

● Decision-making system

The center, as its basic principle, intends to establish a decision-making system that can support strong leadership of the center director. In addition, the center intends to minimize the number of meetings in its operation so that the researchers can devote themselves to their studies. A principal investigators meeting led by the center director is held on a regular basis (about once every month). Matters concerning center operation in general are discussed and reported under the full leadership of the center director. Also, the principal investigators must clearly communicate the intentions of the center director to all the young researchers and graduate students. On October 1, 2008, a Chief Operating Officer was assigned to work under the Director-General in order to reduce the burden on the Director-General and to allow for more efficient and speedier Center management. The Administrative Director oversees administrative duties, while the Chief Operating Officer supervises research. In light of the Center's administrative issues, the MANA Executive Meeting was put in place to allow the Director-General, Chief Operating Officer and Administrative Director to confer at any time to make snap decisions on Center management.

There are currently five external stakeholders, including Nobel Prize winners and prominent researchers, serving as MANA Advisors (see Appendix 8.3). They provide advice on overall Center management and invaluable suggestions on individual research projects, as well as cooperate with our outreach activities by serving as lecturers in science seminars geared toward elementary and junior high school students.

Appendix 8.3: MANA Advisors

● MANA Administration

Starting in 2003, NIMS has about five years of experience in research, using English as the official language of ICYS activities. Therefore, it has the advantage of being able to perform both efficient and international administrative operation by making the best use of its experience and know-how acquired in ICYS. All the documents regarding, for example, office routine regulations, purchase of items, and official trips are today already available both in Japanese and English. As a result, an environment of supporting documentation is close to perfection so that foreigner researchers can devote themselves to their study without a language barrier. Based on the experience in ICYS, MANA has established three teams, *Planning Team, General Affairs Team, Technical Support Team* in October 2008 and added an *Outreach Team* in April 2010. All staff of the MANA Administration is fluent in English.

3.3 Committee Evaluation

● WPI Program Committee

One Program Director (PD) and nine Program Officers (PO), one for each WPI center, have been assigned by JSPS to conduct the follow-up activities. With the assigned PO as its chair, a working group for each WPI center has been established under the Program Committee. Each group comprises about 5-6 specialists in the subject field. As a rule, about half of them are overseas members. Program Director (PD), Program Officer (PO) and Working Group members for MANA in Fiscal Year 2012 are listed in Table 3-2.

Table 3-2: Program Director (PD), Program Officer (PO) and Working Group members for MANA in Fiscal Year 2012.

Program Director (PD): WPI Program	Toshio Kuroki	Senior Advisor, Research Center for Science Systems, JSPS
Program Officer (PO): MANA at NIMS	Gunzi Saito	Professor, Faculty of Agriculture, Meijo University
Working Group Member: MANA at NIMS	Yoshinobu Aoyagi	Professor, Ritsumeikan Global Innovation Research Organization, Ritsumeikan University
Working Group Member: MANA at NIMS	Takehiko Ishiguro	Professor Emeritus, Kyoto University
Working Group Member: MANA at NIMS	Tadashi Matsunaga	President, Tokyo University of Agriculture and Technology
Working Group Member: MANA at NIMS	Hiroshi Yoshida	Professor, Graduate School of Engineering Science, Osaka University
Working Group Member: MANA at NIMS	David L. Allara	Distinguished Professor Chemistry and Professor of Materials Science & Engineering, Departments of Materials Science & Engineering, Pennsylvania State University, USA
Working Group Member: MANA at NIMS	Klaus von Klitzing	Director, Max Planck Institute for Solid State Research, Germany, Nobel Prize laureate

The Evaluation of MANA by the WPI Program Committee consists of an annual Site-Visit at MANA and an annual Follow-Up Meeting. Primary Evaluation criteria are the Achievements of Science as well as the Implementation as a WPI Research Center. The fifth MANA Site Visit by the WPI Program Committee and MEXT and JSPS Officials was held in the auditorium of the new WPI-MANA Building on August 21-22, 2012 (see Fig. 3-4). The schedule included a briefing by the center director, presentations by selected PIs, and poster presentations by young researchers. In addition, a WPI Interim Evaluation Meeting was held in Tokyo on October 24, 2012.

Fig. 3-4: WPI Program Director Prof. Toshio Kuroki (left) and MANA Center Director Prof. Masakazu Aono (right) at the fifth MANA Site Visit in August 2012.

● **MANA Evaluation Committee**

The MANA Evaluation Committee is comprised of 10 external stakeholders, 5 Japanese and 5 Foreigners (members are shown in Appendix 8.4), and Professor Anthony Cheetham of the University of Cambridge acts as Chairman. The committee has met every two years, in March 2008, March 2010 and March 2012, to evaluate MANA research activities and administration. The third MANA Evaluation Committee meeting was held in Tsukuba on March 2, 2012. Presentation of the MANA Progress Report by MANA Director-General Prof. Masakazu Aono and MANA Chief Operating Officer Prof. Yoshio Bando was followed by longer discussions and comments from the Evaluation Committee members. MANA formulates Action Plans based on the Committee's suggestions and proposals.

Appendix 8.4: MANA Evaluation Committee

4. Attractive International Research Environment

MANA is one of the most internationalized research centers in Japan. MANA is firmly advancing the development of an outstanding international research environment in an effort to create a "highly visible research center".

4.1 Fostering Young Scientists

● Melting Pot

When people from diverse backgrounds and with different opinions and view points are able to freely meet and interact, an environment highly conductive to innovation is created. MANA sees itself as a melting pot that offers researchers from a wide range of fields and with diverse cultural and national backgrounds the opportunity to work in such a cosmopolitan environment (see Fig. 4-1). Whether in the lab, in the cafeteria, or during events and other activities, there are always opportunities for communication and interaction. We believe that comprehensive research that spans diverse fields will prove beneficial for many positive future developments. With a view to further enhancing the cosmopolitan atmosphere at MANA, we actively encourage the participation of scientists from around the globe. Currently, more than half of our researchers come from countries other than Japan.

As part of the Melting Pot activity, researchers from MANA are requested to present their research field at the MANA Seminars. When renowned researchers visit MANA, they held seminars to introduce their research projects to stimulate MANA researchers and promote interdisciplinary synergies. In 2012, MANA seminars were conducted with 31 speakers from NIMS and 58 invited renowned researchers from around Japan and the world (total 89 speakers).

Appendix 8.5: MANA Seminars

Fig. 4-1: Left: "Melting-Pot" Environment at MANA. Middle: Young researchers with different nationalities and different research fields gather at the MANA café. Right: MANA's unique 3D system.

● 3D System

The Triple Double (3D) System at MANA (see Fig. 4-1) is a unique system for cultivating the potential of Young Researchers. "3D" stands for Double-Mentor, Double Discipline and Double Affiliation. The objective is to cultivate independence in research allowing these scientists to obtain advice from two or more mentors, enhance interdisciplinary ability by requiring the study of two or more themes, and strengthen the spirit of independence by having them working at two or more organizations. This system imbues Satellite Research Centers and affiliated overseas institutions with even greater significance than before. Through the experience of joint research with overseas mentors, young researchers can improve themselves, and by successfully integrating different disciplines, they can open up new possibilities within their own fields. The 3D system is receiving ongoing praise from Japan and overseas as an effective system for boosting the careers of young researchers.

● ICYS-MANA

With the aim of building an international research environment for young researchers and creating a unique system to guide them, the International Center for Young Scientists (ICYS) was set up by the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) in 2003 through the Special Coordination Funds for promoting Science and Technology and the Program for Encouraging the Development of Strategic Research Centers. The mission of ICYS was to gather excellent young researchers from different countries and specializations to a place where they can conduct research autonomously in a melting pot environment where they can stimulate one another and elicit as much of their youthful creativity as possible. This ICYS program received high marks and even after the conclusion of the program in 2007, the princi-

ple and system of ICYS continued as the NIMS International Center for Young Scientists, which is divided into ICYS-Sengen and ICYS-Namiki (named for their locations). Researchers posted at ICYS-Namiki take part in MANA projects as ICYS-MANA researchers. ICYS-MANA researchers are selected from around the world through open recruitment.

Fig. 4-2: Japanese Culture Class events at NIMS in 2012. Top from left to right: Japanese Calligraphy, Japanese Drum (Wadaiko), All about Sushi and Japanese Green Tea. Bottom from left to right: Sado Tea Ceremony, Karate, Origami and Kimono.

4.2 Throughout Support for Non-Japanese Researchers

With over half of the researchers working at and visiting MANA coming from outside Japan, MANA provides all manner of support to enable them to conduct their research activities without any barriers. Basically, within MANA, information flows in both languages, Japanese and English. This covers seminar information or advice found when riding the elevator, on up to very detailed things. Efforts to use English as a common language have become firmly rooted and correspondence courses, which include screening, as well as overseas language training, have been implemented for the entire administrative staff. With public housing facilities nearby for non-Japanese MANA researchers, they can experience an ideal environment for doing research during their stay. Researchers and accompanying families receive assistance in matters such as finding hospitals, child care facilities, schools, residences, and other necessary information through the support system of NIMS. For researchers from abroad, there is a guidebook in both English and Japanese that covers the necessary items for working at NIMS, including useful information about coming to Japan, starting work at NIMS, conducting research, and leaving NIMS. The guidebook is revised about once a year. A laboratory tour, newcomers are required to join, is held every month using the guidebook. NIMS also offers regular Japanese culture classes (see Fig. 4-2, Table 4-1) and Japanese language classes for foreign researchers to foster an understanding of the host country. In 2012, 149 participants joined the Culture Classes and 59 participants attended the Language Classes.

Table 4-1: Schedule of Japanese Culture Classes in 2012.

1	2012 Feb 17 Kimono (Jidai Isho) (16 participants)	5	2012 Jun 15 Japanese Green Tea (12 participants)	9	2012 Oct 26 Japanese Traditional Arts & Craft (8 participants)
2	2012 Mar 2 Folk Custom of Tsukuba (12 participants)	6	2012 Jul 6 Origami (14 participants)	10	2012 Nov 16 All about Sushi (20 participants)
3	2012 Mar 16 Japanese Calligraphy (16 participants)	7	2012 Aug 27-31 Japanese Drum (Wadaiko) (17 participants)	11	2012 Dec 14 Japanese Sightseeing Spots (13 participants)
4	2012 May 25 Karate (8 participants)	8	2012 Sep 28 Sado Tea Ceremony (13 participants)		

4.3 Research Support and Access to Cutting-Edge Research Facilities

It is the research support that is the pride of MANA. The clean room facility in the MANA Foundry (see Fig. 4-3) is equipped with over 30 facilities for nano-fabrication and characterization to support research of nanoarchitectonics. The MANA Foundry consists of six areas in its 235 m^2 floor space: Lithography Area, Dry Process Area, Nano Fabrication Area, Nano Structure Processing Area, Nano Measurement Area and Thermal Treatment Area. We are able to provide consistent process from test piece preparation to structural observation and functional verification including nano-gap electrode pattering by electric beam lithography on complicated structures such as nano dots, nano wires and nano sheets made of various materials like organic, inorganic, metal, insulator, superconductor and composite. Experienced technical and administrative staff, fluent in English, assist foreign researchers. The MANA Technical Support Staff (TSS) Team has 5 technicians that can speak English, and a variety of support is provided (see Fig. 4-3) to allow researchers to focus on their research, such as equipment maintenance, laboratory cleaning, reagent support, safety measures, and technical studies, transport. and installation when purchasing equipment.

In addition, MANA researchers have full access to the world's most advances, medium- and large-scale user facilities at the host institute NIMS such as high field magnets, a dedicated beamline at Japan's SPring-8 synchrotron facility, high-voltage und ultrahigh vacuum electron microscopes, a belt-type high pressure apparatus, high energy X-ray photoemission spectroscopy and high precision powder X-ray diffractometers.

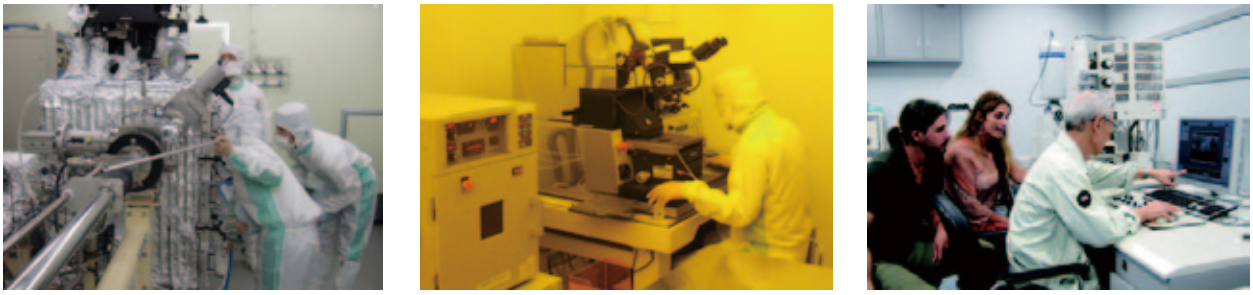


Fig. 4-3: Left and middle: The cleanroom facility in the MANA Foundry. Right: Technical Support Staff (TSS) providing research support.

4.4 The new NanoGREEN/WPI-MANA Building

Next to the MANA Building (13,000 m^2, 5-story) at NIMS Namiki site, construction work of a new multidisciplinary research complex was completed in March 2012 (see Fig. 4-4). The complex consists of two units - the NanoGREEN Building and the WPI-MANA Building (6,000 m^2, 5-story) – with the area between the two buildings serving as a free space where researchers can meet and discuss their work. The complex is a facility for world-class research on environmental and energy materials and nanotechnologies that brings together NIMS and outside researchers and private-sector engineers from Japan and abroad. It is designed to conserve energy and reduce CO_2 emissions – aspirations that are highly pertinent in today's "Culture of the Environment" – and to provide safety and security should disaster occur. The entire building represents a "melting pot" that fuses research in disparate fields, where organizations and individuals can work together in a barrier-free environment.

Fig. 4-4: The MANA Building (left) and the new NanoGREEN/WPI-MANA Building (right) at NIMS Namiki site.

● **Challenge to revolutionary "ZEB" (Zero Energy Building)**

NanoGREEN/WPI-MANA was given the highest "S Rank" by CASBEE (Comprehensive Assessment System for Built Environment Efficiency), a scheme that evaluates and ranks buildings in terms of their environmental performance. For an effective utilization of natural energies, cutting-edge technologies can be found throughout NanoGREEN/WPI-MANA (see Fig. 4-5).

Photocatalyst-coated glass watering system: On hot summer days, the rainwater stored in the top of the window glass is sprinkled. This produces evaporative cooling that controls radiant heat on the glass surfaces and adds a visual sensation of coolness.

Solar panels: Solar panels were integrated into the building as part of the roofing materials. In addition, solar panels were also installed as window roofs connected to the pane glass.

Wooden louvers: Louvers made from recycled wood control the penetration of sunlight into room interiors, thereby lowering the need for air-conditioning. They also diffuse daylight and utilize it as indirect light.

Automatic blinds control system: An automatic blinds control system is installed in the entrance hall constructed with glass walls. The system raises or lowers the blinds depending on the amount of sunlight and adjusts slat angles following the sun's position. It reduces the need for air-conditioning load while maintaining interior brightness.

Fig. 4-5: Effective utilization of natural energies. From left to right: Photocatalyst-coated glass watering system, solar panels, wooden louvers and automatic blinds control system.

● **"Melting Pot Environment" for transdisciplinary research**

NanoGREEN/WPI-MANA provides a research environment caring researcher's habitability and comfort as well as encouraging spaces for free and broad-ranging interaction. Besides "Melting-Pot" in the atrium, offices and laboratories are designed as open spaces (see Fig. 4-6).

Interaction spaces: All The glass-walled atrium holds a cafeteria on the first floor and interaction spaces on second to fifth floors. These areas serve as comfortable settings for far-reaching communication among NIMS and outside researchers and private-sector engineers.

Full-height windows along the corridors: All the researchers' activities in the lab are open to being viewed externally. The office areas are also lined with glass windows—an environment that is open to communication.

Principal Investigator offices: On each floor several researchers of different expertise share the same space in thereby fostering collaborations and creative ideas.

Auditorium: The first-floor auditorium has stepped theater-type seating for 97 people. It is equipped with the latest audiovisual facilities and a large screen. It provides the perfect venue for lively discussions, seminars and workshops.

Fig. 4-6: Comfortable and exciting meeting place. From left to right: Interaction spaces, full-height windows along the corridors, Principal Investigator offices and auditorium.

● **"Micro-Grid System" – Eco-friendly in ordinal times, reliable in an emergency**

NanoGREEN/WPI-MANA is the first commercial "Micro-Grid System" installed building. This system integrates and controls multiple power sources by networking solar panels, emergency power generators, and storage batteries. NIMS's disaster management base is functioned successfully by means of energy-saving in ordinal times and securing energy in an emergency.

Peak-cut effect: NanoGREEN/WPI-MANA can obtain maximum 90kW of "Peak-cut effect" while various instruments, such as testing equipment, air-conditioners, and elevators, are in operation. Due to this effect, energy-saving is expected not only in the summer time which requiring high energy consumption, but also in the rest of the year.

Self-sustained operation during disasters: During a power outage due to a large earthquake or lighting, "Micro-Grid system" can supply power to the critical facilities without interruption. Even if the emergency power generator's fuel is exhausted by the long-term power outage, solar panels and emergency power generators can supply minimum-required power to lightings, computers, and water supply facilities.

● **Commemorative Ceremony for the Completion of NanoGREEN/WPI-MANA Building**

On July 5, 2012, a commemorative ceremony for the completion of the new NanoGREEN/WPI-MANA Building at Namiki site, NIMS, was held with over 150 attendees, including 116 guests (see Fig. 4-7). The ceremony began with an opening address by Dr. Sukekatsu Ushioda, NIMS President. Then four guests, Dr. Ken-ichi Ichihara (the Mayor of Tsukuba city), Mr. Koichi Morimoto (Deputy Director-General of the Research Promotion Bureau, MEXT), Dr. Teruo Kishi (Chair of Executive Board, Tsukuba Innovation Arena), and Prof. Toshio Kuroki (Director of WPI Program), made congratulatory speeches. They encouraged the researchers at MANA and expressed great expectations that further promotion of fusion research will produce innovative results in various fields.

Fig. 4-7: Participants of the Commemorative Ceremony in the Auditorium of the WPI-MANA Building.

5. Research Activities, Output and Achievements

5.1 Research Activities

● **Research Digest 2012**

For an overview of MANA research activities, please refer to yearly published booklet "Research Digest" (see Fig. 5-1), which is part of the MANA Progress Report. Examples of recent research accomplishments of MANA are given in Section 5.3 of this chapter.

Fig. 5-1: Recent issues of the booklet "Research Digest".

● **MANA Research Highlights**

In the past, MANA only issued domestic press releases on its excellent research results, but in September 2011 the Center began publicizing its research worldwide with an English newsletter called MANA Research Highlight. The newsletter, which contains English articles written by the former editor of Nature Nanotechnology, is distributed to over 4,000 media outlets and science journalists and to about 2,000 MANA mailing list members. Particularly outstanding research results are sent to 10,000 researchers around the globe via Science e-mail alerts. With these efforts, we are working to increase MANA's name recognition throughout the global science community. The first two volumes were published in Fiscal Year 2011 (see MANA Progress Report, Facts and Achievements 2011). Volumes 3-6 appeared in Fiscal Year 2012 (see Figs. 5-2, 5-3, 5-4 and 5-5). The information is available on the MANA website (see www.nims.go.jp/mana/research/highlight/index.html).

Volume 3 (July 26, 2012):

Bone tissue engineering: Attaching proteins for better regeneration

Researchers in Japan demonstrate a new protein binding approach for effectively promoting bone regeneration.

Publication:

H. Lu, N. Kawazoe, T. Kitajima, Y. Myoken, M. Tomita, A. Umezawa, G. Chen, Y. Ito,
Spatial immobilization of bone morphogenetic protein-4 in a collagen-PLGA hybrid scaffold for enhanced osteoinductivity,
Biomaterials **33**, 6140 (2012).
doi: 10.1016/j.biomaterials.2012.05.038

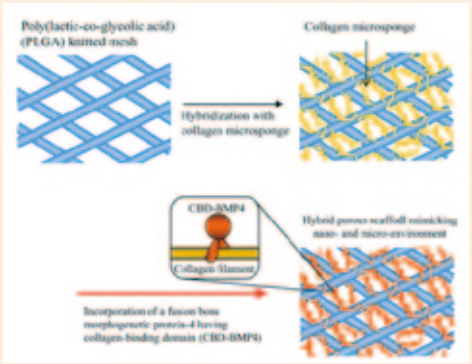


Illustration of collagen/PLGA/CBD-BMP4 hybrid porous scaffold.

Fig. 5-2: Volume 3 of MANA Research Highlight.

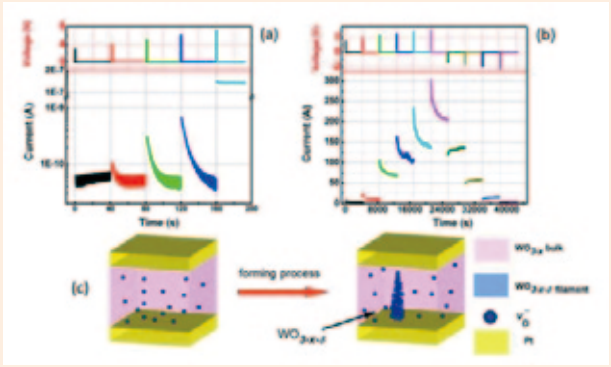
Volume 4 (December 20, 2012):

On-Demand Synaptic Electronics: Circuits that learn and forget

Researchers in Japan and the US propose a nanoionic device with a range of neuromorphic and electrical multifunctions that may allow the fabrication of on-demand configurable circuits, analog memories and digital–neural fused networks in one device architecture.

Publication:

R. Yang, K. Terabe, G. Liu, T. Tsuruoka, T. Hasegawa, J.K. Gimzewski, M. Aono,
On-Demand Nanodevice with Electrical and Neuromorphic Multifunction Realized by Local Ion Migration,
ACS Nano **6**, 9515 (2012).
doi: 10.1021/nn302510e



(a): Volatile (short-term) memory property of two terminal Pt/WO_{3-x}/Pt device before the forming process. (b): Non-volatile (long-term) memory property in the device after forming process. (c): Schematic illustration of the device structures before and after forming process.

Fig. 5-3: Volume 4 of MANA Research Highlight.

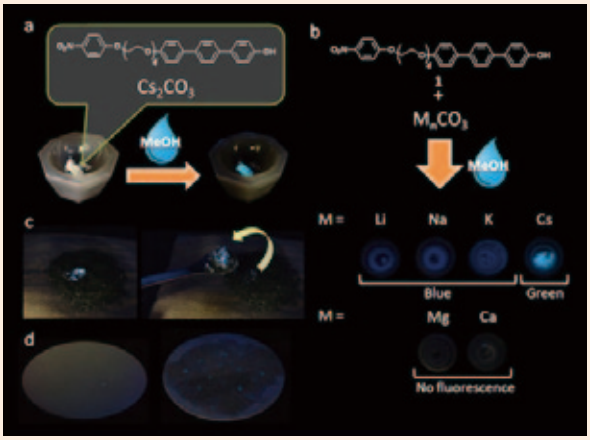
Volume 5 (March 4, 2013):

Detecting caesium with naked eyes

'Micrometre-level naked-eye detection' of caesium ions, a major source of contamination in the vicinity of radioactive leaks, is demonstrated in a material developed by researchers in Japan.

Publication:

T. Mori, M. Akamatsu, K. Okamoto, M. Sumita, Y. Tateyama, H. Sakai, J.P.Hill, M. Abe, K. Ariga,
Micrometer-level naked-eye detection of caesium particulates in the solid state,
Science and Technology of Advanced Materials **14**, 015002 (2013).
doi: 10.1088/1468-6996/14/1/015002



Photographs of fluorescence changes of a mixture of the phenol compound and various carbonate salts after addition of a drop of methanol.

Fig. 5-4: Volume 5 of MANA Research Highlight.

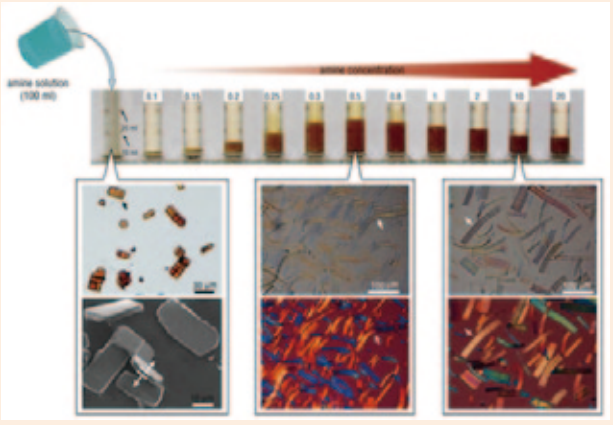
Volume 6 (March 29, 2013):

Inorganic materials display massive and instantaneous swelling and shrinkage

The first observation of massive swelling and shrinkage of inorganic layered materials like a biological cell provides insights into the production of two-dimensional nanocrystals.

Publication:

F. Geng, R. Ma, A. Nakamura, K. Akatsuka, Y. Ebina, Y. Yamauchi, N. Miyamoto, Y. Tateyama, T. Sasaki,
Unusually stable ~100-fold reversible and instantaneous swelling of inorganic layered materials,
Nature Communications **4**, 1632 (2013).
doi: 10.1038/ncomms2641



Macroscopic volume and microscopy characterization of the samples before and after swelling.

Fig. 5-5: Volume 6 of MANA Research Highlight.

● **Grand Challenge Meetings**

Once or twice a year, MANA holds a “camp”-type approach called “Grand Challenge Meetings.” About twenty MANA researchers are selected from among those who are interested in joining this meeting and they engage in free discussions about future grand challenges at MANA at a remote country site for two days. We have observed that this meeting proves remarkably useful for triggering fusion research between MANA’s scientists in different research fields. In January 2011, the first MANA Grand Challenge Meeting was held at Miura Peninsula. The meetings continued in April 2012 with the second MANA Grand Challenge Meeting at a hot-spring resort in Nasu, Tochigi prefecture, and in November 2012 with the Young researcher’s Grand Challenge Meeting at Miura Peninsula (see Fig. 5-6).

Fig. 5-6: Participants of the second Grand Challenge Meeting in Nasu on April 26-27, 2012 (left), and of the Young Researcher’s Grand Challenge Meeting at Miura Peninsula on November 12-13, 2012 (right).

● **2011 Grand Challenge Research program**

In Fiscal Year 2011, the MANA Grand Challenge Research Program was launched as a way to encourage researchers to undertake innovative, "outside-the-box" interdisciplinary research not only limited to materials science. This initiative sought applications for risky yet challenging topics that matched the concept of nanoarchitectonics. MANA offered two types of grants: Class-S and Class-G projects.

Grand Challenge Class-S projects (Seed research)

Funding amount:	up to 500,000 Yen
Research duration:	from October 2011 to March 2012
Awarded projects:	42

Grand Challenge Class-G projects (Grand Challenge research)

Funding amount:	up to 6,000,000 Yen
Research duration:	from November 2011 to March 2013
Awarded projects:	7

● **2012 MANA Theory-Experiment Fusion Research Program**

In Fiscal Year 2012, MANA has decided to launch the MANA Theory-Experiment Fusion Research Program. The purpose of this program is to continually incorporate theory, ranging from physics, chemistry, biology to mathematics, in order to form a powerful infrastructure that can frame difficult problems in a conceptual structure and to aid in visualizing and interpreting data via advanced theory simulations. In October 2012, MANA has awarded five Theory-Experiment Fusion Research projects (see Table 5-1) by review of the 13 submitted proposals and interview of the short-listed proposers.

2012 MANA Theory-Experiment Fusion projects

Funding amount:	up to 20,000,000 Yen
Research duration:	from October 2012 to March 2015
Awarded projects:	5

Table 5-1: List of five awarded 2012 Theory-Experiment Fusion Research projects.

	Name of Applicant	Title of Applicant	Title of Project
1	Kazuhito TSUKAGOSHI	MANA PI (Nano-Materials)	Real Fusion for atomic-film electronics with designed electric state
2	Jinhua YE	MANA PI (Nano-Power)	Construction of Artificial Photosynthetic System by Nanoarchitectonics of Photocatalytic Materials and Nano Metals
3	Naoki FUKATA	Group Leader (Nano-Materials)	Synthesis of functionalized semiconducting nanowires and material design using large scale DFT calculations for the realization of next-generation vertical type transistors
4	Xiao HU	MANA PI (Nano-System)	Exploration of Majorana fermions and their novel quantum functions
5	Jun NAKANISHI	MANA Independent Scientist	Understanding and Projection of Unique Collective Cell Behavior on Nanostructured Surfaces

● **Invitation of Foreign Researchers**

To ensure that MANA is a research center that attracts all levels of researchers from around the world, MANA uses 2 researcher invitation programs.

NIMS Open Research Institute Program:

This program is run by NIMS and brings together all levels of researchers from young researchers to highly regarded scientists. By March 2013, 152 researchers were invited to MANA by this program.

MANA Short-Term Research Program:

This is an original MANA program that invites faculty members from foreign research institutes who can conduct joint research with MANA researchers. Invitees stay at MANA for 1 to 3 months. By March 2013, 47 researchers were invited by this program.

Furthermore, more than 420 researchers had been invited to MANA for seminars and collaborative discussions by March 2013.

5.2 Research Output

● **MANA Research Papers**

Refereed research papers in English with MANA Affiliation published in scientific journals are listed in Appendix 8.6 for 2012 and in Appendix 8.7 for 2011. The lists contain the month of publication, the research field of the involved MANA researchers, and the "digital object identifier" (doi), which can be resolved at http://dx.doi.org/. A digital object identifier (doi) is a unique alphanumeric string assigned by a registration agency (the International doi Foundation) to identify content and provide a persistent link to its location on the Internet.

Appendix 8.6: MANA Research Papers 2012
Appendix 8.7: MANA Research Papers 2011

Table 5-2: Breakdown of MANA papers into the four research fields of MANA. Number of refereed research papers in English with MANA Affiliation published in scientific journals.

Research Field	2012		2011	
Nano-Materials Field	207	47.5 %	233	58.4 %
Nano-System Field	101	23.2 %	69	17.3 %
Nano-Power Field * (Nano-Green Field)	60	13.8 %	64	16.0 %
Nano-Life Field * (Nano-Bio Field)	81	18.6 %	39	9.8 %
Double Field	-13	-3.0 %	-6	-1.5 %
Total	**436**	**100.1 %**	**399**	**100.0 %**

*: In October 2012, the Nano-Green Field was renamed to Nano-Power Field, and the Nano-Bio Field to Nano-Life Field.

Table 5-3: Calculation of average journal impact factor for MANA papers based on the journal impact factors published by Thomson Reuters. Refereed research papers in English with MANA Affiliation published in scientific journals.

Average Journal Impact Factor for MANA papers

2012	2011
5.32	5.31

Table 5-4: Number of papers with MANA Affiliation published in journals with a journal impact factor 2012 above 7.5.

Journal	Journal Impact Factor 2012 *	Number of papers	
		2012	2011
Chemical Reviews	41.298	1	0
Nature Materials	35.749	1	1
Nature Nanotechnology	31.170	1	1
Chemical Society Reviews	24.892	1	1
Progress in Materials Science	23.194	0	1
Advanced Materials	14.829	19	4
Angewandte Chemie - International Edition	13.734	5	4
Nano Letters	13.025	5	8
Advanced Drug Delivery Reviews	12.888	1	1
Gastroenterology	12.821	1	0
ACS Nano	12.062	11	16
Energy & Environmental Science	11.653	2	9
Journal of the American Chemical Society	10.677	10	14
Nature Communications	10.015	0	1
Advanced Functional Materials	9.765	6	5
NPG Asia Materials	9.042	1	0
Chemical Science	8.314	0	1
Chemistry of Materials	8.238	8	8
Physical Review Letters	7.943	4	4
Small	7.823	2	5
Stem Cells	7.701	0	1
Journal of Controlled Release	7.633	1	0
Biomaterials	7.604	4	6

*: Values published by Thomson Reuters.

The breakdown of research papers in English with MANA Affiliation into the four research fields of MANA is shown in Table 5-2. MANA produces about 400 such papers per year, dominated by the contribution from the Nano-Materials Field. As a result of the effort of MANA to reinforce the Nano-Bio / Nano-Life Field, papers from this field have doubled from 39 in 2011 to 81 in 2012. Due to the promotion of interdisciplinary research activities at MANA, Double Field papers, co-authored by MANA scientists from two different research fields, have started to increase from 1.5% in 2011 to 3.0% in 2012. MANA continues to publish many papers in high-impact factor journals (see Tables 5-3 and 5-4). For papers with MANA Affiliation, the average journal impact factor has reached high values of 5.32 in 2012 (based on the journal impact factors 2012 published by Thomson Reuters) and of 5.31 in 2011 (based on the journal impact factors 2011 published by Thomson Reuters). The journal impact factor is a measure of the frequency with which the "average article" in a journal has been cited in a particular year. The impact factor helps to evaluate a journal's relative importance, especially when compared to others in the same field.

Reflecting an advice form the WPI Program Committee, MANA prefers to write scientific papers with WPI-MANA Affiliation, and the number of additional research papers in English without MANA Affiliation decreased from 259 papers in 2011 to 190 papers in 2012. MANA researchers contributed to additional publications (not listed in this report), such as author or editor of publications in other languages than English, author of book chapters, and editor of books or Special Issues of Journals. Many MANA scientists are also members of the board of a journal (see MANA Progress Report, Facts and Achievements 2011, Appendix 8.9).

● **Special Issues on Materials Nanoarchitectnonics**

In Fiscal Year 2011, special issues on MANA were published in two original journals, thereby publicizing the unique concept of nanoarchitectonics and raising MANA's profile. One was a special issue of Science and Technology of Advanced Materials (August 2011; journal impact factor 2011: 3.513), a journal edited and published by MANA's host organization NIMS, and the other was a special issue of Advanced Materials (January 2012; journal impact factor 2012: 14.829), a journal published by John Wiley & Sons. For details, see MANA Progress Report, Facts and Achievements 2011, Appendix 8.8. In 2013, another special issue on materials nanoarchitectonics will appear in the journal Langmuir (Journal impact factor 2012: 4.187).

● **MANA Journal Cover Sheets**

Since the launch of the MANA project in October 2007, MANA scientists have produced many Journal cover sheets of issues that contain their research paper. Different kinds of Journal cover sheets (Journal Front Cover, Journal Inside Front Cover, Journal Back Cover, Journal Inside Back Cover, Journal Frontispiece) related to papers with MANA Affiliation between October 2007 and December 2012 are listed in Appendix 8.8. Some examples are shown in Fig. 5-7.

Appendix 8.8: MANA Journal Cover Sheets

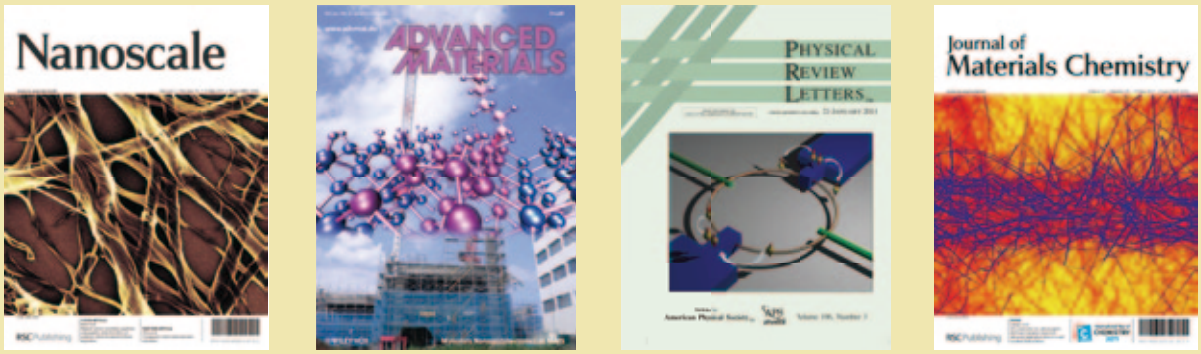


Fig. 5-7: Examples of recent Journal Front Covers related to papers with MANA Affiliation.

● **MANA Patents**

In addition to writing research papers, many MANA scientists actively apply for patents. MANA patent applications and MANA patent registrations between the launch of MANA in October 2007 and December 2012 are listed in Appendix 8.9 and summarized in Table 5-5. In the first five years and three months of the project, MANA made 575 patent applications and 304 patent registrations. All patent applications and patent registrations listed in Appendix 8.9 are or were partly or fully owned by NIMS.

Appendix 8.9: MANA Patents

Table 5-5: Number of MANA Patent Applications and Registrations.

	Total Number (2007 Oct – 2012 Dec)	Average Number (per year)
Japanese Patent Applications	377	71.8
Japanese Patent Registrations	232	44.2
International Patent Applications	198	37.7
International Patent Registrations	72	13.7

● **Commendations**

In 2012, MANA's renowned researchers again won several prestigious prizes and awards.

Chemical Institute of Canada Award 2012

In January 2012, Chemical Institute of Canada (CIC) announced that Prof. Françoise Winnik, MANA Satellite Principal Investigator, won the 2012 Macromolecular Science and Engineering Award. This award is presented to an individual who, while residing in Canada, has made a distinguished contribution to macromolecular science or engineering. The award ceremony was held at the annual Canadian Chemistry Conference in Calgary in May 2012 (see Fig. 5-8).

CSJ Academic Prize 2012

In February 2012, the Chemical Society of Japan (CSJ) announced the list of winners of the Chemical Society of Japan Prize 2012. Dr. Takayoshi Sasaki, MANA Principal Investigator, was awarded the 29th CSJ Academic Prize for his work on "Synthesizing 2D nanosheet and development of its functionalities".

The 3rd Thomson Reuters Research Front Award 2011

In February 2012, Dr. Yoshio Bando, MANA Chief Operating Officer, and Dr. Dmitri Golberg, MANA PI, have been selected to receive the 3rd Thomson Reuters Research Front Award 2011 for their outstanding contributions to the field of Materials Science through their work on "Novel Syntheses of One Dimensional Inorganic Nanomaterials and their Applications". The award ceremony was held at the Thomson Reuters Office in Tokyo in February 2012 (see Fig. 5-8).

The 7th NIMS President's Research Encouragement Award 2012

In April 2012, Dr. Minoru Osada, MANA Associate Principal Investigator, received the 7th NIMS President's Research Encouragement Award (see Fig. 5-8). The award was given to him for his outstanding contribution to the field of Materials Science through his work on "Novel Physical Properties of Oxide Nanosheets and Their Applications".

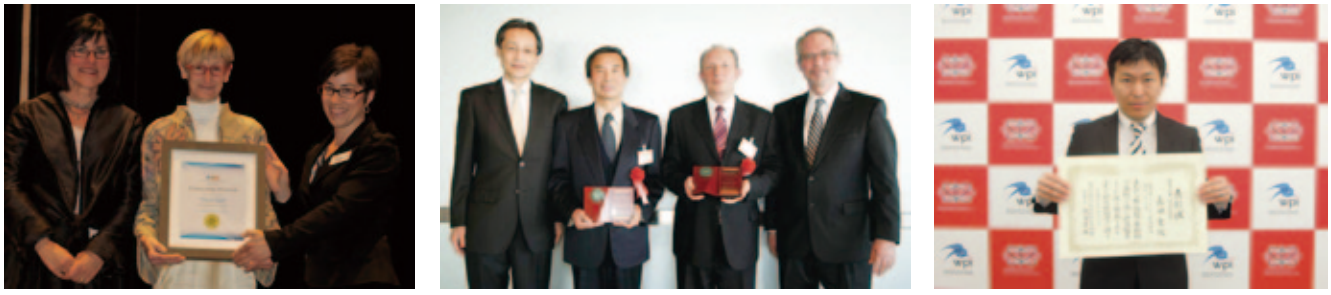


Fig. 5-8: Award Ceremonies. Chemical Institute of Canada Award for Prof. Winnik (left), Thomson Reuters Research Front Award for Dr. Bando and Dr. Golberg (middle), and NIMS President's Research Encouragement Award for Dr. Osada (right).

Funai Research Incentive Award 2012

In April 2012, Dr. Satoshi Tominaka, MANA Independent Scientist, received the Funai Research Incentive Award from Funai Foundation for Information Technology (see Fig. 5-9). The prize is awarded to researchers for excellent contributions to research in fields related to Information technology and Information Science in Japan. The award was given to Dr. Tominaka for his marked work on “Creation of On-Chip Fuel Cells for Ultrasmall Electronics”.

Tsukuba Encouragement Prize 2012

In July 2012, Dr. Yusuke Yamauchi, MANA Independent Scientist, received the Tsukuba Encouragement Prize for young researchers from the Science and Technology Promotion Foundation of Ibaraki. The prize is awarded to young researchers living in Ibaraki Prefecture who have great potential for producing remarkable results in science and technology. The prize was given to Dr. Yamauchi for his work on "Toward effective utilization for rare metals: Development of new nanoporous metals". The award ceremony was held in October 2012 (see Fig. 5-9).

ACerS Edward Orton, Jr. Memorial Lecture 2012

Prof. Zhong Lin Wang, MANA Satellite Principal Investigator, was awarded the ACerS Edward Orton, Jr. Memorial Lecture by the American Ceramic Society. The lecture entitled “Nanogenerators and piezotronics – from basic science to novel applications” was given in October 2012 at the Materials Science & Technology 2012 Conference & Exhibition (MS&T'12) in Pittsburgh, Pennsylvania, US.

The 9th JSPS Prize 2012

In December 2012, Japan Society for the Promotion of Science (JSPS) has announced 24 winners of the 9th JSPS Prize for Fiscal Year 2012. Dr. Kazuhito Tsukagoshi, MANA Principal Investigator, was selected as one of the awardees in the field of Mathematics, Physical Sciences, Chemistry, and Engineering Sciences, for his work on "Nano-Electronics Researches Based on Electrical Conduction Control in Nano-Carbon Conductors". The award ceremony was held at the Japan Academy in Tokyo in February 2013 (see Fig. 5-9).

Fig. 5-9: Award Ceremonies. Funai Research Incentive Award for Dr. Tominaka (left), Tsukuba Encouragement Prize for Dr. Yamauchi (middle), and JSPS Prize for Dr. Tsukagoshi (right).

5.3 Research Achievements

In the 5 years that have passed since MANA was launched in October 2007, MANA has conducted world-class materials research that covers a wide sweep of programs from basic studies to advanced applications. MANA considers theoretical/computational research and the development of novel research equipment to be important. All research at MANA is conducted on the basis of “materials nanoarchitectonics”, which is an essentially important concept for new materials development.

This section contains a brief description of MANA accomplishments. MANA conducts research in the four fields of Nano-Materials, Nano-System, Nano-Power and Nano-Life. Most of the projects represent the outcome of studies bridging several different research fields.

A) Revolutionary nanomaterials created by "nanosheet technology"

MANA has developed a unique method to create novel materials, which is now well known as "nanosheet technology". The method consists of exfoliating layered compounds into unilamellar nanosheets and re-stacking the nanosheets in a designated order to create a new material with a novel characteristic. By this method, we have created numerous revolutionary nanomaterials, a few of which are shown below.

● *World's-highest-dielectric-constant thin films*

We have developed $Sr_2Nb_3O_{10}$ and $Ca_2Nb_3O_{10}$ nanosheet films with a thickness of about 10 nm. They demonstrate the world's highest dielectric constant of more than 200. These materials hold promise as a gate insulator of future field effect transistors (FETs, see Fig. 5-10).

● *Surprising ferroelectric ultrathin films*

The $LaNb_2O_7$ and $Ca_2Nb_3O_{10}$ nanosheet films are usually paraelectric, but, surprisingly enough, their hetero-assembled (superlattice) film becomes ferroelectric. This behavior may be ascribed to the formation of soft interface between the two different nanosheets, resulting in loss of centrosymmetry.

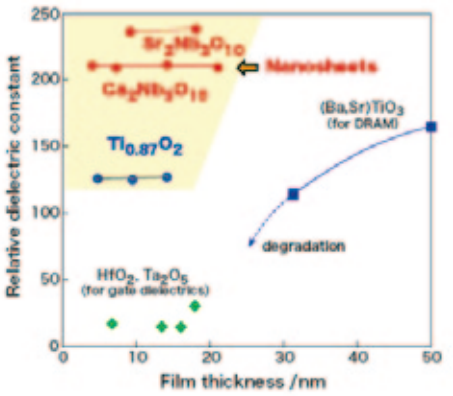


Fig. 5-10: Revolutionary nanomaterials created by "nanosheet technology". Reference: M. Osada et al, Adv. Funct. Mater. **21**, 3482 (2011).

B) Novel "low-dimensional" superconductors

We have discovered various novel superconductors. Three examples are shown below.

● *World's first observation of surface macroscopic superconducting current*

Macroscopic superconducting current through a solid surface has been observed for the first time. Namely, the (111) surface of silicon modified with a small amount of indium, i.e. the Si(111)$\sqrt{7}$x$\sqrt{3}$-In surface, allows superconducting current to flow over a millimeter distance. This is surprising because numerous atomic steps existing on the surface do not disturb the transport of Cooper pairs of electrons. Systematic measurements of critical current and further analysis suggest that each surface atomic step works as a Josephson junction (see Fig. 5-11).

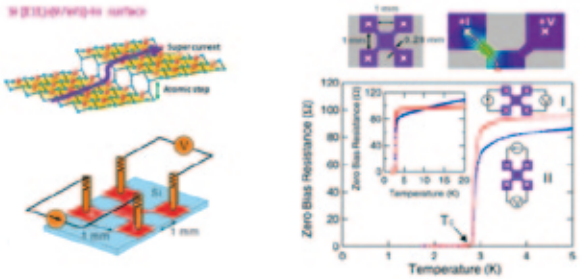


Fig. 5-11: Novel "low-dimensional" superconductors. Reference: T. Uchihashi et al., Phys. Rev. Lett. **107**, 207001 (2011).

● *Flexible fibriform superconductor*

We have developed flexible fibriform nanowhiskers made of C_{60} molecules. The C_{60} nanowhiskers can be doped with potassium (K) by heating the nanowhiskers in the vapor of K. Interestingly, a Meissner effect is observed for the K-doped C_{60} nanowhiskers at temperatures below about 15 K, indicating that the nanowhiskers are superconducting below the temperature.

● *Ultrathin film superconductor*

Recently, we have discovered $FeTe_{1-x}Se_x$, a superconductor with a superconducting temperature (T_c) of about 15 K. Interestingly, even when the material is in the form of an ultrathin film with a thickness as small as 20 nm, T_c is unchanged as compared with bulk $FeTe_{1-x}Se_x$.

C) Nano-power generation/conversion/storage nanomaterials and systems

One of the main concerns of MANA is the generation/conversion/storage of "power" at the nanoscale, where the term "power" represents "usable energy". We have developed various nanomaterials and nanosystems for this purpose. Here are several examples of this cutting-edge technology.

● *World's highest photo-catalytic efficiency*

A new material was developed by incorporating phosphor (P) block element into a simple silver oxide (AgO) with a narrow band gap. The new photocatalytic material, Ag_3PO_4, demonstrates an extremely high quantum yield (~90% for photons with a wave length of ~420 nm) regarding water oxidation as well as organic contaminates decomposition under visible light. This study not only supplies a new strategy for developing visible-light-driven photocatalysts, but also shows a giant step toward realizing an artificial photosynthetic system.

● *Nanogenerators for self-powering nanosystems*

We have developed a simple and effective approach called the scalable sweeping-printing-method for fabricating a flexible high-output nanogenerator (HONG) that can effectively harvest mechanical energy for driving a small commercial electronic component. The HONG consists of two main steps. In the first step, the vertically-aligned ZnO nanowires (NWs) are transferred to a receiving substrate to form horizontally-aligned arrays. Then, parallel stripe type electrodes are deposited to connect all of the NWs together. Using a single layer of HONG structure, an open-circuit voltage of up to 2.03 V and a peak output power density of ~11 mW/cm^3 have been achieved. The generated electric energy was effectively stored utilizing capacitors, and it was successfully used to light a commercial light-emitting diode (LED), landmark progress toward building self-powered devices by harvesting energy from the environment.

D) Boron nitride (BN) "white" nanotubes and nanosheet

We have studied how to prepare boron nitride (BN) nanotubes and nanosheet (monomolecular layer) and have measured their physical properties comprehensively by transmission electron microscope (TEM). BN nanotubes and nanosheet are similar to carbon nanotubes and graphene in structure, but their electrical is far less than carbon nanotubes and graphene; we therefore call them "white" nanotubes and graphene. Recently, we have developed a new BN nanosheet synthesis process which we call "chemical blowing". The nanosheet with thickness of 1-2nm can be created with high yield. We have also found that BN nanotubes have a high tensile strengths (~50 times stronger than steel) and BN nanosheet ("white" graphene) is a semiconductor.

E) Revolutionary nanodevices

MANA has developed various novel devices for the innovation of information and communication technology and has succeeded to materialize several new promising atomic, molecular and quantum devices as follows.

● *Atomic switches as "Beyond CMOS" memory and logic devices*

The atomic switch is a unique switching device developed by MANA. Compared with the conventional CMOS transistor switch, the atomic switch is characterized by a nonvolatile character, simple structure, small size and low power consumption. In collaboration with NEC Corp., we have studied the use of atomic switches to fabricate a compact and high-performance field-programmable gate array (FPGA) and reached the technological level necessary for commercialization (see Fig. 5-12).

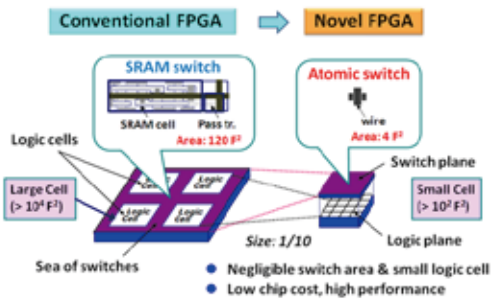


Fig. 5-12: Practical application of atomic switches to materialize compact FPGA. Reference: e.g., T. Hasegawa et al., Adv. Mater. **24**, 252 (2012).

● *Atomic switches for neuromorphic computational network circuits*

Memory is believed to occur in the human brain as a result of two types of synaptic plasticity: short-term plasticity (STP) and long-term potentiation (LTP). STP is achieved through the temporal enhancement of a synaptic connection, which then quickly decays to its initial state. However, repeated stimulation causes a permanent change in the connection to achieve LTP; shorter repetition intervals enable efficient LTP formation from fewer stimuli. Development of artificial (inorganic) synapse that emulates the STP and LTP behaviours is the key-issue in the realization of the Brain-type computer, which we have achieved using an Ag_2S-based gap-type atomic switch (see Fig. 5-13). Namely, pulse input with a lower repetition rate only caused the temporal increase in conductance, corresponding to the STP-mode. Conversely, pulse input with a higher repetition rate achieved a persistent transition to the higher conductance state, corresponding to the LTP mode. The synaptic behaviours are useful for developing artificial neural networking systems made of all solid-state devices, which do not require any pre-programming. Preliminary studies have been made with promising results.

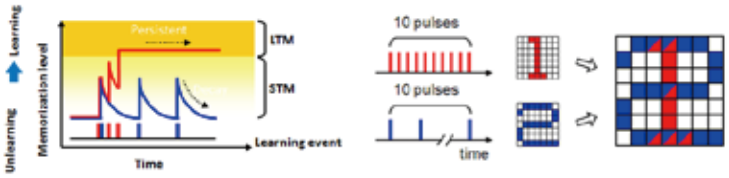


Fig. 5-13: Application of synaptic characteristics of atomic switch. Reference: T. Ohno et al., Nature Mater. **10**, 591 (2011).

● *Novel molecular devices*

We have found the following surprising fact for a C_{60} thin film. Two adjacent C_{60} molecules at any designated position in the film can be chemically bound into a dimer by the tip of the scanning tunneling microscope (STM), and moreover, if the polarity of voltage applied to the tip is reversed, the C_{60} dimer is dissociated reversibly. As an application of this phenomenon, we have demonstrated ultradense data storage with a bit density of 190 Tbit/in^2.

We have developed a method to create a single conductive linear polymer chain (polydiacetylene) at designated positions by initiating chain polymerization of monomers (diacetylene) with a scanning tunneling microscope (STM) tip. Using this method, we have studied construction of a two-terminal nanowiring for a single phthalocyanine molecule and have succeeded in making nanowiring through chemical soldering or firm covalent bonding (see Fig. 5-14).

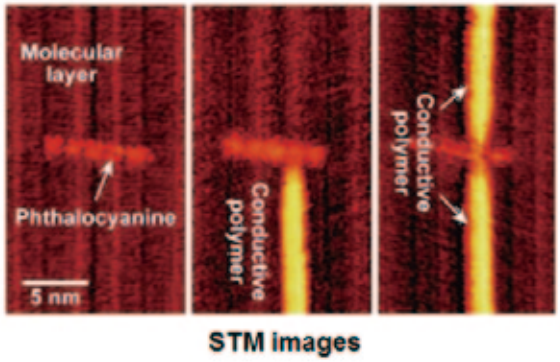


Fig. 5-14: Novel molecular devices towards single-molecular electronics. Reference: J. Okawa et al., J. Amer. Chem. Soc. **133**, 8227 (2011).

● *Novel quantum devices*

MANA has developed a superconductor-based light emitting diode (LED). In this LED, electron Cooper pairs in a superconductor recombine with normal holes in a semiconductor emitting quantum-mechanically entangled photon pairs. This LED is expected to be the key device in quantum information technology because of its promising giant oscillator strength due to the large coherence volume of the superconducting pairs together with the possibility of the on-demand generation of entangled photon pairs.

We have also developed an ultimate superconducting quantum interference device (SQUID), i.e. a nano-SQUID, which can detect even single or several spins. We have clarified the quantum interaction between a nano-SQUID with embedded quantum dots and spins in the quantum dots. This leads to the implementation of an entangled state between a superconducting qubit and spin qubit. The combination of these qubits is a promising candidate for a quantum interface that will be indispensable in the future quantum information network.

F) Novel nanoscale characterization/analysis methods

● *Multiple-probe scanning probe microscopes*

We have been conducting a series of pioneering work for the development of multiple-probe scanning tunneling microscopes (MP-STMs) and atomic force microscopes (MP-AFMs). Recently, we have developed a STM images in which four conductive AFM probes are operated independently and simultaneously in frequency modulation mode using tuning-fork type sensors. By using this QP-AFM, we have succeeded to make four-probe measurement of the electrical conductivity of a flake of graphene put on an insulating substrate (SiO_2, see Fig. 5-15).

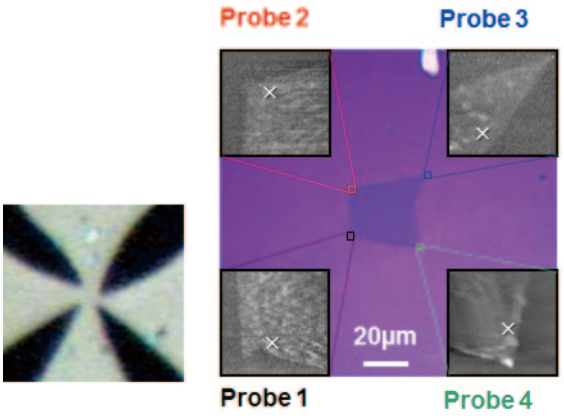


Fig. 5-15: Four probe measurement of the resistivity of a single layer graphene. Reference: T. Nakayama et al., Adv. Mater. **24**, 1675 (2012).

● *Novel ultrasensitive/ultraparallel molecular sensors*

We have developed a membrane-type surface stress sensor (MSS), which is useful for high-sensitivity sensing of various analytes ranging from gaseous to biological molecules. The analyte-induced isotropic surface stress on the membrane is efficiently transduced onto the piezoresistive beams as an amplified uniaxial stress. Experimental evaluation of a first prototype MSS demonstrates an ultrahigh sensitivity which is more than 20 times higher than that of a standard piezoresistive cantilever and comparable to that of optically read-out cantilevers. To demonstrate the capability of MSS for ultraparallel sensing, we have microfabricated a 2D array of MSS. By using this 2D MSS as a gas sensor, we succeeded in "visualizing smells" in real-time by converting signals from each channel in the 2D array into colored-pixels of the "picture."

G) Nano-life related materials research

● *Novel bioimaging method*

Using the surface modification technique, several types of nanoparticles were prepared for bioimaging. Er-doped yttrium oxide (Er:Y_2O_3) nanoparticle emits not only near infrared (NIR) light but visible light under NIR excitation. The latter emission is called infrared-to-visible upconversion (UC) emission. Poly(ethylene glycol) (PEG)–based PEG-b-poly(vinylbenzyl phosphoric acid) (PEG-b-PVBP) stabilized the UC-nanoparticle, which can be utilized as near-infrared bioimaging tools. PEG-b-PVBP also stabilized ion oxide and can be utilized in vivo. Ion oxide nanoparticles thus prepared can be utilized as an MRI imaging probe as well as magnetite-assisted hyperthermia.

H) Theoretical nanoscience

● *Manipulation of quantum entanglement of nonlocal electron pairs*

We propose to measure Josephson current which is purely contributed from entangled electron pairs, by either co-tunneling or split-tunneling. In order to figure out how much split Cooper pairs contribute to the total Josephson current, the oscillation of maximal Josephson current is detected with response to the magnetic flux applied through the area enclosed by the two paths. When the contribution from split Cooper pairs equals to that from co-tunneling ones, the oscillation period is $2\Phi_0$, whereas it should be Φ_0 without split tunneling. This measurement gives an unambiguous evidence for the nonlocal quantum entanglement of electrons.

● *Topological-superconductor Majorana-particle quantum bit system*

In a heterostructure consisting of a superconductor, semiconductor with large spin-orbit coupling and ferromagnetic insulator, if an odd number of fluxes exist in the superconductor, Majorana particles appear in the flux cores and at the edge of the superconductor. If we connect three such heterostructures through a gated pathway, we can control the exchange of Majorana particles between the heterostructures, so that we can make non-Abelian quantum bit operation.

● *Mass-less Leggett mode in three-band superconductors*

The Leggett mode associated with out-of-phase oscillations of the superconducting phase in multiband superconductors usually is heavy due to interband coupling, which makes its excitation and detection difficult. We found the existence of a massless Leggett mode in three-band superconductors with time- reversal-symmetry breaking. The mass of this Leggett mode is small close to the time-reversal-symmetry-breaking transition and vanishes at the transition point, and thus locates within the smallest superconducting energy gap, which makes it stable and detectable, e.g., by means of the Raman spectroscopy. The thermodynamic consequences of this massless mode and possible realization in iron-based superconductors also attract our attention.

● *Loss of charge character in Mott transition*

By using exact solutions and numerical simulations, single-particle spectral properties near the Mott transition are investigated in the one-dimensional Hubbard model. The results show pseudogap, hole-pocket behaviors, anomalous spectral-weight transfer, and the upper Hubbard band, which are reminiscent of anomalous features observed in cuprate high-T_c superconductors. In contrast with conventional metal-to-band-insulator transitions, the Mott transition turned out to be characterized as a loss of charge character from the mode having both spin and charge characters, while the spin part remains almost unchanged. Or, from the insulating side, the Mott transition is characterized by the emergence of a gapless mode whose dispersion relation extends up to the order of hopping integral t [spin exchange J] in the weak [strong] interaction regime (see Fig. 5-16).

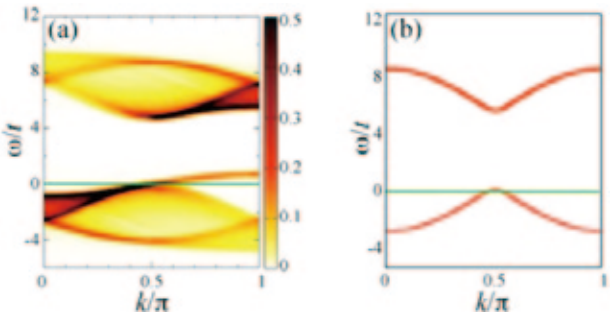


Fig. 5-16: Theoretical studies of Loss of charge character in Mott transition. Reference: M. Kohno, Phys. Rev. Lett. **108**, 076401 (2012).

6. Global Network

6.1 MANA Satellites

One element that is absolutely essential to the carrying out of research by MANA is satellite research. Out of the 24 Principal Investigators (PIs) at MANA, 8 are invited researchers based at outside research institutions at which MANA has established satellite laboratories. As of January 1, 2013, there are 7 MANA satellites, 2 in Japan, 3 in America and 2 in Europe (see Figs. 6-1 and 6-2). They collaborate closely with MANA to advance innovative research related to nanotechnology. Satellite institutions provide support for joint research in fields that cannot be covered by NIMS alone. The satellite PIs act as mentors to young researchers at MANA. It goes without saying that the satellites also serve as bases for disseminating and collecting information. End of March 2013, the two MANA satellite laboratories of Prof. Sir Mark E. Welland at University of Cambridge and Prof. Kazuo Kadowaki at University of Tsukuba have been closed. MANA plans to open a new MANA Satellite at University College of London in 2013.

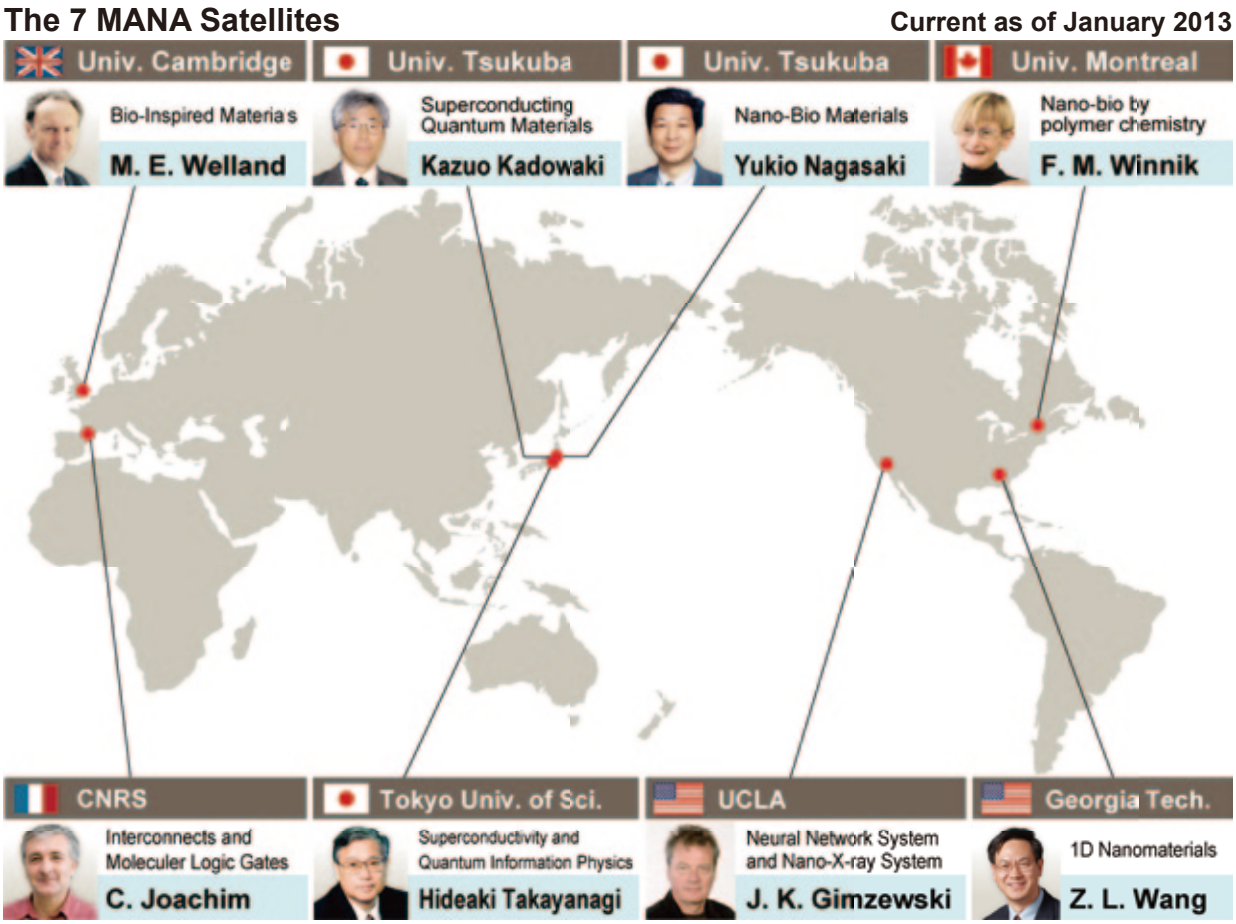


Fig. 6-1: The seven MANA Satellites.

UCLA
USA

Tokyo University of Science
Japan

University of Montreal
Canada

CNRS, Toulouse
France

University of Cambridge
UK

Georgia Tech
USA

University of Tsukuba
Japan

Fig. 6-2: Location of MANA Satellites (as of January 2013). Top row from left to right: University of California (UCLA), USA; Tokyo University of Science, Japan; University of Montreal, Canada; CNRS, Toulouse, France. Bottom row from left to right: University of Cambridge, UK; Georgia Institute of Technology, Atlanta, USA; University of Tsukuba, Japan.

University of Tsukuba, Japan

● **Prof. Kazuo Kadowaki,** *Graduate School of Pure and Applied Sciences*

MANA Satellite PI Kazuo Kadowaki conducts cutting-edge research on quantum nanoscience using high temperature superconductors. Together with researchers and graduate students from University of Tsukuba he is working on (1) the elucidation of the mechanism of terahertz radiation after the discovery in the nano-fabricated mesa structures of high temperature superconductor $Bi_2Sr_2CaCu_2O_{8+\delta}$ single crystals, and on (2) basic research on the topological insulators and the detailed electronic states of superconductors with multi-degree of freedoms. He conducts joint research with MANA PI Xiao Hu. End of March 2013, the MANA Satellite of Prof. Kadowaki has been closed.

● **Prof. Yasuo Nagasaki,** *Graduate School of Pure and Applied Sciences*

MANA Satellite PI Yukio Nagasaki conducts research in the Nano-Life field on new nano-bio imaging and materials design for nanodiagnoses and treatment and evaluates of the attributes of these materials with the aim of creating novel biotools. He engages in research with a group that includes postdoctoral researchers, lecturers, PhD students and Master course students from the University of Tsukuba satellite and has already published 38 papers with MANA Affiliation. He conducts joint research with MANA Independent Scientist Jun Nakanishi.

Tokyo University of Science, Japan

● **Prof. Hideaki Takayanagi,** *Department of Applied Physics*

MANA Satellite PI Hideaki Takayanagi conducts research in the Nano-System field on Mesoscopic Superconductivity and Quantum Information Physics. He is based in Tsukuba and has offices and research space at MANA. He engages in research with 2 MANA Research Associates and Assistant Professors and graduate students from Tokyo University of Science. He has already published 17 papers with MANA Affiliation. His group has developed the nano-SQUID, or nano superconducting quantum interference device, and coupled it with quantum dots. This combination of a highly controllable electronic system and the most highly sensitive magnetic flux meter available opens up new possibilities for quantum information devices. He conducts joint research on quantum transport phenomena with a NIMS group.

University of California Los Angeles (UCLA), United States

● **Prof. James K. Gimzewski, Director of Nano/Pico Characterization Laboratory**

The MANA Satellite at UCLA has set out to develop a neuromorphic system comprising a complex, network of interacting non-linear elements which is capable of generating emergent behaviors considered fundamental to brain function including but not limited to recurrent, critical dynamics. This multi-scale approach involved the combination of self-assembled nanoscale architectures, solid-state electroionics, and electrochemistry to produce Atomic Switch Networks (ASN). The unique properties provided by the ASN represent a clear departure from CMOS-based approaches to computation, exhibit striking similarity to biological systems, and represent a radically alternative pathway for the creation of physically intelligent machines. MANA Satellite PI James K. Gimzewski has visited MANA 20 times in 5.5 years, spending a total of 37 weeks in Japan. He has a strong scientific collaboration with several groups from the MANA System field and has already published 29 papers with MANA Affiliation. The joint research of Prof. Gimzewski with MANA was featured in television in a documentary series about Nano Revolution, which was broadcasted in Japan (NHK, January 2012), in Canada (CBC, October 2011) and France (Arte, March 2012).

Georgia Institute of Technology, United States

● **Prof. Zhong Lin Wang,** *Director of Center for Nanostructure Characterization*

MANA Satellite PI Zhong Lin Wang conducts research in the Nano-Materials field on photonic structures provided by nature and nanogenerators for harvesting mechanical energy. The GIT MANA Satellite in Atlanta has a rich history of personnel exchange with MANA. Since 2008, MANA Group Leader Naoki Fukata has visited GIT already 13 times and stayed for a total of 24 weeks doing collaborative research with Prof. Wang about the development of next-generation high mobility semiconducting nanowire transistors and Li ion battery anodes using Si-related nanostructures. Recent results of this collaboration have been published in October 2012 in the high-ranked journal ACS Nano (see N. Fukata et al., ACS Nano **6**(10), 8887 (2012). doi: 10.1021/nn302881w).

University of Montreal, Canada

● **Prof. Françoise M. Winnik,** *Faculty of Pharmacy and Department of Chemistry*

Prof. Winnik joined MANA in April 2011 as a new MANA Satellite PI at University of Montreal (UdeM) to conduct research in the Nano-Life field on nanoarchitectonics-inspired nanoparticles and interfaces for therapeutic applications. The aim of the project is to provide effective imaging and therapeutic modalities of minimal invasiveness for eventual clinical use. The research relies, on the one hand, on Prof. Winnik's expertise in polymeric/inorganic nanoparticle chemistry and in the elaboration and characterization of thin biopolymer films and, on the other on collaborations with cell biologists and cardiologists. Prof. Winnik has an office and research space at MANA. In the first two years of the project she visited MANA 7 times and stayed a total of 45 weeks in Japan. MANA Independent Scientist Jun Nakanishi is involved in the research project and visited UdeM for one week to meet the Montreal team members and Prof. Tanguay from Montreal Heart Institute.

CNRS, France

● **Prof. Christian Joachim,** *Center for Material Elaboration & Structural Studies (CEMES) at CNRS, Toulouse, France*

MANA Satellite PI Christian Joachim conducts theoretical and experimental research in the Nano-System field on nano-calculating units and the theory of surface electronics interconnections. The CNRS MANA satellite in Toulouse is exploring the limit of atomic scale logic gate design either embedded in a single molecule or atom by atom constructed on a surface. In Fiscal Year 2012, Prof. Joachim has visited MANA 3 times and stayed for a total of 2 1/2 weeks. He has strong scientific collaboration with several groups from the MANA System field (for example with MANA PI Tsuyoshi Hasegawa) and has already published 15 papers with MANA Affiliation. In May 2012, the CNRS MANA satellite moved to a fully refreshed building of 2500 m^2 floor area with 600 m^2 of clean rooms and 6 vibration free LT-UHV-STM laboratories (see Fig. 6-3). Prof. Joachim's group has designed and ordered a new LT-UHV-four probe STM and announced that after the delivery, planned in February 2014, a nano-car race will be held on this machine (for details, see C. Joachim et al., ACS Nano **7**(1), 11 (2013). doi: 10.1021/nn3058246).

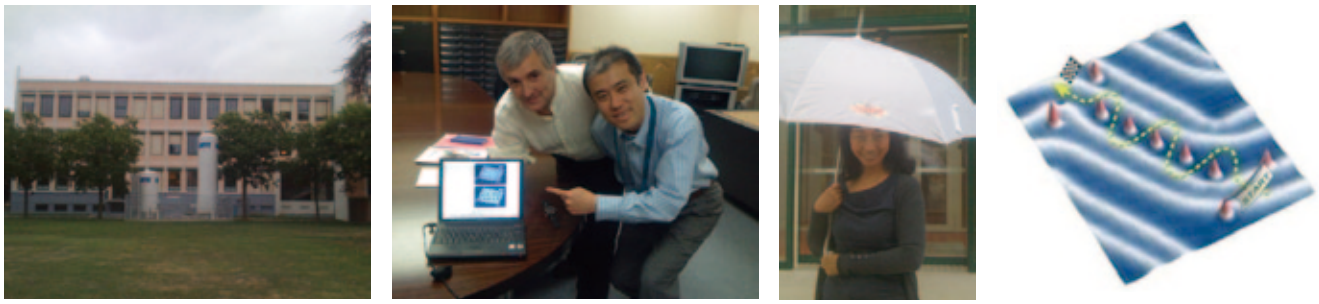


Fig. 6-3: From left to right: The new Building of the CNRS MANA Satellite in Toulouse, France. Research collaboration on the construction of surface atomic wires between MANA Satellite PI Christian Joachim and MANA PI Tsuyoshi Hasegawa. Dr. Jianshu Jiang is working for the MANA project in Toulouse. It has been announced that the world's first nano-car race will be held at the CNRS MANA Satellite, where cars need to circulate around gold atoms separated by 3 nanometers.

University of Cambridge, United Kongdom

● **Prof. Sir Mark E. Welland,** *Director of Cambridge Nanoscience Centre*

MANA Satellite PI Sir Mark E. Welland conducts research on the application of biologically-inspired materials to highly efficient solar cells. University College London (UCL) was added as a partner to the Interdisciplinary Research Collaboration (IRC) in Nanotechnology. Prof. Sir Welland's group at University of Cambridge is conducting the experiments while Dr. David Bowler at UCL is handling the calculations. End of March 2013, the MANA Satellite at University of Cambridge has been closed. MANA plans to open a new MANA Satellite at University College of London in 2013.

6.2 Partnership with Foreign and Domestic Universities

Since MANA is a part of a public research center and not a university, we strive to collaborate with foreign and domestic universities. In 2012 MANA continued to held joint symposia and a summer school with the aim of promoting research exchange and boosting MANA's name recognition in order to scout for talent.

● **Examples of Joint Symposia in 2012**

May 10, 2012

Australia/MANA joint workshop on Nanoarchitectonics for Innovative Materials & Systems

On May 10, 2012, MANA and universities from Australia, including the University of Melbourne, jointly held a workshop with 98 participants to promote research collaborations in a wide variety of fields including nanotechnology, materials science, medical science, environmental and energy (see Fig. 6-4). This workshop was the first symposium held in the auditorium of the WPI-MANA Building.

Fig. 6-4: Participants of the Australia/MANA workshop.

July 19, 2012

1st UdeM-MANA workshop on Nano-Life

On July 19, 2012, MANA and the University of Montreal (UdeM) held a joint workshop on Nano-Life at UdeM (see Fig. 6-5). The workshop with 32 participants aimed to promote cooperative research and exchange of researchers to execute the research on Nano-Life according to a Memorandum of Understanding (MOU) signed between both institutes in 2011.

August 27-31, 2012

The 8th MANA-Cambridge/UCL-UCLA Nanotechnology Summer School

The 8th MANA-Cambridge/UCL-UCLA Nanotechnology Students' Summer School held at MANA on August 27-31, 2012, was organized by a collaboration of the three institutes, MANA of NIMS, Japan, Nanoscience Centre of University of Cambridge, UK, and California NanoSystems Institute of UCLA, USA (see Fig. 6-5). The 19 participating students of this workshop-style event were divided into three teams, where they became "agents" who should tackle the "Mission Impossible: Promoting ignorance, awareness, and crazy ideas" received from the instructors. The students spent much time for group work to execute the mission through active discussion by "agents" with different backgrounds such as research field, culture, nationality and age. Lectures by the instructors encouraged the students to think "crazy" while searching for innovative solutions to change the world with nanotechnology. On the last day of the school, each team presented a mission report and had to deal with questions and comments from the instructors.

November 7, 2012

NSQI-MANA Joint Symposium

On November 7, 2012, the NSQI-MANA Joint Symposium, co-organized by the Centre for Nanoscience and Quantum Information (NSQI), University of Bristol, and MANA, was held at MANA, with the purpose to promote research collaborations in the field of nano-science between both institutes.

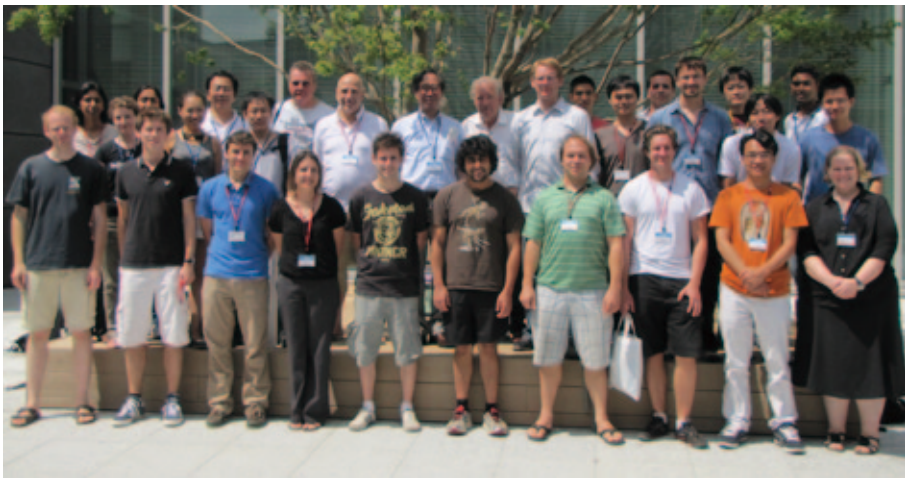


Fig. 6-5: Participants of the 1st MANA-UdeM workshop (left) and the 8th Japan-UK-USA Nanotechnology Summer School (right).

● **Programs for attracting Junior Researchers to MANA**

NIMS Graduate Schools

NIMS operates the "NIMS Graduate Schools" having concluded agreements with selected Japanese universities, and graduate students are taught advanced research by NIMS researchers on the frontlines of their fields. In Fiscal Year 2012, 24 scientists at MANA are teaching in the NIMS Graduate Schools (see Table 6-1). Students in the NIMS Graduate Schools who possess especially outstanding skills are appointed as Junior Researchers and are paid a salary for their contribution to NIMS research. In Fiscal Year 2012, there are 46 Junior Researchers working at MANA, of which 38 are foreigners and 15 are females. In September 2009, the graduate school at University of Tsukuba established a Master's curriculum in which students can take all of their required credits in English. The objective is to attract outstanding foreign students from the Master's program to the NIMS Graduate Schools.

Table 6-1: Number of MANA members at the NIMS Graduate Schools in Fiscal Year 2012.

School	No. of Faculties	No. of Students
University of Tsukuba	11	15
Hokkaido University	5	18
Waseda University	6	10
Kyushu University	2	3

International Joint Graduate Schools

The International Joint Graduate School is a program in which PhD students from renowned universities around the globe spend several months to one year researching under the supervision of NIMS researchers. By March 2013, MANA brought in 43 students within this program from 9 different universities: Moscow State University (Russia), Charles University and the University of Pardubice (Czech Republic), Warsaw University of Technology (Poland), Xian Jiatong University (China), Yonsei University (Korea), Jawaharlal Nehru Centre for Advanced Scientific Research and Anna University (India), Flinders University (Australia).

Internship Program

NIMS established an internship system to proactively accept students from universities throughout Japan and the world which have not concluded agreements with NIMS and provide them with opportunities to partake in materials and nano-technology research. By March 2013, MANA has accepted 179 interns, of which 147 have been foreigners. MANA has welcomed 16 US students from the NSF's National Nanotechnology Infrastructure Network (NNIN) Research Experience for Undergraduates (REU) Program.

7. Enhancement of National and International Recognition

7.1 MANA International Symposium

Once per year, MANA hosts the MANA International Symposium intended to disseminate research results to a wider audience. In addition to invited presenters, all the MANA affiliated scientists participate in three days of presentations and poster sessions, covering the latest research activities. The 6th MANA International Symposium was held in Tsukuba on February 27 – March 1, 2013 (see Figs. 7-1, 7-2, 7-3 and 7-4) with 414 participants from 15 countries. Invited speakers from outside MANA included two Nobel Prize Laureates and 19 renowned scientists from all over the world.

Fig. 7-1: The 6th MANA International Symposium in February/March 2013.

Prof. Suzuki **Prof. Bednorz**

Fig. 7-2: Invited lectures at the 6th MANA International Symposium by Nobel Prize Laureates. Left: Prof. Akira Suzuki (Nobel Laureate in Chemistry 2010, Professor Emeritus, Hokkaido University, Japan) gave a Special Lecture entitled "Cross-Coupling Reactions of Organoborances: An Easy Way for Carbon-Carbon Bonding". Right: Prof. J. Georg Bednorz (Nobel Laureate in Physics 1987, IBM Fellow Emeritus, Switzerland) talked about "High T_c Superconductivity – after a quarter century – a technology ready for Take Off".

Fig. 7-3: Invited lectures at the 6th MANA International Symposium by renowned scientists from outside MANA. Top row from left to right: Prof. Nathan S. Lewis (California Institute of Technology, CalTech, USA), Prof. Hiroshi Imahori (WPI-ICeMS, Kyoto University, Japan), Prof. Andrew A. Gewirth WPI-(I^2CNER, Kyushu University, Japan, and University of Illinois, USA) and Prof. Yoshitada Morikawa (Osaka University). Second row from left to right: Prof. Buddy Ratner (UW Engineered Biomaterials, USA), Prof. Makoto Komiyama (University of Tsukuba, Japan), Prof. Samuel I. Stupp (Northwestern University, USA) and Prof. Masatsugu Shimomura (WPI-AIMR, Tohoku University, Japan). Third row from left to right: Prof. Anthony K. Cheetham (University of Cambridge, UK), Prof. Tokuzo Aida (University of Tokyo, Japan), Prof. Seiji Shinkai (Kyushu University, Japan) and Prof. Gero Decher (Université de Strasbourg and CNRS, France). Fourth row from left to right: Prof. Yasuhiro Koike (Keio University, Japan), Prof. Naoto Nagaosa (University of Tokyo, Japan), Prof. Teruo Ono (Kyoto University, Japan) and Prof. Michelle Y. Simmons (University of New South Wales, Australia). Bottom row from left to right: Prof. Takahiro Shinada (National Institute of Advanced Industrial Science and Technology, AIST, Japan), Prof. Rodney Ruoff (University of Texas, USA) and Prof. Elena Sheka (People's Friendship University of Russia, Russia).


Dr. Ushioda


Dr. Ando


Prof. Kuroki

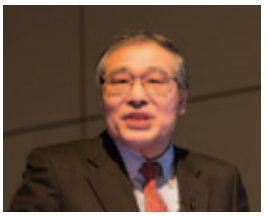

Prof. Saito

Fig. 7-4: From left to right: Opening address by Dr. Sukekatsu Ushioda (NIMS President) and subsequent greeting addresses by Dr. Yoshiaki Ando (Director of Basic Research Promotion Division, MEXT), Prof. Toshio Kuroki (Director of WPI Program) and Prof. Gunzi Saito (WPI Program Officer of MANA).

7.2 MANA 5th Anniversary Memorial Symposium

On October 3, 2012, MANA 5th Anniversary Memorial Symposium was held at the auditorium of the new WPI-MANA Building with a total of 257 attendees to commemorate the five years since MANA's inception on October 1, 2007. The Symposium started with a welcome address by NIMS President Dr. Sukekatsu Ushioda and continued with 3 congratulatory speeches by Prof. Toshio Kuroki (Director of WPI Program), Prof. Gunzi Saito (WPI Program Officer of MANA) and Prof. Sir Mark Welland (MANA Satellite Principal Investigator at University of Cambridge). Subsequently, MANA Director-General Dr. Masakazu Aono spoke about "Five-year journey and future challenges of MANA" and Prof. Yoshinori Tokura from University of Tokyo gave a special lecture entitled "Emergent electromagnetic phenomena in solids". The later part of the program was entitled "Our Future Challenge in MANA" and consisted of eight oral presentations by the MANA researchers. In a subsequent MANA laboratory tour, the attendees were divided into four groups (see Figs. 7-5, 7-6 and 7-7).

Fig. 7-5: The participants of the Memorial Symposium.


Dr. Ushioda


Prof. Kuroki


Prof. Saito


Prof. Sir Welland


Dr. Aono


Prof. Tokura

Fig. 7-6: Top row from left to right: Opening address by Dr. Sukekatsu Ushioda (NIMS President) and subsequent congratulatory addresses by Prof. Toshio Kuroki (Director of WPI Program), Prof. Gunzi Saito (WPI Program Officer of MANA) and Prof. Sir Mark Welland (MANA Satellite Principal Investigator at University of Cambridge). Bottom row from left to right: Lectures by Dr. Masakazu Aono (MANA Director-General) and Prof. Yoshinori Tokura (University of Tokyo). Audience in the auditorium. Dr. Tsuyoshi Hasegawa (MANA PI) explains at the MANA laboratory tour.

Fig. 7-7: Eight oral presentations about "Our Future Challenge in MANA" were given by (from top left to bottom right) Prof. James Gimzewski (MANA Satellite Principal Investigator at UCLA), Dr. Jinhua Ye (MANA PI), Dr. Minoru Osada (MANA Associate PI), Dr. Xiao Hu (MANA PI), Dr. Takashi Uchihashi (MANA Scientist), Dr. Genki Yoshikawa (MANA Independent Scientist), Dr. Mitsuhiro Ebara (MANA Scientist), and Prof. Fançoise Winnik (MANA Satellite Principal Investigator at University of Montreal).

7.3 International Cooperation

Memorandum of Understanding (MOU) is a memorandum exchange between MANA and top institutes from overseas to create joint research in nanotechnology. Main points of these memorandums are communication between researchers, exchange of research information, and providing facility for joint research. A MOU agreement is valid for 5 years and can be renewed if both institutes agree. Between the launch in October 2007 and March 2013, MANA has concluded 39 MOUs with institutions from 14 countries (see Appendix 8.10). As of March 31, 2013, 36 MOUs are valid and 3 have expired.

Appendix 8.10: International Cooperation

7.4 MANA Website

The official English MANA website (www.nims.go.jp/mana/) was launched in February 2008 and is continuously being improved. It provides an overview of MANA, introduces researchers, research projects and output, and informs about events and recent news. In February 2011, the new Japanese MANA website (www.nims.go.jp/mana/jp/index.html) was launched. To further improve the content, both English and Japanese MANA websites are planned to be renewed at the beginning of Fiscal Year 2013.

7.5 MANA Newsletter

The MANA newsletter named "CONVERGENCE" is published with separate English and Japanese issues three times per year and covers activities and progress of the MANA project. It contains interviews with famous researchers (see Fig. 7-8) and articles about top-ranked institutions in Japan and the world with the aim of allowing even the casual reader to gain an affinity with MANA. In order to boost MANA's global name recognition and contribute to expanding its global networks, approximately 3000 copies of the English and Japanese versions of CONVERGENCE are distributed to domestic and overseas researchers, institutions, government offices and private companies in over 65 countries.

MANA Newsletter "CONVERGENCE"

No. 7
February 2011

Prof. Akira FUJISHIMA

No. 8
June 2011

Prof. Masakazu AONO

No. 9
December 2011

Prof. Koichi KITAZAWA

No. 10
February 2012

Prof. Sumio IIJIMA

No. 11
June 2012

Prof. Ei-ichi NEGISHI

No. 12
October 2012

Prof. Kazuhito HASHIMOTO

Fig. 7-8: Issues of the MANA newsletter "Convergence" published in 2011 and 2012.

7.6 Outreach Activities

It is one of the important roles for researchers to disseminate the practical side of research results and activities to attract interest in Science and Technology. In 2010 and 2011, MANA started active outreach activities to win recognition from the general public and children. In October 2010, the 1st MANA Science Café "Melting Pot Club" was held by Dr. Masakazu Aono (MANA Director-General). In March 2011, MANA hosted "Dr. Rohrer's Science Class 2011". Dr. Heinrich Rohrer, Nobel Laureate in Physics, gave a lecture "Science, Fascination and Passion" to 80 junior high-school students. In September 2011, MANA organized "Prof. Kroto's Science Class 2011" for preliminary school students (third and fourth grade) and their parents.

More recently, MANA participated together with other WPI Centers in outreach events coordinated by the World Premier International Research Initiative (WPI), as for example "Science Festa in Kyoto 2011" in December 2011 (see MANA Progress Report, Facts and Achievements 2011).

● **WPI Joint Exhibition at the 2012 AAAS Annual Meeting**

At the 2012 AAAS Annual Meeting in Vancouver, Canada, on February 16-20, the World Premier International Research Center Initiative (WPI) and Japan's Science Ministry (MEXT) hosted a joint exhibition booth in the Japan Pavilion. At the booth, outreach staff from WPI institutes and MEXT introduced the latest progress in various research fields at the WPI centers together with the effort to create an open and international research environment (see Fig. 7-9).

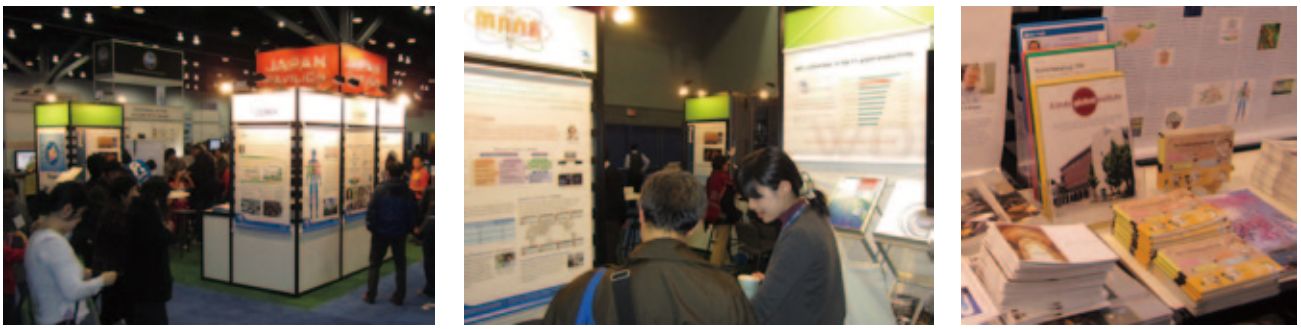


Fig. 7-9: The WPI booth in the Japan Pavilion at the 2012 AAAS Annual Meeting.

● **The 2nd WPI Joint Symposium: Inspiring Insights into Pioneering Scientific Research**

The 2nd WPI Joint Symposium organized by MANA was held at Tsukuba International Convention Center on November 24, 2012 with over 660 attendees. The symposium aimed to encourage close relationship between WPI centers and junior-high and high school students by providing opportunities of contact with cutting-edge science conducted at the research centers in the WPI Program. In the main hall, the symposium came really alive by research presentations of WPI Program Director Prof. Toshio Kuroki and researchers from six WPI centers, and a subsequently held science quiz event. At the booth exhibitions, held in the lobby, the participants attentively listened to the explanation about exhibited panels and experimental demonstrations. Also, the participants enjoyed talking with the speakers and staff from the WPI centers (see Fig. 7-10).

Fig. 7-10: The 2nd WPI Joint Symposium in Tsukuba. Left: Presentation by Dr. Masakazu Aono (MANA Director-General). Middle: Science quiz event for high-school students. Right: Dr. Renzhi Ma (MANA Scientist) explains at the MANA booth.

7.7 Media Coverage

MANA is featured in newspaper articles, on television and in international journals. Between October 2007 and March 2013, in the first 5 1/2 years of the MANA project, 316 press releases about MANA appeared in Japanese newspapers. This corresponds to an average number of 57.5 press releases per year and 4.8 press releases per month. To encourage foreign researchers to issue press releases, MANA has setup a support system.

● **MANA researchers featured in NHK BS Premium Program**

On January 1, 2012, the three MANA researchers Prof. James Gimzewski (MANA Satellite Principal Investigator), Dr. Masakazu Aono (MANA Director-General) and Dr. Genki Yoshikawa (MANA Independent Scientist) were featured on NHK in the BS Premium Program "Atom changes life" (see Fig. 7-11). It was the first part of the series “Nano Revolution” about the latest research results of nanotechnology. The program started with details about Prof. Gimzewski’s history and research. He talked about the development of new functional materials by nanotechnology and their future applications. Then Dr. Aono’s work, the development of an atomic switch, was highlighted as key research to realize a novel brain-type device. The later part of the program featured the development of a highly sensitive sensor by Dr. Yoshikawa with future applications in monitoring and security fields.

Fig. 7-11: The three MANA researchers Prof. James Gimzewski (MANA Satellite Principal Investigator, left), Dr. Masakazu Aono (MANA Director-General, middle) and Dr. Genki Yoshikawa (MANA Independent Scientist, right) were featured on NHK in the BS Premium Program "Atom changes life".

● **MANA Principal Investigator featured in Science**

In the column "Satellite Labs Extend Science" in volume 337 of Science, published on September 28, 2012, MANA Principal Investigator Omar M. Yaghi was featured about a new type of laboratories, where emerging nations seek access to world-class researchers.

7.8 Visitors to MANA

There are several kinds of short-time visitors to MANA.

(a) Researchers visiting MANA for scientific discussion, to give a seminar or to attend a workshop or symposium.
(b) Researchers or students invited to MANA for short-time research activities.
(c) MANA visit of Satellite Principal Investigators, MANA Advisors and Evaluation Committee members.
(d) General Visitors (excluding categories (a), (b), (c)).

Table 7-1: Number of short-time visitors to MANA.

	Total of Visitors (a), (b), (c), (d)	General Visitors (d)
Fiscal Year 2012	565	284
Fiscal Year 2011	248	108
Fiscal Year 2010	315	147

Due to the Great East Japan Earthquake and subsequent nuclear power plant incident in March 2011, the number of visitors to MANA first significantly decreased in Fiscal Year 2011 (April 2011 – March 2012), and strongly increased again in Fiscal Year 2012 (see Table 7-1). In Fiscal Year 2012, the 284 General Visitors to MANA came from all over the world: Europe (63), USA / Canada (27), Asia (156, including 115 from Japan) and other regions (38). In 2012, MANA Visitors included Government Officials (see Fig. 7-12), Top-class Scientists (see Fig. 7-13) and students (see Fig. 7-14).

Fig. 7-12: MANA Visit of Government Officials in 2012. Left: Dr. Stefan Noreén, Former Swedish Ambassador to Japan, Sweden, on May 11. Middle: Dr. Walter Steinmann, Director of Swiss Federal Office of Energy (SFOE), Switzerland, on June 20. Right: Prof. Chung-Yuan Mou, Deputy Minister of the Science Council, Taiwan, on September 5.

Fig. 7-13: MANA Visit of top-class Scientists in 2012. Left: Prof. Bjørn Hafskjold, Dean of Faculty of Natural Science and Technology, Norwegian University of Science and Technology, NTNU, on February 7. Middle: Prof. Motoko Kotani, Director of WPI-AIMR Center, Tohoku University, Sendai, Japan, on April 9. Right: Prof. Mevyn Miles FRS, Director of Centre for Nanoscience and Quantum Information (NSQI), University of Bristol, UK, on November 6-7.

Fig. 7-14: MANA Visit of Students in 2012. Left: Norwegian University of Science and Technology, NTNU, Norway, on March 29. Middle: Oklahoma State University, OSU, USA on May 17. Right: Swiss Federal School of Technology Lausanne, EPFL, Switzerland on July 19.

7.9 MANA Scientific Art Pictures

In November 2011, MANA Director-General Dr. Masakazu Aono has started a call to submit scientific art pictures. After a second call in October 2012, MANA has received over 100 scientific art pictures, which are being used to decorate empty walls in the MANA Building and the new WPI-MANA Building (see Figs. 7-15 and 7-16). In addition, MANA scientific art pictures have been used in MANA promotion videos, MANA original goods, NIMS brochures and NIMS greeting cards.

Fig.7-15: MANA scientific art pictures decorating the passage between the MANA Building and the new WPI-MANA Building.

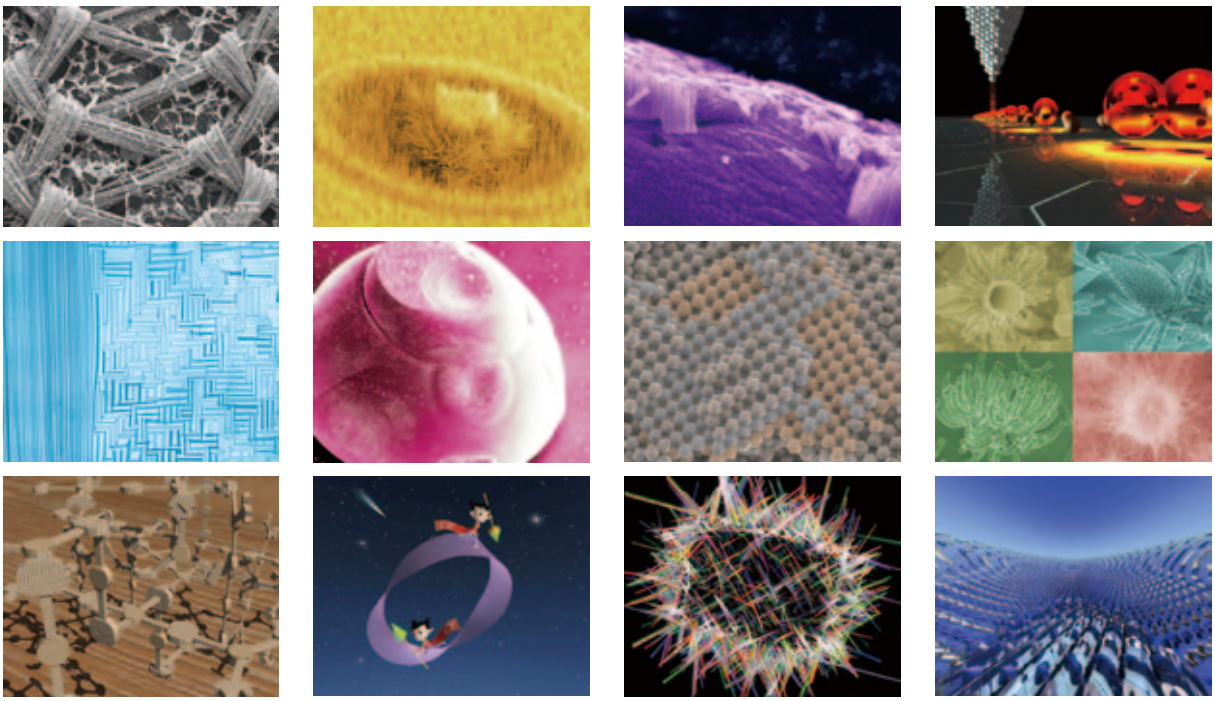


Fig. 7-16: Examples of MANA scientific art pictures.

7.10 MANA History

The MANA History between September 2007 and March 2013 can be found in Appendix 8.11.

Appendix 8.11: MANA History

Appendix 8.1: MANA Top Management

Yoshio BANDO
MANA Chief Operating Officer

Masakazu AONO
MANA Director-General

Takahiro FUJITA
MANA Administrative Director

Appendix 8.2: MANA Research Staff

MANA Principal Investigators (24):

Current as of January 1, 2013

Nano-Life Field (4)

Coordinator

Takao AOYAGI
NIMS

Guoping CHEN
NIMS

Yukio NAGASAKI
Univ. Tsukuba (Satellite)

Françoise M. WINNIK
Univ. Montreal (Satellite)

Nano-Materials Field (7)

Coordinator

Takayoshi SASAKI
NIMS

Katsuhiko ARIGA
NIMS

Yoshio BANDO
NIMS

Toyohiro CHIKYOW
NIMS

Dmitri GOLBERG
NIMS

Kazuo KADOWAKI
Univ. Tsukuba (Satellite)

Zhong Lin WANG
Georgia Tech (Satellite)

Nano-Power Field (4)

Coordinator

Kohei UOSAKI
NIMS

Kazunori TAKADA
NIMS

Omar YAGHI
UCLA

Jinhua YE
NIMS

Nano-System Field (9)

Coordinator

Masakazu AONO
NIMS

James K. GIMZEWSKI
UCLA (Satellite)

Tsuyoshi HASEGAWA
NIMS

Xiao HU
NIMS

Christian JOACHIM
CNRS (Satellite)

Tomonobu NAKAYAMA
NIMS

Hideaki TAKAYANAGI
Tokyo Univ. Sci. (Satellite)

Kazuhito TSUKAGOSHI
NIMS

Sir Mark E. WELLAND
Univ. Cambridge (Satellite)

Group Leaders (11), Associate PI (1), MANA Scientists (45): Current as of January 1, 2013

Nano-Materials Field (24)


Naoki FUKATA (Group Leader)


Takao MORI (Group Leader)


Takashi SEKIGUCHI (Group Leader)


Minoru OSADA (Associate PI)


Jun CHEN


Yasuo EBINA


Masahiro GOTO


Jonathan HILL


Yusuke IDE


Qingmin JI


Jin KAWAKITA


Naoyuki KAWAMOTO


Renzhi MA


Masanori MITOME


Takahiro NAGATA


Takayuki NAKANE


Isao OHKUBO


Tadashi OZAWA


Lok Kumar SHRESTHA


Ryutaro SOUDA


Yutaka WAKAYAMA


Shinjiro YAGYU


Yoshiyuki YAMASHITA


Michiko YOSHITAKE

Nano-Power Field (5)


Yoshitaka TATEYAMA (Group Leader)


Hiori KINO


Hidenori NOGUCHI


Tsuyoshi OHNISHI


Kentaro TASHIRO

Nano-System Field (10)


Tadaaki NAGAO (Group Leader)


Kazuya TERABE (Group Leader)


Hideo ARAKAWA


Masanori KOHNO


Katsumi NAGAOKA


Yuji OKAWA


Makoto SAKURAI


Yoshitaka SHINGAYA


Tohru TSURUOKA


Takashi UCHIHASHI

Nano-Life Field (18)


Nobutaka HANAGATA (Group Leader)


Masanori KIKUCHI (Group Leader)


Hisatoshi KOBAYASHI (Group Leader)


Akiyoshi TANIGUCHI (Group Leader)


Akiko YAMAMOTO (Group Leader)


Mitsuhiro EBARA


Giancarlo FORTE


Sachiko HIROMOTO


Yoshihisa KAIZUKA


Chiho KATAOKA


Kohsaku KAWAKAMI


Naoki KAWAZOE


Norio MARUYAMA


Tamaki NAGANUMA


Yasushi SUETSUGU


Tetsushi TAGUCHI


Tomohiko YAMAZAKI


Chiaki YOSHIKAWA

MANA Independent Scientists (12):

Current as of January 1, 2013

MANA Independent Scientists


Ryuichi ARAFUNE


Alexei A. BELIK


Ryoma HAYAKAWA


Joel HENZIE


Takeo MINARI


Satoshi MORIYAMA


Jun NAKANISHI


Naoto SHIRAHATA


Satoshi TOMINAKA


Katsunori WAKABAYASHI


Yusuke YAMAUCHI


Genki YOSHIKAWA

ICYS-MANA Researchers (9):

Current as of January 1, 2013

ICYS-MANA Researchers


Fatin HAJJAJ


Hicham HAMOUDI


Ming HU


Shinsuke ISHIHARA


Song-Lin LI


Liwen SANG


Daiming TANG


Ken WATANABE


Tianyou ZHAI

MANA Research Associates (41):

Current as of January 1, 2013

Nano-Materials Field (16)


Bishnu Prasad BASTAKOTI
Nepal


Watcharop CHAIKITTISILP
Thailand


Nethravathi CHIKKAVENKATASWAMY
India


Fengxia GENG
China


Kazuhiro HOSONO
Japan


Jan LABUTA
Czech


Baowen LI
China


Xia LI
China


Amir PAKDEL
Iran


Hoon Seok SEO
Korea


Ying SUN
China


Tatyana TERENTYEVA
Belgium


Chengxiang WANG
China


Xi WANG
China


Wei YI
China


Jun ZHANG
China

Nano-System Field (15)


Rhiannon CREASEY
Australia


Takami HINO
Japan


Chih-Wei HU
China


Xueyuan HU
China


Bhaskar KAVIRAJ
India

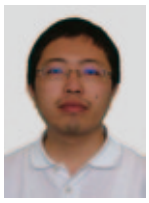

Pradyot KOLEY
India


Qifeng LIANG
China


Marina MAKAROVA
Russia


Saumya Ranyan MOHAPATRA
India


Kota SHIBA
Japan


Qi WANG
China


Yong XU
China


Rui YANG
China


Yiping YAO
China


Shunsuke YOSHIKAWA
Japan

Nano-Power Field (6)


Indrajit BHATTACHARYYA
India


Batu GHOSH
India


Qing KANG
China


Sajna KAPPAM VEETTIL
India


Lequan LIU
China


Lakshminarayanan PIRAMUTHU
India

Nano-Life Field (4)


Ida
DULINSKA-MOLAK
Poland


Lingfeng
GUO
China


Yiu Ting Richard
LAU
China

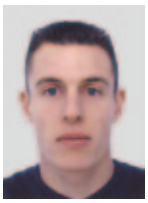

Jasmine
LI
Singapore

JSPS Fellows (11):

Current as of January 1, 2013

Nano-Materials Field (5)


Mao
LI
China


Wim Gustaaf Frans
VAN ROSSOM
Belgium


Julien
VIEAUD
France


Jianxun
XU
China


Cuifeng
ZHOU
Australia

Nano-System Field (2)


Sudipta
DUTTA
India


Puneet
MISHRA
India

Nano-Power Field (1)


Satoru
SATO
Japan

Nano-Life Field (3)


Song
CHEN
China


Naokazu
IDOTA
Japan


Stefania
PAGLIARI
Italy

Appendix 8.3: MANA Advisors

Advisors such as Nobel Prize Winners and world prominent researchers provide their experience and guide MANA researchers and scientists.

MANA Advisors (5):

Current as of January 1, 2013

Prof. Heinrich Rohrer
1986 Nobel Prize Winner in Physics
Switzerland

Prof. Sir Harry Kroto
1996 Nobel Prize Winner in Chemistry
Florida State University
USA

Prof. C.N.R. Rao
Honorary President of the
Jawaharlal Nehru Centre
for Advanced Scientific Research
India

Prof. Galen D. Stucky
University of California
Santa Barbara
USA

Prof. Teruo Kishi
Former President of NIMS
Japan

Appendix 8.4: MANA Evaluation Committee

Evaluation Committee members provide us their critical comments and expert recommendations on the operation and research strategy of the MANA project.

MANA Evaluation Committee members (10):

Current as of January 1, 2013

Chair

Anthony K. Cheetham
Professor
University of Cambridge,
UK

Takuzo Aida
Professor
University of Tokyo,
Japan

Morinobu Endo
Professor
Shinshu University,
Japan

Horst Hahn
Professor
Forschungszentrum Karlsruhe,
Germany

Kazuhito Hashimoto
Professor
University of Tokyo,
Japan

Yoshio Nishi
Professor
Stanford University,
USA

Manfred Rühle
Professor
Max Planck Institute,
Germany

Rodney S. Ruoff
Professor
The University of Texas,
USA

Louis Schlapbach
Professor
Former Director of EMPA
Switzerland

Kazunori Tanaka
Principal Fellow, JST
Center for Research
and Development Strategy
Japan

Appendix 8.5: MANA Seminars

List of MANA Seminars (January – December 2012):

1	2012 Jan 13 *Tunability of Electronic Transitions Using Interface of Coupled Quantum Structures* **Dr. Somobrata Acharya** Centre for Advanced Materials (CAM), Indian Association for the Cultivation of Science, **India**	12	2012 Feb 20 *Nanogenerators for self-powered system and piezotronics for active flexible electronics* **Prof. Zhong Lin Wang** School of Materials Science and Engineering, Georgia Institute of Technology, **USA**
2	2012 Jan 16 *Conformational analysis of receptor protein for biomimetic nanobio interface* **Dr. Keiichi Torimitsu** Basic Research Laboratories, Nippon Telegraph and Telephone Corporation (NTT), **Japan**	13	2012 Feb 24 *Graphene edges; its unconventional electronic structure and the origin of activities in graphene* **Prof. Toshiaki Enoki** Department of Chemistry Graduate School of Science and Engineering, Tokyo Institute of Technology, **Japan**
3	2012 Jan 16 *Atomic Force Microscopy Imaging of Receptor Proteins* **Prof. John Ryan** Clarendon Laboratory, University of Oxford, **UK**	14	2012 Mar 5 *Bridging the Interface: Observing and designing molecular magnetism* **Prof. Germar Hoffmann** Department of Physics, National Taiwan University, **Taiwan**
4	2012 Jan 17 *Nanostructured $BiFeO_3$ and its Electrical, Magnetic and Optical Behaviors* **Prof. Yuan-Hua Lin** Department of Materials Science and Engineering, Tsinghua University, **China**	15	2012 Mar 16 *Towards a tunable superconductivity transition in small molecule organic compounds by combined scanning probe microscopies* **Dr. César Moreno Sierra** ICYS-Sengen Researcher, NIMS, **Japan**
5	2012 Jan 19 *Bands of massless electrons and liquid lattice at the Pb/Si interface* **Prof. Han Woong Yeom** Pohang University of Science and Technology, **Korea**	16	2012 Mar 16 *Solution assembly of pi-containing small-molecule hydrophobic amphiphiles* **Dr. Martin Hollamby** ICYS-Sengen Researcher, NIMS, **Japan**
6	2012 Jan 19 *Quasicrystals: Novel templates for the growth of thin films with exotic- and nano-structures* **Prof. Hem Raj Sharma** Department of Physics, The University of Liverpool, **UK**	17	2012 Mar 16 *Self-assembled monolayer (SAM): The puzzle* **Dr. Hicham Hamoudi** ICYS-MANA Researcher, NIMS, **Japan**
7	2012 Jan 26 *Monitoring Plasmon-Assisted Photochemical Reaction in Ultra-Small Space by Surface-Enhanced Raman Scattering* **Prof. Kei Murakoshi** Department of Chemistry, Faculty of Science, Hokkaido University, **Japan**	18	2012 Mar 22 *The importance of non-covalent interactions in the process of structure determination, on physical properties and on crystal engineering* **Prof. Mark Elsegood** Chemistry Department, Loughborough University, **UK**
8	2012 Feb 3 *Understanding of Electron Transfer through a Single Molecule* **Prof. Jianwei Zhao** School of Chemistry and Chemical Engineering, Nanjing University, **China**	19	2012 Apr 10 *Biopolymer stabilized nanoparticles as catalysts for photocatalytic water oxidations* **Dr. Dominic Walsh** School of Chemistry, University of Bristol, **UK**
9	2012 Feb 10 *3D X-ray Microscopy – Extending Synchrotron Optics to the Materials Science Laboratory* **Dr. Eric Snyder and Dr. Arno Merkle** Xradia, Inc., **USA**	20	2012 Apr 20 *Hollow Microporous Nanostructures: Exquisite Construction of Prussian Blue Analogues* **Dr. Ming Hu** ICYS-MANA Researcher, NIMS, **Japan**
10	2012 Feb 17 *Grain boundary effect on oxygen diffusion in Ba-based perovskite oxides* **Dr. Ken Watanabe** ICYS-MANA Researcher, NIMS, **Japan**	21	2012 Apr 20 *Random Fan-Out State Induced by Site-Random Interlayer Couplings* **Dr. Ryo Tamura** ICYS-Sengen Researcher, NIMS, **Japan**
11	2012 Feb 17 *Exploration for magnetoelectric multiferroics showing strong magnetoelectric coupling* **Prof. Tsuyoshi Kimura** Division of Materials Physics, Graduate School of Engineering Science, Osaka University, **Japan**	22	2012 Apr 24 *Nanostructured materials and their functional applications* **Prof. Qiang Xu** National Institute of Advanced Industrial Science and Technology (AIST) and Kobe University, **Japan**

23	2012 May 7 *Photo-triggered assemblies of amphiphilic copolymers with and with no surfactants: experimental studies and model predicting the response to light* **Dr. Christophe Tribet** Department of Chemistry, The École normale supérieure (ENS), **France**
24	2012 May 11 *Graphene systems under external perturbations* **Prof. Young-Woo Son** School of Computational Sciences, Korea Institute for Advanced Study, **Korea**
25	2012 May 14 *RSC Publishing – Advancing the Chemical Sciences* **Dr. Jim Milne** Publishing Managing Director, The Royal Society of Chemistry, **UK**
26	2012 May 15 *The Importance of Packing: Manipulating Light and Matter at the Nanoscale for Chemical and Biochemical Sensing* **Dr. Joel Henzie** Department of Chemistry, University of California, Berkeley, **USA**
27	2012 May 17 *A New Polymeric "Nanogel" Carrier System for Delivery of Small Hydrophobic Drugs* **Prof. Allan Hoffman** Department of Bioengineering, University of Washington, **USA**
28	2012 May 18 *Photoelectrical energy-conversion devices based on III-Nitride semiconductors* **Dr. Liwen Sang** ICYS-MANA Researcher, NIMS, **Japan**
29	2012 May 18 *Growth of Single-layer Graphene and Hexagonal Boron Nitride on Metal Substrates* **Dr. Jianhua Gao** ICYS-Sengen Researcher, NIMS, **Japan**
30	2012 May 25 *New Trend of Functional Nanoporous Materials* **Dr. Yusuke Yamauchi** MANA Independent Scientist, NIMS, **Japan**
31	2012 Jun 1 *Your Nanostructure Exposed! A Thorough Look at Nanostructural Characterization with Small-Angle Scattering* **Dr. Brian Richard Pauw** ICYS-Sengen Researcher, NIMS, **Japan**
32	2012 Jun 1 *Graphene "Dopant": Ambipolar Engineering of Graphitic Carbon Nitride* **Dr. Yuanjian Zhang** ICYS-MANA Researcher, NIMS, **Japan**
33	2012 Jun 5 *Soft Confinement Effects for Designing Nanostructured Materials* **Prof. Ömer Dağ** Department of Chemistry, Bilkent University, **Turkey**
34	2012 Jun 6 *Use of Carbon Nanotubes in Novel Solar Cells* **Prof. Joseph G. Shapter** Flinders Centre for NanoScale Science & Technology, Flinders University, **Australia**
35	2012 Jun 6 *Organic Electronics – Investigations of Interfaces, Morphology and Design* **Prof. David Lewis** Flinders Centre for NanoScale Science & Technology, Flinders University, **Australia**
36	2012 Jun 8 *Electrochemistry of Graphene* **Prof. Martin Pumera** Division of Chemistry & Biological Chemistry, School of Physical and Mathematical Sciences, Nanyang Technological University, **Singapore**
37	2012 Jun 8 *Nanoscale Switching Behavior and Electronic Properties of Ultrathin Ferroelectric Structures* **Prof. Alexei Gruverman** Department of Physics and Astronomy, University of Nebraska-Lincoln, **USA**
38	2012 Jun 11 *XAS studies of fuel cell electrocatalysts* **Prof. Andrea Russell** School of Chemistry, University of Southampton, **UK**
39	2012 Jun 12 *Stability and Reversibility Control of Micropillar Assembly by Surface Chemistry: Expanding Application of Intramolecular Interactions at Solid/Liquid Interface* **Prof. Mariko Matsunaga** Department of Electrical, Electronic and Communication Engineering, Chuo University, **Japan**
40	2012 Jun 13 *Nano-Carbon Materials in Batteries and Solar Cells* **Dr. Sharali Malik** Institute of Nanotechnology, Karlsruhe Institute of Technology, **Germany**
41	2012 Jun 15 *Anion Chemistry in Solid State Materials: New routes to oxyfluoride materials* **Dr. Yoshihiro Tsujimoto** ICYS-MANA Researcher, NIMS, **Japan**
42	2012 Jun 15 *Development of high coercivity and performance Dy-free Nd-Fe-B permanent magnets* **Dr. Hossein Sepehri Amin** ICYS-Sengen Researcher, NIMS, **Japan**
43	2012 Jun 28 *Nanoscale Structures as Drug Carriers for Pharmaceutical Reformulation* **Prof. Xing-Jie Liang** Deputy Director, Key Laboratory for Biomedical Effects of Nanomaterials and Nanosafety, Chinese Academy of Sciences, **China**
44	2012 Jul 3 *Electronic Materials Engineering and Soft Matter Investigations: Towards stimulus responsive micro and nano-architectures* **Prof. Vincent Craig** Department of Applied Mathematics, Research School of Physics and Engineering, Australian National University, **Australia**
45	2012 Jul 6 *All-optical modulation and amplification in a photonic-crystal cavity with two-level systems* **Dr. Hiroyuki Takeda** ICYS-Sengen Researcher, NIMS, **Japan**

46	2012 Jul 6 *Electron emission from one-atom-thick surfaces of carbon nanotubes and graphene nanoribbons driven by internal electric field* **Dr. Xianlong Wei** ICYS-MANA Researcher, NIMS, **Japan**
47	2012 Jul 6 *Towards an atomistic picture of the active interface in dye sensitized solar cells* **Prof. Joost Van de Vondele** Nanoscale Simulations, Department of Materials, Swiss Federal Institute of Technology (ETH) Zurich, **Switzerland**
48	2012 Jul 13 *Research and Development work at NPL, New Delhi on metal-matrix composites reinforced with carbon nanotubes and BN nanotubes* **Dr. S. K. Singhal** Physics and Engineering of Carbon, National Physical Laboratory, **India**
49	2012 Jul 19 *Room-Temperature Ceramic-Based Composite Coating by Aerosol Deposition* **Prof. Song-Min Nam** College of Electronics & Information Engineering, Kwangwoon University, **Korea**
50	2012 Jul 19 *Macrocycles: Catalysis and beyond* **Prof. Carl Redshaw** School of Chemistry, University of East Anglia, **UK**
51	2012 Jul 20 *Optically- and electrically-driven dual-gate transistor with diarylethene photochromic channel layers* **Dr. Ryoma Hayakawa** ICYS-MANA Researcher, NIMS, **Japan**
52	2012 Jul 20 *Interfacial Interactions in High Efficiency Dye-sensitized Solar Cells* **Dr. Xudong Yang** ICYS-Sengen Researcher, NIMS, **Japan**
53	2012 Jul 27 *Probing the Dynamics of Andreev States in Coherent Normal/Superconducting Ring* **Prof. Meydi Ferrier** Solid State Physics Laboratory, Université Paris sud, Orsay, **France**
54	2012 Aug 6 *Phase Transitions and Ordered Phases in the Monolayers at the Air-Water Interface* **Prof. Md. Mufazzal Hossain** Department of Chemistry, University of Dhaka, **Bangladesh**
55	2012 Aug 28 *Remote excitation of SERS/Fluorescence on sub-diffraction limited plasmonic waveguide* **Prof. Hiroshi Uji-i** Department of Chemistry, Katholieke Universiteit Leuven, **Belgium**
56	2012 Sep 7 *One-step route to functional hybrid nanocomposites* **Dr. Zoe Schnepp** ICYS-Sengen Researcher, NIMS, **Japan**
57	2012 Sep 7 *One-Dimensional CdS Nanostructures: From Synthesis to Applications* **Dr. Tianyou Zhai** ICYS-MANA Researcher, NIMS, **Japan**
58	2012 Sep 14 *High-yield Preparation, Chemical Exfoliation and Structural Modification of Layered Transition-metal Hydroxide Nanocones* **Prof. Xiaohe Liu** Dept of Inorganic Materials, School of Minerals Processing and Bioengineering, Central South University, **China**
59	2012 Sep 21 *Surfactant induced morphological modifications of crystalline C_{60}* **Dr. Lok K. Shrestha** MANA Scientist, NIMS, **Japan**
60	2012 Sep 21 *Application of Mesoporous Silica Particles as Smart Inorganic Filler Materials* **Dr. Norihiro Suzuki** ICYS-Sengen Researcher, NIMS, **Japan**
61	2012 Sep 24 *An Electronically Integrated $TiO_{2-x}N_x$ + Au Nanocomposite for Solar H_2 Generation* **Dr. C. S. Gopinath** Catalysis Division and Center of Excellence on Surface Science, National Chemical Laboratory, **India**
62	2012 Sep 27 *Self-directed structuring of hybrid silicas and their functionalization* **Dr. Michel Wong Chi Man** Institut Charles Gerhardt, Montpellier, **France**
63	2012 Sep 28 *Something New in Bio-Nanotechnology* **Dr. Masahiko Hara** Director of RIKEN-HYU Collaboration Research Center, RIKEN Advanced Science Institute, **Japan**
64	2012 Oct 4 *Hollow Micro/Nano Materials* **Prof. Fangli Yuan** Institute of Process Engineering, Chinese Academy of Science, **China**
65	2012 Oct 5 *Understanding and Tailoring the Biological-Material Interface* **Prof. Robert Short** Director of Mawson Institute, University of South Australia, **Australia**
66	2012 Oct 5 *An ultra-bright and monochromatic electron point source enabled by nanotechnology* **Dr. Han Zhang** ICYS-Sengen Researcher, NIMS, **Japan**
67	2012 Oct 5 *Tailoring Nano- and Micro-Structure of Copper(II) Oxide toward PGM-free Exhaust Catalyst* **Dr. Shinsuke Ishihara** ICYS-MANA Researcher, NIMS, **Japan**
68	2012 Oct 12 *Control of wettability on solid surfaces, and scope for its applications* **Prof. Naoya Yoshida** Department of Environmental and Energy Chemistry, Kogakuin University, **Japan**
69	2012 Oct 12 *Hydroxyapatite and Silicate Bioceramics: from Morphology and Composition Control to Applications* **Prof. Kaili Lin** Shanghai Institute of Ceramics, Chinese Academy of Sciences, **China**

70	2012 Oct 19 *Mechanical Properties of 1-D Materials by In Situ Transmission Electron Microscopy* **Dr. Daiming Tang** ICYS-MANA Researcher, NIMS, **Japan**	80	2012 Nov 16 *Thin-film photovoltaic cells based on III-Nitride semiconductors* **Dr. Liwen Sang** ICYS-MANA Researcher, NIMS, **Japan**
71	2012 Oct 19 *Characterization of pentacene on $Ti0_2$(101) by simultaneous STM/AFM* **Dr. Cesar Moreno** ICYS-Sengen Researcher, NIMS, **Japan**	81	2012 Nov 16 *Control of Order of Phase Transition by Distortion Effect in Frustrated System* **Dr. Ryo Tamura** ICYS-Sengen Researcher, NIMS, **Japan**
72	2012 Oct 24 *Fluorescence Modulation in Self-assembled π-Gels* **Dr. Ayyappanpillai Ajayaghosh** National Institute of Interdisciplinary Science and Technology (NIIST), CSIR, **India**	82	2012 Nov 28 *Gradient-Index Optics and Concentrating Photovoltaics* **Prof. Duncan Moore** Rudolf and Hilda Kingslake Professor of Optical Engineering, Vice Provost for Center for Entrepreneurship, University of Rochester, **USA**
73	2012 Oct 26 *Growth of Mn_5Ge_3 multilayers for spintronic and biosensor* **Prof. Matthieu Petit** Aix-Marseille University - Polytech'Marseille/CINaM-CNRS, **France**	83	2012 Dec 7 *Growth of Single-layer Graphene on Single Crystal Pt(111) Substrates* **Dr. Jianhua Gao** ICYS-Sengen Researcher, NIMS, **Japan**
74	2012 Oct 26 *From thiacalix[n]arenes to azacalix[n]arenes toward new opportunities and new applications* **Prof. Jean-Manuel Raimundo** Aix-Marseille University, CINaM UMR CNRS 7325, Chemistry Department, Molecular Engineering and Functional Materials, **France**	84	2012 Dec 7 *Oxygen diffusion study on mixed ionic-electronic conductive oxides* **Dr. Ken Watanabe** ICYS-MANA Researcher, NIMS, **Japan**
75	2012 Nov 2 *Hydrophobic amphiphilicity – from micelles to larger assemblies* **Dr. Martin Hollamby** ICYS-Sengen Researcher, NIMS, **Japan**	85	2012 Dec 14 *Soluble carbon nanotubes -fundamental and advanced materials design-* **Prof. Naotoshi Nakashima** Department of Applied Chemistry, Kyushu University, **Japan**
76	2012 Nov 2 *Rapid thickness identification and electronic transport in MoS_2 atomic sheets* **Dr. Song-Lin Li** ICYS-MANA Researcher, NIMS, **Japan**	86	2012 Dec 14 *Simulation of charge transfer: from oxides to organic semiconductors to proteins* **Prof. Jochen Blumberger** Department of Physics and Astronomy, University College London (UCL), **UK**
77	2012 Nov 9 *Patterned Organic Crystals from a Direct Spin-coating Process for Transistor Arrays* **Prof. Yun Li** School of Electronic Science & Engineering, Nanjing University, **China**	87	2012 Dec 21 *Spreading dynamics of a dye doped smectic liquid crystal domain at air-water interface* **Dr. P. Viswanath** Centre for Soft Matter Research, **India**
78	2012 Nov 9 *Effect of Ce(III) on Electroploymerization of Aniline onto Active Metal Substrate* **Prof. Amar Prasad Yadav** Central Department of Chemistry, Tribhuvan University, **Nepal**	88	2012 Dec 26 *Spin transport in Graphene* **Prof. Barbaros Özyilmaz** Department of Physics & NanoCore & Graphene Research Center, National University of Singapore, **Singapore**
79	2012 Nov 14 *Chemistry of Graphene Oxide and its Hybrid Nanomaterials* **Prof. Byeong-Su Kim** Interdisciplinary School of Green Energy, Ulsan National Institute of Science and Technology (UNIST), **Korea**	89	2012 Dec 27 *Imaging and manipulating molecular quantum states in an STM tunnel junction* **Dr. We-Hyo Soe** Institute of Materials, Research and Engineering, A*STAR, **Singapore**

Appendix 8.6: MANA Research Papers 2012

List of refereed Research Papers 2012 in English with MANA Affiliation published in scientific journals (436 papers):

1	Z. Ahmed, S. Belitto, M.L. Di Vona, M. Trombetta, E. Traversa, S. Licoccia, *Sulphonated poly ether ether ketone/amino-diphenylsilandiol composite electrolyte for PEM fuel cells,* Journal of Applied Polymer Science **124**(3), 2610 (2012). doi: 10.1002/app.34906 Published: MAY 2012. Field: Nano-Green. MANA Affiliation: yes.
2	K. Akatsuka, G. Takanashi, Y. Ebina, M. Haga, T. Sasaki, *Electronic Band Structure of Exfoliated Titanium- and/or Niobium-Based Oxide Nanosheets Probed by Electrochemical and Photoelectrochemical Measurements*, Journal of Physical Chemistry C **116**(23), 12426 (2012). doi: 10.1021/jp302417a Published: JUN 2012. Field: Nano-Materials. MANA Affiliation: yes.
3	A.M. Ako, M.S. Alam, M. Rahman, J.P. Hill, N.M. Snachez-Ballester, K. Ariga, G. Buth, C.E. Anson, A.K. Powell, *Self-Assembly of a Mononuclear [Fe^{III}(L)(EtOH)$_2$] Complex Bearing an n-Dodecyl Chain on Solid Highly Oriented Pyrolytic Graphite Surfaces*, Chemistry - A European Journal **18**(51), 16419 (2012). doi: 10.1002/chem.201202858 Published: DEC 2012. Field: Nano-Materials. MANA Affiliation: yes.
4	C. Anand, P. Srinivasu, G.P. Mane, S.N. Talapaneni, D.S. Dhawale, M.A. Wahab, S.V. Priya, S. Varghese, Y. Sugi, A. Vinu, *Preparation of mesoporous titanosilicate molecular sieves with a cage type 3D porous structure for cyclohexene epoxidation*, Microporous and Mesoporous Materials **160**, 159 (2012). doi: 10.1016/j.micromeso.2012.05.014 Published: SEP 2012. Field: Nano-Materials. MANA Affiliation: yes.
5	A. Aparecido-Ferreira, H. Miyazaki, S.L. Li, K. Komatsu, S. Nakaharai, K. Tsukagoshi, *Enhanced current-rectification in bilayer graphene with an electrically tuned sloped bandgap*, Nanoscale **4**(24), 7842 (2012). doi: 10.1039/C2NR32526H Published: JUN 2012. Field: Nano-System. MANA Affiliation: yes.
6	R. Arafune, H.J. Shin, J. Jung, E. Minamitani, N. Takagi, Y. Kim, M. Kawai, *Combined Scanning Tunneling Microscopy and High-Resolution Electron Energy Loss Spectroscopy Study on the Adsorption State of CO on Ag(001)*, Langmuir **28**(37), 13249 (2012). doi: 10.1021/la3024088 Published: SEP 2012. Field: Nano-Materials. MANA Affiliation: yes.
7	K. Ariga, S. Ishihara, H. Abe, M. Li, J.P. Hill, *Materials nanoarchitectonics for environmental remediation and sensing*, Journal of Materials Chemistry **22**(6), 2369 (2012). doi: 10.1039/C1JM14101E Published: FEB 2012. Field: Nano-Materials. MANA Affiliation: yes.
8	K. Ariga, H. Ito, J.P. Hill, H. Tsukube, *Molecular recognition: from solution science to nano/materials technology*, Chemical Society Reviews **41**(17), 5800 (2012). doi: 10.1039/C2CS35162E Published: SEP 2012. Field: Nano-Materials. MANA Affiliation: yes.
9	K. Ariga, Q. Ji, J.P. Hill, Y. Bando, M. Aono, *Forming nanomaterials as layered functional structures toward materials nanoarchitectonics*, NPG Asia Materials **4**, e17 (2012). doi: 10.1038/am.2012.30 Published: MAY 2012. Field: Nano-Materials, Nano-System. MANA Affiliation: yes.
10	K. Ariga, Q. Ji, M.J. McShane, Y.M. Lvov, A. Vinu, J.P. Hill, *Inorganic Nanoarchitectonics for Biological Applications*, Chemistry of Materials **24**(5), 728 (2012). doi: 10.1021/cm202281m Published: MAR 2012. Field: Nano-Materials. MANA Affiliation: yes.
11	K. Ariga, Q. Ji, G.J. Richards, J.P. Hill, *Soft Capsules, Hard Capsules, and Hybrid Capsules*, Soft Materials **10**(4), 387 (2012). doi: 10.1080/1539445X.2010.523751 Published: OCT 2012. Field: Nano-Materials. MANA Affiliation: yes.
12	K. Ariga, T. Mori, J.P. Hill, *Mechanical Control of Nanomaterials and Nanosystems*, Advanced Materials **24**(2), 158 (2012). doi: 10.1002/adma.201102617 Published: JAN 2012. Field: Nano-Materials. MANA Affiliation: yes.
13	K. Ariga, T. Mori, J.P. Hill, *Evolution of molecular machines: from solution to soft matter interface*, Soft Matter **8**(1), 15 (2012). doi: 10.1039/C1SM06832F Published: JAN 2012. Field: Nano-Materials. MANA Affiliation: yes.
14	K. Ariga, A. Vinu, Y. Yamauchi, Qingmin Ji, J.P. Hill, *Nanoarchitectonics for Mesoporous Materials,* Bulletin of the Chemical Society of Japan **85**(1), 1 (2012). doi: 10.1246/bcsj.20110162 Published: JAN 2012. Field: Nano-Materials. MANA Affiliation: yes.
15	H. Ataee-Esfahani, Y. Nemoto, M. Imura, Y. Yamauchi, *Facile Synthesis of Nanoporous Pt–Ru Alloy Spheres with Various Compositions toward Highly Active Electrocatalysts*, Chemistry – An Asian Journal **7**(5), 876 (2012). doi: 10.1002/asia.201200053 Published: MAY 2012. Field: Nano-Materials. MANA Affiliation: yes.
16	A.V. Avizienis, H.O. Sillin, C. Martin-Olmos, H.H. Shieh, M. Aono, A.Z. Stieg, J.K. Gimzewski, *Neuromorphic Atomic Switch Networks*, Plos One **7**(8), e42772 (2012). doi: 10.1371/journal.pone.0042772 Published: AUG 2012. Field: Nano-System. MANA Affiliation: yes.
17	U. Balakrishnan, N. Ananthi, S. Velmathi, M.R. Benzigar, S.N. Talapaneni, S.S. Aldeyab, K. Ariga, A. Vinu, *Immobilization of chiral amide derived from (1R,2S)-(−)-norephedrine over 3D nanoporous silica for the enantioselective addition of diethylzinc to aldehydes*, Microporous and Mesoporous Materials **155**, 40 (2012). doi: 10.1016/j.micromeso.2012.01.005 Published: JUN 2012. Field: Nano-Materials. MANA Affiliation: yes.

18	B.P. Bastakoti, L.C. Chen, K.C.W. Wu, Y. Yamauchi, *Block copolymer assisted synthesis of porous α-Ni(OH)$_2$ microflowers with high surface areas as electrochemical pseudocapacitor materials,* Chemical Communications **48**(73), 9150 (2012). doi: 10.1039/c2cc32945j Published: SEP 2012. Field: Nano-Materials. MANA Affiliation: yes.
19	B.P. Bastakoti, M. Imura, Y. Nemoto, Y. Yamauchi, *Synthesis of MoO_3 nanotubes by thermal mesostructural transition of spherical triblock copolymer micelle templates*, Chemical Communications **48**(99), 12091 (2012). doi: 10.1039/C2CC36287B Published: DEC 2012. Field: Nano-Materials. MANA Affiliation: yes.
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387	J.S. Wi, L.K. Shrestha, T. Nagao, *Topographically controlled growth of silver nanoparticle clusters*, Physica Status Solidi – Rapid Research Letters **6**(5), 202 (2012). doi: 10.1002/pssr.201206082 Published: MAY 2012. Field: Nano-Materials, Nano-System. MANA Affiliation: yes.
388	J.S. Wi, S. Tominaka, K. Uosaki, T. Nagao, *Porous gold nanodisks with multiple internal hot spots*, Physical Chemistry Chemical Physics **14**(25), 9131 (2012). doi: 10.1039/c2cp40578d Published: JUL 2012. Field: Nano-System, Nano-Green. MANA Affiliation: yes.

389	J. Williams, H. Yoshikawa, S. Ueda, Y. Yamashita, K. Kobayashi, Y. Adachi, H. Haneda, T. Ohgaki, H. Miyazaki, T. Ishigaki, N. Ohashi, *Polarity-dependent photoemission spectra of wurtzite-type zinc oxide*, Applied Physics Letters **100**(5), 051902 (2012). doi: 10.1063/1.3673553 Published: JAN 2012. Field: Nano-Materials. MANA Affiliation: yes.
390	K.C.W. Wu, Y. Yamauchi, *Controlling physical features of mesoporous silica nanoparticles (MSNs) for emerging applications*, Journal of Materials Chemistry **22**(4), 1251 (2012). doi: 10.1039/C1JM13811A Published: JAN 2012. Field: Nano-Materials. MANA Affiliation: yes.
391	L.H. Wu, Q.F. Liang, Z. Wang, X. Hu, *Chiral Majorana fermion edge states in a heterostructure of superconductor and semiconductor with spin-orbit coupling*, Journal of Physics: Conference Series **393**, 012018 (2012). doi: 10.1088/1742-6596/393/1/012018 Published: NOV 2012. Field: Nano-System. MANA Affiliation: yes.
392	X. Wu, J.G. Li, Q. Zhu, J. Li, R. Ma, T. Sasaki, X. Li, X. Sun, Y. Sakka, *The effects of Gd^{3+} substitution on the crystal structure, site symmetry, and photoluminescence of Y/Eu layered rare-earth hydroxide (LRH) nanoplates*, Dalton Transactions **41**(6), 1854 (2012). doi: 10.1039/C1DT11332A Published: FEB 2012. Field: Nano-Materials. MANA Affiliation: yes.
393	G. Xi, S. Ouyang, P. Li, J. Ye, Q. Ma, N. Su, H. Bai, C. Wang, *Ultrathin W18O49 Nanowires with Diameters below 1 nm: Synthesis, Near-Infrared Absorption, Photoluminescence, and Photochemical Reduction of Carbon Dioxide*, Angewandte Chemie – International Edition **51**(10), 2395 (2012). doi: 10.1002/anie.201107681 Published: MAR 2012. Field: Nano-Green. MANA Affiliation: yes.
394	G. Xi, J. Ye, Q. Ma, N. Su, H. Bai, C. Wang, *In Situ Growth of Metal Particles on 3D Urchin-like WO_3 Nanostructures*, Journal of the American Chemical Society **134**(15), 6508 (2012). doi: 10.1021/ja211638e Published: APR 2012. Field: Nano-Green. MANA Affiliation: yes.
395	Y. Xie, Y. Ding, X. Li, C. Wang, J.P. Hill, K. Ariga, W. Zhang, W. Zhu, *Selective, sensitive and reversible "turn-on" fluorescent cyanide probes based on 2,2'-dipyridylaminoanthracene–Cu^{2+} ensembles*, Chemical Communications **48**(94), 11513 (2012). doi: 10.1039/C2CC36140J Published: DEC 2012. Field: Nano-Materials. MANA Affiliation: yes.
396	H. Xu, X. Chen, S. Ouyang, T. Kako, J. Ye, *Size-Dependent Mie's Scattering Effect on TiO_2 Spheres for the Superior Photoactivity of H_2 Evolution*, Journal of Physical Chemistry C **116**(5), 3833 (2012). doi: 10.1021/jp209378t Published: FEB 2012. Field: Nano-Green. MANA Affiliation: yes.
397	J.Q. Xu, T. Mori, Y. Bando, D. Golberg, D. Berthebaud, A. Prytuliak, *Synthesis of CeB_6 thin films by physical vapor deposition and their field emission investigations*, Materials Science and Engineering B **177**(1), 117 (2012). doi: 10.1016/j.mseb.2011.09.038 Published: JAN 2012. Field: Nano-Materials. MANA Affiliation: yes.
398	J.Q. Xu, H. Onodera, T. Sekiguchi, D. Golberg, Y. Bando, T. Mori, *Fabrication, characterization, cathodoluminescence, and field-emission properties of silica (SiO_2) nanostructures*, Materials Characterization **73**, 81 (2012). doi: 10.1016/j.matchar.2012.08.001 Published: NOV 2012. Field: Nano-Materials. MANA Affiliation: yes.
399	L. Xu, A. Yamamoto, *In vitro degradation of biodegradable polymer-coated magnesium under cell culture condition*, Applied Surface Science **258**(17), 6353 (2012). doi: 10.1016/j.apsusc.2012.03.036 Published: JUN 2012. Field: Nano-Bio. MANA Affiliation: yes.
400	L. Xu, A. Yamamoto, *Characteristics and cytocompatibility of biodegradable polymer film on magnesium by spin coating*, Colloids and Surfaces B **93**, 67 (2012). doi: 10.1016/j.colsurfb.2011.12.009 Published: MAY 2012. Field: Nano-Bio. MANA Affiliation: yes.
401	X. Xu, T. Zhai, M. Shao, J. Huang, *Anodic formation of anatase TiO_2 nanotubes with rod-formed walls for photocatalysis and field emitters*, Physical Chemistry Chemical Physics **14**(47), 16371 (2012). doi: 10.1039/C2CP43168H Published: DEC 2012. Field: Nano-Materials. MANA Affiliation: yes.
402	Y. Xu, P. Darmawan, C. Liu, Y. Li, T. Minari, G. Ghibaudo, K. Tsukagoshi, *Tunable contact resistance in double-gate organic field-effect transistors*, Organic Electronics **13**(9), 1583 (2012). doi: 10.1016/j.orgel.2012.05.008 Published: SEP 2012. Field: Nano-System. MANA Affiliation: yes.
403	H. Yamada, C. Urata, Y. Aoyama, S. Osada, Y. Yamauchi, K. Kuroda, *Preparation of Colloidal Mesoporous Silica Nanoparticles with Different Diameters and Their Unique Degradation Behavior in Static Aqueous Systems*, Chemistry of Materials **24**(8), 1462 (2012). doi: 10.1021/cm3001688 Published: APR 2012. Field: Nano-Materials. MANA Affiliation: yes.
404	M. Yamaguchi, D.M. Tang, C. Zhi, Y. Bando, D. Shtansky, D. Golberg, *Synthesis, structural analysis and in situ transmission electron microscopy mechanical tests on individual aluminum matrix/boron nitride nanotube nanohybrids*, Acta Materialia **60**(17), 6213 (2012). doi: 10.1016/j.actamat.2012.07.066 Published: OCT 2012. Field: Nano-Materials. MANA Affiliation: yes.
405	M. Yamamoto, K. Wakabayashi, *Magnetic response of conductance peak structure in junction-confined graphene nanoribbons*, Nanoscale **4**(4), 1138 (2012). doi: 10.1039/C1NR11056J Published: FEB 2012. Field: Nano-System. MANA Affiliation: yes.
406	Y. Yamauchi, T. Itagaki, T. Yokoshima, K. Kuroda, *Preparation of Ni nanoparticles between montmorillonite layers utilizing dimethylaminoborane as reducing agent*, Dalton Transactions **41**(4), 1210 (2012). doi: 10.1039/C1DT11395J Published: JAN 2012. Field: Nano-Materials. MANA Affiliation: yes.

407	Y. Yamauchi, A. Tonegawa, M. Komatsu, H. Wang, L. Wang, Y. Nemoto, N. Suzuki, K. Kuroda, *Electrochemical Synthesis of Mesoporous Pt–Au Binary Alloys with Tunable Compositions for Enhancement of Electrochemical Performance*, Journal of the American Chemical Society **134** (11), 5100 (2012). doi: 10.1021/ja209044g Published: MAR 2012. Field: Nano-Materials. MANA Affiliation: yes.
408	T. Yamazaki, *An Amperometric Sensor Based on Gold Electrode Modified by Soluble Molecularly Imprinted Catalyst for Fructosyl Valine*, Electrochemistry **80**(5), 353 (2012). doi: 10.5796/electrochemistry.80.353 Published: MAY 2012. Field: Nano-Bio. MANA Affiliation: yes.
409	R. Yang, K. Terabe, G. Liu, T. Tsuruoka, T. Hasegawa, J.K. Gimzewski, M. Aono, *On-Demand Nanodevice with Electrical and Neuromorphic Multifunction Realized by Local Ion Migration*, ACS Nano **6**(11), 9515 (2012). doi: 10.1021/nn302510e Published: NOV 2012. Field: Nano-System. MANA Affiliation: yes.
410	R. Yang, K. Terabe, T. Tsuruoka, T. Hasegawa, M. Aono, *Oxygen migration process in the interfaces during bipolar resistance switching behavior of WO_{3-x}-based nanoionics devices*, Applied Physics Letters **100**(23), 231603 (2012). doi: 10.1063/1.4726084 Published: JUN 2012. Field: Nano-System. MANA Affiliation: yes.
411	W. Yi, Y. Matsushita, M. Tanaka, A.A. Belik, *High-Pressure Synthesis, Crystal Structure, and Properties of Bi-Pd_2O_4 with Pd^{2+} and Pd^{4+} Ordering and $PbPd_2O_4$*, Inorganic Chemistry **51**(14), 7650 (2012). doi: 10.1021/ic3006579 Published: JUL 2012. Field: Nano-Materials. MANA Affiliation: yes.
412	S. Yin, K. Terabe, M.F. Toney, V. Subramanian, *Effect of sintering conditions on mixed ionic-electronic conducting properties of silver sulfide nanoparticles*, Journal of Applied Physics **111**(5), 053530 (2012). doi: 10.1063/1.3693310 Published: MAR 2012. Field: Nano-System. MANA Affiliation: yes.
413	R. Yogamalar, P.S. Venkateswaran, M.R. Benzigar, K. Ariga, A. Vinu, A.C. Bose, *Dopant Induced Bandgap Narrowing in Y-Doped Zinc Oxide Nanostructures*, Journal of Nanoscience and Nanotechnology **12**(1), 75 (2012). doi: 10.1166/jnn.2012.5760 Published: JAN 2012. Field: Nano-Materials. MANA Affiliation: yes.
414	K. Yokota, J. Takeda, C. Dang, G. Han, D.N. McCarthy, T. Nagao, S. Hishita, M. Kitajima, I. Katayama, *Surface metallic states in ultrathin Bi(001) films studied with terahertz time-domain spectroscopy*, Applied Physics Letters **100**(25), 251605 (2012). doi: 10.1063/1.4729149 Published: JUN 2012. Field: Nano-System. MANA Affiliation: yes.
415	C. Yoshikawa, S. Hattori, T. Honda, C.F. Huang, H. Kobayashi, *Non-biofouling property of well-defined concentrated poly(2-hydroxyethyl methacrylate) brush*, Materials Letters **83**, 140 (2012). doi: 10.1016/j.matlet.2012.05.123 Published: SEP 2012. Field: Nano-Bio. MANA Affiliation: yes.
416	G. Yoshikawa, T. Akiyama, F. Loizeau, K. Shiba, S. Gautsch, T. Nakayama, P. Vettiger, N.F. de Rooij, M. Aono, *Two Dimensional Array of Piezoresistive Nanomechanical Membrane-Type Surface Stress Sensor (MSS) with Improved Sensitivity*, Sensors **12**(11), 15873 (2012). doi: 10.3390/s121115873 Published: NOV 2012. Field: Nano-System. MANA Affiliation: yes.
417	K. Yoshimatsu, T. Yamazaki, I.S. Chronakis, L. Ye, *Influence of template/functional monomer/cross-linking monomer ratio on particle size and binding properties of molecularly imprinted nanoparticles*, Journal of Applied Polymer Science **124**(2), 1249 (2012). doi: 10.1002/app.35150 Published: APR 2012. Field: Nano-Bio. MANA Affiliation: yes.
418	K. Yoshimoto, R. Kojima, E. Takahashi, M. Ichino, H. Miyoshi, Y. Nagasaki, *3D Cell Co-culture System on Hydrogel Micro-Patterned Surface Fabricated by Photolithography*, Journal of Photopolymer Science and Technology **25**(1), 47 (2012). doi: 10.2494/photopolymer.25.47 Published: JUL 2012. Field: Nano-Bio. MANA Affiliation: yes.
419	M. Yoshitake, *Prediction of Influence of Oxygen in Annealing Atmosphere on Surface Segregation Behavior in Layered Materials*, Japanese Journal of Applied Physics **51**(8), 085601 (2012). doi: 10.1143/JJAP.51.085601 Published: AUG 2012. Field: Nano-Materials. MANA Affiliation: yes.
420	T. Yoshitomi, Y. Nagasaki, *Design and Preparation of a Nanoprobe for Imaging Inflammation Sites*, Biointerphases **7**, 7 (2012). doi: 10.1007/s13758-011-0007-5 Published: FEB 2012. Field: Nano-Bio. MANA Affiliation: yes.
421	T. Yoshitomi, Y. Yamaguchi, A. Kikuchi, Y. Nagasaki, *Creation of a blood-compatible surface: A novel strategy for suppressing blood activation and coagulation using a nitroxide radical-containing polymer with reactive oxygen species scavenging activity*, Acta Biomaterialia **8**(3), 1323 (2012). doi: 10.1016/j.actbio.2011.11.029 Published: MAR 2012. Field: Nano-Bio. MANA Affiliation: yes.
422	X. Yuan, D. Fabregat, K. Yoshimoto, Y. Nagasaki, *High PEGylation efficiency of pentaethylenehexamine-end poly(ethylene glycol) (mPEG-N6) for active-ester surface*, Colloids and Surfaces B **92**, 25 (2012). doi: 10.1016/j.colsurfb.2011.11.013 Published: APR 2012. Field: Nano-Bio. MANA Affiliation: yes.
423	X. Yuan, D. Fabregat, K. Yoshimoto, Y. Nagasaki, *Development of a high-performance immunolatex based on "soft landing" antibody immobilization mechanism*, Colloids and Surfaces B **99**, 45 (2012). doi: 10.1016/j.colsurfb.2011.09.040 Published: NOV 2012. Field: Nano-Life. MANA Affiliation: yes.
424	M.B. Zakaria, N. Suzuki, K. Shimasaki, N. Miyamoto, Y.T. Huang, Y. Yamauchi, *Synthesis of Mesoporous Titania Nanoparticles with Anatase Frameworks and Investigation of Their Photocatalytic Performance*, Journal of Nanoscience and Nanotechnology **12**(6), 4502 (2012). doi: 10.1166/jnn.2012.6205 Published: JUN 2012. Field: Nano-Materials. MANA Affiliation: yes.

425	W. Zhai, H. Lu, L. Chen, X. Lin, Y. Huang, K. Dai, N. Kawazoe, G. Chen, J. Chang, *Silicate bioceramics induce angiogenesis during bone regeneration*, Acta Biomaterialia **8**(1), 341 (2012). doi: 10.1016/j.actbio.2011.09.008 Published: JAN 2012. Field: Nano-Bio. MANA Affiliation: yes.
426	H.X. Zhang, M. Kato, Y. Sasaki, T. Ohba, H. Ito, A. Kobayashi, H.C. Chang, K. Uosaki, *Terpyridine platinum(II) complexes containing triazine di- or tri-thiolate bridges: structures, luminescence, electrochemistry, and aggregation*, Dalton Transactions **41**(37), 11497 (2012). doi: 10.1039/c2dt30997a Published: OCT 2012. Field: Nano-Power. MANA Affiliation: yes.
427	H. Zhang, T. Yamazaki, C. Zhi, N. Hanagata, *Identification of a boron nitride nanosphere-binding peptide for the intracellular delivery of CpG oligodeoxynucleotides*, Nanoscale **4**(20), 6343 (2012). doi: 10.1039/C2NR31189E Published: OCT 2012. Field: Nano-Life. MANA Affiliation: yes.
428	J. Zhang, H.P. Lang, G. Yoshikawa, C. Gerber, *Optimization of DNA Hybridization Efficiency by pH-Driven Nanomechanical Bending*, Langmuir **28**(15), 6494 (2012). doi: 10.1021/la205066h Published: APR 2012. Field: Nano-System. MANA Affiliation: yes.
429	K. Zhang, S. Zhang, K. Sodeyama, X. Yang, H. Chen, M. Yanagida, Y. Tateyama, L. Han, *A New Factor Affecting the Performance of Dye-Sensitized Solar Cells in the Presence of 4-tert-Butylpyridine*, Applied Physics Express **5**(4), 042303 (2012). doi: 10.1143/APEX.5.042303 Published: APR 2012. Field: Nano-Green. MANA Affiliation: yes.
430	L. Zhang, Y. Kaizuka, N. Hanagata, *Imaging of Fas–FasL membrane microdomains during apoptosis in a reconstituted cell–cell junction*, Biochemical and Biophysical Research Communications **422**(2), 298 (2012). doi: 10.1016/j.bbrc.2012.04.152 Published: JUN 2012. Field: Nano-Bio. MANA Affiliation: yes.
431	N. Zhang, S. Ouyang, T. Kako, J. Ye, *Synthesis of hierarchical Ag_2ZnGeO_4 hollow spheres for enhanced photocatalytic property*, Chemical Communications **48**(79), 9894 (2012). doi: 10.1039/C2CC34738E Published: OCT 2012. Field: Nano-Power. MANA Affiliation: yes.
432	X.M. Zhang, D. Golberg, Y. Bando, N. Fukata, *n-ZnO/p-Si 3D heterojunction solar cells in Si holey arrays*, Nanoscale **4**(3), 737 (2012). doi: 10.1039/C2NR11752E Published: FEB 2012. Field: Nano-Materials. MANA Affiliation: yes.
433	Y. Zhang, K. Fugane, T. Mori, L. Niu, J. Ye, *Wet chemical synthesis of nitrogen-doped graphene towards oxygen reduction electrocatalysts without high-temperature pyrolysis*, Journal of Materials Chemistry **22**(14), 6575 (2012). doi: 10.1039/C2JM00044J Published: APR 2012. Field: Nano-Green. MANA Affiliation: yes.
434	Y. Zhang, T. Mori, J. Ye, *Polymeric Carbon Nitrides: Semiconducting Properties and Emerging Applications in Photocatalysis and Photoelectrochemical Energy Conversion*, Science of Advanced Materials **4**(2), 282 (2012). doi: 10.1166/sam.2012.1283 Published: FEB 2012. Field: Nano-Green. MANA Affiliation: yes.
435	G. Zhu, Y. Zhou, S. Wang, R. Yang, Y. Ding, X. Wang, Y. Bando, Z.L. Wang, *Synthesis of vertically aligned ultralong ZnO nanowires on heterogeneous substrates with catalyst at the root*, Nanotechnology **23**(5), 055604 (2012). doi: 10.1088/0957-4484/23/5/055604 Published: FEB 2012. Field: Nano-Materials. MANA Affiliation: yes.
436	Q. Zhu, J.G. Li, R. Ma, T. Sasaki, X. Yang, X. Li, X. Sun, Y. Sakka, *Well-defined crystallites autoclaved from the nitrate/NH_4OH reaction system as the precursor for $(Y,Eu)_2O_3$ red phosphor: Crystallization mechanism, phase and morphology control, and luminescent property*, Journal of Solid State Chemistry **192**, 229 (2012). doi: 10.1016/j.jssc.2012.04.015 Published: AUG 2012. Field: Nano-Materials. MANA Affiliation: yes.

Note: The list of refereed MANA Research Papers 2012 in English without MANA Affiliation published in scientific journals (190 papers) is not shown.

Appendix 8.7: MANA Research Papers 2011

List of refereed Research Papers 2011 in English with MANA Affiliation published in scientific journals (399 papers):

1	E. Abdullayev, K. Sakakibara, K. Okamoto, W. Wei, K. Ariga, Y. Lvov, *Natural Tubule Clay Template Synthesis of Silver Nanorods for Antibacterial Composite Coating,* ACS Applied Materials & Interfaces **3**(10), 4040 (2011). doi: 10.1021/am200896d Published: OCT 2011. Field: Nano-Materials. MANA Affiliation: yes.
2	Y. Adachi, N. Ohashi, T. Ohgaki, T. Ohnishi, I. Sakaguchi, S. Ueda, H. Yoshikawa, K. Kobayashi, J.R. Williams, T. Ogino, H. Haneda, *Polarity of heavily doped ZnO films grown on sapphire and SiO_2 glass substrates by pulsed laser deposition,* Thin Solid Films **519**(18), 5875 (2011). doi: 10.1016/j.tsf.2011.02.087 Published: JUL 2011. Field: Nano-Materials. MANA Affiliation: yes.
3	S. Alam, C. Anand, S.M.J. Zaidi, T.S. Naidu, S.S. Al-Deyab, A. Vinu, *Iron Oxide Nanoparticles Embedded onto 3D Mesochannels of KIT-6 with Different Pore Diameters and Their Excellent Magnetic Properties*, Chemistry - An Asian Journal **6**(3), 834 (2011). doi: 10.1002/asia.201000456 Published: MAR 2011. Field: Nano-Materials. MANA Affiliation: yes.
4	R. Arena, M.S. Wang, Z. Xu, A. Loiseau, D. Golberg, *Young modulus, mechanical and electrical properties of isolated individual and bundled single-walled boron nitride nanotubes*, Nanotechnology **22**(26), 265704 (2011). doi: 10.1088/0957-4484/22/26/265704 Published: JUL 2011. Field: Nano-Materials. MANA Affiliation: yes.
5	K. Ariga, *Materials innovation through interfacial physics and chemistry,* Physical Chemistry Chemical Physics **13**(11), 4780 (2011). doi: 10.1039/c1cp90016a Published: MAR 2011. Field: Nano-Materials. MANA Affiliation: yes.
6	K. Ariga, J.P. Hill, *Monolayers at air-water interfaces: from origins-of-life to nanotechnology,* Chemical Record **11**(4), 199 (2011). doi: 10.1002/tcr.201100004 Published: AUG 2011. Field: Nano-Materials. MANA Affiliation: yes.
7	K. Ariga, S. Ishihara, H. Izawa, H. Xia, J.P. Hill, *Operation of micro and molecular machines: a new concept with its origins in interface science,* Physical Chemistry Chemical Physics **13**(11), 4802 (2011). doi: 10.1039/c0cp02040k Published: MAR 2011. Field: Nano-Materials. MANA Affiliation: yes.
8	K. Ariga, S. Ishihara, J. Labuta, J.P. Hill, *Supramolecular Approaches to Nanotechnology: Switching Properties and Dynamic Functions,* Current Organic Chemistry **15**(21), 3719 (2011). doi: 10.2174/138527211797884629 Published: NOV 2011. Field: Nano-Materials. MANA Affiliation: yes.
9	K. Ariga, M. Li, G.J. Richards, J.P. Hill, *Nanoarchitectonics: A Conceptual Paradigm for Design and Synthesis of Dimension-Controlled Functional Nanomaterials,* Journal of Nanoscience and Nanotechnology **11**(1), 1 (2011). doi: 10.1166/jnn.2011.3839 Published: JAN 2011. Field: Nano-Materials. MANA Affiliation: yes.
10	K. Ariga, Y.M. Lvov, K. Kawakami, Q. Ji, J.P. Hill, *Layer-by-layer self-assembled shells for drug delivery*, Advanced Drug Delivery Reviews **63**(9), 762 (2011). doi: 10.1016/j.addr.2011.03.016 Published: AUG 2011. Field: Nano-Materials. MANA Affiliation: yes.
11	K. Ariga, M. McShane, Y.M. Lvov, Q. Ji, J.P. Hill, *Layer-by-layer assembly for drug delivery and related applications,* Expert Opinion on Drug Delivery **8**(5), 633 (2011). doi: 10.1517/17425247.2011.566268 Published: MAY 2011. Field: Nano-Materials. MANA Affiliation: yes.
12	K. Ariga, T. Mori, J.P. Hill, *Control of nano/molecular systems by application of macroscopic mechanical stimuli,* Chemical Science **2**(2), 195 (2011). doi: 10.1039/c0sc00300j Published: FEB 2011. Field: Nano-Materials. MANA Affiliation: yes.
13	K. Ariga, K. Sakakibara, G.J. Richards, J.P. Hill, *Dynamic supramolecular systems at interfaces,* Supramolecular Chemistry **23**(3-4), 183 (2011). doi: 10.1080/10610278.2010.521830 Published: APR 2011. Field: Nano-Materials. MANA Affiliation: yes.
14	H. Ataee-Esfahani, Y. Nemoto, L. Wang, Y. Yamauchi, *Rational synthesis of Pt spheres with hollow interior and nanosponge shell using silica particles as template,* Chemical Communications **47**(13), 3885 (2011). doi: 10.1039/c0cc05233g Published: APR 2011. Field: Nano-Materials. MANA Affiliation: yes.
15	A.A. Belik, *Local distortions in multiferroic $BiMnO_3$ as a function of doping,* Science and Technology of Advanced Materials **12**(4), 044610 (2011). doi: 10.1088/1468-6996/12/4/044610 Published: AUG 2011. Field: Nano-Materials. MANA Affiliation: yes.
16	A.A. Belik, A.M. Abakumov, A.A. Tsirlin, J. Hadermann, J. Kim, G. Van Tendeloo, E. Takayama-Muromachi, *Structure and Magnetic Properties of $BiFe_{0.75}Mn_{0.25}O_3$ Perovskite Prepared at Ambient and High Pressure,* Chemistry of Materials **23**(20), 4505 (2011). doi: 10.1021/cm201774y Published: OCT 2011. Field: Nano-Materials. MANA Affiliation: yes.
17	A.A. Belik, T. Furubayashi, H. Yusa, E. Takayama-Muromachi, Perovskite, *$LiNbO_3$, Corundum, and Hexagonal Polymorphs of $(In_{1-x}M_x)MO_3$,* Journal of the American Chemical Society **133**(24), 9405 (2011). doi: 10.1021/ja2010362 Published: JUN 2011. Field: Nano-Materials. MANA Affiliation: yes.

18	A.A. Belik, Y. Matsushita, Y. Katsuya, M. Tanaka, T. Kolodiazhnyi, M. Isobe, E. Takayama-Muromachi, *Crystal structure and magnetic properties of 6H-$SrMnO_3$,* Physical Review B **84**(9), 094438 (2011). doi: 10.1103/PhysRevB.84.094438 Published: SEP 2011. Field: Nano-Materials. MANA Affiliation: yes.
19	A.A. Belik, Y. Matsushita, M. Tanaka, E. Takayama-Muromachi, *Low-Temperature Vacuum Reduction of $BiMnO_3$,* Inorganic Chemistry **50**(16), 7685 (2011). doi: 10.1021/ic2007233 Published: AUG 2011. Field: Nano-Materials. MANA Affiliation: yes.
20	A.A. Belik, P. Naumov, J. Kim, S. Tsuda, *Low-temperature structural phase transition in synthetic libethenite Cu_2PO_4OH,* Journal of Solid State Chemistry **184**(11), 3128 (2011). doi: 10.1016/j.jssc.2011.09.026 Published: NOV 2011. Field: Nano-Materials. MANA Affiliation: yes.
21	D. Berthebaud, T. Nishimura, T. Mori, *Microstructure and Thermoelectric Properties of Dense YB22C2N Samples Fabricated Through Spark Plasma Sintering,* Journal of Electronic Materials **40**(5), 682 (2011). doi: 10.1007/s11664-011-1509-0 Published: MAY 2011. Field: Nano-Materials. MANA Affiliation: yes.
22	K. Bhattacharyya, S. Varma, A.K. Tripathi, A. Vinu, A.K. Tyagi, *Gas-Phase Photooxidation of Alkenes by V-Doped TiO_2-MCM-41: Mechanistic Insights of Ethylene Photooxidation and Understanding the Structure–Activity Correlation,* Chemistry - A European Journal **17**(44), 12310 (2011). doi: 10.1002/chem.201001121 Published: OCT 2011. Field: Nano-Materials. MANA Affiliation: yes.
23	L. Bi, E. Fabbri, Z. Sun, E. Traversa, *A novel ionic diffusion strategy to fabricate high-performance anode-supported solid oxide fuel cells (SOFCs) with proton-conducting Y-doped $BaZrO_3$ films,* Energy & Environmental Science **4**(2), 409 (2011). doi: 10.1039/c0ee00353k Published: FEB 2011. Field: Nano-Green. MANA Affiliation: yes.
24	L. Bi, E. Fabbri, Z. Sun, E. Traversa, *Sinteractive anodic powders improve densification and electrochemical properties of $BaZr_{0.8}Y_{0.2}O_{3-\delta}$ electrolyte films for anode-supported solid oxide fuel cells,* Energy & Environmental Science **4**(4), 1352 (2011). doi: 10.1039/C0EE00387E Published: APR 2011. Field: Nano-Green. MANA Affiliation: yes.
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396	C. Zhi, W. Meng, T. Yamazaki, Y. Bando, D. Golberg, C. Tang, N. Hanagata, *BN nanospheres as CpG ODN carriers for activation of toll-like receptor 9*, Journal of Materials Chemistry **21**(14), 5219 (2011). doi: 10.1039/c1jm10199d Published: APR 2011. Field: Nano-Materials. MANA Affiliation: yes.
397	C. Zhi, Y. Xu, Y. Bando, D. Golberg, *Highly Thermo-conductive Fluid with Boron Nitride Nanofillers,* ACS Nano **5**(8), 6571 (2011). doi: 10.1021/nn201946x Published: AUG 2011. Field: Nano-Materials. MANA Affiliation: yes.
398	Q. Zhu, J.G. Li, C. Zhi, R. Ma, T. Sasaki, J.X. Xu, C.H. Liu, X.D. Li, X.D. Sun, Y. Sakka, *Nanometer-thin layered hydroxide platelets of $(Y_{0.95}Eu_{0.05})_2(OH)_5NO_3{\cdot}xH_2O$: exfoliation-free synthesis, self-assembly, and the derivation of dense oriented oxide films of high transparency and greatly enhanced luminescence,* Journal of Materials Chemistry **21**(19), 6903 (2011). doi: 10.1039/c1jm00048a Published: MAY 2011. Field: Nano-Materials. MANA Affiliation: yes.
399	M. Zunic, L. Chevallier, E. Di Bartolomeo, A. D'Epifanio, S. Licoccia, E. Traversa, *Anode Supported Protonic Solid Oxide Fuel Cells Fabricated Using Electrophoretic Deposition,* Fuel Cells **11**(2), 165 (2011). doi: 10.1002/fuce.200900104 Published: APR 2011. Field: Nano-Green. MANA Affiliation: yes.

Note: The list of refereed MANA Research Papers 2011 in English without MANA Affiliation published in scientific journals (259 papers) is not shown.

Appendix 8.8: MANA Journal Cover Sheets

Journal cover sheets related to papers with MANA Affiliation (October 2007 – December 2012):

	Journal name *Type of cover sheet*	Year	Volume	Issue	doi number (of related paper)
1	Physics Today *Journal Front Cover*	2008	61	12	10.1063/1.3047660
2	Advanced Functional Materials *Journal Front Cover*	2009	19	15	10.1002/adfm.200900295
3	Advanced Functional Materials *Journal Inside Front Cover*	2009	19	12	10.1002/adfm.200801435
4	Advanced Materials *Journal Inside Front Cover*	2009	21	20	10.1002/adma.200802441
5	Advanced Materials *Journal Inside Front Cover*	2009	21	44	10.1002/adma.200901321
6	Journal of Materials Chemistry *Journal Front Cover*	2009	19	3	10.1039/b808320g
7	Journal of Materials Chemistry *Journal Inside Front Cover*	2009	19	25	10.1039/B903791H
8	Journal of Nanoscience and Nanotechnology *Journal Front Cover*	2009	9	1	10.1166/jnn.2009.J076
9	Journal of Porphyrins and Phthalocyanines *Journal Front Cover*	2009	13	1	10.1142/S1088424609000061
10	Physical Chemistry Chemical Physics *Journal Inside Front Cover*	2009	11	29	10.1039/B822802G
11	Soft Matter *Journal Back Cover*	2009	5	19	10.1039/B909397D
12	Solid State Physics (in Japanese) *Journal Front Cover*	2009	44	2	(not available)
13	Advanced Functional Materials *Journal Front Cover*	2010	20	3	10.1002/adfm.200901878
14	Journal of Materials Chemistry *Journal Front Cover*	2010	20	32	10.1039/C0JM01013H
15	Materials Transactions *Journal Front Cover*	2010	51	11	10.2320/matertrans.M2010192
16	Nanoscale *Journal Inside Front Cover*	2010	2	2	10.1039/B9NR00415G
17	Science and Technology of Advanced Materials *Front Cover of Promotional Copy*	2010	11	5	10.1088/1468-6996/11/5/054506
18	Angewandte Chemie – International Edition *Journal Frontispiece*	2011	50	6	10.1002/anie.201005271
19	Angewandte Chemie – International Edition *Journal Frontispiece*	2011	50	17	10.1002/anie.201007370
20	Chemical Communications *Journal Inside Front Cover*	2011	47	45	10.1039/C1CC15169J
21	Energy & Environmental Science *Journal Inside Back Cover*	2011	4	11	10.1039/C1EE01400E
22	Journal of Materials Chemistry *Journal Front Cover*	2011	21	18	10.1039/C0JM04557H
23	Journal of Materials Chemistry *Journal Inside Front Cover*	2011	21	44	10.1039/C1JM13180J

	Journal name *Type of cover sheet*	Year	Volume	Issue	doi number (of related paper)
24	Journal of Nanoscience and Nanotechnology *Journal Front Cover*	2011	11	9	10.1166/jnn.2011.4718
25	Journal of the American Chemical Society *Journal Front Cover*	2011	133	20	10.1021/ja110691t
26	Physical Chemistry Chemical Physics *Journal Back Cover*	2011	13	11	10.1039/C0CP02025G
27	Physical Review Letters *Journal Front Cover*	2011	106	3	10.1103/PhysRev-Lett.106.037002
28	Small *Journal Frontispiece*	2011	7	4	10.1002/smll.201001849
29	Small *Journal Frontispiece*	2011	7	10	10.1002/smll.201002350
30	Advanced Functional Materials *Journal Front Cover*	2012	22	13	10.1002/adfm.201103110
31	Advanced Functional Materials *Journal Frontispiece*	2012	22	17	10.1002/adfm.201290101
32	Advanced Materials *Journal Front Cover*	2012	24	2	10.1002/adma.201290004
33	Advanced Materials *Journal Frontispiece*	2012	24	2	10.1002/adma.201102617
34	Advanced Materials *Journal Frontispiece*	2012	24	2	10.1002/adma.201103241
35	Advanced Materials *Journal Frontispiece*	2012	24	2	10.1002/adma.201102958
36	Advanced Materials *Journal Inside Front Cover*	2012	24	2	10.1002/adma.201103053
37	Chemical Communications *Journal Inside Back Cover*	2012	48	33	10.1039/C2CC31118F
38	Chemical Communications *Journal Inside Front Cover*	2012	48	40	10.1039/C2CC30643C
39	Chemistry - A European Journal *Journal Frontispiece*	2012	18	6	10.1002/chem.201102013
40	Journal of Materials Chemistry *Journal Inside Back Cover*	2012	22	14	10.1039/C2JM00044J
41	Journal of Materials Chemistry *Journal Back Cover*	2012	22	21	10.1039/C2JM16629A
42	Nanoscale *Journal Front Cover*	2012	4	8	10.1039/C2NR11835A
43	Nanoscale *Journal Front Cover*	2012	4	10	10.1039/C2NR00010E
44	Oyo Buturi (in Japanese) *Journal Front Cover*	2012	81	12	(not available)
45	Physica Status Solidi: RRL *Journal Front Cover*	2012	6	5	10.1002/pssr.201206082
46	Physical Chemistry Chemical Physics *Journal Back Cover*	2012	14	17	10.1039/C2CP24010F
47	Polymer Journal *Journal Front Cover*	2012	44	6	10.1038/pj.2012.30

Appendix 8.9: MANA Patents

All MANA patent applications and MANA patent registrations listed in this Appendix are or were partly or fully owned by NIMS.

1. List of Japanese Patent Applications (October 2007 – December 2012):

No.	Date of Application / *Name of Invention*	Application Number
1	2007 Oct 15 *Porous scaffold material for regeneration and its production method*	2007-267503
2	2007 Oct 18 *Porous scaffold material*	2007-271048
3	2007 Oct 18 *Zinc sulfide nano-cable*	2007-271145
4	2007 Oct 19 *Method for producing zinc oxide fine wire in large quantity*	2007-272490
5	2007 Oct 23 *Heat-resistant resin composition excellent in mechanical property and manufacturing method*	2007-275072
6	2007 Oct 24 *Co-based Heusler alloy*	2007-276353
7	2007 Oct 24 *A metal compound probe for Raman spectroscopy*	2007-276691
8	2007 Oct 30 *Boron nitride based nanotube, method of manufacturing the same and boron nitride nanotube gel*	2007-282523
9	2007 Oct 30 *Single crystal of $Tm_xHo_yLiLn_{(1-x-y)}F_4$ and laser oscillator using the same*	2008-542203
10	2007 Nov 16 *Magnesium based medical device, and method for producing the same*	2008-544212
11	2007 Dec 4 *Collagen sponge and method of manufacturing the same*	2007-313323
12	2007 Dec 5 *Method for synthesizing anion-exchangeable layered double hydroxides*	2007-314339
13	2007 Dec 14 *Nanotubes and nanowires bound by phosphor molecules with covalent bond*	2007-323034
14	2007 Dec 17 *Optical element and display device using same*	2007-325022
15	2007 Dec 20 *Dielectric materials, and method for producing the same*	2008-551070
16	2007 Dec 21 *Sintered steel and manufacturing method therefor*	2007-329408
17	2007 Dec 21 *Integrated materials based on bis (terpyridine) compounds, method for producing the same, and hybrid polymer-based equipment using the same*	2008-552104
18	2007 Dec 26 *Mesoporous carbon, and method for producing the same*	2007-334245
19	2007 Dec 26 *Cage-type mesoporous silica, method for producing the same, and absorbent using the same*	2007-334246
20	2007 Dec 26 *Mesoporous carbon, and method for producing the same*	2007-334247
21	2007 Dec 27 *Boron nitride nanofiber and method of manufacturing the same*	2007-336861
22	2007 Dec 28 *Emulsifiable preparation*	2007-340588
23	2008 Jan 7 *Dope for forming*	2008-000645
24	2008 Jan 9 *Composite porous scaffold*	2008-002289
25	2008 Jan 18 *Oxide layered phosphors and oxide nanosheet phosphors*	2008-009659
26	2008 Jan 23 *Swellable layered double hydroxide and its manufacturing method, and gel-like substance, sol-like substance and nanosheet using the same*	2008-012914
27	2008 Jan 25 Oxide layered illuminant and oxide nanosheet illuminant	2008-014606
28	2008 Jan 31 *Porous tricalcium phosphate-based sintered body and its manufacturing method*	2008-021807
29	2008 Feb 4 *Process for producing anisotropic magnetic material, and anisotropic magnetic material*	2008-024123
30	2008 Feb 5 *Iodide-based single crystal materials, method of producing the same, and scintillator based on the same*	2008-557187
31	2008 Feb 6 *Layered rare earth hydroxide and anion-exchange material and fluorescent material using it*	2008-025833
32	2008 Feb 6 *Method for producing layered rare earth hydroxide*	2008-025834
33	2008 Feb 8 *Photo catalyst thin film material, manufacturing method of the same, and products based on the same*	2008-557174
34	2008 Feb 12 *Ferroelectric thin film*	2008-029848
35	2008 Feb 14 *All-solid lithium secondary battery*	2008-032828
36	2008 Feb 18 *Electrode and method of manufacturing the same, and lithium ion secondary battery*	2008-036537
37	2008 Feb 21 *Wavelength conversion element consisting of lithium tantalate single crystal*	2008-039835
38	2008 Feb 26 *Lamellar hydroxide, monolayer nanosheet and their production methods*	2008-043681
39	2008 Mar 4 *Fibrous papers of boron nitride, and method for fabricating the same*	2009-502637

No.	Date of Application / *Name of Invention*	**Application Number**
40	2008 Mar 5 *Electronic device and manufacturing method therefor*	**2008-054671**
41	2008 Mar 7 *Method for preparing and culturing decellularized soft tissues*	**2009-504037**
42	2008 Mar 12 *Specimen making and evaluation device*	**2008-062344**
43	2008 Mar 13 *Storage media, recording system, and methods for data recording and erasing*	**2009-509014**
44	2008 Mar 17 *Recording media, its implementation, and the methods for recording and erasing information*	**2009-505219**
45	2008 Mar 18 *Display element*	**2008-069447**
46	2008 Mar 19 *Thermosetting resin composite material, and method for producing the same*	**2009-509153**
47	2008 Mar 25 *Artificial opal film production device*	**2008-076953**
48	2008 Mar 25 *Binary aluminum-based sintered material, and method for producing the same*	**2009-509121**
49	2008 Mar 26 *Inspecting method for compound semiconductor substrate*	**2008-079863**
50	2008 Mar 26 *Electron source, and manufacturing method of electron source*	**2008-080358**
51	2008 Mar 26 *Method for manufacturing self-supporting wafer of Mg containing ZnO mixed single crystal and Mg containing ZnO mixed single crystal used for it*	**2008-080629**
52	2008 Mar 26 *Method for manufacturing ZnO single crystal and self-supporting wafer of ZnO single crystal obtained by it*	**2008-080639**
53	2008 Apr 4 *Mesoporous carbon nitride, and method for producing the same*	**2009-509329**
54	2008 Apr 8 *Porous silica (MeKIT-5) into which metal is added and method for producing the same*	**2008-100264**
55	2008 Apr 9 *Ternary alloy of FePtP*	**2008-100931**
56	2008 Apr 21 *Polymer electrolyte composition having excellent mechanical characteristics and dimensional stability, and method for manufacturing the same*	**2008-110103**
57	2008 Apr 25 *Photochromic film*	**2008-116194**
58	2008 Apr 30 *Polarization conversion element*	**2008-118118**
59	2008 Apr 30 *Transparent magnetic film, method of reading magnetization pattern, method for manufacturing transparent magnetic film, and magnetization pattern*	**2008-118785**
60	2008 May 1 *Carbon dioxide removing agent and its regenerating method*	**2008-119573**
61	2008 May 1 *Method for synthesizing anion-exchangeable layered double hydroxides*	**2008-119873**
62	2008 May 8 *Metal nanoparticles, method for producing the same, and electrolyte using the same*	**2009-514175**
63	2008 May 9 *Magnesium alloys with high strength and high ductility*	**2009-514158**
64	2008 May 13 *Sintered oxide superconducting materials, and method for producing the same*	**2008-125639**
65	2008 May 20 *TiN-based crystalline substance*	**2008-131419**
66	2008 May 20 *TiN-based crystalline substance and its joined body*	**2008-131424**
67	2008 May 22 *Organic-inorganic hybrid polymers, method for producing the same, and method for controlling the same*	**2009-515275**
68	2008 May 23 *Transparent magnetic film, reading techniques for magnetic patterns, and method for producing the same*	**2008-135379**
69	2008 May 26 *Method of manufacturing large pore diameter mesoporous metal having uniform pore diameter*	**2008-137184**
70	2008 May 30 *Aluminum silicon carbide powder and its production method*	**2008-143492**
71	2008 Jun 4 *Resin composition excellent in mechanical characteristics and dimensional stability and its manufacturing method*	**2008-146788**
72	2008 Jun 5 *Photocatalyst nanosheet, photocatalyst material, and their manufacturing methods*	**2008-147592**
73	2008 Jun 10 *Electro-magnetic absorbers*	**2008-151636**
74	2008 Jun 30 *Oxide superconductive sintered body, and method for producing the same*	**2008-170178**
75	2008 Jul 11 *Phosphor-based nanosheets and fluorescent lightning, solar cells and color displays using the same*	**2008-180826**
76	2008 Jul 11 *Nanosheet paint*	**2008-180828**
77	2008 Jul 15 *Photoresponsive drug transporter and photoresponsive drug transporter with drug*	**2008-184326**
78	2008 Jul 29 *Compound oxide semiconductor, yellow pigment using the same, and photocatalyst*	**2008-194346**
79	2008 Jul 30 *Method for manufacturing carbon nitride porous material (MCN)*	**2008-195652**
80	2008 Jul 31 *Artificial vertebral body*	**2008-198735**
81	2008 Aug 1 *Nano flake-like metal composite material, and manufacturing method of the same and surface enhanced raman scattering active substrate*	**2008-199217**

No.	Date of Application / *Name of Invention*	Application Number
82	2008 Aug 1 *Co based Heusler alloy*	2008-199712
83	2008 Aug 8 *Switching device, and usage of the same*	2009-526504
84	2008 Aug 22 *Amorphous base material*	2008-214300
85	2008 Aug 28 *Magnetic thin-film element*	2008-219619
86	2008 Aug 29 *Cobalt-based Heusler alloy*	2008-220648
87	2008 Sep 4 *Organic solvent dispersive media composed of titanium oxide, method for producing the same, and thin film using the same*	2009-531280
88	2008 Sep 5 *Surface enhanced infrared absorption sensor and process for producing it*	2008-228904
89	2008 Sep 16 *Surface cleaning method for biocompatible material and cleaning apparatus used for the same*	2008-237148
90	2008 Sep 22 *Magnesium alloy*	2008-243311
91	2008 Sep 22 *Magnesium alloy*	2008-243342
92	2008 Sep 26 *Solid hybrid material containing polymer brushes, and method for producing the same*	2008-247361
93	2008 Sep 30 *Bio sensor, method for detecting bio-materials using the same, and kit using the same*	2008-255393
94	2008 Oct 8 *Graphene-coated member and method for producing the same*	2008-261875
95	2008 Oct 10 *Method for producing sintered compact of compound with perovskite structure*	2008-264418
96	2008 Oct 20 *Prepreg having excellent thermal conductivity, method for producing prepreg, and laminated plate*	2008-269820
97	2008 Oct 22 *Cage-type mesoporous silica (SNC-2), method for producing the same and adsorbent using the same*	2008-271929
98	2008 Oct 22 *Mesoporous carbon (CNP-2) and method for producing the same*	2008-272012
99	2008 Oct 24 *Mesoporous carbon (MC-MCM-48) and method for producing the same*	2008-274047
100	2008 Oct 24 *Magnifier device of photo-electric field, and probe using the same*	2009-538282
101	2008 Oct 27 *Particulate, medicine particulate, and methods for producing them*	2008-275019
102	2008 Oct 27 *Experimental animal, and method of evaluating capability of improving bone disease using the same*	2008-275776
103	2008 Nov 11 *Dye-sensitized solar cell*	2008-288304
104	2008 Nov 20 *Semiconductor nanowires, method for synthesizing the same, and vertical-type field effect transistors using the same*	2008-296940
105	2008 Nov 21 *Hetero-nanowire and production method of the same*	2008-297575
106	2008 Nov 25 *Co-based heusler alloy, and magnetic element using the same*	2008-299551
107	2008 Dec 2 *All-solid battery*	2008-307276
108	2008 Dec 2 *Anion exchanging layered hydroxide compound, and method for producing the same*	2009-544675
109	2008 Dec 3 *Method for calibration of dopant impurities*	2008-308073
110	2008 Dec 10 *Carbon nanotube coated uniformly with ultrathin nanoprecise organically modified silica layer*	2008-314948
111	2008 Dec 11 *Nanoscale pH sensor*	2008-315147
112	2008 Dec 18 *Organic field effect transistor*	2008-321975
113	2008 Dec 18 *Nanorod formulation for liquid crystal display for polarization control-type electro-optical apparatus*	2008-322401
114	2008 Dec 22 *All-solid battery*	2008-325282
115	2008 Dec 25 *Medical biological absorbent member and method of manufacturing the same*	2008-330445
116	2009 Jan 15 *Nano conductance material and method of manufacturing the same*	2009-006731
117	2009 Jan 16 *Dry process apparatus*	2009-007329
118	2009 Jan 21 *PH sensing material having nanometer size and method for manufacturing same*	2009-010581
119	2009 Feb 2 *Mg-based structured member*	2009-021268
120	2009 Feb 2 *Regular mesoporous fullerene having large specific surface area and method for producing the same*	2009-021407
121	2009 Feb 2 *Titanium oxide nanoparticles*	2009-021457
122	2009 Feb 3 *Boron nitride spherical nanoparticle and method of producing the same*	2009-022174
123	2009 Feb 20 *Nanocrystal particle coated with organic molecular film and manufacturing method of nanocrystal particle coated with organic molecular film*	2009-037746
124	2009 Feb 23 *Scanning multi probe microscope and probe for scanning probe microscope*	2009-039357
125	2009 Feb 25 *New diblock copolymer and high mobility/photoconductivity anisotropic nanowire formed by self-assembling of the diblock copolymer*	2009-041732

No.	Date of Application / *Name of Invention*	Application Number
126	2009 Mar 3 *Surface increasing raman scattering reactive nanoscale pH sensor*	2009-048844
127	2009 Mar 5 *Prepreg having excellent thermal conductivity, method for producing prepreg, and laminated plate*	2009-051914
128	2009 Mar 6 *Light-emitting element*	2009-052779
129	2009 Mar 17 *Tissue regeneration method*	2009-063698
130	2009 Mar 18 *Production method of nano-sheet deposition film*	2009-066236
131	2009 Mar 27 *Probe for scanning type probe microscope, and scanning type probe microscope*	2009-078274
132	2009 Mar 30 *Layered rare earth hydroxide, thin film thereof and method of manufacturing them*	2009-081303
133	2009 Apr 2 *Light emitting device composed of silicon nanoparticles*	2009-089645
134	2009 Apr 2 *Rare earth oxide fluorescent material, thin film using the same, and methods for producing them*	2009-090042
135	2009 Apr 14 *Sheet-like illuminant*	2009-097564
136	2009 Apr 16 *Ferromagnetic tunnel junctionand its applications to magnetoresistive devices*	2009-099483
137	2009 Apr 16 *Light emitting nano sheet, fluorescent illumination body, solar cell, color display using the same*	2009-099595
138	2009 Apr 20 *Nanosheet paint*	2009-101578
139	2009 Apr 23 *Electrically conductive polyrotaxane*	2009-105010
140	2009 Apr 27 *Wavelength conversion element, wavelength conversion device, and lithium tantalate single crystal used for the same*	2009-107382
141	2009 Apr 27 *Fluorocarbon resin composition excellent in wear resistance, and process for producing the same*	2009-107770
142	2009 May 8 *Photodegradable hetero-bivalent crosslinking agent*	2009-114028
143	2009 May 14 *Anode material and lithium battery using the same*	2009-117114
144	2009 May 22 *Electrochromic display device*	2009-123863
145	2009 May 25 *Hydrogen evolution material*	2009-125016
146	2009 May 25 *Dielectric film, device using the same, and method for producing the same*	2010-513081
147	2009 Jun 1 *Zinc sulfide nanobelts, method for producing the same, and UV sensitive device using the same*	2009-131847
148	2009 Jun 2 *Hetero pn junction semiconductor, and method for producing the same*	2009-132693
149	2009 Jun 10 *Electromagnetic wave absorbing material*	2010-516872
150	2009 Jun 18 *Display device, and color electric paper using the same*	2009-145842
151	2009 Jun 19 *Nanosheet paint*	2009-146595
152	2009 Jun 24 *Biosensor, method for detecting biological material with biosensor, and kit therefor*	2009-149329
153	2009 Jul 13 *Nano sheet coating*	2009-164728
154	2009 Jul 21 *Molecular electronic device, and method of manufacturing the same*	2009-169740
155	2009 Jul 23 *Thermoelectric element*	2009-171907
156	2009 Jul 23 *Rare earth multi-boride thermoelectric element, and thermoelectric element using the same*	2009-171979
157	2009 Jul 24 *Thermoelectric semiconductor, and thermoelectric power generation element using the same*	2009-172597
158	2009 Jul 27 *Metal nanoparticle having dendritic portion and method for producing the same*	2009-173879
159	2009 Aug 6 *Current-perpendicular-to-plane giant magnetoresistance (CPP-GMR) element*	2009-182968
160	2009 Aug 6 *Rubber composition excellent in mechanical characteristic, and method for producing the same*	2009-183438
161	2009 Aug 20 *Substrate, method for producing the same, semiconductor device using the same, and method for producing the semiconductor device*	2009-190948
162	2009 Aug 26 *Nanoribbon and manufacturing method thereof, fet using nanoribbon and manufacturing method thereof, and base sequence determination method using nanoribbon and apparatus for the same*	2009-194892
163	2009 Aug 26 *Aluminum nitride nanoribbon*	2009-195249
164	2009 Aug 31 *Method for producing graphene film*	2009-199126
165	2009 Sep 7 *Conductor substrate, manufacturing method of conductor substrate, device, and electronic equipment*	2009-205911
166	2009 Sep 24 *Method and device for simultaneously thermally analyzing a plurality of specimens*	2009-219189
167	2009 Sep 25 *Polymer brush-solid composite material, and method for producing the same*	2010-530875
168	2009 Oct 6 *Blue/ultraviolet light detection device using single-crystal ZnSe nanobelt, and method of manufacturing the same*	2009-232381
169	2009 Oct 8 *Ultrathin boron nitride nanosheet, method for production thereof, and optical material containing the nanosheet*	2009-234651

No.	Date of Application / *Name of Invention*	**Application Number**
170	2009 Oct 14 *Boron doped semiconductor nanowire and manufacturing method thereof*	**2009-236883**
171	2009 Nov 10 *Boron nitride nanotube derivative, its dispersion, and method for producing the boron nitride nanotube derivative*	**2009-257104**
172	2009 Nov 11 *Method for analyzing and measuring dopant element in dopant element dope Ge*	**2009-258108**
173	2009 Nov 26 *Method for producing contact and structure in an organic semiconductor device*	**2009-268309**
174	2009 Dec 2 *Zinc sulfide nanobelt, UV light detection sensor and method for producing the same*	**2009-274154**
175	2009 Dec 9 *Method for manufacturing boron nitride nanotube*	**2009-279375**
176	2009 Dec 9 *Microscale ultraviolet sensor and method of manufacturing the same*	**2009-279520**
177	2009 Dec 10 *Nanoparticle production apparatus and nanoparticle production method using the same*	**2009-280039**
178	2010 Jan 5 *Phenylboronic acid-based monomer and phenylboronic acid-based polymer*	**2010-000821**
179	2010 Jan 12 *Highly porous solid material made of biodegradable polymer, and method for producing the same*	**2010-003539**
180	2010 Jan 14 *Perpendicular magnetic recording medium and method for manufacturing the same*	**2010-005598**
181	2010 Jan 29 *Titanium oxide nanoparticles*	**2010-548566**
182	2010 Feb 2 *Method of manufacturing anisotropic sliding material and anisotropic sliding material*	**2010-021517**
183	2010 Feb 3 *Bio friendly device*	**2010-022565**
184	2010 Feb 5 *Bioabsorbable polymer, and medical equipment and artificial blood vessel using the same*	**2010-023909**
185	2010 Feb 5 *Method of manufacturing electrode for battery, electrode obtained by this method, and battery with this electrode*	**2010-024592**
186	2010 Feb 8 *Smart window using organic metal hybrid polymers, and method for producing the same*	**2010-025058**
187	2010 Feb 9 *Apparatus and method for measurement of photoelectric conversion ability in photoelectric conversion element and measuring method*	**2010-026307**
188	2010 Feb 9 *Solid battery*	**2010-026451**
189	2010 Feb 19 *Contact structure of organic semiconductor device, organic semiconductor device, and method of fabricating the same*	**2010-034179**
190	2010 Feb 22 *Method for testing biodegradability, and material containing fullerene fiber for medical use*	**2010-035688**
191	2010 Feb 24 *Metal complex array, method for producing the same and material*	**2010-038460**
192	2010 Feb 26 *Si nanowire in which zero-dimensional structure is scattered in one-dimensional structure and method for producing the same*	**2010-042439**
193	2010 Feb 26 *Hetero pn junction semiconductor, and method for producing the same*	**2011-501678**
194	2010 Mar 4 *Epitaxial growing method of graphene film*	**2010-047225**
195	2010 Mar 5 *Method for synthesizing brookite*	**2010-048998**
196	2010 Mar 10 *All solid battery*	**2010-052980**
197	2010 Mar 11 *Organic solvent dispersion in which flaky perovskite oxide particle is blended and method for producing the same, and perovskite oxide thin film using the organic solvent dispersion and method for producing the same*	**2010-054207**
198	2010 Mar 11 *Organic solvent dispersion in which flaky titanium oxide is blended and method for producing the same, and titanium oxide thin film using the organic solvent dispersion and method for producing the same*	**2010-054215**
199	2010 Mar 23 *Method for growing single crystal silicon having square cross section and silicon wafer having square section*	**2010-066177**
200	2010 Mar 26 *Reduced hydrogen water-forming agent*	**2010-072288**
201	2010 Mar 29 *Fluorescence emitting silicon nanoparticle and method for producing the same*	**2010-073977**
202	2010 Mar 31 *Method for forming polarization inversion*	**2010-081377**
203	2010 Mar 31 *Highly-transparent alumina ceramic and method for producing the same*	**2010-082042**
204	2010 Mar 31 *All solid-state lithium battery*	**2010-082678**
205	2010 Apr 1 *Material for producing hydrogen*	**2010-084753**
206	2010 Apr 5 *Fullerene structure, method for manufacturing the same, and application using the same*	**2010-087058**
207	2010 Apr 15 *Magnetic tunnel junction, and device with magneto resistance effect using the same*	**2011-509351**
208	2010 Apr 19 *Inductor composed of arrayed capacitors*	**2010-096217**
209	2010 Apr 30 *Textured max phases, and method for producing the same*	**2010-104687**
210	2010 May 10 *Method for fabricating polymer fibers*	**2010-108171**

No.	Date of Application / *Name of Invention*	**Application Number**
211	2010 May 13 *Anode material, and secondary lithium battery using the same*	**2011-513373**
212	2010 May 18 *Silicon nanoparticle-silicon nanowire composite material, solar cell, light-emitting device, and manufacturing method*	**2010-113778**
213	2010 May 20 *Rare-earth permanent magnets, and method for producing the same*	**2010-116531**
214	2010 May 21 *Super-hard composite material and method for producing the same*	**2010-116823**
215	2010 May 24 *Hydrogen generating material, method for producing same, method for producing hydrogen, and apparatus for producing hydrogen*	**2010-118582**
216	2010 May 24 *Low-temperature sintering method of silicon carbide powder*	**2010-118851**
217	2010 May 24 *Surface stress sensor*	**2010-118859**
218	2010 May 25 *Electrospun fiber mat composite and glucose sensor*	**2010-118973**
219	2010 May 28 *Rare earth boron carbide based thermoelectric semiconductor doped with transition metal, method of producing the same and thermoelectric power generation element*	**2010-122311**
220	2010 May 31 *Electrode catalyst for fuel cell and manufacturing method thereof*	**2010-124715**
221	2010 May 31 *Electrode catalyst for fuel cell and manufacturing method thereof*	**2010-124716**
222	2010 Jun 1 *Analyzer and manufacturing method of analyzer*	**2010-126335**
223	2010 Jun 7 *Display devices, and color electric paper using the same*	**2011-519733**
224	2010 Jun 15 *Powdery medicine inhalation device*	**2010-136369**
225	2010 Jun 25 *Counting method of two-dimensional atomic film, and counting system using the same*	**2010-145314**
226	2010 Jun 30 *Method for producing organic semiconductor thin film*	**2010-148435**
227	2010 Jul 6 *Electrochromic complex compound and electrochromic element using the same*	**2010-153792**
228	2010 Jul 13 *Power storage device*	**2010-158605**
229	2010 Jul 22 *Detection device and biosensor*	**2010-164955**
230	2010 Jul 30 *Rare- earth based permanent magnet, and method for producing the same*	**2010-171905**
231	2010 Aug 9 *Boron nitride nanotube derivative, its dispersion, and method for producing the boron nitride nanotube derivative*	**2010-178678**
232	2010 Aug 18 *Substrate semiconductor device, and method for producing the same*	**2011-527724**
233	2010 Aug 26 *Piezoelectric ceramics, and method for producing the same*	**2010-189469**
234	2010 Aug 31 *Fiber probe, and method for producing the same*	**2010-193012**
235	2010 Aug 31 *Device for forming polarization inversion region*	**2010-193460**
236	2010 Sep 3 *Fiber fragment manufacturing method*	**2010-197279**
237	2010 Sep 15 *High hardness b4c oriented by ferromagnetic field technique and method for manufacturing the same*	**2010-206450**
238	2010 Sep 17 *Sugar responsive gel and medicine administering device*	**2010-208796**
239	2010 Sep 22 *Electrochemical transistor*	**2010-211492**
240	2010 Sep 24 *Electrolyte material for solid fuel cell and manufacturing method thereof*	**2010-213251**
241	2010 Sep 28 *Chiral shift reagent for NMR and method for determining optical purity and absolute configuration using the same*	**2010-216279**
242	2010 Oct 4 *Manufacturing method for sic nanoparticle by nitrogen plasma*	**2010-224452**
243	2010 Oct 5 *Tissue adhesive membrane, and method for producing the same*	**2010-225360**
244	2010 Oct 5 *Tissue adhesive membrane, and method for producing the same*	**2010-225368**
245	2010 Oct 6 *Method for synthesizing powders of sulfide and selenide*	**2010-226230**
246	2010 Oct 12 *Mixing and discharging device*	**2010-229851**
247	2010 Oct 13 *Ferroelectric film based on superlattice structure, method for producing the same, and device using the same*	**2010-230132**
248	2010 Oct 14 *Field-effect transistor and method of manufacturing the same*	**2010-231352**
249	2010 Oct 29 *Switching element and switch array*	**2010-242874**
250	2010 Nov 4 *Graphene semiconductor device, and method for producing the same*	**2010-247122**
251	2010 Nov 4 *Sintered body, oriented electrode containing the sintered body, and battery comprising the oriented electrode*	**2010-247699**
252	2010 Nov 9 *Method of producing dense material of electrolyte for solid oxide fuel cell*	**2010-250535**
253	2010 Nov 26 *Bio hybrid materials and stents, and method for producing the same*	**2010-263403**

No.	Date of Application / *Name of Invention*	Application Number
254	2010 Nov 26 *Metal complex and dye-sensitized solar battery using metal complex*	2010-264260
255	2010 Nov 26 *Nickel-free stainless stent*	2010-264359
256	2010 Nov 26 *Metal complex, ligand, and dye-sensitized solar battery using the metal complex*	2010-264427
257	2010 Nov 26 *Structure of organic semiconductor device, and method for making contact*	2011-543310
258	2010 Dec 1 *Metal complex, dye-sensitized oxide semiconductor electrode, and dye-sensitized solar battery*	2010-268761
259	2010 Dec 21 *Graphene substrate, and method for producing the same*	2010-284021
260	2010 Dec 24 *Zirconium diboride powder and method for synthesizing the same*	2010-286891
261	2011 Jan 4 *Electrical printing media and equipment, and printing method using the same*	2011-000032
262	2011 Jan 7 *Highly porous solid material made of biodegradable polymer and method for producing the same, and cell-seeding method*	2011-002204
263	2011 Jan 7 *Method for producing conductive zinc oxide film*	2011-002026
264	2011 Jan 13 *Layered rare earth hydroxide, method for producing the same and application thereof*	2011-005297
265	2011 Jan 27 *Method for producing anion-exchangeable layered double hydroxides*	2011-014710
266	2011 Jan 27 *Nobel water-swellable layered double hydroxides, nanosheet materials derived from the same, and method for producing the same*	2011-014742
267	2011 Feb 1 *Smart window using organic/inorganic hybrid polymers, and method for producing the same*	2011-552777
268	2011 Feb 1 *Bio-compatible tool*	2011-552788
269	2011 Feb 10 *Mesoporous metal film, and method for producing mesoporous metal film from low-concentration aqueous surfactant solution*	2011-027021
270	2011 Feb 14 *Synthetic method of carbide-derived carbon*	2011-029140
271	2011 Feb 17 *Double oxide laminate, solid electrolyte film-electrode assembly including the double oxide laminate, lithium secondary battery, and method for producing the double oxide laminate*	2011-032043
272	2011 Mar 9 *Base material sheet for regenerative medicine*	2011-051475
273	2011 Mar 10 *Organic/metal hybrid polymer which contains metal whose coordination number is 4 and bisphenanthroline derivative, ligand thereof, and method for producing the same*	2011-052269
274	2011 Mar 10 *Organic/fluorescent metal hybrid polymer and ligand thereof*	2011-052361
275	2011 Mar 10 *Plate single crystal composed of metal oxide, thin film of the metal oxide, production methods for the single crystal and the film and variable-resistance element using the single crystal or the film*	2011-052950
276	2011 Mar 22 *Sintered type positive electrode and battery equipped with the sintered type positive electrode*	2011-062916
277	2011 Mar 23 *All solid-state lithium battery*	2012-509420
278	2011 Mar 25 *Metal catalyst structure and method for producing the same*	2011-066987
279	2011 Mar 25 *Method for producing bactericidal and antibacterial base material and antibacterial base material*	2011-067386
280	2011 Mar 25 *Isopropyl acrylamide derivative having azido group or alkyne group and polymer thereof*	2011-067969
281	2011 Mar 28 *Immune stimulating oligonucleotide and curative agent containing the same*	2011-070049
282	2011 Apr 1 *Method for synthesizing reduction type titanium oxide*	2011-081599
283	2011 Apr 6 *Method for manufacturing evaluation sample piece, method for manufacturing inclusion body evaluation sample piece, and method for evaluating cell invasive properties into madreporic body*	2011-084130
284	2011 Apr 20 *Method for detecting bio-molecules, and electrode tip based on the same*	2011-094452
285	2011 Apr 22 *Composite cathode material for solid oxide fuel cell operating at medium-low temperature, composite cathode for solid oxide fuel cell, and method for manufacturing electrolyte-composite cathode structure for solid oxide fuel cell*	2011-095576
286	2011 May 2 *Short fiber scaffold material, method for making short fiber-cell composite agglomerated mass, and short fiber-cell composite agglomerated mass*	2011-102759
287	2011 May 9 *Adhesive substrate and method for manufacturing the same*	2011-104571
288	2011 May 9 *Surface stress sensor*	2012-517210
289	2011 May 10 *Polymer fiber, method for producing the same, and equipment using the same*	2012-514804
290	2011 May 18 *I_3^- intercalated layered double hydroxides, and method for producing the same*	2011-111055
291	2011 May 19 *Multilayer assemblies of high-k dielectric nanosheets, method for producing the same, devices using the same*	2011-112462
292	2011 May 23 *Electrode body, method for manufacturing the same, and lithium ion secondary battery*	2011-114885

No.	Date of Application / *Name of Invention*	**Application Number**
293	2011 Jun 3 *Porous carbon films, method for producing the same, and applications of the same*	**2011-125485**
294	2011 Jun 3 *Porous thin films of carbon nitrides, method for producing the same, and applications of the same*	**2011-125611**
295	2011 Jun 6 *Porous copper sulfides, method for producing the same, and applications of the same*	**2011-126344**
296	2011 Jun 8 *Device for driving synapse*	**2011-127824**
297	2011 Jun 9 *Magneto-optical materials, method for producing the same, and device using the same*	**2011-128998**
298	2011 Jun 21 *Derivative compound, and method for producing the same*	**2011-137308**
299	2011 Jun 22 *Method for determining the number of layers of atomic structures in a two-dimensional thin film, and apparatus using the same*	**2012-521560**
300	2011 Jun 27 *Method for forming organic semiconductor thin film, semiconductor element, and organic field effect transistor*	**2011-141945**
301	2011 Jul 5 *Dielectric thin films, devices using the same, condensers using the same*	**2011-149486**
302	2011 Jul 11 *Probe for fiber and manufacturing method of the same*	**2011-152786**
303	2011 Jul 15 *Mesoporous carbon cage functionalized by amino radicals, and method for producing the same*	**2011-156513**
304	2011 Jul 20 *Quantum chemistry device, and mutual compensating circuit using the same*	**2011-158981**
305	2011 Aug 1 *Method for producing composites of conducting polymers and metal*	**2011-168502**
306	2011 Aug 9 *Method for predicting interface termination species, and computer program using the same*	**2011-173575**
307	2011 Aug 19 *HVJ-Ex film, and method for producing the same*	**2011-179272**
308	2011 Aug 31 *Method for producing anion-exchangeable layered double hydroxides*	**2011-188138**
309	2011 Sep 9 *Method for producing single crystal organic semiconductor, and device using the same*	**2011-197147**
310	2011 Sep 13 *Three-dimensional porous scaffolds with micropatterned structures, and method for producing the same*	**2011-200013**
311	2011 Oct 6 *N-type thermoelectric conversion element utilizing carbon- and nitrogen-doped rare-earth polyboride-based high-temperature acid-resistant n-type thermoelectric material*	**2011-221529**
312	2011 Oct 11 *Sample heating system for measuring friction force and wear*	**2011-223559**
313	2011 Oct 25 *Method for producing nanosheet monolayer films by spin-coating method*	**2011-233848**
314	2011 Nov 1 *Luminescent germanium nanoparticles, and method for producign the same*	**2011-239933**
315	2011 Nov 2 *Method for producing biologically reactive carbon nanotube functionalized by bonding redox protein through non-conjugated bond*	**2011-241273**
316	2011 Nov 28 *Ultra high speed shutter system for vacuum use*	**2011-258444**
317	2011 Nov 28 Sputter gun	**2011-258456**
318	2011 Nov 29 *Polymer electrolyte-type anode materials with high carbon oxide refractoriness for fuel cells*	**2011-260234**
319	2011 Nov 30 *Nickel free and high nitrogen stainless material, rolling and elongation process using the same, method for producing the same, and thin tubes made from the same*	**2011-261664**
320	2011 Dec 14 *Nickel-free, high-nitrogen stainless material, polymer nanowires containing nanoparticles, and method for producing the same*	**2011-273538**
321	2011 Dec 15 *Apparatus for visualizing the measured results of a sensor array*	**2011-274223**
322	2011 Dec 20 *Vertically-stacked plasmonic metal disk array for trapping broadband light*	**2011-279027**
323	2012 Jan 13 *Method for producing cobalt (ii) hydroxide-iron (iii) hexagonal plate-like lamellar crystal*	**2012-005050**
324	2012 Jan 13 *Method for producing nanosheet membranes and inorganic compound thin membranes*	**2012-005331**
325	2012 Jan 25 *Device made by using tin oxide single crystals*	**2012-012886**
326	2012 Feb 10 *Whisker crystals of iron-based superconductors, and method for producing the same*	**2012-027737**
327	2012 Feb 20 *Tin oxide single crystal wires*	**2012-033976**
328	2012 Feb 23 *Deposition method of conductive polymer-metal complexes and conductive polymer-metal complexes*	**2012-036899**
329	2012 Feb 24 *Organic electron field effect transistor*	**2012-038732**
330	2012 Feb 27 *Actuators using layered multiple oxides, and their controlling method*	**2012-039478**
331	2012 Mar 2 *Bio-absorbing support for medicine eradication, and medical equipment based on it*	**2012-047025**
332	2012 Mar 12 *Rare-earth aluminoboride-based thermoelectric semiconductors, method for producing the same, and device based on the same*	**2012-053938**

No.	Date of Application / *Name of Invention*	Application Number
333	2012 Mar 16 *Carbon structural material, and method for producing the same*	2012-060778
334	2012 Mar 21 *Sensor device for measurement of small samples*	2012-064304
335	2012 Mar 23 *Method for producing synthesized collagen nanofibers*	2012-067627
336	2012 Mar 23 *Hemostatic agent, containing synthesized collagen nanofibers*	2012-067629
337	2012 Mar 26 *Tool for hemostatic medicine, and apparatus for mixing the same*	2012-069721
338	2012 Apr 11 *Integrated electrode catalyst, containing encapsulated dendrimer nanoparticles, and method for producing the same*	2012-090413
339	2012 Apr 17 *Surface stress sensor with double-sided coating*	2012-094299
340	2012 Apr 19 *Bio-materials coated by Hap cobalt composites*	2012-096056
341	2012 Apr 27 *Oxygen reduction electrode, and catalyst based on the same*	2012-102717
342	2012 Apr 27 *Method for producing mesoporous silicon dioxide*	2012-103848
343	2012 Apr 27 *Mesoporous silicon dioxide*	2012-103852
344	2012 May 10 *Kit for producing branched polymers, bridged polymers, injectable hydrogels and hydrogels*	2012-108661
345	2012 May 22 *Microbelts consisting of core/shell structure mold oxides, method for producing the same, humidity sensors using the same*	2012-105203
346	2012 May 25 *Titanium oxide, yellow pigments using the same, and photocatalyst based on the same*	2012-119634
347	2012 May 28 *Device units for topological quantum calculation using green Majorana Fermion particles, handling method of the same, devices for topological quantum calculation, and handling method of the same*	2012-120520
348	2012 Jun 7 *Manufacturing method of organic semiconductor thin films by self-constructive two-layer separation, and organic semiconductor devices*	2012-130269
349	2012 Jun 14 *Thin film transistor, method for producing the same, and equipment using the same*	2012-134940
350	2012 Jun 26 *Embolism agents, and method for producing the same*	2012-142788
351	2012 Jun 27 *Method for manufacturing surface enhanced infrared absorption sensor*	2012-144529
352	2012 Jun 29 *Qualitative measurement method of water content in non-proton polar solvents, and water detector agents based on the same*	2012-146816
353	2012 Jul 9 *Film with optimized ionization potential, method for producing the same, and equipment using the same*	2012-153328
354	2012 Jul 30 *Casting furnace of silicon crystals*	2012-167854
355	2012 Jul 30 *Bio-inactive membrane, coating liquid, method for producing the same, and substrate material for bio-inactive treatment agents*	2012-169005
356	2012 Aug 1 *Equipment of band lineups, and measurement method of the same*	2012-170994
357	2012 Aug 1 *High proton conductive polymer, method for producing the same, and humidity sensor using the same*	2012-171062
358	2012 Aug 9 *Fabrication method of nanosheet single film with spin coating method, super-hydrophilic material, and substrate materials for oxide thin film and their derived materials*	2012-177153
359	2012 Aug 21 *Fabrication equipment and method of polymer EL devices, and fabrication equipment and method of CVD thin films*	2012-182178
360	2012 Aug 31 *Filler support material, method for producing the same, and bone repair kit based on the same*	2012-192599
361	2012 Sep 10 *Method for producing group IV semiconductor nano thin wire*	2012-198008
362	2012 Sep 19 *Method for producing metal silicides*	2012-205508
363	2012 Oct 2 *Sample heating equipment for anti-abrasive and anti-corrosive measurements*	2012-220189
364	2012 Oct 24 *Material for lithium secondary battery, method for producing anodes using the same, and battery using the same*	2012-234924
365	2012 Oct 24 *Dispersion liquid for conductive polymer metal composite thin film, and method for producing the same*	2012-235178
366	2012 Nov 1 *Array-type sensor using reinforced electromagnetic fields, measurement method using the same, and measurement equipment using the same*	2012-241527
367	2012 Nov 1 *Undoped cerium oxide nanoparticles with air stable fluorite structure and high cerium content, and method for producing the same*	2012-242148
368	2012 Nov 12 *Sputter gun*	2012-248866
369	2012 Nov 13 *Framework compound, and method for producing the same*	2012-249657
370	2012 Nov 20 *Ultra high speed shutter system for vacuum use*	2012-253996
371	2012 Nov 21 *Organic and inorganic composites, and method for producing the same*	2012-255616
372	2012 Nov 22 *Conjunction membranes of organic tissues, and method for producing the same*	2012-255955

No.	Date of Application / *Name of Invention*	Application Number
373	2012 Nov 22 *Small size nickel carbon nanoparticles, method for producing the same, electrode catalyst using the same*	2012-256243
374	2012 Nov 26 *Metal detecting sensor, method for producing the same, equipment using the same*	2012-257009
375	2012 Dec 11 *Meso fine pore inorganic oxide porous materials, and method for producing the same*	2012-270820
376	2012 Dec 19 *Phosphor ropes and detecting methods of cesium containing organic matters*	2012-277466
377	2012 Dec 28 *Oxidation resistant nickel aluminum nanoparticles, method for producing the same, and bonding coated layers using the same*	2012-287587

2. List of Japanese Patent Registrations (October 2007 – December 2012):

No.	Date of Registration / *Name of Invention*	Registration Number
1	2007 Oct 19 *Gallium oxide nanowires, and method for producing the same*	4025869
2	2007 Oct 19 *Magnesium oxide nanocables and nanotubes, and method for producing the same*	4025872
3	2007 Oct 19 *Boron nitride nanowires, and method for producing the same*	4025873
4	2007 Oct 19 *Method for manufacturing gallium nitride nanowires coated with gallium oxide layers*	4025876
5	2007 Oct 26 *Boron nitride nanotubes containing magnesium peroxide, and method for manufacturing the same*	4029158
6	2007 Nov 9 *Manganic acid nanosheets, and method for producing the same*	4035599
7	2007 Nov 22 *Layered cobalt oxide hydrate*	4041883
8	2007 Dec 14 *Electrochromic device*	4051446
9	2007 Dec 21 *Composite material for hydrogen generation, and method for fabricating the same*	4054877
10	2008 Jan 18 *Porous manganese oxide pillared with aluminum polyoxoions*	4065953
11	2008 Jan 25 *Manufacturing method of magnetic recording medium, where writing is easily performed*	4069205
12	2008 Feb 1 *Method for producing single crystal alpha and beta silicon nitride nano ribbons*	4072622
13	2008 Feb 22 *Terbium-boron-silicon based rare earth polyboride: a high temperature antioxidant and thermoelectric material*	4081547
14	2008 Mar 21 *Sintered body of grain-oriented ceramics, and method for producing the same*	4096053
15	2008 Apr 11 *Lithium tantalate single crystal, optical element thereof, and method for producing the same*	4107365
16	2008 Jun 20 *Photorefractive material*	4139881
17	2008 Jul 4 *Method for poling ferroelectric single crystals*	4148451
18	2008 Sep 19 *Glycosaminoglycan-polycation complex for matrix of anagenesis, and method for producing the same*	4187917
19	2008 Oct 3 *Shape control method of nanostructures*	4192237
20	2008 Oct 24 *Sustained release material for medicine in living body*	4204772
21	2008 Nov 7 *Zinc oxide based multilayer structure, and its fabricating process*	4210748
22	2008 Nov 14 *Device and method for alternating immersion for treating living-body tissue material*	4215956
23	2008 Nov 14 *New glycosaminoglycan/inorganic ion complex, its production method, and medical material containing the same*	4216946
24	2008 Dec 5 *Biodegradability control of composite biomaterial*	4226830
25	2008 Dec 12 *Method for producing layered double hydroxide with ion-exchangeable anions by removing carbonate-ion from hydrotalcite, and use of the hydroxide*	4228077
26	2009 Feb 20 *Cadmium-zinc-sulfide nanocables, and method for producing the same*	4258741
27	2009 Mar 6 *Textured sintered bodies of beta-alumina and beta”-alumina, and method of manufacturing the same*	4269049
28	2009 Apr 24 *Combined material of chitosan and calcium phosphate, and method for producing the same*	4297393
29	2009 Apr 24 *Fixing method for radioactive elements*	4297417
30	2009 Jul 31 *Method for manufacturing apatite-coating organic material*	4349596
31	2009 Aug 21 *Thin film with ferroelectric mesocrystals, and method for producing the same*	4360467
32	2009 Sep 4 *Membrane fixing system*	4370220

No.	Date of Registration / *Name of Invention*	Registration Number
33	2009 Sep 11 *Hydrated sodium cobalt oxide, and its production method*	4370382
34	2009 Sep 18 *Osteoanagenesis induction material*	4374410
35	2009 Oct 2 *Material for preventing adhesion*	4378442
36	2009 Oct 2 *Manufacturing apparatus for biological tissue filling material*	4379679
37	2009 Nov 20 *Organic-inorganic composite biological material, and manufacturing method for the same*	4408603
38	2009 Nov 27 *Method for manufacturing wurtzite type group III-V nitride thin film crystal*	4413558
39	2009 Dec 4 *Filling material for biological tissue, and its manufacturing method*	4416152
40	2009 Dec 11 *Optical modulator*	4420202
41	2010 Jan 8 *Modularized artificial bone*	4431668
42	2010 Jan 8 *Silicon nanoparticle covered with zinc sulfide film, and method for producing the same*	4431685
43	2010 Jan 8 *Ultrahigh vacuum scanning probe microscope*	4431733
44	2010 Jan 8 *Manufacturing method of aluminum nitride nano-ribbon*	4431745
45	2010 Jan 22 *Semiconductor substrate, and its manufacturing method*	4441605
46	2010 Jan 22 *Aluminum nitride nanotube covered with boron nitride film, and method for producing the same*	4441617
47	2010 Feb 12 *Method for producing hexagonal zinc sulfide nanotube*	4452813
48	2010 Mar 12 *Single crystal alpha-alumina nanotube, and method for producing the same*	4469982
49	2010 Mar 26 Ceramic porous materials	4478777
50	2010 Apr 9 *Zinc oxide nanoplate-nanorod bonded article, and method for producing the same*	4487057
51	2010 Apr 23 *Hologram recording medium, and hologram recording and reproducing apparatus*	4496328
52	2010 Apr 23 *Silicon nanoparticle coated with zinc selenide film, and its manufacturing method*	4496353
53	2010 Apr 30 *Method of manufacturing oriented apatite sintered material*	4504100
54	2010 Jun 4 *Polarization reversal forming method*	4521859
55	2010 Jun 18 *Method of manufacturing manganese-doped gallium nitride nano-wire*	4528938
56	2010 Jun 18 *Apatite molded material and ceramic having specific adsorption characteristic to specified protein, and method for manufacturing the same*	4528957
57	2010 Jun 18 *Biomaterials*	4529005
58	2010 Jun 25 *Calcium zirconate powder*	4534001
59	2010 Jun 25 *Method for manufacturing high purity boron nitride nanotube*	4534016
60	2010 Jul 2 *Manufacturing method of zinc sulfide nano-cable containing zinc*	4538620
61	2010 Jul 2 *Cold rolled steel sheet for deep drawing having excellent denting resistance*	4538682
62	2010 Jul 23 *Lithium niobate single crystal, optical element thereof, and method for producing the same*	4553081
63	2010 Jul 30 *Adsorbent for radioactive element-containing waste, and method of immobilizing radioactive element*	4556007
64	2010 Jul 30 *Zinc sulfide/silicon core/shell nanowire, and method for producing the same*	4556015
65	2010 Aug 20 *Wavelength conversion element consisting of lithium tantalate single crystal*	4569911
66	2010 Sep 3 *Method of manufacturing highly ordered ceramic structural body consisting of oriented single crystal grain*	4576522
67	2010 Sep 3 *Photo catalyst based on visible-light responsive composites*	4576556
68	2010 Sep 3 *Method for producing indium phosphide nano-tube*	4576603
69	2010 Sep 3 *Method for producing single crystal indium nitride nanotube*	4576604
70	2010 Sep 3 *Single crystal zinc sulfide nanotube, and its manufacturing method*	4576607
71	2010 Sep 10 *Silicon nitride nano-wire coated with silicon nitride nanosheet, and its manufacturing method*	4581121
72	2010 Sep 10 *Intravital decomposing and absorbing adhesive material for medical use*	4585743
73	2010 Sep 17 *Method of forming polarization inversion*	4587366
74	2010 Sep 24 *Single crystal of lithium niobate, its optical element, and method for manufacturing the crystal*	4590531
75	2010 Sep 24 *Boron carbide nanobelt, and manufacturing method thereof*	4590599
76	2010 Sep 24 *Polarizable magnetic thin film structure, and its manufacturing method*	4590600
77	2010 Oct 1 *Fine structure patterning method*	4595119

No.	Date of Registration / *Name of Invention*	Registration Number
78	2010 Oct 15 *Indium germanate submicron tube, and its manufacturing method*	4604248
79	2010 Oct 22 *Method for processing zinc oxide monocrystal wafer*	4610870
80	2010 Oct 29 *Cerium phosphate nano tube, and method for producing the same*	4613342
81	2010 Oct 29 *Method for producing optical element with back-switch phenomena, and wavelength conversion element obtained by the method*	4613347
82	2010 Oct 29 *Optical wavelength conversion element, and method for producing the same*	4613358
83	2010 Oct 29 *Ferroelectric material, two-color holographic recording medium, and wavelength select filter*	4614199
84	2010 Nov 4 *Method of analyzing DNA sequence using field-effect device, and base sequence analyzer*	4608697
85	2010 Nov 12 *Manufacturing process of polymalic acid copolymer*	4621885
86	2010 Nov 12 *Magnetic medium*	4621899
87	2010 Dec 3 *Zinc oxide phosphor, process for producing the same, and light emitting device*	4635184
88	2010 Dec 3 *Method of controlling orientation angle in manufacturing method of structure, in which single crystal grains are oriented*	4635189
89	2010 Dec 3 *Polarization reversing method via charge amount control, and wavelength conversion element using same*	4635246
90	2010 Dec 3 *Method for testing durability of metal material for living body in cellular environment, and apparatus of the same*	4635247
91	2010 Dec 3 *Fluorescent material, method for producing the same, and luminous device*	4635250
92	2010 Dec 10 *Noble metal-containing titanate nanotube multilayered film, and its manufacturing method*	4639364
93	2010 Dec 10 *Average pore diameter control method for porous body including apatite/collagen composite fiber*	4643166
94	2010 Dec 24 *Method for producing silicon carbon nanoparticles by nitrogen plasma*	4649586
95	2011 Jan 7 *Nano composite magnet, and its manufacturing method*	4654409
96	2011 Jan 14 *Visible-light responsive composite oxide photo catalyst*	4660766
97	2011 Jan 21 *Optical element, and its manufacturing method*	4665162
98	2011 Jan 28 *Manufacturing method of platinum single crystal electrode for oxide thin film*	4670076
99	2011 Jan 28 *Manufacturing method of polymeric fibers*	4670080
100	2011 Jan 28 *Perfectly dissolved boron nitride nanotubes by polymer wrapping and purification of boron nitride nanotubes through functionalization*	4670100
101	2011 Feb 4 *Guided bone regeneration membrane*	4674315
102	2011 Feb 4 *Hydrothermal synthesis of birnessite-type manganese oxide nanobelts, and the electrochemical measurements*	4674347
103	2011 Feb 4 *The first template-free growth of crystalline silicon microtubes*	4674349
104	2011 Feb 4 *Fluorination and electrical conductivity of boron nitride nanotubes*	4674353
105	2011 Feb 10 *Anisotropic magnetic material, and its production process*	4680272
106	2011 Feb 10 *Porous composite containing calcium phosphate, and process for producing the same*	4680771
107	2011 Feb 18 *Copper oxide thin film low-friction material, and film-forming method therefore*	4686360
108	2011 Mar 11 *High-strength and high-ductility carbon steel, and method for producing the same*	4696263
109	2011 Mar 11 *Apatite/collagen cross-linked porous material containing self-organized apatite/collagen composite, and process for producing the same*	4699759
110	2011 Mar 18 *Fabrication of zinc sulfide/silicon carbon nanocables, silicon carbon shelled zinc sulfide nanoribbons and sheets, and silicon carbon nanotubes and tubes*	4701451
111	2011 Mar 18 *Tantalum oxide nano mesh, and method for synthesizing the same*	4701459
112	2011 Mar 18 *Optical controlling element*	4703158
113	2011 Mar 25 *Tripod-type functional interfacial molecule for immobilizing biomolecule, and gene detecting device using it*	4706074
114	2011 Mar 25 *Large-scale fabrication of boron nitride nanohorn*	4706077
115	2011 Mar 25 *Fabrication of highly crystalline side-to side biaxial heterostructures of zinc oxide/germanium, coaxial zinc oxide / germanium / zinc oxide and germanium / zinc oxide / germanium*	4706078
116	2011 Apr 22 *Carbon porous material, and method for producing the same*	4724877
117	2011 Apr 22 *Process of manufacturing of boron nitride nanotubes with decentralized liquids and acile polymeric*	4725890
118	2011 Apr 22 *Ceramic dental restoration, and its production method*	4729421

No.	Date of Registration / *Name of Invention*	Registration Number
119	2011 Jun 10 *Single-crystalline sub-micrometer zinc selenide tubes*	4756236
120	2011 Jun 10 *Highly luminescent semiconductor gallium nitride hollow spheres with very small shell thickness*	4756239
121	2011 Jul 1 *Two-layer bioreactor*	4771123
122	2011 Jul 29 *Transmission electron microscope*	4788887
123	2011 Jul 29 *Artificial vertebra*	4790917
124	2011 Aug 19 *Manufacturing of porous boron nitrides*	4803422
125	2011 Sep 2 *Indium phosphide nanowire covered with carbon film, and method for producing the same*	4811846
126	2011 Sep 2 *Bone outgrowth agent, and therapeutic agent for osteoporosis*	4814477
127	2011 Sep 9 *Diamond-like carbon thin film and plastic film, and gas barrier plastic bottle using the thin film*	4817102
128	2011 Sep 9 *Single-source precursor for chemical vapor deposition of collapsed boron nitride nanotubes*	4817103
129	2011 Sep 30 *Method for making one-dimensional structural array and crossbar structure on a substrate*	4831485
130	2011 Sep 30 *Magneto-optical materials, synthesis method for magneto-optical materials, and magneto-optical devices utilizing magneto-optical materials*	4831595
131	2011 Sep 30 *Magnetic artificial superlattices, and their fabrication method*	4831629
132	2011 Oct 14 *Metallic boride doped rare earth higher boride thermoelectric material, and its fabrication method*	4840755
133	2011 Oct 21 *Solid-liquid mixed type two-component system in vivo decomposing and absorbing adhesive medical material*	4844806
134	2011 Oct 21 *Porous ceramic material, and method of producing the same*	4844932
135	2011 Nov 11 *Production method of molded solid electrolyte*	4859007
136	2011 Nov 11 *Superconducting materials with high critical current properties, and their fabrication method*	4859165
137	2011 Nov 18 *Probe using semiconductor nano-thin line, and its manufacturing method*	4863460
138	2011 Nov 18 *Method of warm spraying*	4863487
139	2011 Dec 2 *High-performance all-solid lithium battery*	4873479
140	2011 Dec 2 *Process for producing porous object comprising of apatite/collagen composite fiber*	4873555
141	2011 Dec 2 *Method of boron nitride nanotube wall diameter control*	4873690
142	2011 Dec 2 *Thin film of zinc oxide, and its manufacturing method*	4873726
143	2011 Dec 9 *Stereo-regular polyacrylonitrile-based resin composition, and method for producing the same*	4881020
144	2011 Dec 16 *Micro-patterned nanofibrous nonwoven mat, and its manufacturing method*	4883498
145	2011 Dec 22 *Method of forming indium gallium nitride epitaxial thin film*	4873705
146	2012 Jan 6 *Nano wires having junctions of gallium and zinc sulfide coated by silica films, and method for fabricating the same*	4894180
147	2012 Jan 13 *Biological evaluation methods for medical equipment*	4900568
148	2012 Jan 13 *Dysprosium carbon nitrides, and method for fabricating the same*	4900580
149	2012 Jan 13 *Non-crystalline metal composites, their fabrication method, and products from them*	4900617
150	2012 Jan 27 *Resin compounds, and method for fabricating the same*	4911447
151	2012 Jan 27 *Surface reforming of medical devices and medical devices*	4911565
152	2012 Jan 27 *Medical devices, and surface reforming of medical devices*	4911566
153	2012 Jan 27 *Bio-decomposable, and absorbable adhesive medical materials*	4912565
154	2012 Feb 3 *Gallium sulfide sub-micron meter tubes, and fabrication method thereof*	4915764
155	2012 Feb 17 *Sodium thiophosphate-iron compounds, method for fabricating the same, and lithium battery using the same*	4924963
156	2012 Feb 17 *Optical switches*	4925037
157	2012 Feb 17 *Compounds of reinforced phenoxy resin system, and method for fabricating the same*	4928126
158	2012 Feb 24 *Aluminum nitride ribbons*	4930952
159	2012 Mar 2 *Porous materials made of apatite/collagen composites, and method for fabricating the same*	4934773
160	2012 Mar 2 *Compounded nano wires, and method for fabricating the same*	4936039
161	2012 Mar 2 *Elastomer resin compounds of poly urethane system, and method for fabricating the same*	4938513
162	2012 Mar 9 *Carbon nitride porous materials, and method of fabricating the same*	4941953

No.	Date of Registration / *Name of Invention*	Registration Number
163	2012 Mar 9 *Tungsten oxide nano sheets, and method for fabricating the same*	4941980
164	2012 Mar 9 *Transparent heat-resistant resin compounds, and method for fabricating the same*	4944468
165	2012 Mar 16 *Composite films, and method for fabricating the same*	4947458
166	2012 Mar 16 *All solid batteries*	4948510
167	2012 Mar 23 *All solid lithium secondary batteries*	4953406
168	2012 Mar 23 *Magnetic membranes, method for fabricating the same, and magneto-optic devices using the same*	4953933
169	2012 Apr 13 *Composite materials made of calcium phosphate and apatite/collagen composites*	4968639
170	2012 Apr 13 *Resin compounds with increased heat-resistance and mechanical properties, and method for fabricating the same*	4971643
171	2012 Apr 13 *Liquids with boron nitride nanotube disperse system, and nonwoven fabrics made from them*	4971836
172	2012 May 11 *Fabrication methods of single-electron devices*	4982728
173	2012 May 11 *All solid lithium batteries*	4982866
174	2012 May 25 *Hexagonal single crystal nanotubes, and method for fabricating the same*	4997622
175	2012 May 25 *Visible-light respondive photo catalyst*	4997627
176	2012 May 25 *Nano actuators*	4997633
177	2012 May 25 *All solid secondary batteries*	5001616
178	2012 Jun 1 *Materials with multiple structures, and lithium batteries by using them*	5004066
179	2012 Jun 1 *Occlusion of iodine*	5004230
180	2012 Jun 8 *Composite materials made of apatite/collagen composites, and method for fabricating the same*	5008135
181	2012 Jun 15 *Manufacturing methods of cermet coating films, and parts made from cermet coating films*	5013364
182	2012 Jun 15 *Heat resistant resin compounds, and method for fabricating the same*	5015469
183	2012 Jun 15 *Heat resistant resin complex compounds, and method for fabricating the same*	5015563
184	2012 Jun 22 *Polarization conversion device, and integrated type polarization conversion devices*	5019964
185	2012 Jun 22 *Calcium phosphate porous spherical particles, and calcium phosphate porous spherical multi layered particles with partly surface supported or substituted by metal ions*	5022267
186	2012 Jun 22 *Polyacene compounds, method for fabricating the same, and polymer electric devices using the same*	5022596
187	2012 Jun 29 *One dimensional orientated porous composites, and method for fabricating the same*	5024780
188	2012 Jun 29 *Polymer, inorganic or metal layered materials, and fabrication method thereof*	5024798
189	2012 Jun 29 *Antimicrobial particles, and method for fabricating the same*	5025367
190	2012 Jul 6 *Composite nano-wire coated by silicon dioxide, and method for fabricating the same*	5030075
191	2012 Jul 6 *Manganese oxide nano-meshes, and method for synthesizing the same*	5030076
192	2012 Jul 27 *Film making methods of gallium nitride and other group III nitrides*	5044860
193	2012 Jul 27 *Sintered porous materials of tri-calcium phosphate, and method for fabricating the same*	5045933
194	2012 Jul 27 *Heat-resistant resin compounds, and method for fabricating the same*	5048955
195	2012 Aug 3 *Heat and oxidation-resistant n-type thermo-electric materials of carbon, and nitrogen doped rare earth boride compound system, and methods of fabricating the same*	5051412
196	2012 Aug 3 *Artificial corneas*	5051424
197	2012 Aug 3 *Heat resistant resin compounds, and method for fabricating the same*	5054313
198	2012 Aug 3 *Resins of polyether-sulfone system compounds with high heat resistivity, and method for fabricating the same*	5054314
199	2012 Aug 3 *Heat resistant resin complex compound, and method of fabricating the same*	5054344
200	2012 Aug 10 *Boron nitride nano fibers, and method for fabricating the same*	5059589
201	2012 Aug 24 *Formed resin materials of polycarbonate system, and method for fabricating the same*	5069411
202	2012 Aug 24 *Heat resistant resin complex compound, and method for fabricating the same*	5069432
203	2012 Aug 31 *HVOF thermal spraying equipment*	5071706
204	2012 Sep 7 *Micro-machining methods using low pressure scanning electron microscope, and method for fabricating the same*	5077863

No.	Date of Registration / *Name of Invention*	**Registration Number**
205	2012 Sep 7 *Vacuum sputtering equipment*	**5077919**
206	2012 Sep 7 *Core-shell structured materials, hollow-shell structured materials, and methods for fabricating the same*	**5077922**
207	2012 Sep 7 *High communicating porous material, and method for fabricating the same*	**5077935**
208	2012 Sep 7 *Thermoplastic resin complex compound, and method for fabricating the same*	**5080027**
209	2012 Sep 14 *Nanotubes of boron nitride system, and method for fabricating the same*	**5083683**
210	2012 Oct 5 *Organic acids or their derivative active ester materials, and method for fabricating the same*	**5097900**
211	2012 Oct 5 *Coating film, and method for fabricating the same*	**5098109**
212	2012 Oct 5 *Manufacturing methods for polar inverted domain, and equipment, and devices using the same*	**5098113**
213	2012 Oct 5 *Fibrous papers of boron nitride, and method for fabricating the same*	**5099117**
214	2012 Oct 5 *Condensers, and method for fabricating the same*	**5099710**
215	2012 Oct 12 *Coating method*	**5105349**
216	2012 Oct 12 *Sponge-like fibrous steric structures, and method for fabricating the same*	**5105352**
217	2012 Oct 12 *Boron nitride spherical nano particles, and method for fabricating the same*	**5105372**
218	2012 Oct 26 *Structures of metal-layer tunnel-barrier sensors*	**5114774**
219	2012 Oct 26 *Photo-catalyst based thin films, method for fabricating the same, and devices using the same*	**5118067**
220	2012 Nov 2 *Silicon carbide nano structure materials, and method for fabricating the same*	**5120797**
221	2012 Nov 2 *Transformed cell groups, and method for manufacturing the same*	**5121155**
222	2012 Nov 2 *Liquid fullerene derivatives, method for fabricating the same, and devices using the same*	**5121710**
223	2012 Nov 2 *Heat resistant resin complex compounds, and method for fabricating the same*	**5123521**
224	2012 Nov 9 *Semiconductor materials, and method for fabricating the same*	**5126845**
225	2012 Nov 16 *Electrode materials for lithium secondary batteries made of lithium-chromium-titan oxides, and method for fabricating the same*	**5131887**
226	2012 Nov 16 *High heat-resistant, dimension-stable resin compounds, and method for fabricating the same*	**5134205**
227	2012 Nov 30 *Complex compounds, and fabrication of materials using the same*	**5144925**
228	2012 Dec 7 *Multiple thin films, and method for fabricating the same*	**5146866**
229	2012 Dec 14 *Resin compounds formed from elastomers of polyetheres-teramid system, and method for fabricating the same*	**5154760**
230	2012 Dec 14 *Scanning probe microscope, and method for measurement of probe relative position using the same*	**5156380**
231	2012 Dec 21 *High polymer bridging materials, and method for fabricating the same*	**5156890**
232	2012 Dec 28 *Platinum/cerium oxide based conductive carbon nano hetero anode materials, and method for fabricating the same*	**5164089**

3. List of International Patent Applications (October 2007 – December 2012):

Note: PCT: Patent Cooperation Treaty EPC: European Patent Convention

No.	Date of Application / **Country** *Name of Invention*	**Application Number**
1	2007 Oct 30 **PCT** *Single crystal of $Tm_xHo_yLiLn_{(1-x-y)}F_4$ and laser oscillator using the same*	**PCT/JP2007/071449**
2	2007 Nov 7 **US** *Nested modulator*	**11/983071**
3	2007 Nov 16 **EPC** *Magnesium-based medical device and process for producing the same*	**7832046.2**
4	2007 Nov 16 **PCT** *Magnesium-based medical device and process for producing the same*	**PCT/JP2007/072316**
5	2007 Nov 16 **US** *Magnesium-based medical device and process for producing the same*	**12/515089**
6	2007 Dec 20 **Korea** *Dielectric element and method for producing the same*	**2009-7008027**
7	2007 Dec 20 **PCT** *Dielectric element and method for producing the same*	**PCT/JP2007/074552**
8	2007 Dec 20 **US** *Dielectric element and method for producing the same*	**12/448528**

No.	Date of Application **Application Number** **Country** *Name of Invention*
9	2007 Dec 21 **PCT/JP2007/074761** **PCT** *Bis(terpyridine) compound metal assembled body, hybrid polymer, method for producing the same and use of the same*
10	2008 Feb 5 **PCT/JP2008/052221** **PCT** *Iodide single crystal, method for production thesame, and scintillator comprising the same*
11	2008 Feb 8 **200880004598.4** **China** *Photocatalytic film, method for forming the same, and photocatalytic film coated product*
12	2008 Feb 8 **8711059.9** **EPC** *Photocatalytic film, method for forming the same, and photocatalytic film coated product*
13	2008 Feb 8 **2009-7016985** **Korea** *Photocatalytic film, method for forming the same, and photocatalytic film coated product*
14	2008 Feb 8 **PCT/JP2008/052180** **PCT** *Photocatalytic film, method for forming the same, and photocatalytic film coated product*
15	2008 Feb 8 **12/526150** **US** *Photocatalytic film, method for forming the same, and photocatalytic film coated product*
16	2008 Mar 4 **200880007381.9** **China** *Boron nitride fiber paper and method for producing the same*
17	2008 Mar 4 **8721663.6** **EPC** *Boron nitride fiber paper and method for producing the same*
18	2008 Mar 4 **2009-7014147** **Korea** *Boron nitride fiber paper and method for producing the same*
19	2008 Mar 4 **PCT/JP2008/054247** **PCT** *Boron nitride fiber paper and method for producing the same*
20	2008 Mar 4 **12/529845** **US** *Boron nitride fiber paper and method for producing the same*
21	2008 Mar 5 **97107671** **Taiwan** *Boron nitride fiber paper and method for producing the same*
22	2008 Mar 11 **PCT/JP2008/054844** **PCT** *Substrate for crystal growth, and method for crystal growth using the same*
23	2008 Mar 11 **97108461** **Taiwan** *Mg-containing ZnO mixed single crystal, laminate thereof and their production methods*
24	2008 Mar 13 **PCT/JP2008/054656** **PCT** *Lead-free magneto-optical devices and their fabrication methods*
25	2008 Mar 14 **200880008873.X** **China** *Mg-containing ZnO mixed single crystal, laminate thereof and their production methods*
26	2008 Mar 14 **8722549.6** **EPC** *Mg-containing ZnO mixed single crystal, laminate thereof and their production methods*
27	2008 Mar 14 **2009-7021721** **Korea** *Mg-containing ZnO mixed single crystal, laminate thereof and their production methods*
28	2008 Mar 14 **PCT/JP2008/055179** **PCT** *Mg-containing ZnO mixed single crystal, laminate thereof and their production methods*
29	2008 Mar 14 **12/531513** **US** *Mg-containing ZnO mixed single crystal, laminate thereof and their production methods*
30	2008 Mar 14 **13/443124** **US** *Mg-containing ZnO mixed single crystal, laminate thereof and their production methods*
31	2008 Mar 17 **PCT/JP2008/054917** **PCT** *Recording medium, and recording device and information recording/erasure method using the same*
32	2008 Mar 19 **PCT/JP2008/055799** **PCT** *Thermosetting resin composite composition, resin molded body, and method for producing the composition*
33	2008 Mar 21 **97110093** **Taiwan** *Thermosetting resin composite composition, resin molded body, and method for producing the composition*
34	2008 Mar 25 **8738847.6** **EPC** *Sintered binary aluminum alloy powder, and method for production thereof*
35	2008 Mar 25 **PCT/JP2008/055602** **PCT** *Sintered binary aluminum alloy powder, and method for production thereof*
36	2008 Mar 25 **12/450432** **US** *Sintered binary aluminum alloy powder, and method for production thereof*
37	2008 Apr 4 **PCT/JP2008/056802** **PCT** *Mesopoorus carbon nitride materials, and method for producing the same*
38	2008 May 8 **8752758.6** **EPC** *Metal nanoparticle, electrode using the same, and method for production of the same*
39	2008 May 8 **PCT/JP2008/058897** **PCT** *Metal nanoparticle, electrode using the same, and method for production of the same*
40	2008 May 8 **12/451358** **US** *Metal nanoparticle, electrode using the same, and method for production of the same*
41	2008 May 9 **8752560.6** **EPC** *Mg-based alloy*
42	2008 May 9 **2009-7022266** **Korea** *Mg-based alloy*
43	2008 May 9 **PCT/JP2008/058677** **PCT** *Mg-based alloy*
44	2008 May 9 **12/451356** **US** *Mg-based alloy*
45	2008 May 22 **PCT/JP2008/059475** **PCT** *Organic-inorganic hybrid polymer, method for production thereof, and method for control of molecular weight*
46	2008 Jun 9 **12/135472** **US** *Magnetic film, magnetic recording/ reproducing device, and polarization conversion component*
47	2008 Jun 24 **61/132931** **US** *Phenylbornic acid self-assembled monolayer substrate for highly specific detection of sialicaoid*
48	2008 Aug 8 **8826995.6** **EPC** *Switching element and application of the same*
49	2008 Aug 8 **PCT/JP2008/064328** **PCT** *Switching element and application of the same*
50	2008 Aug 8 **12/672151** **US** *Switching element and application of the same*

No.	Date of Application / Country / Name of Invention	Application Number
51	2008 Sep 4 EPC *Organic solvent dispersion of titania nanosheet and its film*	8829388.1
52	2008 Sep 4 PCT *Organic solvent dispersion of titania nanosheet and its film*	PCT/JP2008/065989
53	2008 Sep 4 US *Organic solvent dispersion of titania nanosheet and its film*	12/676626
54	2008 Sep 5 EPC *Surface enhanced infrared absorption sensor and method for producing the same*	8828985.5
55	2008 Sep 5 PCT *Surface enhanced infrared absorption sensor and method for producing the same*	PCT/JP2008/066107
56	2008 Sep 5 US *Surface enhanced infrared absorption sensor and method for producing the same*	12/676723
57	2008 Oct 24 EPC *Optical electric field amplifying element and probe using the same*	8841615.1
58	2008 Oct 24 PCT *Optical electric field amplifying element and probe using the same*	PCT/JP2008/069366
59	2008 Oct 24 US *Optical electric field amplifying element and probe using the same*	12/739596
60	2008 Dec 2 EPC *Process for producing anion exchange layered double hydroxide*	8858187.1
61	2008 Dec 2 PCT *Process for producing anion exchange layered double hydroxide*	PCT/JP2008/071869
62	2008 Dec 2 US *Process for producing anion exchange layered double hydroxide*	12/734955
63	2009 Feb 4 US *Process for producing anisotropic magnetic material and anisotropic magnetic material*	12/365401
64	2009 Feb 12 PCT *Totally-solid lithium secondary battery*	PCT/IB2009/000240
65	2009 Feb 17 Australia *Electrode element, method of manufacturing electrode element, and lithium ion secondary battery*	2009215336
66	2009 Feb 17 China *Electrode element, method of manufacturing electrode element, and lithium ion secondary battery*	200980105606.9
67	2009 Feb 17 EPC, France, Germany, UK *Electrode element, method of manufacturing electrode element, and lithium ion secondary battery*	9712887
68	2009 Feb 17 Korea *Electrode element, method of manufacturing electrode element, and lithium ion secondary battery*	2010-7018206
69	2009 Feb 17 PCT *Electrode element, method of manufacturing electrode element, and lithium ion secondary battery*	PCT/IB2009/000279
70	2009 Feb 17 US *Electrode element, method of manufacturing electrode element, and lithium ion secondary battery*	12/866111
71	2009 Mar 18 China *Process for producing ZnO single crystal, self-supporting ZnO single-crystal wafer obtained by the same, self-supporting wafer of Mg-containing ZnO mixed single crystal, and process for producing Mg-containing ZnO mixed single crystal for use in the same*	200980110142
72	2009 Mar 18 EPC *Process for producing ZnO single crystal, self-supporting ZnO single-crystal wafer obtained by the same, self-supporting wafer of Mg-containing ZnO mixed single crystal, and process for producing Mg-containing ZnO mixed single crystal for use in the same*	9726041.8
73	2009 Mar 18 Korea *Process for producing ZnO single crystal, self-supporting ZnO single-crystal wafer obtained by the same, self-supporting wafer of Mg-containing ZnO mixed single crystal, and process for producing Mg-containing ZnO mixed single crystal for use in the same*	2010-7023512
74	2009 Mar 18 PCT *Process for producing ZnO single crystal, self-supporting ZnO single-crystal wafer obtained by the same, self-supporting wafer of Mg-containing ZnO mixed single crystal, and process for producing Mg-containing ZnO mixed single crystal for use in the same*	PCT/JP2009/055301
75	2009 Mar 18 US *Process for producing ZnO single crystal, self-supporting ZnO single-crystal wafer obtained by the same, self-supporting wafer of Mg-containing ZnO mixed single crystal, and process for producing Mg-containing ZnO mixed single crystal for use in the same*	12/934835
76	2009 Mar 23 Taiwan *Process for producing ZnO single crystal, self-supporting ZnO single-crystal wafer obtained by the same, self-supporting wafer of Mg-containing ZnO mixed single crystal, and process for producing Mg-containing ZnO mixed single crystal for use in the same*	98109335
77	2009 Mar 25 EPC *Device for forming artificial opal membrane and method for forming artificial opal membrane*	9724096.4
78	2009 Mar 25 PCT *Device for forming artificial opal membrane and method for forming artificial opal membrane*	PCT/JP2009/055977
79	2009 Mar 25 US *Device for forming artificial opal membrane and method for forming artificial opal membrane*	12/736275
80	2009 May 25 China *Dielectric film, dielectric element, and process for producing the dielectric element*	200980118276.7
81	2009 May 25 Korea *Dielectric film, dielectric element, and process for producing the dielectric element*	2010-7025789
82	2009 May 25 PCT *Dielectric film, dielectric element, and process for producing the dielectric element*	PCT/JP2009/059550
83	2009 May 25 US *Dielectric film, dielectric element, and process for producing the dielectric element*	12/993952
84	2009 Jun 10 EPC *Electromagnetic wave absorbent material*	9762515.6
85	2009 Jun 10 PCT *Electromagnetic wave absorbent material*	PCT/JP2009/060636

No.	Date of Application / Country / Name of Invention	Application Number
86	2009 Jun 10 US *Electromagnetic wave absorbent material*	12/997338
87	2009 Jun 10 US *Electromagnetic wave absorbent material*	13/559986
88	2009 Jul 13 EPC *Luminescent nanosheets, and fluorescent illuminators, solar cells and color displays utilizing the same as well as nanosheet paints*	9794544.8
89	2009 Jul 13 PCT *Luminescent nanosheets, and fluorescent illuminators, solar cells and color displays utilizing the same as well as nanosheet paints*	PCT/JP2009/062681
90	2009 Jul 13 US *Luminescent nanosheets, and fluorescent illuminators, solar cells and color displays utilizing the same as well as nanosheet paints*	12/737370
91	2009 Sep 8 China *Composite material comprising high-molecular-weight matrix and low-molecular-weight organic compound and process for producing same*	200980134329.4
92	2009 Sep 8 EPC *Composite material comprising high-molecular-weight matrix and low-molecular-weight organic compound and process for producing same*	9811312.9
93	2009 Sep 8 PCT *Composite material comprising high-molecular-weight matrix and low-molecular-weight organic compound and process for producing same*	PCT/JP2009/004432
94	2009 Sep 8 US *Composite material comprising high-molecular-weight matrix and low-molecular-weight organic compound and process for producing same*	13/060532
95	2009 Sep 24 PCT *Alloy particle and wire used in air plasma spray or wire arc spray*	PCT/JP2009/066508
96	2009 Sep 24 US *Alloy particle and wire used in air plasma spray or wire arc spray*	13/119881
97	2009 Sep 25 PCT *Polymer brush composite and method for producing same*	PCT/JP2009/066680
98	2009 Oct 7 Germany *Graphene-coated member and process for producing same*	112009002392.4
99	2009 Oct 7 PCT *Graphene-coated member and process for producing same*	PCT/JP2009/067516
100	2009 Oct 7 US *Graphene-coated member and process for producing same*	13/123053
101	2009 Oct 19 PCT *Prepreg having excllent heat conductivity, method for producing prepreg, and molded plate*	PCT/JP2009/068293
102	2009 Oct 19 Taiwan *Prepreg having excllent heat conductivity, method for producing prepreg, and molded plate*	98135439
103	2009 Dec 1 Australia *All-solid battery*	2009323792
104	2009 Dec 1 Brazil *All-solid battery*	PI0922356-8
105	2009 Dec 1 Canada *All-solid battery*	2745379
106	2009 Dec 1 China *All-solid battery*	200980148585.9
107	2009 Dec 1 EPC *All-solid battery*	9774725.7
108	2009 Dec 1 India *All-solid battery*	4126/DELNP/2011
109	2009 Dec 1 Korea *All-solid battery*	2011-7012550
110	2009 Dec 1 PCT *All-solid battery*	PCT/IB2009/007634
111	2009 Dec 1 Russia *All-solid battery*	2011122217
112	2009 Dec 1 Taiwan *All-solid battery*	98140999
113	2009 Dec 1 US *All-solid battery*	13/131764
114	2010 Jan 29 China *Mg-based structured member*	201080005817.8
115	2010 Jan 29 EPC *TiO_2 nanoparticles*	10735907.7
116	2010 Jan 29 EPC *Mg-based structured member*	10735918.4
117	2010 Jan 29 PCT *TiO_2 nanoparticles*	PCT/JP2010/051256
118	2010 Jan 29 PCT *Mg-based structured member*	PCT/JP2010/051284
119	2010 Jan 29 US *TiO_2 nanoparticles*	13/147420
120	2010 Feb 2 US *Boron nitride spherical nano-grains and fabrication method of the same*	12/698897
121	2010 Apr 12 US *Boron nitride fiber paper and method for producing the same*	12/758787
122	2010 Apr 15 EPC *Ferromagnetic tunnel junction structure, and magnetoresistive effect element and spintronics device each comprising same*	10764510.3
123	2010 Apr 15 PCT *Ferromagnetic tunnel junction structure, and magnetoresistive effect element and spintronics device each comprising same*	PCT/JP2010/056785
124	2010 Apr 15 US *Ferromagnetic tunnel junction structure, and magnetoresistive effect element and spintronics device each comprising same*	13/264460
125	2010 Apr 22 EPC *Electrically conductive polyrotaxane*	10767136.4
126	2010 Apr 22 PCT *Electrically conductive polyrotaxane*	PCT/JP2010/057178
127	2010 Apr 22 US *Electrically conductive polyrotaxane*	13/264474
128	2010 May 13 EPC *Negative-electrode material and lithium secondary battery using same*	10774966.5

No.	Date of Application / Country / Name of Invention	Application Number
129	2010 May 13 PCT *Negative-electrode material and lithium secondary battery using same*	PCT/JP2010/058110
130	2010 May 13 US *Negative-electrode material and lithium secondary battery using same*	13/319589
131	2010 May 24 China *Hydrogen generating material, method for producing same, method for producing hydrogen, and apparatus for producing hydrogen*	201080022074.5
132	2010 May 24 EPC *Hydrogen generating material, method for producing same, method for producing hydrogen, and apparatus for producing hydrogen*	10780522.8
133	2010 May 24 PCT *Hydrogen generating material, method for producing same, method for producing hydrogen, and apparatus for producing hydrogen*	PCT/JP2010/058770
134	2010 May 26 US *Totally Synthetic, Phenylboronic Acid-Based Glucoseresponsive Hydrogel For Self-Regulated Insulin Delivery System*	61/348334
135	2010 Jun 7 EPC *Display element and color electronic paper using same*	10789392.7
136	2010 Jun 7 PCT *Display element and color electronic paper using same*	PCT/JP2010/059638
137	2010 Jun 7 US *Display element and color electronic paper using same*	13/378772
138	2010 Aug 18 PCT *Substrate, substrate production method, semiconductor element, and semiconductor element production method*	PCT/JP2010/064319
139	2010 Nov 1 US *Highly porous solid material made of biodegradable polymer and method of fabricating, processing, and cell-seeding the same*	12/916919
140	2010 Nov 26 China *Fabrication method and structure of electrode for organic device*	201080053634.3
141	2010 Nov 26 EPC *Fabrication method and structure of electrode for organic device*	10833311.3
142	2010 Nov 26 PCT *Fabrication method and structure of electrode for organic device*	PCT/JP2010/071096
143	2010 Dec 27 EPC *Phenylboronic acid monomer and phenylboronic acid polymer*	10842222.1
144	2010 Dec 27 PCT *Phenylboronic acid monomer and phenylboronic acid polymer*	PCT/JP2010/073544
145	2010 Dec 27 US *Phenylboronic acid monomer and phenylboronic acid polymer*	13/520710
146	2011 Jan 12 PCT *Perpendicular magnetic recording medium and its manufacturing method*	PCT/JP2011/050316
147	2011 Feb 1 EPC *Smart window using organic-metallic hybrid polymer, method of producing smart window, and smart window system*	11739734.9
148	2011 Feb 1 EPC *Biocompatible device*	11739750.5
149	2011 Feb 1 PCT *Smart window using organic-metallic hybrid polymer, method of producing smart window, and smart window system*	PCT/JP2011/052007
150	2011 Feb 1 PCT *Biocompatible device*	PCT/JP2011/052058
151	2011 Feb 1 US *Biocompatible device*	13/576718
152	2011 Feb 1 US *Smart window using organic-metallic hybrid polymer, method of producing smart window, and smart window system*	13/577598
153	2011 Feb 3 US *Production method for electrode for battery, electrode produced by production method, and battery including electrode*	13/020257
154	2011 Feb 7 US *Solid battery*	13/022064
155	2011 Feb 9 China *Production method for electrode for battery, electrode produced by production method, and battery including electrode*	201110036455.5
156	2011 Feb 9 China *Solid battery*	201110036463.X
157	2011 Mar 23 EPC *All-solid-state lithium cell*	11765400.4
158	2011 Mar 23 Korea *All-solid-state lithium cell*	2012-7025356
159	2011 Mar 23 PCT *All-solid-state lithium cell*	PCT/JP2011/056989
160	2011 Mar 23 US *All-solid-state lithium cell*	13/636961
161	2011 Apr 28 France *Transparent electric conductor*	1153653
162	2011 May 9 EPC *Surface stress sensor*	11786474.4
163	2011 May 9 Korea *Surface stress sensor*	2012-7030791
164	2011 May 9 PCT *Surface stress sensor*	PCT/JP2011/060673
165	2011 May 9 US *Surface stress sensor*	13/699667
166	2011 May 10 China *Polymer fiber, production method for same, and production device*	201180023013.5
167	2011 May 10 India *Polymer fiber, production method for same, and production device*	9623/DELNP/2012
168	2011 May 10 PCT *Polymer fiber, production method for same, and production device*	PCT/JP2011/060758

No.	Date of Application / Country / Name of Invention	Application Number
169	2011 May 10 US *Polymer fiber, production method for same, and production device*	13/696863
170	2011 May 19 PCT *Method for producing rare earth permanent magnets, and rare earth permanent magnets*	PCT/JP2011/061488
171	2011 May 24 EPC *Sugar responsive gel and medicine administering device*	11786640
172	2011 May 24 PCT *Sugar responsive gel and medicine administering device*	PCT/JP2011/061869
173	2011 Jun 1 PCT *Analysis device and manufacturing method for same*	PCT/JP2011/062638
174	2011 Jun 22 PCT *Method for determining number of layers of two-dimensional thin film atomic structure and device*	PCT/JP2011/064861
175	2011 Jul 20 EPC *Sensing device and biosensor*	11809649.4
176	2011 Jul 20 PCT *Sensing device and biosensor*	PCT/JP2011/066393
177	2011 Jul 20 US *Sensing device and biosensor*	13/513939
178	2011 Sep 2 PCT *Low-friction ZnO coating and method for producing same*	PCT/JP2011/069994
179	2011 Sep 8 PCT *Electrochemical transistor*	PCT/JP2011/070440
180	2011 Sep 8 Taiwan *Electrochemical transistor*	100133708
181	2011 Oct 4 PCT *Two-component tissue adhesive and method for producing same*	PCT/JP2011/072835
182	2011 Oct 4 PCT *Ferroelectric thin film having superlattice structure, manufacturing method thereof, ferroelectric element, and manufacturing method thereof*	PCT/JP2011/072844
183	2011 Oct 5 PCT *Tissue adhesive film and method for producing same*	PCT/JP2011/072962
184	2011 Nov 2 PCT *Manufacturing method for graphene substrate, and graphene substrate*	PCT/JP2011/075883
185	2011 Nov 24 PCT *Bio-hybrid material, production method therefor, and stent*	PCT/JP2011/077021
186	2011 Nov 25 PCT *Nickel-free stainless steel stent*	PCT/JP2011/077241
187	2011 Nov 25 PCT *Method for manufacturing graphene substrate, and graphene substrate*	PCT/JP2011/077879
188	2012 Jan 18 PCT *Water-swelling layered double hydroxide, method for production same, gel of sol substance, double hydroxide nanosheet, and method for preparation of the same*	PCT/JP2012/050973
189	2012 Jan 18 PCT *Method for producing anion-exchanging layered double hydroxide and method for substituting carbonate ion of layered double hydroxide containing carbonate ion*	PCT/JP2012/050976
190	2012 Apr 20 PCT *Dielectronic thin film, dielectronic thin film element, and thin film capacitor*	PCT/JP2012/060691
191	2012 Apr 20 PCT *Electrode chip for detecting biological molecule, and method for detecting biological molecules*	PCT/JP2012/060785
192	2012 Apr 26 PCT *Transparent electric conductor*	PCT/EP2012/057661
193	2012 May 18 PCT *High dielectric nanosheet laminate, high dielectric element and method for manufacturing high dielectric elements*	PCT/JP2012/062765
194	2012 Jun 29 US *SERS template for micro liquid*	61666302
195	2012 Jul 29 PCT *Method for depositing conductive polymer-metal composite and conductive polymer-metal composite*	PCT/JP2012/069236
196	2012 Aug 22 US *Method for fabricating thin films of nano single-sheets by spin coating method*	13/591372
197	2012 Nov 30 PCT *Method for rolling and draw bench machining of nickel free high nitrogen stainless, seamless thin tube made of nickel free high nitrogen stainless and method for fabricating the same*	PCT/JP2012/081186
198	2012 Dec 13 PCT *Nano wire containing nano particles and method for fabricating the same*	PCT/JP2012/082421

4. List of International Patent Registrations (October 2007 – December 2012):

Note: PCT: Patent Cooperation Treaty EPC: European Patent Convention

No.	Date of Registration / Country / Name of Invention	Registration Number
1	2007 Oct 31 Singapore *Apatite/collagen crosslinked porous material containing self-organized apatite/collagen composite, and process for producing the same*	SGP111835
2	2007 Nov 6 US *Nanotube, nano thermometer, and method for producing the same*	7291299
3	2008 Jan 9 France, Italy, Netherlands, Switzerland, UK *Apatite/collagen crosslinked porous material containing self-organized apatite/collagen composite, and process for producing the same*	1566186
4	2008 Jan 9 Germany *Apatite/collagen crosslinked porous material containing self-organized apatite/collagen composite, and process for producing the same*	60318613.0-08

No.	Date of Registration / Registration Number Country / Name of Invention
5	2008 Feb 19 **7331709** **US** *Temperature measuring method using micro temperature sensing element*
6	2008 Mar 5 **200380102761.8** **China** *Apatite/collagen crosslinked porous material containing self-organized apatite/collagen composite, and process for producing the same*
7	2008 Mar 17 **815929** **Korea** *High strength and high ductile magnesium alloys, and method for fabricating the same*
8	2008 Apr 22 **7362209** **US** *Zinc oxide resistor, and its manufacturing method*
9	2008 Jun 11 **1684112** **EPC, UK** *Method of inverting polarization by controlling defect density or degree of order of lattice points, and optical wavelength conversion element*
10	2008 Jun 11 **602004014399.5-08** **Germany** *Method of inverting polarization by controlling defect density or degree of order of lattice points, and optical wavelength conversion element*
11	2008 Jul 22 **7403327** **US** *Wavelength conversion element having multi-gratings and light generating apparatus using said element, and wavelength conversion element having cylindrical ferroelectric single crystals and light generating apparatus using said element*
12	2008 Oct 1 **I-301423** **Taiwan** *Zinc oxide resistor, and its manufacturing method*
13	2008 Nov 4 **7446930** **US** *Method of inverting polarization by controlling defect density or degree of order of lattice points, and optical wavelength conversion element*
14	2008 Nov 19 **ZL200480024102.1** **China** *Calcium phosphate porous spherical particles, and calcium phosphate multi-layered spherical particles partly substituted or surface-supported by metal ions*
15	2008 Nov 28 **872079** **Korea** *Apatite/collagen cross-linked porous material containing self-organized apatite/collagen bridged porous material, and process for producing the same*
16	2008 Dec 2 **2467252** **Canada** *Composite biomaterials*
17	2009 Feb 24 **7494664** **US** *Composite biomaterials*
18	2009 May 12 **7531160** **US** *Hollow spheres and flakes of titanium dioxide, and their production method*
19	2009 May 19 **7535162** **US** *Zinc oxide phosphor, process die producing the same, and light emitting device*
20	2009 Jun 10 **ZL200580021762.9** **China** *High strength and high ductile magnesium alloys, and method for fabricating the same*
21	2009 Jul 15 **ZL200580018142.X** **China** *High-performance all-solid lithium battery*
22	2009 Jul 21 **7563394** **US** *Platinum / cerium oxide electroconductive carbon nano-hetero anode material, and production method thereof*
23	2009 Nov 4 **1598085** **EPC, France, Germany, Italy, UK** *Biodegradable and pressure-sensitive materials for medical use*
24	2009 Nov 19 **10018394** **Germany** *Calcium phosphate porous sintered body, and production thereof*
25	2009 Dec 30 **ZL03821540.3** **China** *Polymer bridging materials, and method for fabricating the same*
26	2010 Jan 12 **2390099** **Canada** *Vital tissue for tendon or ligament, and process for producing the same*
27	2010 Jan 20 **ZL200680001957.1** **China** *Lithium ion-conductive solid electrolyte, method for producing the same, solid electrolyte for lithium secondary battery using such solid electrolyte, and all-solid lithium battery using such solid electrolyte for secondary battery*
28	2010 Jan 26 **7651675** **US** *Process for producing flaky titanium oxide capable of absorbing visible light*
29	2010 Feb 24 **ZI200580037218.3** **China** *Apatite/collagen crosslinked porous material, and process for producing the same*
30	2010 Mar 30 **7689067** **US** *Nested modulator*
31	2010 Jun 8 **7732573** **US** *Method for producing porous body comprising apatite/collagen composite fibers*
32	2010 Jul 22 **7741454** **US** *Biological low molecular weight derivatives*
33	2010 Sep 7 **2489156** **Canada** *Scaffold for regenerating hard/soft tissue interface*
34	2010 Sep 16 **AUP2005230313** **Australia** *Method of controlling average pore size of porous materials containing apatite/collagen composite fiber materials*
35	2010 Oct 29 **SGP125780** **Singapore** *Method of controlling average pore size of porous materials containing apatite/collagen composite fiber materials*
36	2010 Dec 1 **1642599** **EPC, France, Germany, UK** *Composite porous materials containing calcium phosphate, and fabrication method of the same*
37	2010 Dec 15 **ZL200810074155.4** **China** *Device for detection of bio-molecules, and method for analyzing nucleic acids using the same*
38	2011 Jan 18 **7871476** **US** *Magnesium alloy exhibiting high strength and high ductility, and method for production thereof*
39	2011 Jan 18 **7871638** **US** *Scaffold material for regeneration of hard tissue/soft tissue interface*
40	2011 Feb 15 **7888013** **US** *Method of analyzing DNA sequence using field-effect device, and base sequence analyzer*
41	2011 May 4 **1362565** **France, Germany, UK** *Artificial vertebra*
42	2011 May 17 **7943114** **US** *Fine hollow powder, thin flaky titanium oxide powder obtained by pulverization of the fine hollow powder, and processes for producing the same*

No.	Date of Registration / Registration Number Country / Name of Invention
43	2011 May 24 **7947249** **US** *Fine hollow powder, thin flaky titanium oxide powder obtained by pulverization of the fine hollow powder, and processes for producing the same*
44	2011 Jul 12 **7976717** **US** *Method of forming polarization reversal area, apparatus thereof, and device using it*
45	2011 Jul 12 **7976775** **US** *Sintered binary aluminum alloy powder sintered material, and method for production thereof*
46	2011 Aug 9 **7993782** **US** *All-solid lithium battery*
47	2011 Aug 10 **1640695** **France, Germany, UK** *Temperature measuring method using micro temperature sensing element*
48	2011 Aug 30 **8008357** **US** *Method of controlling average pore diameter of porous material containing apatite/collagen composite fiber*
49	2011 Sep 27 **8025766** **US** *Boron nitride based fiber paper, and manufacturing process thereof*
50	2011 Oct 11 **8034101** **US** *Magnesium-based biodegradable metallic material*
51	2011 Oct 26 **1078946** **Korea** *Photo catalyzing thin films, method for manufacturing photo catalyzing thin films, and products of catalyzing thin film and coated film*
52	2011 Oct 27 **2009215336** **Australia** *Electrode element, method of manufacturing electrode element, and lithium ion secondary battery*
53	2011 Nov 8 **8053116** **US** *Lithium ion-conductive solid electrolyte, method for producing the same, solid electrolyte for lithium secondary battery using such solid electrolyte, and all-solid lithium battery using such solid electrolyte for secondary battery*
54	2012 Jan 10 **8092773** **US** *Liquid fullerene derivative, method for producing the same, and device using the same*
55	2012 Mar 20 **8141168** **US** *Scanning probe microscope and a method to measure relative position between probes*
56	2012 Mar 21 **1959025** **EPC, France, Germany, Switzerland, UK** *Temperature measuring method using micro temperature sensing element*
57	2012 Apr 24 **8163386** **US** *Fine hollow powder thin flaky titanium oxide powder obtained by pulverization of the fine hollow powder, and processes for producing the same*
58	2012 May 1 **8168151** **US** *Organic/inorganic composite biomaterials, and process for producing the same*
59	2012 May 21 **I364862** **Taiwan** *Lithium ion conductive electrolyte and method for fabricating the same; electrolyte for lithium secondary batteries using the same electrolytes, and all solid cell using the same electrolytes for secondary battery*
60	2012 May 22 **8184426** **US** *Dielectric element and method for producing the dielectric element*
61	2012 Jun 5 **8193499** **US** *Surface enhanced infrared absorption sensor, and method for producing the same*
62	2012 Jun 7 **1155969** **Korea** *Method for controlling mean pore size of porous materials containing apatite/collagen composite fibers*
63	2012 Jun 13 **1437148** **France, Germany, UK** *Organic/inorganic composite bio materials, and method for fabricating the same*
64	2012 Jun 26 **8207391** **US** *Adsorbent for radioelement-containing waste, and method for fixing radioelement*
65	2012 Aug 15 **ZL200880007381.9** **China** *Boron nitride based fibrous paper, and method for fabricating the same*
66	2012 Aug 29 **1548004** **France, Germany, Italy, UK** *Bio low molecular derivatives*
67	2012 Sep 19 **ZL200880004598.4** **China** *Photo catalyzing thin films, method for manufacturing photo catalyzing thin films, and products of catalyzing thin film and coated film*
68	2012 Sep 21 **1187578** **Korea** *Method for fabricating porous materials containing apatite/collagen composite fibers*
69	2012 Oct 18 **8039090** **US** *Porous composite containing calcium phosphate, and process for producing the same*
70	2012 Nov 20 **8313846** **US** *Magnetic artificial super lattice, and method for producing the same*
71	2012 Nov 27 **8320154** **US** *Switching element, and application of the same*
72	2012 Dec 12 **ZL200780053105.1** **China** *Resin composition materials*

Appendix 8.10: International Cooperation

List of MOU agreements of MANA with overseas institutions signed between October 2007 and March 2013:

No.	Organization, **Country** Signed (Expired)
1	Kent State University, Department of Chemistry, **USA** Signed: 2008 Jan 10 (Expired: 2013 Jan 10)
2	Rensselaer Polytechnic Institute, Chemistry and Biological Engineering, **USA** Signed: 2008 Feb 28 (Expired: 2013 Feb 28)
3	University of California, Los Angeles (UCLA), **USA** Signed: 2008 Mar 24 (Expired: 2013 Mar 24)
4	Georgia Institute of Technology (GIT), Center for Nanostructure Characterization, **USA** Signed: 2008 May 6
5	CNRS, Centre d'élaboration de matériaux et d'études structurales (CEMES), **France** Signed: 2008 May 30
6	University of Cambridge, Nanoscience Centre, **UK** Signed: 2008 Jun 20
7	Indian Institute of Chemical Technology (IICT), **India** Signed: 2008 Jul 3
8	University of Basel, Institute of Physics, National Center of Competence for Nanoscale Science, **Switzerland** Signed: 2008 Jul 20
9	Yonsei University, Seoul, **Korea** Signed: 2008 Sep 1
10	Indian Institute of Science, Education and Research, **India** Signed: 2008 Dec 19
11	University of Karlsruhe, Institute for Inorganic Chemistry, Supramolecular Chemistry Group, **Germany** Signed: 2009 Jan 29
12	Fudan University, Department of Chemistry, New Energy and Materials Laboratory (NEML), **China** Signed: 2009 Mar 16
13	Indian Institute of Technology Madras, National Centre for Catalysis Research (NCCR), **India** Signed: 2009 Apr 5
14	University of Cologne, Institute of Inorganic Chemistry, Inorganic and Materials Chemistry, **Germany** Signed: 2009 May 28
15	École Polytechnique Fédérale de Lausanne (EPFL), Institute of Microengineering, **Switzerland** Signed: 2009 Jul 20
16	University of Rome Tor Vergata, Center for Nanoscience & Nanotechnology & Innovative Instrumentation (NAST), **Italy** Signed: 2009 Jul 30
17	University of Heidelberg, Kirchhoff Institute of Physics, **Germany** Signed: 2009 Aug 31
18	Loughborough University, **UK** Signed: 2009 Oct 28
19	Lawrence Berkeley National Laboratory (LBNL), **USA** Signed: 2010 Feb 9
20	University of Valenciennes, **France** Signed: 2010 May 20
21	Friedrich-Alexander University, Erlangen-Nürnberg, **Germany** Signed: 2010 Jun 21
22	Fudan University, Department of Materials Science, **China** Signed: 2010 Jul 23
23	EWHA Womans University Seoul, Department of Chemistry and Nanoscience, **Korea** Signed: 2010 Aug 27
24	Karlsruhe Institute of Technology, **Germany** Signed: 2010 Sep 16
25	Univesité de la Méditerranée, Marseille, **France** Signed: 2010 Sep 20
26	Anhui Key Laboratory of Nanomaterials and Nanostructures, **China** Signed: 2010 Oct 6
27	Multidisciplinary Center for Development of Ceramic Materials, **Brazil** Signed: 2010 Oct 26
28	Vietnam National University Ho Chi Minh City, **Vietnam** Signed: 2011 Jan 24
29	King Saud University, **Saudi Arabia** Signed: 2011 Jan 25
30	LMPG, Grenoble, **France** Signed: 2011 Feb 1
31	Université de Montréal (UdeM), **Canada** Signed: 2011 Jul 4
32	Flinders University, **Australia** Signed: 2011 Jul 19
33	University of Melbourne, **Australia** Signed: 2011 Sep 21
34	Shanghai Institute of Ceramics, **China** Signed: 2011 Dec 1
35	Tsinghua University, **China** Signed: 2012 Jan 28
36	Hanoi University of Science and Technology (HUST), **Vietnam** Signed: 2012 Feb 7
37	University of Sao Paolo, **Brazil** Signed: 2012 Apr 25
38	University College London (UCL), **UK** Signed: 2012 Oct 8
39	Kyungpook National University, **Korea** Signed: 2013 Jan 18

Appendix 8.11: MANA History

MANA History between October 2007 and March 2013:

Fiscal Year 2007

Date	Event	Date	Event
2007 Sep 12	NIMS with the project called "International Center for Materials Nanoarchitectonics (MANA)" has been selected to participate as one of five institutions in the World Premier International (WPI) Research Center Initiative, a program sponsored by the Ministry of Education, Culture, Sports, Science and Technology (MEXT)	2008 Feb 7	The 1st MANA Seminar entitled "Nanotechnology, a Key to Sustainability" was given by Dr. Heinrich Rohrer (Nobel Laureate in Physics 1986 and MANA Advisor)
		2008 Feb 28	MANA signed a Memorandum of Understanding (MOU) with Rensselaer Polytechnic Institute, USA
2007 Oct 1	Official Inauguration of MANA	2008 Mar 10-13	The 1st MANA International Symposium was held in Tsukuba
2007 Oct 18	The Launching Ceremony of MANA was held at Okura Frontier Hotel, Tsukuba	2008 Mar 12	1st MANA Evaluation Committee Meeting
2008 Jan 10	MANA signed a Memorandum of Understanding (MOU) with Kent State University, USA	2008 Mar 24	MANA signed a Memorandum of Understanding (MOU) with University of California, Los Angeles (UCLA), USA
2008 Feb 1	Launch of the new MANA Website in English		

Fiscal Year 2008

Date	Event	Date	Event
2008 Apr 1	Start of ICYS-MANA Program	2008 Jul 28 – Aug 1	The 5th NIMS-IRC-UCLA Nanotechnology Summer School was held at NIMS
2008 Apr 16	1st MANA Site Visit by the WPI Program Committee	2008 Sep 1	MANA signed a Memorandum of Understanding (MOU) with Yonsei University, Seoul, Korea
2008 May 6	MANA signed a Memorandum of Understanding (MOU) with Georgia Institute of Technology (GIT), USA	2008 Sep 11	Dr. Kohei Uosaki (MANA PI) was named "International Society of Electrochemistry Fellow"
2008 May 7	Dr. Ajayan Vinu (MANA Independent Scientist) received the Asian Excellent Young researcher Lectureship Award 2008 by the Chemical Society of Japan	2008 Sep 25	Dr. Masayoshi Higuchi (MANA Independent Scientist) received the "SPSJ Hitachi Chemical Award" given by the Society of Polymer Science, Japan (SPSJ)
2008 May 20	1st Follow-up Meeting by the WPI Follow-Up Committee	2008 Oct 1	Celebration of 1st Anniversary of MANA. Organizational Reform of MANA
2008 May 30	MANA signed a Memorandum of Understanding (MOU) with CNRS, France	2008 Oct 6	Dr. Yoshio Bando (MANA Chief Operating Officer) was named "American Ceramic Society Fellow"
2008 Jun 2	NIMS Overseas Operation Office opened at the University of Washington, USA	2008 Nov 27-28	2nd MANA Site Visit by the WPI Program Committee
2008 Jun 20	MANA signed a Memorandum of Understanding (MOU) with University of Cambridge, UK	2008 Dec 11	MANA activities were introduced in the NHK Program "Ohayou Nippon (Good Morning Japan)"
2008 Jul 3	MANA signed a Memorandum of Understanding (MOU) with Indian Institute of Technology (IICT), Hyderabad, India	2008 Dec 13	Dr. Alexei Belik (MANA Independent Scientist) and Dr. Pavuluri Srinivasu (ICYS-MANA Researcher) received the "Encouragement of Research in Materials Science Award" given by the Materials Research Society of Japan
2008 Jul 9	Dr. Kenji Kitamura (MANA PI) received the "Inoue Harushige Prize" given by the Japan Science and Technology Agency		
2008 Jul 16	Dr. Takayoshi Sasaki (MANA PI) and Dr. Minoru Osada (MANA Scientist) received the "2008 Tsukuba Prize"	2008 Dec 19	MANA signed a Memorandum of Understanding (MOU) with Indian Institute of Science, Education and Research, India
2008 Jul 19	Prof. Sir Harry W. Kroto visited MANA	2009 Jan 29	MANA signed a Memorandum of Understanding (MOU) with University of Karlsruhe, Germany
2008 Jul 20	MANA signed a Memorandum of Understanding (MOU) with University of Basel, Switzerland	2009 Feb 25-27	The 2nd MANA International Symposium was held in Tsukuba

Date	Event	Date	Event
2009 Mar 16	MANA signed a Memorandum of Understanding (MOU) with Fudan University, China	2009 Mar 28	Dr. Ajayan Vinu (MANA Independent Scientist) received the "CSJ Award for Young Chemists" given by the Chemical Society of Japan
2009 Mar 17	2nd Follow-up Meeting by the WPI Follow-Up Committee		

Fiscal Year 2009

Date	Event	Date	Event
2009 Apr 5	MANA signed a Memorandum of Understanding (MOU) with Indian Institute of Technology, Madras, India	2009 Oct 13	MANA-URTV Joint Workshop on Nanostructured Materials for Sustainable Development was held at University Rome Tor Vergata, Italy
2009 Apr 14	Dr. Minoru Osada (MANA Scientist) received the "Young Scientists' Prize" given by the Minister of Education, Culture, Sports, Science and Technology (MEXT)	2009 Oct 13-14	The 1st MANA-CEMES Joint Workshop on Fusion of Theory and Experiment was held at the MANA Satellite in CNRS Toulouse, France
2009 May 8	Dr. Kazuhiro Hono (MANA PI) received the "2009 Honda Frontier Award" given by the Honda Memorial Foundation	2009 Oct 26	Dr. Naoki Ohashi (MANA PI) received the "Richard M. Fulrath Award" given by the American Ceramics Society
2009 May 19	Prof. James K. Gimzewski (MANA PI) was elected as "Fellow of the Royal Society"	2009 Oct 28	MANA signed a Memorandum of Understanding (MOU) with Loughborough University, UK
2009 May 28	MANA signed a Memorandum of Understanding (MOU) with University of Cologne, Germany	2009 Nov 10	Nanjing University-Anhui Normal University-Hokkaido University-MANA Joint Symposium was held at Nanjing University, China
2009 Jun 15-17	The 8th Japan-France Workshop on Nanomaterials held at NIMS	2009 Dec 2	Dr. Ajayan Vinu (MANA Independent Scientist) received the "ICSB Award of Excellence" given by the Indian Scociety of Chemists and Biologists
2009 Jul 3	The 1st MANA-NSC Joint Workshop on Fusion of Nanotechnology and Bioscience was held at the MANA Satellite at University of Cambridge, UK	2009 Dec 10	The Osaka University-MANA/NIMS Joint Symposium on "Advanced Structural and Functional Materials Design" was held at Osaka University
2009 Jul 14	A delegation from U.S. Department of Energy (DOE) and U.S. Department of Defense (DOD) visited MANA	2009 Dec 18	Visit of the MANA Satellite at UCLA by WPI Program Director Prof. Toshio Kuroki
2009 Jul 20	MANA signed a Memorandum of Understanding (MOU) with EPFL, Switzerland	2010 Jan 7-8	3rd MANA Site Visit by the WPI Program Committee
2009 Jul 30	MANA signed a Memorandum of Understanding (MOU) with University of Rome Tor Vergata, Italy	2010 Jan 14	The 1st Waseda University-MANA/NIMS Joint Symposium on "Advanced Materials Designed at Nano- and Meso-scales toward Practical Chemical Wisdom" was held at Waseda University
2009 Jul 27-31	The 6th MANA-NSC-CNSI Nanotechnology Students' Summer School was held at the UCLA MANA Satellite, Los Angeles, USA	2010 Jan 31	Prof. James Gimzewski (MANA Satellite Principal Investigator) was featured in the NHK's satellite TV program "The proposal for the future (mirai-e-no teigen)"
2009 Aug 31	MANA signed a Memorandum of Understanding (MOU) with University of Heidelberg, Germany	2010 Feb 4	Prof. James Gimzewski (MANA Satellite Principal Investigator) was featured in the NHK's satellite TV program "The proposal for the future (mirai-e-no teigen)"
2009 Sep 20-22	XJTU-NIMS/MANA Workshop on Materials Science 2009 was held at Xi'an Jiaotong University, China	2010 Feb 4	Dr. Yusuke Yamauchi (MANA Independent Scientist) received "Inoue Research Aid for Young Scientists"
2009 Sep 25	Dr. Jun Nakanishi (MANA Independent Scientist) received the "Japan Society for Analytical Chemistry Award for Younger Researchers"	2010 Feb 9	MANA signed a Memorandum of Understanding (MOU) with Lawrence Berkeley National Laboratory (LBNL), USA
2009 Sep 29	Dr. Kohsaku Kawakami (MANA Scientist) received the "JSCTA Award for Young Scientists" given by the Japan Society of Calorimetry and Thermal Analysis	2010 Feb 16	Dr. Takayoshi Sasaki (MANA PI) ranked as the 18th most-prolific author in the high quality journal "Chemistry of Materials" (Impact Factor 5.046)
2009 Oct 2	Prof. Svante Lindqvist, Nobel Museum Director and Chair at the Royal Institute of Technology, Stockholm, visited MANA	2010 Mar 3	Dr. Masayoshi Higuchi (MANA Independent Scientist) received the "Marubun Academy Award"
2009 Oct 5	Dr. Kohei Uosaki (MANA PI) received the "ECS Fellow Award" given by the Electrochemical Society	2010 Mar 3-5	The 3rd MANA International Symposium was held in Tsukuba
2009 Oct 9	Prof. Sir Harry W. Kroto visited MANA for one-on-one meetings with young scientists	2010 Mar 5	2nd MANA Evaluation Committee Meeting
2009 Oct 10-12	Tsukuba-Shinchu Bilateral Symposium on "Advanced Materials Science and Technology" was held at National Tsing Hua University, Taiwan		

Date	Event	Date	Event
2010 Mar 21	Dr. Masanori Kohno (MANA Scientist) received the “Young Scientist Award” given by the Physical Society of Japan (PSJ)	2010 Mar 27	Dr. Kohei Uosaki (MANA PI) received the “Chemical Society of Japan Award”
2010 Mar 24-26	The Workshop on "Materials Nanoarchitectonics for Sustainable Development" as a part of the "Invitation Program for Advanced Research Institutions in Japan" sponsored by the Japan Society for the Promotion of Science (JSPS), was held in Gora, Hakone, Japan		

Fiscal Year 2010

Date	Event	Date	Event
2010 Apr 1	Dr. Tsuyoshi Hasegawa (MANA PI) and Dr. Kazuya Terabe (MANA Scientist) received the “NIMS President's Research Achievement Award”	2010 Sep 16	MANA signed a Memorandum of Understanding (MOU) with Karlsruhe Institute of Technology, Germany
2010 Apr 1	Dr. Yusuke Yamauchi (MANA Independent Scientist) received the “Ceramic Society of Japan Award”	2010 Sep 20	MANA signed a Memorandum of Understanding (MOU) with Université de la Méditerrannée, Marseille, France
2010 Apr 13	Dr. Katsunori Wakabayashi (MANA Independent Scientist) received the “Young Scientists' Prize” given by the Ministry of Education, Culture, Sports, Science and Technology (MEXT)	2010 Oct 6	MANA signed a Memorandum of Understanding (MOU) with Anhui Key Laboratory of Nanomaterials and Nanostructures, China
2010 May 20	MANA signed a Memorandum of Understanding (MOU) with University of Valenciennes, France	2010 Oct 11	Research results of the Traversa Group (MANA) on “Micro-Solid Oxide Fuel Cells” was introduced on Sankei News and Nikkei Online
2010 May 25	Dr. Yoshihiro Tsujimoto (ICYS-MANA Researcher) received the “Research Progress Award” given by the Japan Society of Powder and Powder Metallurgy (JSPM)	2010 Oct 28	The 1st MANA Science Café “Melting Pot Club” on “What is nanotechnology?” was held at Frontier Hotel Okura, Tsukuba
2010 Jun 14-15	The joint IBM and NIMS/MANA symposium on "Characterization and manipulation at the atomic scale" was held in Tsukuba	2010 Oct 22	Research results on the “Development of an Exhaust Gas Catalyst” by Dr. Katsuhiko Ariga (MANA PI) and Dr. Hideki Abe (NIMS Advanced Electronic Materials Center) were introduced in the October 22 issue of Nikkei Online
2010 Jun 21	MANA signed a Memorandum of Understanding (MOU) with Friedrich-Alexander University Erlangen-Nürnberg, Germany	2010 Oct 26	MANA signed a Memorandum of Understanding (MOU) with Multidisciplinary Center for Development of Ceramic Materials, Brazil
2010 Jul 14	3rd Follow-up Meeting by the WPI Follow-Up Committee	2010 Nov 11	Outreach activities of MANA were featured in the NHK program "Ohayou Nippon (Good Morning Japan)
2010 Jul 23	MANA signed a Memorandum of Understanding (MOU) with Fudan University, China	2010 Nov 11	Dr. Ajayan Vinu (MANA Independent Scientist) has been selected as the recipient of the prestigious “Friedrich Wilhelm Bessel Research Award 2010” given by the Alexander von Humboldt Foundation, and as recipient of the “Catalysis Society of India Award 2010”
2010 Aug 9	Research results of Dr. Ajayan Vinu (MANA Independent Scientist) on “a new fabrication of gold nanoparticles by self-assembly of nanoporous materials” were reported in Nikkei Online		
2010 Aug 18	MANA received a high appraisal from the WPI program committee for the activity in Fiscal Year 2009	2010 Nov 24-26	The 9th Japan-French International Workshop was held in Toulouse, France
2010 Aug 25	Three research subjects proposed by MANA researchers were selected for funding from Core Research of Evolutional Science & Technology (CREST) and Precursory Research for Embryonic Science and Technology (PRESTO) by the Japan Science and Technology Agency	2010 Dec 1	The 2nd Waseda University-MANA/NIMS Joint Symposium was held at NIMS
		2010 Dec 9	Ms. Kumiko Hayashi, Parliamentary Secretary for Education, Culture, Sports, Science and Technology (MEXT) visited MANA
2010 Aug 27	MANA signed a Memorandum of Understanding (MOU) with EWHA Womans University Seoul, Korea	2010 Dec 15	Mr. Lim Chuan Poh, Chairman, Agency for Science, Technology and Research (A*STAR), Singapore, visited MANA
2010 Aug 27	The 1st NIMS-EWHA workshop on “ Advanced Functional Materials” (NEWAM-10) was held in Tsukuba	2010 Dec 21	Dr. Masakazu Aono, MANA Director-General, was selected as a winner of the “2010 Feynman Prize in Nanotechnology” given by Foresight Institute, USA
2010 Sep 9	Dr. Kohei Uosaki (MANA PI) received the “Japanese Photochemistry Association Lectureship Award 2010”		

Date	Event	Date	Event
2011 Jan 1	The researchers Dr. Jinhua Ye (MANA PI) and Dr. Yusuke Yamauchi (MANA Independent Scientist) were featured in the NHK Special program "Can Japan Survive?"	2011 Feb 4	Research of Dr. Jinhua Ye (MANA PI) was introduced in the NHK Eco Channel
2011 Jan 17	Dr. Katsuhiko Ariga (MANA PI) received the "2010 Nice-Step Scientist (NISTEP) Award" by the National Institute of Science and Technology Policy	2011 Feb 6	Dr. Katsuhiko Ariga (MANA PI) received the "ISCB Award for Excellence 2011" in the area of Chemical Sciences given by the Indian Society of Chemists and Biologists (ISCB)
2011 Jan 19	The satellite workshop "Dirac Electron Systems 2011" of the workshop "Graphene Workshop in Tsukuba 2011" was held at NIMS Namiki-site	2011 Feb 18	Dr. H.E. Virachai Virameteekul, Minister of Science and Technology, Thailand, visited MANA
2011 Jan 24	MANA signed a Memorandum of Understanding (MOU) with Vietnam National University Ho Chi Minh City, Vietnam	2011 Feb 18	Dr. Masayoshi Higuchi (MANA Independent Scientist) received the "Gottfried Wagener Prize 2010" given by German Innovation Award
2011 Jan 25	MANA signed a Memorandum of Understanding (MOU) with King Saud University, Saudi Arabia	2011 Feb 28	The workshop on "Advanced Functional Nanomaterials" was held in Chennai, India
2011 Jan 27-28	The 1st MANA Grand Challenge Meeting was held in Miura Peninsula, Kanagawa prefecture	2011 Feb 28	Research of Dr. Tsuyoshi Hasegawa (MANA PI) was introduced in the NHK English radio program "Japan and World Update"
2011 Jan 29	Mr. Yoichiro Genba, Minister of State for Science and Technology Policy, visited MANA	2011 Mar 2-4	The 4th MANA International Symposium was held in Tsukuba
2011 Feb 1	Launch of the new MANA Website in Japanese	2011 Mar 5	MANA hosted "Prof. Rohrer's Science Class" for junior high-school students
2011 Feb 1	MANA signed a Memorandum of Understanding (MOU) with LMPG, Grenoble, Fance	2011 Mar 5	Prof. Heinrich Rohrer's Science Class 2011 was held at NIMS
		2011 Mar 11	MANA was hit by the Great Tohoku-Kanto earthquake

Fiscal Year 2011

Date	Event	Date	Event
2011 Apr 1	Four MANA researchers, MANA PI Dr. Katsuhiko Ariga, MANA Scientist Dr. Emiliana Fabbri, MANA Scientist Dr. Daniele Pergolesi and MANA Scientist Dr. Tetsushi Taguchi received NIMS President's Research Awards	2011 Dec 1	MANA signed a Memorandum of Understanding (MOU) with Shanghai Institute of Ceramics, China
2011 Jun 28-29	4th MANA Site Visit by the WPI Program Committee	2011 Dec 14	MANA was given the grade "A" in the WPI Program Interim Evaluation
2011 Jul 4	MANA signed a Memorandum of Understanding (MOU) with Université de Montréal (UdeM), Canada	2011 Dec 17-18	MANA exhibited a booth at "Science Festa in Kyoto 2011"
2011 Jul 19	MANA signed a Memorandum of Understanding (MOU) with Flinders University, Australia	2012 Jan 10	MANA was featured in a special issue of the journal Advanced Materials (IF 10.88) published by John Wiley & Sons, Inc.
2011 Sep 5-8	The 7th Japan-UK-USA Nanotechnology Students' Summer School was held at the MANA Satellite at University of Cambridge, UK	2012 Jan 23	Prof. Françoise Winnik (MANA Satellite PI) won the 2012 Macromolecular Science and Engineering Award of the Chemical Institute of Canada (CIC)
2011 Sep 17	MANA hosted "Prof. Kroto's Science Class 2011" for preliminary school students and their parents	2012 Jan 28	MANA signed a Memorandum of Understanding (MOU) with Tsinghua University, China
2011 Sep 21	MANA signed a Memorandum of Understanding (MOU) with University of Melbourne, Australia	2012 Feb 7	MANA signed a Memorandum of Understanding (MOU) with Hanoi University of Science and Technology, Vietnam
2011 Oct 7	The Osaka University-MANA/NIMS Joint Symposium on "Advanced Structural and Functional Materials Design" was held at Osaka University	2012 Feb 8	Dr. Takayoshi Sasaki (MANA PI) received the "29th CSJ Academic Prize" given by the Chemical Society of Japan (CSJ)
2011 Oct 19	4th Follow-up Meeting by the WPI Follow-Up Committee	2012 Feb 14	Dr. Yoshio Bando (MANA Chief Operating Officer) and Dr. Dmitri Golberg (MANA PI) received the "3rd Thomson Reuters Research Front Award"
2011 Oct 31	The NIMS/MANA-Flinders University Joint Symposium on "Nanoscience and Nanotechnology" was held at NIMS	2012 Feb 16-20	MANA participated in the WPI Joint Exhibition at the 2012 AAAS Annual Meeting in Vancouver, Canada
2011 Nov 1	The 3rd Waseda University-MANA/NIMS Joint Symposium was held at Waseda University	2012 Feb 29 – Mar 2	The 5th MANA International Symposium was held in Tsukuba
2011 Nov 19	MANA Visit of Minister Masaharu Nakagwa (MEXT)	2012 Mar 2	3rd MANA Evaluation Committee Meeting

Fiscal Year 2012

Date	Event	Date	Event
2012 Apr 2	Dr. Minoru Osada (MANA API) received the "7th NIMS President's Research Encouragement Awarad"	2012 Oct 8	MANA signed a Memorandum of Understanding (MOU) with University College London (UCL), UK
2012 Apr 14	Dr. Satoshi Tominaka (MANA Independent Scientist) received the "Funai Research Incentive Award" given by the Funai Foundation for Information Technology	2012 Oct 9	Prof. Zhong Lin Wang (MANA Satellite Principal Investigator) was awarded the ACerS Edward Orton, Jr. Memorial Lecture by the American Ceramic Society.
2012 Apr 25	MANA signed a Memorandum of Understanding (MOU) with University of Sao Paolo, Brazil	2012 Oct 24	5th Follow-up Meeting by the WPI Follow-Up Committee
2012 Apr 26-27	The 2nd MANA Grand Challenge Meeting was held in Nasu, Tochigi prefecture	2012 Nov 7	The NSQI-MANA Joint Symposium was held at NIMS
2012 May 7	The MANA Second-term Kickoff Meeting was held at NIMS	2012 Nov 12-13	Young researcher's MANA Grand Challenge Meeting was held at Miura Peninsula, Kanagawa prefecture
2012 May 10	The Australia/MANA joint workshop on "Nanoarchitectonics for Innovative Materials & Systems" was held at NIMS	2012 Nov 24	The 2nd WPI Joint Symposium: Inspiring Insights into Pioneering Scientific Research was held in Tsukuba
2012 Jul 5	Commemorative Ceremony for the Completion of the new NanoGREEN/WPI-MANA Building	2012 Dec 17	Dr. Kazuhito Tsukagoshi (MANA PI) received the 9th JSPS Prize from the Japan Society for the Promotion of Science.
2012 Jul 19	The 1st UdeM-MANA Workshop on "Nano-Life" was held in Montreal, Canada	2013 Jan 18	MANA signed a Memorandum of Understanding (MOU) with Kyungpook National University, Korea
2012 Jul 25	Dr. Yusuke Yamauchi (MANA Independent Scientist) received the "Tsukuba Encouragement Prize"	2013 Feb 14-18	MANA participated in the WPI Joint Exhibition at the 2013 AAAS Annual Meeting in Boston, USA
2012 Aug 21-22	5th MANA Site Visit by the WPI Program Committee	2013 Feb 27 – Mar 1	The 6th MANA International Symposium was held in Tsukuba
2012 Aug 27-31	The 8th MANA-Cambridge/UCL-UCLA Nanotechnology Summer School was held at MANA	2013 Mar 11	The 4th NIMS/MANA-Waseda International Symposium was held at NIMS
2012 Sep 5	Prof. Chung-Yuan Mou, Deputy Minister of the National Science Council, Taiwan, visited MANA	2013 Mar 18	The Osaka University-NIMS/MANA Joint Symposium on "Advanced Structural and Functional Materials Design" was held at NIMS
2012 Sep 28	Prof. Omar M. Yaghi (MANA Principal Investigator) was featured in Science, volume 337, in the column "Satellite Labs Extend Science".	2013 Mar 19	The International Symposium MASA 2013 on "Material Architectonics for Sustainable Action" was held at NIMS
2012 Oct 1	The PCCP-MANA Symposium on "Nanotechnology, Materials and Physical Chemistry" was held at NIMS		
2012 Oct 3	The MANA 5th Anniversary Memorial Symposium was held at NIMS		

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International Center for Materials Nanoarchitectonics (MANA)
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