MANA Progress Report

Facts and Achievements 2013

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

The International Center for Materials Nanoarchitectonics (MANA) was founded in 2007 as one of the original five centers under the World Premier International Research Center (WPI) Initiative of Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT). Winning critical acclaim for the research achievements in its first five year term, MANA advanced into its second term in 2012. Our vision is to "create a better future for humanity by opening up a new paradigm of nanotechnology through supporting the development of new materials." MANA believes that conceptual innovation must be brought into the nanotechnology developed to date. We express the concept of this innovated nanotechnology by the term nanoarchitectonics, making effective use of it in everyday research activities in search for new materials.

MANA achieved outstanding research results in its first term five year term not just because we steered ourselves in the unique research direction stated above but also because we have been dedicated to building an international environment. Around half of our researchers come from overseas, we train young scientists, promote interdisciplinary research and send research outcomes out to the world. MANA will continue to be committed to researching new materials as a world leading institute, and I am looking forward to your warm support for our activities.

The MANA Progress Report consists of two booklets named "Research Digest 2013" and "Facts and Achievements 2013." This booklet "Facts and Achievements 2013" serves as a summary to highlight the progress of the MANA project. The other booklet "Research Digest 2013" presents MANA research activities.

Nano Revolution
for the Future

MANA Progress Report
Facts and Achievements 2013

1. WPI Project Progress Report

In June 2013, MANA submitted a WPI Project Progress Report for Fiscal Year 2012 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 two pages of the report entitled *Summary of State of WPI Center Progress (MANA)* are 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):

Conducting research of the highest world level

We at MANA take great pride in having conducted the world's highest level materials research these past six years. Most of the accomplishments described below represent the outcome of studies bridging two or three different research fields. Our finding on unusually massive, instantaneous and reversible swelling of layered crystals will provide important insights into delamination reaction and contribute to controlled production of high-quality nanosheets. We have found more important properties/functions of the atomic switch, such as interesting characteristics similar to the synapse in the neuron network of the human brain. We have developed several oxide photo-catalysts with sufficient negative conduction band potential to successfully convert CO_2 into CH_4 fuel under light irradiation. Theoretical studies and the development of novel measurement methods are regarded as very important for nanoarchitectonics research in MANA. Recently, various important results triggering great interest have been obtained such as half metallic antiferromagnet as a prospective material for spintronics by first principles calculations. We have also developed revolutionary in situ measurements of the tensile strength on very thin Si nanowires inside a transmission electron microscope.

Advancing fusion of various research fields

To promote research fusion, we have established a variety of programs. The Grand Challenge Research Program was launched in FY2011, and in the spring of 2013, after two years, a debrief meeting of the seven selected projects was held in an open style and it was clearly observed that all the projects had already obtained noteworthy preliminary results. In FY2012, we launched the Theory-Experiment Fusion Research Program and the Nano-Life Fusion Research Program. Five applications for the former and two applications for the latter were accepted through hearing. According to a follow-up review after one year, all of the projects made a good start. MANA held "camp"-type Grand Challenge Meetings twice in FY 2012. We have observed that these meetings are remarkably useful in triggering fusion research among MANA's scientists in different research specialties. The new WPI-MANA Building has emphasized transparency and increased interaction between researchers from different disciplines.

Globalization of the institution

About 300 researchers from around the globe, including renowned scientists, young faculty and students, have visited MANA. The number of requests from Japanese and foreign government agencies, universities and research institutes to hold research meetings with MANA increased. MANA has become one of Japan's premier international research hubs where numerous researchers from around the world gather, and is accomplishing one of its missions—to construct a network of nanotechnology centers throughout the world. We continue to engage in a wide range of initiatives to spread the word about our original concept of nanoarchitectonics and to raise MANA's recognition. We announced an open forum entitled "Nanoarchitectonics and the Interface" in the American Chemical Society's *Langmuir*. The special issue was published in June 2013, and 33 of the 48 papers were contributed by non-MANA researchers from around the world. A similar special issue entitled "Nanoarchitectonics and Porous Materials" was published in the *Journal of Nanoscience and Nanotechnology* in April 2013. The Thomson Reuters citation rankings are an important indicator of research performance. While the global rankings of Japanese universities and research institutes have fallen across the board, NIMS's ranking in the field of materials science has soared from 13th to 4th in the world and from 4th to 1st in Japan in five years thanks to substantial contributions of MANA.

Implementing organizational reforms

The various systemic reforms implemented by MANA to date are gradually permeating our host institution, NIMS, thereby facilitating its own systemic reforms. NIMS established the International Center for Young Scientists (ICYS) to select and train young outstanding post-doc researchers from around the world, and it uses this as a career path system for handpicking the best candidates for permanent researcher positions at NIMS. MANA plays a central role as an organization for accepting and training ICYS Researchers. In light of this, an ICYS system was established to cultivate young researchers working in new fields in two NIMS' newly established centers. Also MANA's international research institute administration systems are now spreading to other universities and research institutes.

Efforts to secure the center's future development over the mid- to long term

NIMS's third five-year plan, which commenced in April 2011, already includes a strategy aimed at making MANA a permanent organization. MANA is positioned within NIMS as the Nano-scale Materials Division, one of NIMS's three research divisions. Along with efforts to ensure the organizational permanence of MANA, NIMS is deliberately increasing the number of the Center's permanent researchers and administrative staff. Regardless of whether the WPI program grant is extended or not, NIMS promises to provide the following research resources for MANA:

i) Approximately 100 core members will be assigned to MANA as permanent employees of NIMS;
ii) Expenses required to sustain basic and fundamental research at MANA are borne from NIMS operations subsidies totaling more than 1 billion yen.

However, MANA strongly requests a five-year extension of the program. We will designate the five-year extension as a period to establish MANA's "world premier status" and become independent, and we will enact the following initiatives.

i) We will work to cover the salaries of permanent and fixed-term staff members with operations subsidies and external funding, respectively.
ii) MANA's original programs will be transferred, as much as possible, to NIMS, and we will operate those programs that need to be implemented on their own on a self-sustaining basis.
iii) We will encourage our researchers to engage in challenging and interdisciplinary research, thereby cultivating numerous highly creative research projects and leading to more external funding.

2. WPI Program and MANA

The content of Section 2.1 is partly based on information published on the website of Japan Society for the Promotion of Science (JSPS) in March 2014 (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. The wpi logo is shown in Fig. 2-1.

wpi World Premier International Research Center Initiative

Fig. 2-1: WPI logo.

● **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.

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 2-1: 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
Follow-up Procedure:	● WPI Program Committee conducts follow-up activities on progress being made by the WPI centers with an eye to developing them into *highly visible research centers*

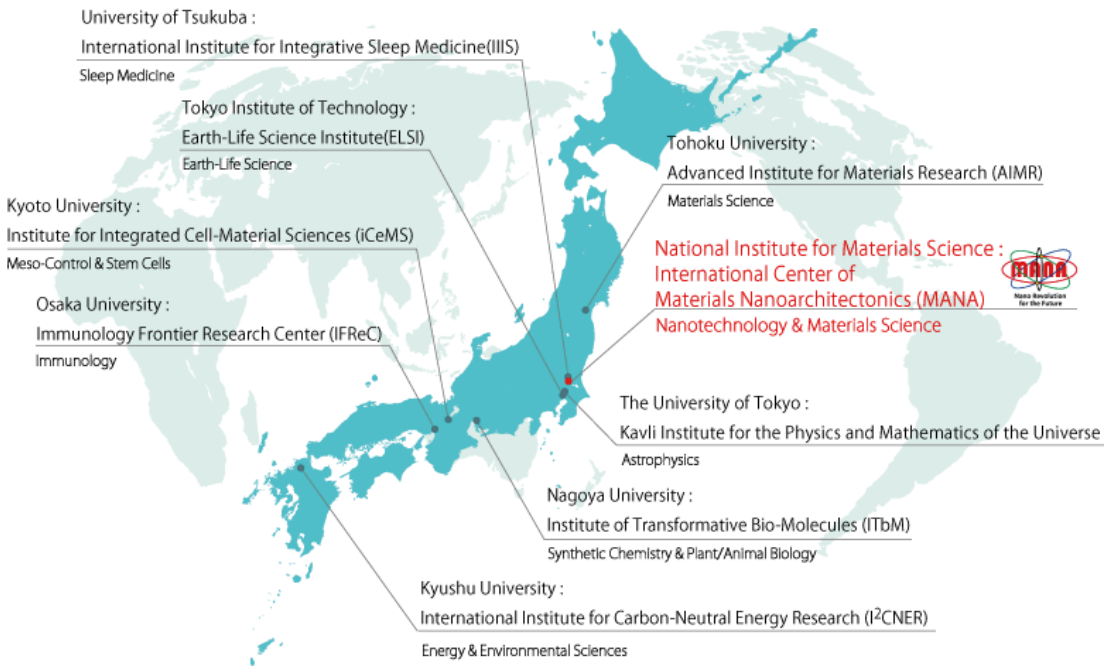


Fig. 2-2: Location of the 9 WPI research centers.

● **Selected WPI Programs**

The National Institute for Materials Science (NIMS) was one of the original five institutes selected for a WPI grant in FY2007 and later in October of that year, established the International Center for Materials Nanoarchitectonics (MANA). A sixth WPI center was added in FY2010 and 3 more WPI centers were selected in FY2012. The 9 WPI research centers with MANA being the only one not integrated into a university are shown in Fig. 2-2 and summarized in Table 2-2. 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 5 years term of operation in April 2012.

Table 2-2: The 9 WPI research centers (as of January 1, 2014).

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

2.2 MANA, the WPI Research Center at NIMS

● **What is MANA?**

The International Center for Materials Nanoarchitectonics (MANA) was founded in October 2007 as one of the original five centers under the World Premier International research Center Initiative (WPI) of Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT). Wining critical acclaim for the research achievements of its first five year term, MANA advanced into its second five year term in April 2012. MANA's Vision and Missions are displayed in Fig. 2-3.

MANA's Vision

For a better world of the future, leading the world in new materials research by pioneering the new paradigm of nanotechnology (nanoarchitectonics).

MANA's Missions

Face the challenge of developing ground-breaking new materials on the basis of the materials nanoarchitectonics concept.

Create a "melting pot" where top-level researchers gather from around the world.

Foster and secure young scientists having the confidence to battle towards challenging research targets.

Construct a network of nanotechnology centers throughout the world.

Fig. 2-3: MANA's Vision and Missions.

● **What is Nanoarchitectonics?**

Nanotechnology will continue to play a crucial role in the development of new materials. Nanotechnology is often mistakenly understood as an extension of the microtechnology that has been used so effectively in microfabrication of semiconductors, in other words, as a mere extension of existing techniques by pushing microtechnology to the ultramicro level. However, true nanotechnology us qualitatively different from microtechnology. *Nanoarchitectonics* is a term that was coined by MANA for innovative nanotechnology that properly recognizes the qualitative difference.

When applying nanoarchitectonics, it is essential to understand the following 4 key points.

(1) In the ultra-microscopic nanoscale world, structures cannot necessarily be fabricated as designed due to thermal or statistical fluctuations or the limits of control methods. Considering this, *Producing reliable functions from components that contain imperfections and structures that display ambiguity* is one key point.

(2) Nanoscale materials frequently display novel, interesting properties, but those components do not always manifest useful functions, either as single components or as simple aggregates. Thus, the second key point is to create completely new material functions by effectively producing organic interactions between the same or different components, that is, *From construction of structure to organization of interactions*.

(3) Thirdly, unexpected new functions as a whole often emerge from complex systems consisting of a huge number of nanoscale components. This phenomena, namely, *Quantity changes quality*, must not be overlooked.

(4) It is also necessary to pioneer a new theoretical field called *nanotheory* that can enter the range of the 3 points noted above. First-principles study of atoms, molecules, electrons, photons, spin, and te like is not sufficient; new approximations, which are bold but also appropriate, must be introduced.

Based on this concept of nanoarchitectonics, MANA is engaged in research encompassing the full range from basic to applied science in four research fields. These are Nano-Materials, Nano-System, Nano-Power, and Nano-Life (see Fig. 2-4).

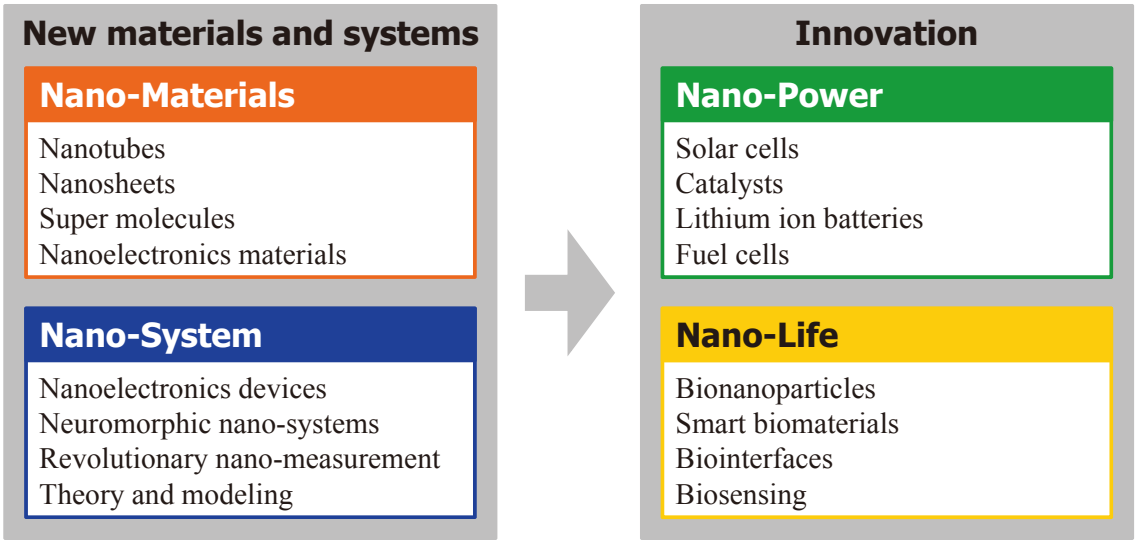


Fig. 2-4: The four research fields of MANA (as of January 1, 2014).

● **Research Objectives of MANA**

Research objectives for each of the four research fields of MANA are as follows.

Nano-Materials

Synthesis of New Nanoscale Materials and their Artificial Organization for Design of Advanced Functionalities

MANA researchers are engaged in research with the aim of creating new nanomaterials such as nanotubes, nanorods, nanosheets, etc. by utilizing original synthesis techniques, beginning with soft chemistry, supramolecular chemistry, and combinatorial techniques. In this work, we are strongly aware not only of size and shape at the nanometer order, but also precise control of the composition and structure of materials. From this perspective, we aim to discover new physical properties and phenomena and greatly enhance functions under the guiding principle of discovery and exploration of new nanomaterials. In elucidating physical properties, we actively use cutting-edge nanocharacterization techniques such as an advanced TEM system combined with STM and AFM, etc. We are also developing chemical nanotechnology, which enables artificial construction of high-order nanostructured materials by arrangement and integration of nanomaterials obtained in this manner at the nano level by chemical process and hybridization with other materials, with the goal of creating new functions and new technologies that are greatly superior to existing ones.

Nano-System

The Quest for Novel Nanosystems to Go Beyond Common Sense of Today and Lead the Information Processing Revolution of Tomorrow

The aims of the MANA Nano-System Field are to discover new functions which appear as a result of the mutual interaction of nanostructures that individually have interesting properties, and to systematically investigate their use in nanosystems. Concretely, we are engaged in basic research on phenomena such as atomic transport, molecular reaction process, charge transport, spin transport, plasmon excitation, superconductivity, etc. in nanoscale materials, and in the development of a wide range of devices utilizing those phenomena, including atomic switches, artificial synapses, molecular devices, qubits (quantum bits) in which quantum interference can not be destroyed, neural network-like network circuits, next-generation CMOS devices, ultra-high sensitivity, super parallel-type molecular sensors, etc. Because we give high priority to the development of new nanoscale characterization methods, we developed a multi-probe scanning probe microscope and other characterization instruments. We are also actively engaged in interdisciplinary and fusion research with other fields in MANA.

Nano-Power

High Efficiency Materials and Energy Conversion Systems for a Sustainable Society

The key of efficient use of solar energy is the arrangement of the molecules responsible for various functions such as electron transport and reactions. Efficient ion transport and electron transport play key roles in the storage, transportation, and extraction of energy, for example, in secondary cells (rechargeable batteries) and fuel cells. For this reason, control of interfacial atoms and molecules is indispensable. The arrangement of atoms and molecules at the catalyst surface is also a crucial key for achieving high selectivity and high efficiency in catalysts that are essential for resource-saving and energy-saving chemical process. In short, the scientific basis for realizing a sustainable society is designing the interfacial atomic/molecular arrangement corresponding to the purpose and realizing the actual arrangement as designed, in other words, *interfacial nanoarchitectonics*. Based on this concept of interfacial nanoarchitectonics, researchers in the Nano-Power Field are engaged in research and development of systems for high efficiency matter-energy conversion by free manipulation of atoms and molecules and control of nanostructures.

Nano-Life

Nano-Biological Functional Materials Realizes Material Therapy

Our aim is to create novel biomaterials that realize "materials therapy" for safe and secure advanced medical treatment. Materials therapy is an approach in which diagnosis and treatment of diseases are performed using materials, and the materials themselves demonstrate effects precisely like those of drugs. Although cells are the smallest unit in the human body, cells can be organized by cell groups and the adhesive proteins, etc. that support them, which then form organs that can perform complex functions. In this process, the homeostasis of the body is maintained by communications between biomolecules. In the MANA Nano-Life Field, we are developing new biomaterials that control biofunctions at the nano level by using nanoarchitectonics. In particular, we are carrying our research linked to clinical treatment by combining the two focuses of *Diagnosis/prevention* and *Treatment* of disease. These technologies can be expected to greatly reduce the time and cost of conventional treatment methods, and to lead to new therapeutic technologies that can also be applied to high urgency diseases.

● **WPI Evaluation of MANA**

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 2013 are listed in Table 2-3.

Table 2-3: Program Director (PD), Program Officer (PO) and Working Group members for MANA in Fiscal Year 2013.

Program Director (PD): WPI Program	Toshio Kuroki	Senior Advisor, Research Center for Science Systems, JSPS
Deputy Program Director: WPI Program	Akira Ukawa	RIKEN Advanced Institute for Computational Science
Program Officer (PO): MANA at NIMS	Gunzi Saito	Professor, Faculty of Agriculture, Meijo University
Working Group Member: MANA at NIMS	Yoshinobu Aoyagi	Eminent 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 sixth 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 19-20, 2013 (see Fig. 2-5). 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 29, 2013.

Fig. 2-5: Sixth MANA Site Visit in August 2013. Top row from left to right: WPI Program Director Prof. Toshio Kuroki, WPI Working Group Members for MANA, and MANA Center Director Prof. Masakazu Aono. Bottom row from left to right: Presentation by MANA Satellite PI Prof. Z.L. Wang and poster session.

3. Organization, Members and International Research Environment of MANA

3.1 MANA Organization and Members

● **Organization of MANA**

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.

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.

In October 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.

The MANA Administration Office has been established with three teams in October 2008 (*Planning Team*, *General Affairs Team*, *Technical Support Team)* and added an *Outreach Team* in April 2010. All staff of the MANA Administration is fluent in English.

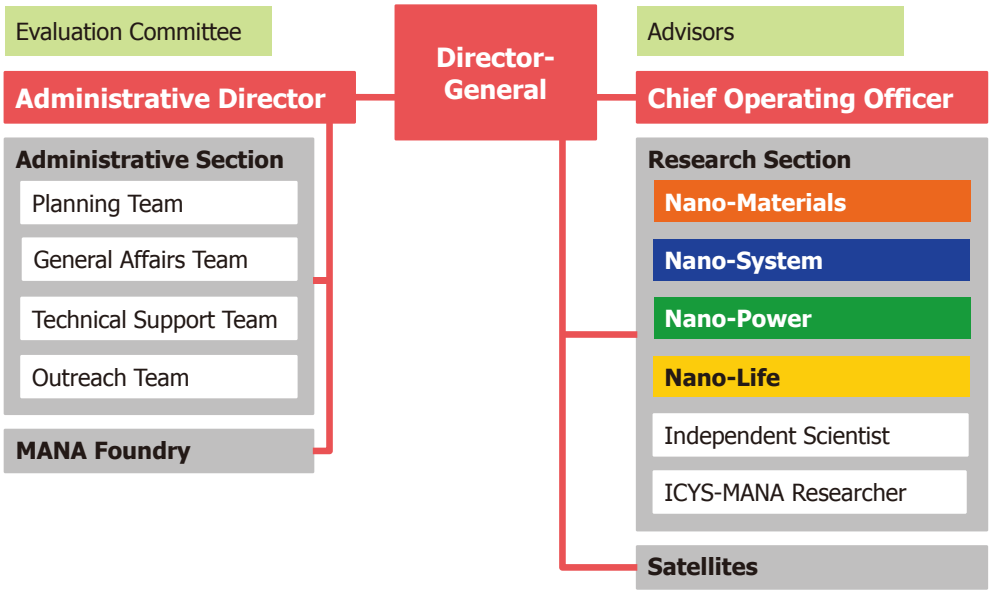


Fig. 3-1: Organization of MANA (as of January 2014).

Table 3-1: MANA members and duties.

Director-General Center oversight	**MANA Independent Scientist** A fixed-term younger researcher who conducts his/her own research independently in the 3D system
Chief Operating Officer Assists the Director-General and supervises research	**ICYS-MANA Researcher** A postdoctoral fellow selected from all over the world by open recruitment. He/she performs his/her research independently while receiving advice from mentors and Principal Investigators
Administrative Director Takes orders from the Director-General and supervises clerical and administrative duties	**MANA Research Associate** A postdoctoral fellow working in a group of a Principal Investigator or MANA Independent Scientist
Principal Investigator (PI) An internationally known world top-class scientist who plays 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	**Graduate Student** A doctor-course student at an institution affiliated with NIMS. He/she participates in research at MANA under the tutelage of a Principal Investigator, MANA Scientist and/or a MANA Independent Scientist
Associate Principal Investigator (API) A young promising scientist, who is expected to perform his/her own research at a level comparable to Principal Investigators	**Research Support Staff** Technicians that support research work
Group Leader A researcher who is leading a research group of a unit headed by one of the Principal Investigators	**Administrative Staff** Staff that supports administrative duties
MANA Scientist A researcher from NIMS who conducts research together with a Principal Investigator	

● **Workforce of MANA**

As of January 1, 2014, MANA employs 230 staff (see Table 3-2). Out of 202 researchers at MANA, half are foreign nationalities hailing from 22 different countries (see Table 3-3), and the 40 female researchers constitute 19.8% of the total.

Appendix 7.1: MANA Top Management
Appendix 7.2: MANA Research Staff

Table 3-2: MANA workforce (as of January 1, 2014).

Position	Number	Non-Japanese	Female
Principal Investigators	22	8	2
Associate Principal Investigators	2	1	0
Group Leaders	11	0	1
MANA Scientists	50	7	8
Independent Scientists	12	2	0
ICYS-MANA Researchers *	10	8	2
MANA Research Associates *	51	42	12
JSPS Fellows *	8	5	2
Junior Researchers #	36	28	13
Technical Staff	10	0	2
Administrative Staff	18	1	16
Total	**230**	**102**	**58**

*: Postdocs #: Graduate Students

Proportion of Foreign Researchers: 50.0% (101/202)
Proportion of Female Researchers: 19.8% (40/202)

Table 3-3: MANA workforce with foreign nationality (as of January 1, 2014).

Region	Country	MANA PI, API	MANA Scientist	Indep. Scientist	ICYS-MANA Researcher	Research Associate	JSPS Fellow	Graduate Student	Staff	Total
Asia	China	2	3		5	21	1	18		50
	India				1	9	1	2		13
	Korea		1			2		3		6
	Indonesia					1		1		2
	Nepal		1				1			2
	Taiwan					1	1			2
	Hong Kong					1				1
	Singapore					1				1
Oceania	Australia					1				1
	Fiji							1		1
Europe	Russia	1		1		1				3
	U.K.	2	1							3
	Belgium				1					1
	Czech					1				1
	France	1								1
	Germany						1			1
	Hungary					1				1
	Switzerland								1	1
Near East	Iran					2				2
Africa	Egypt							3		3
	Algeria				1					1
America	USA	2		1						3
	Canada	1	1							2
Total		**9**	**7**	**2**	**8**	**42**	**5**	**28**	**1**	**102**

● **MANA Advisors**

As of January 2014, there are three external stakeholders, including Nobel Prize winners and prominent researchers, serving as MANA Advisors (see Appendix 7.3). 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. In April 2013, MANA appointed two prominent researchers as International Cooperation Advisors (see Appendix 7.3). They provide MANA with advice on joint research with overseas research institutes and the formulation of a global nanotech network.

Appendix 7.3: MANA Advisors and International Cooperation Advisors

Dr. Heinrich Rohrer (Nobel Laureate in Physics, 1986), who was an Adviser of MANA, passed away at 9 pm on May 16th, 2013.

We sincerely pray that his soul may rest in peace.

All of us in MANA are devastated by this sad news. However, as we find solace in the many wonderful memories we have of him, we wish to express our most heartfelt appreciation for his earnest encouragement to us in MANA. Thank you very much indeed, Heini.

Masakazu Aono,
on behalf of all of Dr. Rohrer's friends in MANA

● **MANA Evaluation Committee**

As of January 2014, the MANA Evaluation Committee is comprised of 8 external stakeholders, 3 from Japan and 5 from abroad (members are shown in Appendix 7.4), and Professor Anthony Cheetham of the University of Cambridge acts as Chairman. Committee members provide frank opinions and expert recommendations on MANA's administration and research strategy. The committee has met in Tsukuba every two years, in March 2008, March 2010 and March 2012.

Appendix 7.4: MANA Evaluation Committee

3.2 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*.

● Melting Pot Environment of Different Scientific Fields, Cultures, and Nationalities

Fusion of different fields and cultures creates the possibility of innovation. At MANA, we are pursuing a *melting pot environment* where world-class human resources from diverse fields or specialization and different nationalities and cultures can come together and work *under one roof*. This is fostering a rich international perspective and giving birth to new ideas and original, creative research. The WPI-MANA Building, which was completed in the spring of 2012, was designed so that researchers in many fields can share the same space by removing the walls of offices on each floor to form single large rooms. We also made transparency a priority in laboratories by using glass-paneled corridor walls and doors throughout the new building (see Fig. 3-2) so that researchers who come and go outside labs can see the experiments in progress inside.

Fig. 3-2: Labs with glass-paneled walls to encourage transparency in the new WPI-MANA Building.

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 2013, MANA seminars were conducted with 45 speakers from NIMS and 84 invited renowned researchers from around Japan and the world (total 129 speakers).

Appendix 7.5: MANA Seminars

● Unique Triple Double (3D) System

MANA has created a unique system for training young scientists that we call the Triple Double (3D) system. Each young researcher at MANA is encouraged to have two mentors (see Fig. 3-3), one who is a scientist at NIMS, and the other from outside NIMS (particularly a mentor from another country). Young MANA researchers have 2 mentors (Double Mentor), do research spanning 2 fields of specialization (Double Discipline), and are affiliated with 2 institutions (Double Affiliation). The Triple Double system takes its name from these 3 Ds. By having young researchers work at research institutes in other countries, carry our research with the world's top scientists, and do interdisciplinary and fusion type research, MANA is training a new generation of scientists with an international vision and interdisciplinary capabilities.

Fig. 3-3: MANA Advisor Sir Harry W. Kroto, Nobel Laureate in Chemistry 1986, encourages MANA's 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 principle and system of ICYS continued as the NIMS International Center for Young Scientists (see Fig. 3-4).

Fig. 3-4: Logo of the NIMS International Center for Young Scientists.

ICYS-MANA has been organized in MANA to continue and develop the concept of ICYS. Talented young multinational researchers will gather to conduct independent research in a melting pot environment mixing different research fields and cultures. In MANA, principal investigators with excellent abilities and careers are conducting cutting-edge research in

materials science. These scientists will serve as mentors to ICYS-MANA researchers, based on a principle of respect for young researchers' ideas. Nanotechnology and Nanomaterials are the central issue of MANA. However, MANA covers wider area of materials science and will accept researchers not only of nanotechnology and nanomaterials but of various fields if they are excellent.

ICYS researchers are hired twice a year by way of international open recruiting. Over the 6.5 years between October 2007 and March 2014, 78 researchers have been hired from a total of 942 applications, including 835 foreign applicants (89%). Of these, more than half (40) have been hired under the ICYS-MANA system.

- **YAMATO-MANA Program**

Meanwhile, despite the fact that MANA has developed into an outstanding international research hub within Japan, the WPI program committee remarked that the number of Japanese postdocs is low and should be increased. For this reason, MANA established in January 2013 the YAMATO-MANA Program (**Y**oung, **A**spiring **M**otherland **A**cademics **TO MANA**, see Fig. 3-5) to bring talented young Japanese researchers to MANA in an effort to cultivate Japan's future leaders; this is a Center-wide effort to locate human resources. (Note: *Yamato* is an ancient name of Japan.)

Fig. 3-5: YAMATO-MANA program.

- **Throughout Support for Non-Japanese Researchers**

To build an international research center, it's important to cultivate an environment where researchers from around the world can easily come together to engage in research and other activities. With the aim of creating international research environment at every level, English has been made the official language of MANA. Seminars and meetings, e-mail communications, research plans, office procedures – everything is available in English. Guidebooks and the official website have been put into English and Japanese. For newly joined researchers, the orientation session and laboratory tour are conducted by staff this is fluent in English (see Fig. 3-6). MANA has also published a manga comic book in English called *The Challenging Daily Life*, which is full of practical tips that should be helpful to international researchers new to Japan (see Fig. 3-6). A support system has been put in place at MANA so that all international researchers, even those who haven't learned Japanese yet, can start their lives in Japan without difficulty. The system provides information necessary for daily life, for example, about public agencies, searching for a house or apartment and emergency support.

Fig. 3-6: Throughout support for non-Japanese researchers. Lab tour for newly joined researchers (left), a manga comic book with practical tips (middle), and Japanese language class for beginners (right).

Japanese language and culture classes are held for overseas researchers at MANA in order to help deepen their understanding of Japan. Japanese language classes are divided into introductory and beginner levels, and are held in three terms throughout the year (see Fig. 3-6). Students hold a speech contest during the final lesson of each term. In 2013, 83 participants attended the Japanese language classes. The Japanese culture class is held monthly. Specialist instructors are invited to give lectures on traditional Japanese culture as shown in Fig. 3-7 and listed in Table 3-4. In 2013, 154 participants joined the Japanese culture classes.

Fig. 3-7: Japanese culture class events at NIMS in 2013. Top from left to right: Karate, Kimono, Indigo-dyeing & Japanese Weaving, and Calligraphy. Bottom from left to right: Japanese Drum (Wadaiko), Ceramic Art, Ai-zome & Hina Doll Festival, and Sightseeing in Japan.

Table 3-4: Schedule of Japanese culture classes in 2013.

1	2013 Feb 8 **Kabuki and Bunraku Puppet Theater** (10 participants)	5	2013 May 24 **Calligraphy** (11 participants)	9	2013 Sep 21 **Indigo-dyeing & Japanese Weaving** (11 participants)
2	2013 Mar 2 **Ai-zome & Hina Doll Festival** (15 participants)	6	2013 Jun 21 **Origami** (10 participants)	10	2013 Nov 8 **Karate** (5 participants)
3	2013 Mar 29 **Kimono** (17 participants)	7	2013 Jul 22 & 29 **Japanese Drum (Wadaiko)** (8 participants)	11	2013 Nov 29 **Ikebana** (15 participants)
4	2013 Apr 26 **Sightseeing in Japan** (18 participants)	8	2013 Aug 30 **Ceramic Art** (15 participants)	12	2013 Dec 16 **Sushi** (19 participants)

● **Cutting-edge Research Environment**

Researchers at MANA have the opportunity to use some of the world's most advanced, highest performance research equipment at MANA's host institution, the National Institute for Materials Science (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.

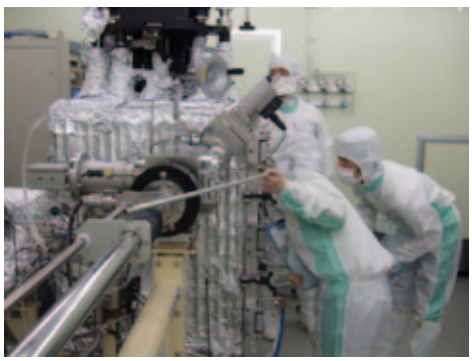


Fig. 3-8: The clean room facility in the MANA Foundry.

MANA has set up an independent MANA Foundry (see Fig. 3-8) 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.

In addition, MANA researchers have access to more than 50 user facilities and can use these with the support of experienced English speaking staff from the MANA Technical Support Team (TST).

● **New Research 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. 3-9). 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. The building received the rank of S, the highest possible rating, from CASBEE, a tool for assessing and rating the environmental performance of buildings.

Fig. 3-9: The new WPI-MANA Building at NIMS Namiki site.

The WPI-MANA Building employs the latest technologies, including a photocatalytic glass watering system, solar panels and sun louvers. Temperature, humidity and brightness are all controlled automatically to achieve energy efficiency while ensuring comfort. It is MANA's forward-looking attempt at developing a zero-energy building (ZEB).

By linking solar panels, emergency generators and storage batteries into a network, MANA was the first institution in Japan to adopt a microgrid. The microgrid will provide seamless power to key facilities even if power is interrupted during a disaster. Even during long power outages, the solar panels and storage batteries can supply the necessary minimum amount of power. Under normal circumstances when various equipment is in operation, the system has a peak output of 90 kW.

Zero-Energy Buildings (ZEB)

ZEBs are buildings that use energy-saving technology and renewable energy to bring their net energy consumption as close as possible to zero.

4. Research Activities, Output and Achievements

4.1 Research Activities

● **Research Digest 2013**

For an overview of MANA research activities, please refer to yearly published booklet Research Digest (see Fig. 4-1), which is part of the MANA Progress Report. Examples of recent research accomplishments of MANA are given in Section 4.3 of this chapter.

Fig. 4-1: 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 Highlights*. The newsletter, which contains English articles written by the former editor of Nature Nanotechnology, is distributed by sending out more than 7000 e-mails to all over the world. *MANA Research Highlights* spotlights the latest findings by MANA scientists. The highlights are written to be accessible to a wide audience, like foreign media, science journalists, research institutes around the world and researchers. With these efforts, we are working to increase MANA's name recognition throughout the global

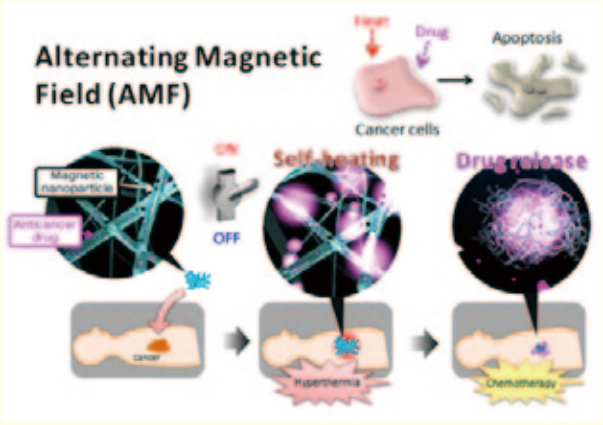
Volume 7 (July 12, 2013):

Smart anticancer nanofibers: Setting treatments to work together

Incorporating magnetic nanoparticles and an anticancer drug into crosslinked polymer nanofibers presents a twofold treatment for fighting cancer with diminished side effects.

Publication:

Y.J. Kim, M. Ebara, T. Aoyagi,
A Smart Hyperthermia Nanofiber with Switchable Drug Release for Inducing Cancer Apoptosis,
Advanced Functional Materials **23**(46), 5753, (2013).
doi: 10.1002/adfm.201300746



Design concept for a smart hyperthermia nanofiber system that uses magnetic nanoparticles (MNPs) dispersed in temperature-responsive polymers.

Fig. 4-2: Volume 7 of MANA Research Highlights.

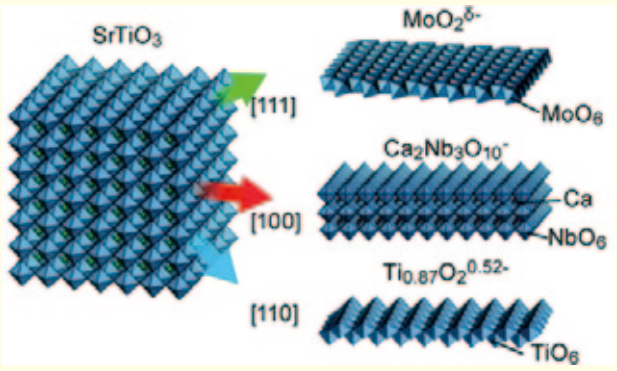
Volume 8 (December 12, 2013):

Crystal film growth: nanosheets extend epitaxial growth applications

Molecularly thin two-dimensional crystals can alleviate the lattice matching restrictions of epitaxial crystalline thin film growth, as reported by researchers in Japan.

Publication:

T. Shibata, H. Takano, Y. Ebina, D.S. Kim, T.C. Ozawa, K. Akatsuka, T. Ohnishi, K. Takada, T. Kogure, T. Sasaki,
Versatile van der Waals epitaxy-like growth of crystal films using two-dimensional nanosheets as a seed layer: orientation tuning of $SrTiO_3$ films along three important axes on glass substrates,
Journal of Materials Chemistry C **2**(3), 441 (2014).
doi: 10.1039/C3TC31787K



Schematic illustration of nanosheet structures for $Ca_2Nb_3O_{10}^-$, $Ti_{0.87}O_2^{0.52}$-, and MoO_2^{δ}- nanosheets and corresponding crystal planes of $SrTiO_3$.

Fig. 4-3: Volume 8 of MANA Research Highlights.

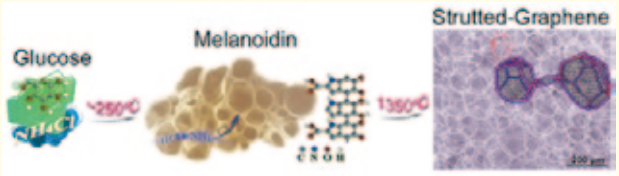
science community. The first two volumes were published in Fiscal Year 2011 (see MANA Progress Report, Facts and Achievements 2011). Volumes 3-6 appeared in Fiscal Year 2012 (see MANA Progress Report, Facts and Achievements 2012). Volumes 7-13 appeared in Fiscal Year 2013 (see Figs. 4-2 to 4-8). The information is available on the MANA website (see www.nims.go.jp/mana/research/index.html).

Volume 9 (January 24, 2014):

3D Strutted-Graphene by a Sugar Blowing Method

Robust, highly conductive 3D graphene structures for use in super-capacitors, through a method inspired by blown sugar, created.

Publication:
X.B. Wang,Y.J. Zhang, C.Y. Zhi, X. Wang, D.M. Tang, Y.B. Xu, Q.H. Weng, X.F. Jiang, M. Mitome, D. Golberg, Y. Bando,
Three-dimensional strutted graphene grown by substrate-free sugar blowing for high-power-density supercapacitors,
Nature Communications **4**, 2905 (2013).
doi: 10.1038/ncomms3905



Scanning electron microscopy images for showing sugar blowing process: glucose were polymerized and blown by released ammonia into melanoidin bubbles in heating, which bubbles were finally converted into strutted graphene containing mono-/few-layered graphene membranes and graphitic struts.

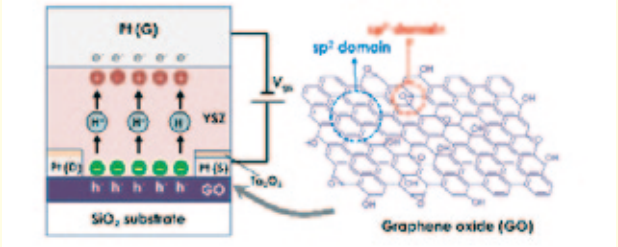
Fig. 4-4: Volume 9 of MANA Research Highlights.

Volume 10 (January 30, 2014):

In Situ Bandgap Tuning of Graphene Oxide Achieved by Electrochemical Bias

The ability to modulate the physical properties of graphene oxide within electronic components could have numerous applications in technology.

Publication:
T. Tsuchiya, K. Terabe, M. Aono,
In Situ and Non-Volatile Bandgap Tuning of Multilayer Graphene Oxide in an All-Solid-State Electric Double-Layer Transistor,
Advanced Materials **26**(7), 1087 (2014).
doi: 10.1002/adma.201304770



The newly-fabricated EDL transistor with graphene oxide (GO) made by WPI-MANA researchers allows fine tuning of bandgaps in the GO, meaning that conductivity, as well as magnetic and optical properties, can be carefully controlled.

Fig. 4-5: Volume 10 of MANA Research Highlights.

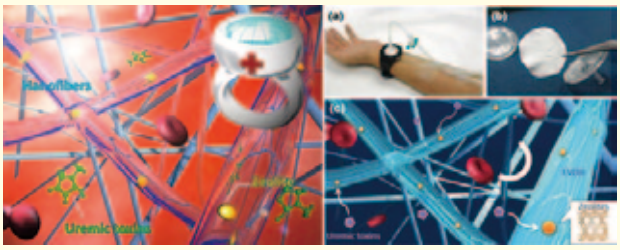
Volume 11 (March 4, 2014):

A simple way to treat kidney failure

A new technique for purifying blood using a nanofiber mesh could prove useful as a cheap, wearable alternative to kidney dialysis.

Publication:

K. Namekawa, M.T. Schreiber, T. Aoyagi, M. Ebara, *Fabrication of zeolite–polymer composite nanofibers for removal of uremic toxins from kidney failure patients*, Biomaterials Science **2**(5), 674 (2014).
doi: 10.1039/C3BM60263J



The newly-fabricated nanofiber mesh for the removal of toxins from the blood, made by WPI-MANA researchers, may be incorporated into wearable blood purification systems for kidney failure patients.

Fig. 4-6: Volume 11 of MANA Research Highlights.

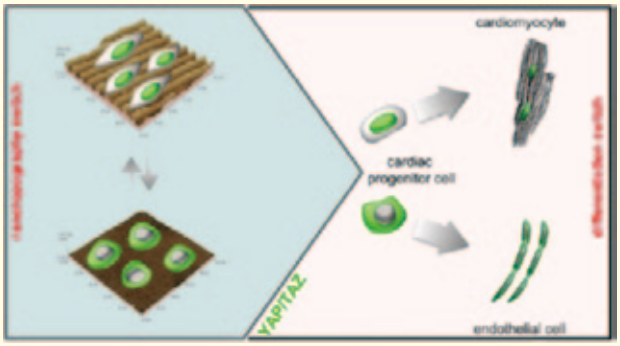
Volume 12 (March 14, 2014):

Heart cells respond to stiff environments

Proteins associated with the regulation of organ size and shape have been found to respond to the mechanics of the microenvironment in ways that specifically affect the decision of adult cardiac stem cells to generate muscular or vascular cells.

Publication:

D. Mosqueira, S. Pagliari, K. Uto, M. Ebara, S. Ramanazzo, C. Escobedo-Lucea, J. Nakanishi, A. Taniguchi, O. Franzese, P. Di Nardo, M.J. Goumans, E. Traversa, P. Pinto-do-Ó, T. Aoyagi, G. Forte, *Hippo Pathway Effectors Control Cardiac Progenitor Cell Fate by Acting as Dynamic Sensors of Substrate Mechanics and Nanostructure,*
ACS Nano **8**(3), 2033 (2014).
doi: 10.1021/nn4058984



Schematic illustrating how mechanical properties of substrates affect where YAP/TAZ protein localization in cardiac stem cells (left) and how this affects stem cell development and function (right).

Fig. 4-7: Volume 12 of MANA Research Highlights.

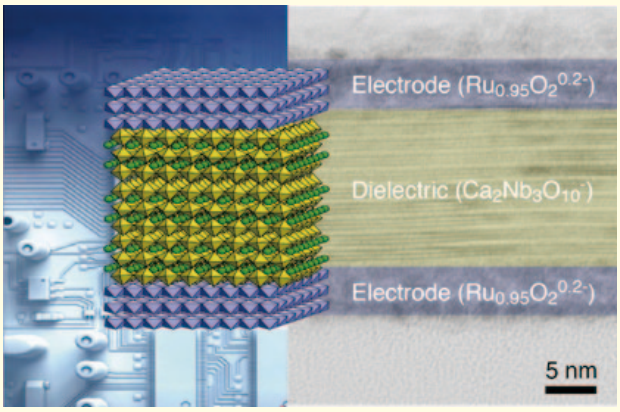
Volume 13 (March 19, 2014):

Oxide nanosheets trump current state-of-the art capacitor materials

Researchers developed ultrathin high-performance capacitors using LEGO-like game of oxide nanosheets.

Publication:

C.X. Wang, M. Osada, Y. Ebina, B.W. Li, K. Akatsuka, K. Fukuda, W. Sugimoto, R.Z. Ma, T. Sasaki,
All-Nanosheet Ultrathin Capacitors Assembled Layer-by-Layer via Solution-Based Processes,
ACS Nano **8**(3), 2658 (2014).
doi: 10.1021/nn406367p



Schematic illustration (left) and cross-sectional high-resolution TEM image (right) of the all-nanosheet ultrathin capacitor.

Fig. 4-8: Volume 13 of MANA Research Highlights.

- **Advancing Fusion of Various Research Fields**

Since the launch in October 2007, MANA has regarded the fusion of different research fields as a gateway to accomplishing advanced research. MANA's research organization, comprising four research fields, was designed so as to promote the fusion of different research fields. Briefly, basic research in the Nano-Materials and Nano-System fields is fused to application research in the Nano-Power and Nano-Life fields (the latter two were called Nano-Green and Nano-Bio fields in the first five-year period). MANA has seen this scheme work considerably well. It should be pointed out that MANA's seven research satellites placed in the USA, UK, France, Canada and Japan have also contributed significantly to research fusion.

In 2011 MANA has started to hold a camp-type approach called *Grand challenge meetings*. Some twenty MANA researchers are selected from among those 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. Grand challenge meetings were held in January 2011 (Miura peninsula), in April 2012 (hot spring resort in Nasu) and in November 2012 (young researcher's meeting at Miura peninsula). We have observed that these meetings are remarkably useful in triggering fusion research among MANA's scientists in different research specialties.

MANA has established various programs to encourage precursory, interdisciplinary research.

- **Fusion Research Program (6 projects, FY2009 – FY2010)**
  Encouragement of interdisciplinary research
- **Grand Challenge Program (7 projects, FY2011 – FY2012)**
  To promote challenging but risky research projects
- **Nano-Bio (Nano-Life) Fusion Research Program (2 projects, FY2012 – FY2014)**
  Interdisciplinary research in Nano-Bio / Nano-Life field
- **Theory-Experiment Fusion Research Program (5 projects, FY2012 – FY2014)**
  True fusion of experimental and computational science

● **2013 MANA Theory-Experiment Fusion Research Program**

In Fiscal Year 2013, MANA has decided to continue the MANA Theory-Experiment Fusion Research Program with a second call for proposal. 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 June 2013, MANA has awarded five new Theory-Experiment Fusion Research projects (see Table 4-1) by review of the 8 submitted proposals and interview of the short-listed proposers.

2013 MANA Theory-Experiment Fusion projects

Funding amount: one MANA research associate (preferably theoretician) and a research grant of 5,000,000 Yen

Research duration: 3 years (FY2013 through FY2015)

Awarded projects: 5

Table 4-1: List of five awarded 2013 Theory-Experiment Fusion Research projects.

	Name of Applicant	Title of Applicant	Title of Project
1	Joel HENZIE	MANA Independent Scientist	Predicting the shape and structural properties of colloidal nanocrystals
2	Hiori KINO	MANA Scientist (Nano-Power)	Electronic transport through molecular wires & circuits
3	Tadaaki NAGAO	Group Leader (Nano-System)	Oxide-nanoantenna integrated nanosystem for high-efficiency photoelectric conversion
4	Yoshitaka TATEYAMA	Group Leader (Nano-Power)	Nanoarchitectonic control of efficient oxidation process on surface/interface for next-generation catalyst and fuel cell
5	Françoise M. WINNIK	MANA PI (Nano-Life)	Controlling the dynamics of cell spreading/ aggregation through the synergy of soft matter theoretical physics and polymer chemistry

● **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 2014, 164 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 2014, 59 researchers were invited by this program.

Furthermore, more than 572 researchers had been invited to MANA for seminars and collaborative discussions by March 2014.

4.2 Research Output

● **MANA Research Papers**

Between October 2007 and December 2013, MANA researchers published 2362 MANA affiliated research papers in English. The breakdown into the different years is displayed in Fig. 4-9. The number of papers has increased year by year until 2011, and then remained at a high value of slightly above 470 papers per year since 2011. The 479 MANA papers published in 2013 are listed in Appendix 7-6 including the *digital object identifier* (doi) and the *Accession number* (WOS) for the Web of Science database. A digital object identifier (doi), which can be resolved at http://dx.doi.org/ is a unique alphanumeric string assigned by a registration agency (the International doi Foundation) to identify content and provide persistent link to its location on the internet. To date, research at the MANA Satellites has yielded 243 MANA affiliated articles or 10.3% of the total of 2362 MANA papers.

Appendix 7.6: MANA Research Papers 2013

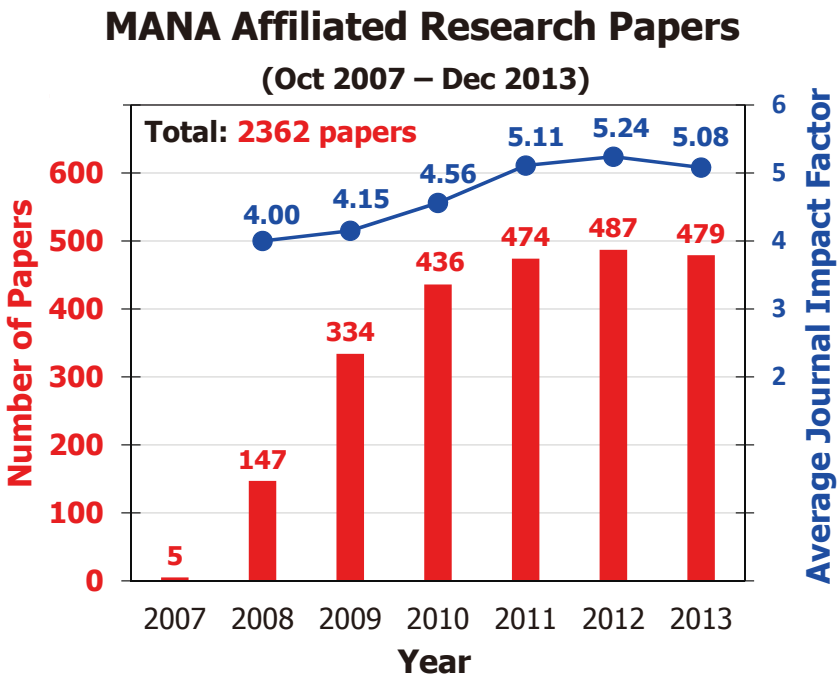


Fig. 4-9: MANA affiliated research papers in English published between October 2007 and December 2013 and average journal impact factor. Source: Web of Science database, as of July 2014.

The high quality of MANA's research is witnessed by a large number of papers that our researchers have published in high impact journals. Of the 479 papers that MANA researchers published in 2013, 72 papers (or 15%) appeared in top journals with an impact factor 2013 above 7.5 (see Table 4-2.) The average impact factor of the journals in which MANA papers have been published is also shown in Fig. 4-9. The value increased from 4.0 in 2008 to 5.11 in 2011, and remained at an extremely high value above 5 since 2011.

Table 4-2: Number of MANA papers published 2013 in top journals with an impact factor 2013 above 7.5.

Name of journal	Journal impact factor 2013 *	Number of papers 2013
Nature Nanotechnology	33.265	1
Chemical Society Reviews	30.425	1
Accounts of Chemical Research	24.348	1
Energy & Environmental Science	15.490	3
Advanced Materials	15.409	7
Advanced Energy Materials	14.385	1
Nano Letters	12.940	6
ACS Nano	12.033	13
Journal of the American Chemical Society (JACS)	11.444	10
Angewandte Chemie - International Edition	11.336	6
Nature Communications	10.742	5
Advanced Functional Materials	10.439	4
NPG Asia Materials	9.902	1
Proceedings of the National Academy of Sciences of the United States of America (PNAS)	9.809	1
Chemistry of Materials	8.535	2
Biomaterials	8.312	3
Physical Review Letters	7.728	2
Journal of Biomedical Nanotechnology	7.578	1
Small	7.514	4

*: Source: Web of Science database, as of July 2014.

The quality and quantity of MANA publications clearly reflect the level of basic research activities. Of the total of 2362 MANA papers, 80 have achieved very high acclaim, entering the top 1% in the world by number of citations (source: SCOPUS database, as of May 2014). Thus, top 1% papers accounted for a high percentage (3.4%) of all published papers. MANA satellites contributed to 7.5% of the 80 MANA top 1% papers. The journals publishing a large number of top 1% papers are listed in Table 4-3. MANA top 1% papers appeared in 34 different journals.

Table 4-3: Journals publishing a large number of MANA top 1% papers.

Name of journal	Journal impact factor 2013 *	Number of MANA top 1% papers #
Advanced Materials	15.409	14
Journal of the American Chemical Society	11.444	9
Advanced Functional Materials	10.439	7
Journal of Materials Chemistry ***	6.108 **	6
Nature Materials	36.425	3
Nano Letters	12.940	3
ACS Nano	12.033	3
Chemistry of Materials	8.636	3

#: Source SCOPUS database, as of May 2014.
*: Source: Web of Science database, as of July 2014
**: newest available journal impact factor (2012)
***: including Journal of Materials Chemistry A

MANA researchers proactively conduct joint research with researchers from around Japan and throughout the world. From the total of 2362 MANA papers, 43% have been international joint work (see Fig. 4-10). The number of internationally co-authored MANA papers increased annually, and in 2013, it accounted for more than half of all papers published. This is a high number that is comparable to Germany, one of the world leaders in internationally co-authored papers.

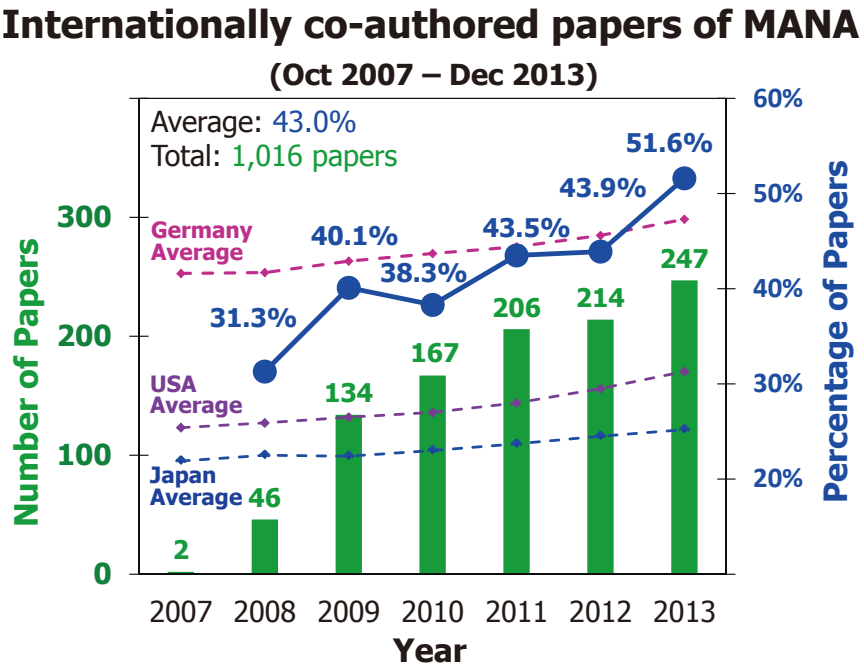


Fig. 4-10: Internationally co-authored papers of MANA published between October 2007 and December 2013. Information based on SCOPUS database. Source of national average: SciVal database, Elsevier B.V., as of June 2014.

Elsevier recently devised a new indicator called Field-Weighted Citation Impact (FWCI), which adjusts citation counts depending on the level of focus in a given field, thus enabling the comparison of the quality of papers from research centers in different fields. With an extremely high FWCI of 2.50, MANA's performance is on par with elite universities in the United States (see Fig. 4-11).

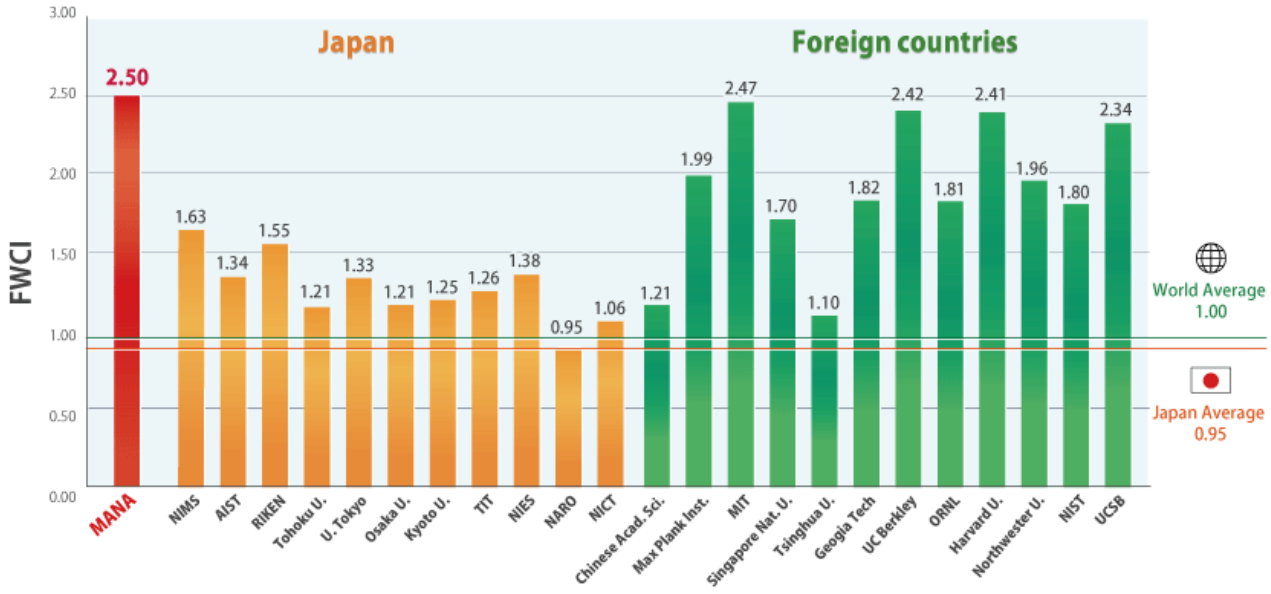


Fig. 4-11: Field Weighted Citation Impact (FWCI) of MANA and other institutions in the world. Source: SciVal database, Elsevier B.V., as of February 2014. FWCIs were calculated for papers published during six years from 2008 to 2013.

● **Special Issues on Material Nanoarchitectonics**

In order to spread the word about our original concept of nanoarchitectonics and to raise MANA's recognition, MANA has published special issues in four original journals (see Fig. 4-12).

- Science and Technology of Advanced Materials (11 articles, 1 preface, 100 pages)
- Advanced Materials (14 articles, 3 editorials, 175 pages)
- Journal of Nanoscience and Nanotechnology (98 articles, 1 editorial, 748 pages)
- Langmuir (49 articles, 1 preface, 386 pages)

In FY2011, two journals of original refereed contributions, *Science and Technology of Advanced Materials* and *Advanced Materials* published special features on MANA which served as compilations of the research outcomes of MANA researchers. In FY2012 and FY2013, MANA took this one step further and announced an open forum entitled *Nanoarchitectonics and the Interface* in the American Chemical Society's *Langmuir* and received submissions form many non-MANA researchers. The special issue was published in June 2013 with 34 of the 49 papers from non-MANA researchers from around the world. MANA issued a similar call for papers in the *Journal of Nanoscience and Nanotechnology* (American Scientific Publishers), and published a special issue entitled *Nanoarchitectonics and Porous Materials* in April 2013.

Fig. 4-12: Special Issues on *Materials Nanoarchitectonics* published in original journals.

● **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 2013 are listed in Appendix 7.7. Some examples are shown in Fig. 4-13.

Appendix 7.7: MANA Journal Cover Sheets

Fig. 4-13: Examples of recent journal front covers related to MANA affiliated papers.

● **MANA Patents**

In addition to writing research papers, many MANA scientists actively apply for patents. The number of MANA patent applications and MANA patent registrations between the launch of MANA in October 2007 and December 2013 is illustrated in Fig. 4-14 and summarized in Table 4-4. The total number of 1056 MANA patents increased to above 1000 (640 applications and 416 registrations). The trend in recent 4 years shows a decrease of the number of patent applications and an increase of the number of patent registrations (see Fig. 4-14). A complete list of patent applications and registrations can be found in Appendix 7.8 of this report (for 2013) and in Appendix 8.9 of the report *Facts and Achievements 2012* (for Oct 2007 to Dec 2012). All listed patent applications and patent registrations are or were partly or fully owned by NIMS.

Appendix 7.8: MANA Patents

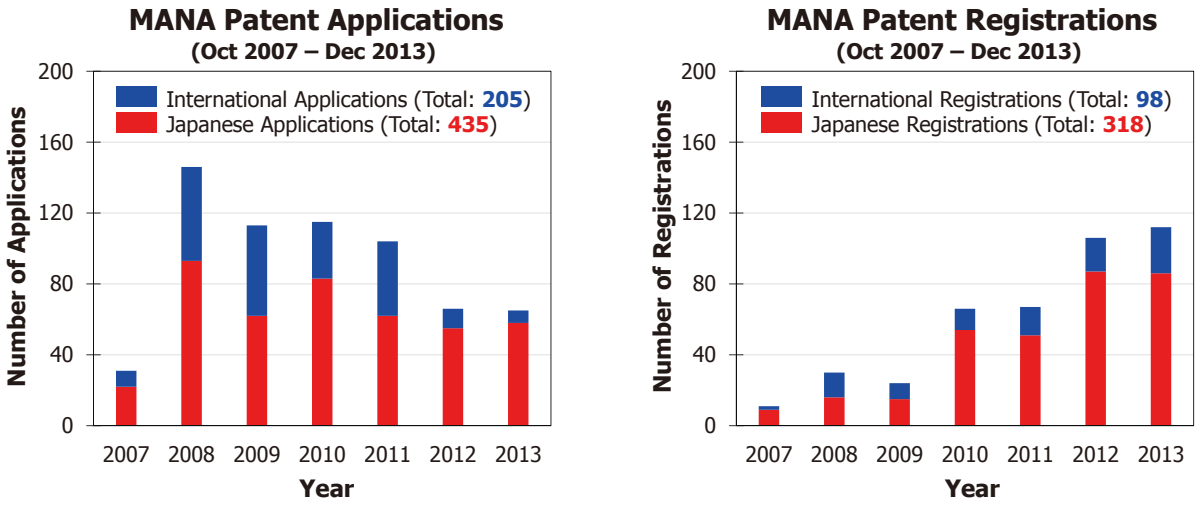


Fig. 4-14: Number of MANA patent applications and registrations between October 2007 and December 2013.

Table 4-4: Number of MANA patent applications and registrations.

	Total Number (2007 Oct – 2013 Dec)	Average Number (per year)
Japanese Patent Applications	435	69.6
Japanese Patent Registrations	318	50.9
International Patent Applications	205	32.8
International Patent Registrations	98	15.7

● **Commendations**

In 2013, MANA's renowned researchers again won several prestigious prizes and awards.

PCCP Prize 2013

MANA Independent Scientist Yusuke Yamauchi is the proud recipient of the 7th PCCP Prize 2013 for his work on *Nano-to-Microgram Scale X-ray Crystallography of Non-crystalline Compounds Using Crystalline Sponges*. The PCCP Prize is awarded annually to promising young researchers (up to 35 years old) by Physical Chemistry Chemical Physics, a journal published by the Royal Society of Chemistry, a London based organization for advancing the chemical sciences. Each year the Chemical Society of Japan prepares a list of candidates at the behest of the RSC, with the award conferred at a ceremony held jointly with the RSC at the annual spring meeting. The award ceremony was held on April 2, 2013 (see Fig. 4-15).

Fellow of the Royal Society of Chemistry

MANA Principal Investigator Katsuhiko Ariga has been admitted as a Fellow of the Royal Society of Chemistry on April 5, 2013.

MEXT Commendations for Science and Technology for FY2013

Commendations are awarded by MEXT to individuals who have increased motivation among science and technology practitioners and contributed to raising the level of Japan's scientific standards by producing remarkable achievements in the research development of science and technology or in the advancement of science understanding. An Award ceremony was held at the Ministry on April 16, 2013 and the following three MANA researchers received prizes: PI Takayoshi Sasaki received the *Science and Technology Prize (for Research)* for the project *Creation of nanosheets by exfoliation of layered compounds and their applications*; Independent Scientist Alexei A. Belik received the *Young Scientist's Prize* for the project *Research on new oxides with multiferroic properties*, and Independent Scientist Yusuke Yamauchi received the *Young Scientist's Prize* for the project *Synthesis of functional inorganic nanoporous materials and their applications*.

Society of Polymer Science Japan's International Award 2013

MANA Principal Investigator Françoise M. Winnik won the Society of Polymer Science Japan (SPSJ)'s International Award for the project *Studies on Thermoresponsive and Amphiphilic Polymers*. The award ceremony was held at the Society's 62nd annual meeting at the Kyoto International Conference Center on May 29, 2013 (see Fig. 4-15). The SPSJ International Prize was established in order to recognize the efforts of foreign polymer scientists who have contributed to basic and applied science in the fields of polymer science or engineering for many years and who have an outstanding track record of exchange with Japanese researchers.

Tsukuba Encouragement Prize 2013

On September 3, 2013, the Science and Technology Promotion Foundation of Ibaraki announced a laureate of a Tsukuba Encouragement Prize (Young Researchers Division), which was received by Independent Scientist Genki Yoshikawa from MANA. Aiming to promote creative research activities, this prize honors researchers involved with science and technology in Ibaraki Prefecture who have obtained significant research results. Dr. Yoshikawa was awarded the prize for research entitled *Development of Ultrahigh-Sensitivity Nanomechanical Membrane-type Surface Stress Sensors*.

Nanoscience Prize 2013

Prof. Masakazu Aono, Director-General of MANA, was selected to receive the Nanoscience Prize 2013 by the Organizing Committee of the 12th International Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures (ACSIN-12). The award recognizes Prof. Aono's *Outstanding record or achievements in research on atomic-level control of surfaces, interfaces, and nanostructure and contributions to nanoscience and nanotechnology*. The award ceremony was held in Tsukuba on November 7, 2013 (see Fig. 4-15).

Chemical Society of Japan (CSJ) Award for Young Chemists FY2013

On December 20, 2013, the Chemical Society of Japan (CSJ) announced that MANA Independent Scientist Yusuke Yamauchi receives the 63rd CSJ Award for Young Chemists (award for FY2013). The award was based on the high evaluation of Dr. Yamauchi's ground-breaking original research *Tailored Synthesis of Nanoporous Metals by Molecular Templates*.

Fig. 4-15: Award Ceremonies with researchers from MANA. The Nanoscience Prize 2013 for MANA Director-General Prof. Masakazu Aono (left), the Society of Polymer Science Japan (SPSJ)'s International Award 2013 for MANA Satellite PI Prof. Françoise M. Winnik (middle), and the PCCP Prize 2013 for Independent Scientist Dr. Yusuke Yamauchi (right).

4.3 Research Achievements

MANA entered the second five-year period of the WPI program from FY2012 garnering high evaluations of the activities of the first five-year period. We at MANA take great pride in having conducted the world's highest level materials research that spans a wide range of programs from basic studies to advanced applications. In this research, we regard theoretical studies and the development of novel measurement methods as very important. All research in MANA is conducted on the basis of *materials nanoarchitectonics*, which we regard as a key concept for new materials development.

This section contains a brief description of recent MANA accomplishments. MANA conducts research in the four fields of Nano-Materials, Nano-System, Nano-Power and Nano-Life. It should be pointed out that the Nano-Green and Nano-Bio fields, having existed in the first five-year period, were remodeled into the Nano-Power and Nano-Life fields, respectively, in October 2012, five years after MANA's establishment. Most of the accomplishments described below represent the outcome of studies bridging two or three different research fields.

A) Further remarkable progress in *nanosheet technology*

We are creating a wide variety of novel materials based on our original *nanosheet technology*, which features soft-chemical delamination and restacking *nanosheet* processes. In addition to the remarkable results obtained in the first 5-year period, the following unexpected discoveries have been made recently.

- *Unusually massive, instantaneous and reversible swelling of layered crystals*

We have found that layered titanate crystals show enormous ~100 fold swelling in an amino alcohol solution in a few seconds then shrink back to their original size also in seconds (see Fig. 4-16). This unprecedented behavior is dramatically different from that with quaternary ammonium as a well-known delaminating agent. This finding will provide important insights into delamination reaction and contribute to controlled production of high-quality nanosheets.

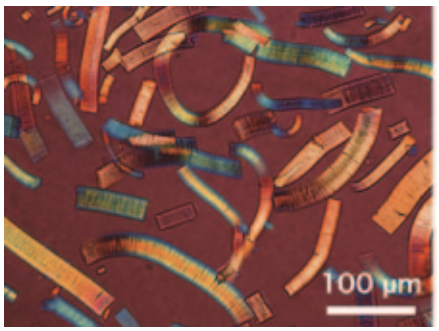


Fig. 4-16: Huge swelling of titanate crystals. Reference: T. Sasaki et al., Nature Commun. **4**, 1632 (2013).

- *Hydroxide nanocones as the first example except for carbon-like material*

We have found that homogeneous precipitation of Co or Ni salts in a presence of surfactant produces a unique hydroxide-based nanocone. This is the first nanocone structure derived from non-carbon materials. The nanocone was found to be delaminated, providing a new route to hydroxide nanosheets.

B) Further remarkable progress in the *atomic switch*

We developed the *atomic switch* in the first 5-year period of MANA. This is a novel electronic device in which migration of atoms at the nanoscale perform ON/OFF switching depending on the polarity of applied voltage. This is in contrast to the conventional transistor switch in which a change of the electronic state due to voltage change is responsible for ON/OFF switching. Teamed with the NEC Corp., we have already reached a technological level of mounting the atomic switch in practical integrated circuits for significantly improved performance. Recently, we have found more important properties/functions of the atomic switch as described below.

- *Synaptic characteristics of the atomic switch discovered*

We have found that a certain type of atomic switch exhibits interesting characteristics similar to the synapse in the neuron network of the human brain. Namely, even if the atomic switch is switched ON by a voltage pulse, it gradually becomes an OFF state under zero voltage. However, if a strong voltage pulse is applied, the ON state is maintained forever under zero voltage. Interestingly, even if the voltage pulse is not significantly strong, by applying such voltage pulses repeatedly at a high frequency, an ON state is obtained suddenly and the state is stable forever under zero voltage.

- *Networks of hundreds of millions of atomic switches exhibit unexpected characteristics*

The results described above encouraged us to construct a random network of hundreds of millions of atomic switches (see Fig. 4-17). We constructed the network by combining the lithography of Pt electrodes and wet chemistry to form Ag and Ag_2S dendritic nanowires. At each crossing points of Ag and Ag_2S nanowires, an atomic switch was formed. This network comprising hundreds of millions of atomic switches exhibited unexpected characteristics that are attracting great interest. For example, when we apply a DC voltage between two of the Pt electrodes, the conductance between them does not increase

monotonically with time but repeats increase and decrease at all time scales of 100 ms, 1 and 100 s, indicating that recurrent currents flow in the network. This promises the possibility of novel computational circuits.

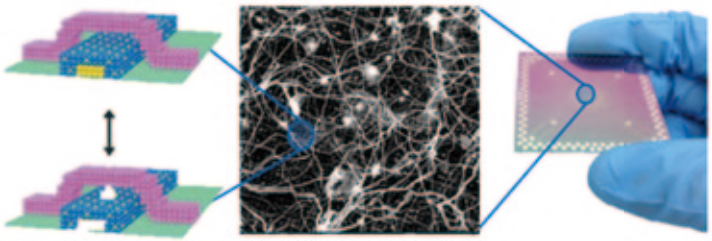


Fig. 4-17: Random network of hundreds of millions of atomic switches, which exhibits unexpected characteristics. Reference: A. Stieg et al., Adv. Mater. **24**, 286 (2012).

C) Towards realization of artificial photosynthesis

We have made considerable headway in realizing one of the three MANA grand challenges, i.e. practical artificial photosynthesis. Two examples are shown below.

- *Efficient conversion of CO_2 to CH_4 fuel by oxide nanowires*

We have developed several oxide photo-catalysts with sufficient negative conduction band potential to successfully convert CO_2 into CH_4 fuel under light irradiation. In particular, we have revealed that controlling surface oxygen deficiency is critical in carbon dioxide reduction reactions. An extensive study from both experimental and theoretical approaches demonstrated that the enhanced catalytic activity resulted from oxygen deficiency-related synergistic effects on the visible light absorption and the carbon dioxide adsorption properties of the catalyst surface. The result provides an important guideline for developing highly efficient catalysts (see Fig. 4-18).

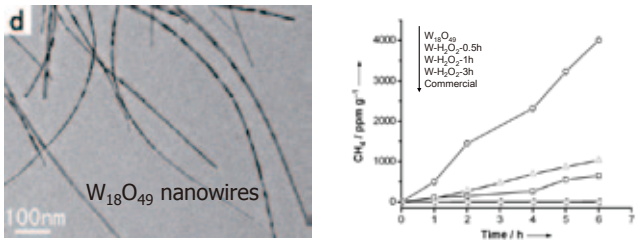


Fig. 4-18: Efficient conversion of CO_2 to CH_4 fuel by oxide nanowires. Reference: G. Xi et al., Angew. Chem. Int. Ed., **51**, 2395 (2012).

- *A new strategy for enhancing solar-fuel production via modulating reaction- environment*

We found that surface alkalinization induced by a high alkalinity of the solution environment can significantly shift the surface energy band of $SrTiO_3$ photocatalyst to a more negative level, supplying a strong potential for H_2O reduction and consequently promoting the photocatalytic efficiency of H_2 evolution to a quantum efficiency as high as 25.6% under visible light irradiation.

D) Theoretical nanoarchitectonics

Theoretical studies are regarded as very important for nanoarchitectonics research in MANA. Recently, various important results triggering great interest have been obtained. Two examples are shown below.

- *Half metallic antiferromagnet as a prospective material for spintronics*

Spintronics, expected to be next-generation technology, is based on the spin degree of freedom of electrons, a new notch additional to charge. Half metals (HM), a class of materials which are metallic in one spin channel and insulating in the opposite spin channel, are ideal for spintronics since they can yield infinite magnetoresistance. We noticed that the iron pnictides can be used to generate an even novel state called half metallic antiferromagnet (HMAFM), which is further characterized by zero total magnetization. We focus on $BaFe_2As_2$, a poor metal of AFM order with zero net magnetization. Nominally, an Fe atom has six 3d electrons and shows an effective spin moment of 4 μ_B due to Hund's coupling. We propose to replace half the Fe atoms with the Cr atoms, noticing that Cr possesses four 3d electrons and thus will not change the AFM order of the parent material, while it will modify the band structure due to the different atomic number. This idea has been confirmed successfully with first principles calculations, which indicate clearly $BaCrFeAs_2$ is a HMAFM (see Fig. 4-19).

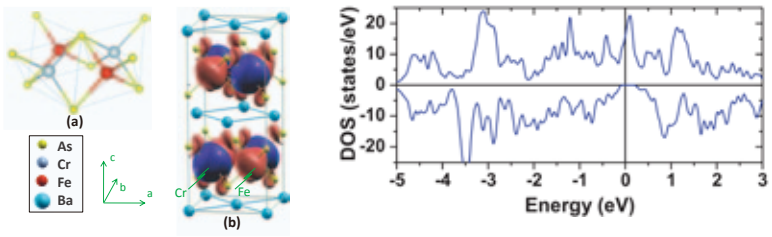


Fig. 4-19: Lattice structure, distribution of spin magnetization and the density of states of $BaCrFeAs_2$. Reference: X. Hu, Adv. Mater. **24**, 294 (2012).

● *Novel topological material*

By using staggered electric potential, antiferromagnetic exchange field and spin-orbit coupling, we can control the spin, valley and sublattice degrees of freedom of electrons on a honeycomb lattice, and achieve a novel topological insulator with simultaneous finite charge and spin Chern numbers. With first principles calculations we demonstrated that the scheme can be realized by material modification in perovskite G-type AFM insulators grown along (111) direction, where d electrons hop on a buckled honeycomb lattice and exhibit Dirac behaviors. In a finite sample of this material, there appears a quantized edge current with full spin polarization, while the total magnetization is compensated to zero. In this topological HMAFM, the spin polarization of the dissipationless edge current can be inverted by electric field, which has a great advantage in spintronics.

E) Valence tunable Resistivity Random Access Memory

As a future nonvolatile memory, Resistivity Random Access Memory (ReRAM) has been a focus. In this memory, the most urgent issue is the reliability at the memory function. The ReRAM function is dominated by vacancy formation and the reliability depends on the controlled number of vacancies. However, under the bias, applied voltage causes many vacancies, resulting in device breakdown. The self-limiting control of vacancy is expected. Nd_2O_5 is a candidate to balance the valence due to mixed valence, and Ta_2O_5 is noticed as a stable host oxide for ReRAM. By combinatorial screening, the best composition of Nd_2O_5-Ta_2O_5 was found and stable and reliable ReRAM operation was demonstrated.

F) Development of revolutionary in situ TEM techniques for nanomaterial property analysis

● *First tensile strength measurements on ultrathin silicon nanowires*

We designed a unique nanomechanical stage for the first direct measurements of the tensile strength on very thin Si nanowires inside a transmission electron microscope under a spatial resolution of 0.17 nm and for the first time obtained the diameter dependence of Si wire strength at such tiny dimensions. This value was found to linearly increase with a decrease in wire diameter and reached more than 11 GPa for the thinnest nanowires of 8 nm in diameter (see Fig. 4-20). This data has a crucial value for the future development of Si-based nanoelectronics and accurate estimates of sustainability.

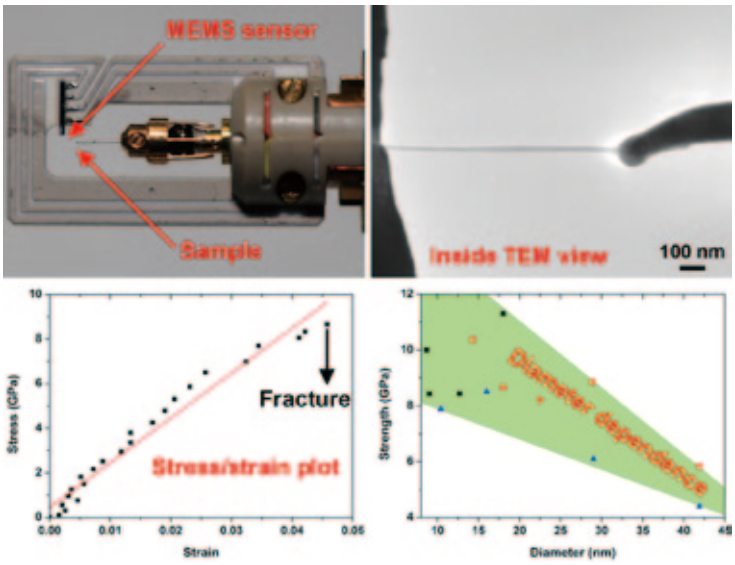


Fig. 4-20: Nanomechanical measurements inside a transmission electron microscope on ultrathin silicon nano-wires. Reference: D.M. Tang et al., Nano Lett. **12**, 1898 (2012).

● *Ultrastrong and superlight Al-BN nanotube composites*

Using an analogous setup we performed direct in situ bending and tensile testing on individual boron nitride nanotube (BNNT)/Al nanocomposites prepared by magnetron sputtering of Al on a BN nanotube powder. In parallel, high-resolution TEM images and video recordings were taken for the analysis of deformation kinetics and fracture mechanisms. The nanohybrids having an individual BN nanotube core with a decently thick aluminum coating (40-200 nm) withstood nearly 10-20 times higher stresses compared to a pure not armed Al metal, reaching huge values exceeding 1.0 GPa (comparable to the best high-strength steels), while exhibiting a density of less than 2.5 g/cm^3. This pioneering work opens up a prospective pathway for making ultralight and super strong *dream* structural materials.

G) Nano-life related materials research

For development of novel biomaterials or devices to repair the human body, it is necessary to prepare composite materials by joining different kinds of material surfaces or by employing novel methods for surface modification with bio-active molecules.

We have discovered novel peptides that can specifically bind metallic or ceramic surfaces, by the phage display method. As metallic materials, nickel-free high nitrogen stainless steel (HNS), Co-Cr alloy and SUS316L were selected because HNS

is used for drug-eluting stents in our research. The developed peptide is adsorbed effectively to the Co-Cr alloy surface. In addition, we analyzed the binding capacity for HNS of the peptide binding. We observed no desorption in any serum. This means that the peptide was adsorbed on the surface strongly. In drug eluting stents, drug-sustained release is required for long-time suppression of stenosis. The developed peptide is expected to contribute to fabrication of a stably-bound matrix for drug release. We also prepared the antibody-peptide complex to investigate the enhancement of cell-materials interaction. The antibody binds the endothelial cells. Larger amounts of the cells adhered on only the complex-adsorbed metallic surface. It was found that the developed peptide is very effective as a linker-molecule.

H) Novel nanoscale characterization/analysis methods

- *New paradigm of nanomechanical sensors*

We have been developing advanced nanomechanical sensors based on a membrane-type surface stress sensor (MSS). Recently, we have succeeded in overcoming one of the long-standing major issues of nanomechanical sensors, that is, the coating problem. We investigated the nanomechanical properties of MSS and found that a double-side coating is applicable to MSS instead of a single-side coating which is a standard method with various difficulties. The double-side coating allows almost any kind of coating method to be implemented including dip coating methods, making nanomechanical sensors open to virtually all coating materials. Double-side-coated MSS represents a new paradigm of one-chip-one-channel (channels on a chip are all coated with the same receptor layers) shifting from the conventional one-chip-multiple-channel (channels on a chip are coated with different receptor layers) paradigm.

- *Novel real-time molecule identifier based on dynamic chemical desorption*

We have developed nanomechanical gas sensors with minimal experimental requirements such as *one polymer* in *ambient air*. Dynamic desorption behavior modulated by changing the thickness of a polymer receptor layer can yield multiple signals from an identical polymer material (see Fig. 4-21). Taking advantage of the high sensitivity of the MSS platform, sick house syndrome chemicals were clearly identified even with one polymer in ambient air. With this new strategy, we can prepare a large variety of receptor layers from a few types of polymers.

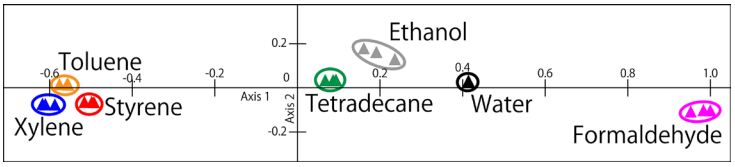


Fig. 4-21: Novel gas identification with minimal requirements. Reference: G. Yoshikawa et al., (to be published).

5. Global Nanotechnology Network

5.1 MANA Satellite Network

Seven out of the 24 MANA Principal Investigators (PIs) and Associate Principal Investigators (APIs) are visiting researchers from external research institutes. MANA has satellite laboratories at research institutions to which PIs and APIs are affiliated. The satellite laboratories speedily and rationally facilitate joint research and also play a crucial role in training young researchers. MANA aims to serve as a global network hub for nanotechnology. The satellite laboratories promote innovative research as front-line bases of the global network.

As of January 2014, there are seven MANA satellite laboratories, two in Europe, two in Japan and three in USA/Canada (see Figs. 5-1 and 5-2). At the end of FY2012, the two MANA satellite laboratories of Prof. Sir Mark E. Welland at University of Cambridge (UCAM) and Prof. Kazuo Kadowaki at University of Tsukuba have been closed. In FY2013, a new MANA satellite laboratory has been opened at University College London (API Dr. David Bowler).

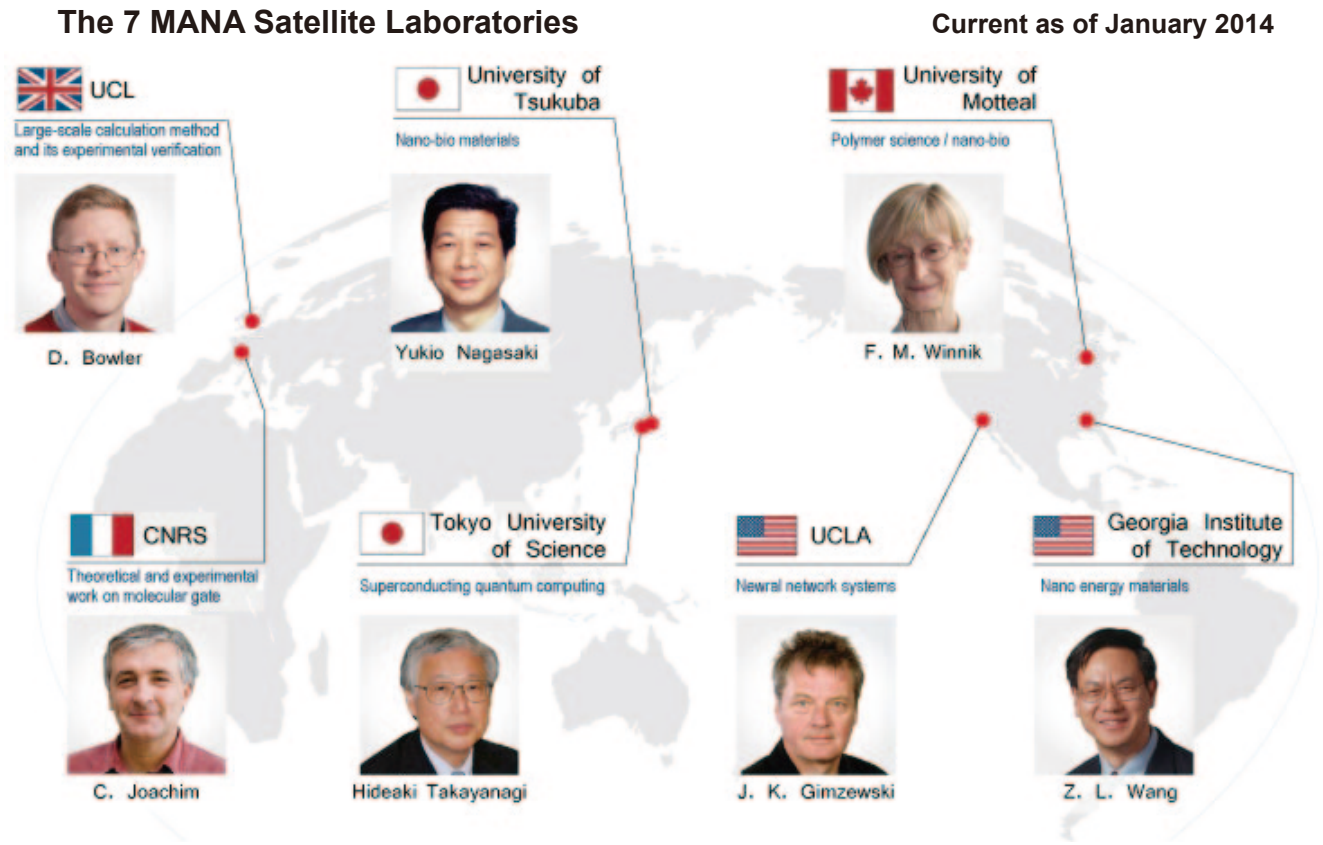


Fig. 5-1: The seven MANA satellite laboratories.

University College London (UCL)
UK

University of Tsukuba
Japan

University of Montreal (UdeM)
Canada

CNRS, Toulouse
France

Tokyo University of Science
Japan

UCLA
USA

Georgia Tech
USA

Fig. 5-2: Location of the seven MANA satellite laboratories. Top row from left to right: University College London (UCL), UK; University of Tsukuba, Japan; and University of Montreal (UdeM), Canada. Bottom row from left to right: CNRS, Toulouse, France; Tokyo University of Science, Japan; University of California Los Angeles (UCLA), USA; and Georgia Institute of Technology (GIT), Atlanta, USA.

5.2 International Nanotechnology Research Network

MANA signs Memoranda of Understanding (MOUs) with universities and research institutes around the globe in order to promote the creation of an international nanotechnology research network by way of joint research projects. A MOU agreement is valid for 5 years and can be renewed if both institutes agree. Between the launch in October 2007 and March 2014, MANA has concluded 44 MOUs and renewed 2 MOUs with institutions from 15 countries (see Appendix 7.9). As of March 31, 2014, 34 MOUs are valid and 12 have expired. The network of the 34 valid MANA MOUs is listed in Table 5-1. Photos of MOU signing ceremonies in FY2013 are shown in Fig. 5-3.

Table 5-1: Network of the 34 valid MANA MOUs (as of March 31, 2014).

Region	Number of valid MOUs
Europa	15
Asia	11
North America	3
Australia	2
South America	2
Middle East	1
Total	**34**

Appendix 7.9: International Cooperation

Fig. 5-3: MOU signing ceremonies in Tsukuba. Left side: MANA MOU with NCNST, Beijing, China, signed on June 24, 2013. Photo: Prof. Yuliang Zhao, Deputy Director-General of NCNST (left) and Prof. Masakazu Aono, Director-General of MANA (right). Right side: MANA MOU with NSQI, University of Bristol, UK, signed on March 7, 2014. Photo: Prof. Mervin Miles, Director of NSQI (left) and Prof. Masakazu Aono, Director-General of MANA (right).

5.3 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 2013, MANA continued to hold joint workshops and symposia with the aim of promoting research exchange and boosting MANA's name recognition in order to scout for talent.

- **List of Workshops and Joint Symposia held in 2013**

Jan 29-30, 2013

The 2nd Canada-Japan Nanotechnology Workshop 2013

On January 29-30, 2013, the 2nd Canada-Japan Nanotechnology Workshop was held at Tokyo Big Sight with 95 participants. Future collaborations between Canada and Japan in the fields environment and energy, nano electronics, quantum electronics, biomaterials, and nano-structures/tools were discussed. Key note lectures addressed the current Japanese policy toward science and technology as well as the current nanotechnology research in Canada. 20 speakers from institutes in both countries included 5 oral presentations from MANA researchers (see Fig. 5-4).


Fig. 5-4: Participants of the 2nd Canada-Japan Nanotechnology Workshop 2013 (left) and the 4th NIMS/MANA-Waseda University International Symposium (right).

Mar 11, 2013

The 4th NIMS/MANA-Waseda University International Symposium

On March 11, 2013, the 4th NIMS/MANA-Waseda University International Symposium was held at NIMS with over 80 participants. Featured were presentations by graduate program professors, together with 46 poster presentations by affiliated researchers (see Fig. 5-4).

Mar 18, 2013

The 6th Osaka University-NIMS/MANA Joint Symposium

On March 18, 2013, the 6th Osaka University NIMS/MANA Joint Symposium on *Advanced Structural and Functional Materials Design* was held at the WPI-MANA Auditorium. Researchers, postdocs and students introduced their findings to colleagues through oral and poster presentations.

Mar 19, 2013

The International Symposium on Material Architectonics for Sustainable Action (MASA 2013)

On March 19, 2013, the International Symposium MASA 2013 was jointly held at the WPI-MANA Auditorium by the Tianjin University - NIMS Joint Research Center (TNJRC), MANA and the Particulate Fluids Processing Centre at University of Melbourne, Australia. The program included 8 oral presentations by researchers from the participating institutes in Australia, China and Japan.

Jun 28-29, 2013

The International Workshop on Thermoelectric Research & Thermal Management Technology

On June 28-29, 2013, MANA hosted the International Workshop on Thermoelectric Research & Thermal Management Technology. The workshop aimed to share cutting-edge research results on thermoelectric materials and thermal management technology in order to improve the current state of affairs, where more than two-thirds of primary energy input is converted into waste heat that is unused and exhausted into the atmosphere. Top researchers inside and outside MANA took part in the workshop with over 80 participants, which consisted of 12 oral presentations, a round table discussion and a tour of MANA labs (see Fig. 5-5).

Oct 9-11, 2013

Swiss-Japanese Nanoscience Workshop on Materials Phenomena at Small Scale

As part of the *150 Years Anniversary of the Establishment of Diplomatic Relations between Switzerland and Japan*, a Swiss-Japanese Nanoscience Workshop was held at the WPI-MANA Auditorium jointly by the Japan Science and Technology Agency (JST), Swiss Federal Institute of Technology in Zurich (ETHZ), and Japan's National institute for Materials Science (NIMS). Over a 3-day period Japanese and Swiss research institutes introduced cutting-edge research achievements, and researchers from the two countries enjoyed active exchanges (see Fig. 5-5).

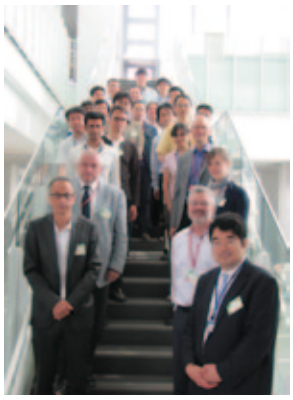


Fig. 5-5: Participants of the International Workshop on Thermoelectric Research & Thermal Management Technology (left) and the Swiss-Japanese Workshop on Materials Phenomena at Small Scale (right).

● 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 2013, 24 scientists at MANA are teaching in the NIMS Graduate Schools (see Table 5-2). 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 FY 2013, there are 46 junior researchers working at MANA, of which 39 are foreigners and 19 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 5-2: Number of MANA members at the NIMS Graduate Schools in FY2013.

School	No. of Faculties	No. of Students
University of Tsukuba	11	20
Hokkaido University	5	13
Waseda University	6	11
Kyushu University	2	2

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 2014, MANA brought in 44 students within this program from 10 different universities (see Fig. 5-6): Flinders University (Australia), Xian Jiatong University (China), Charles University and the University of Pardubice (Czech Republic), Anna University and Jawaharlal Nehru Centre for Advanced Scientific Research (India), Yonsei University (Korea), Warsaw University of Technology (Poland), Moscow State University (Russia), National Taiwan University (Taiwan).

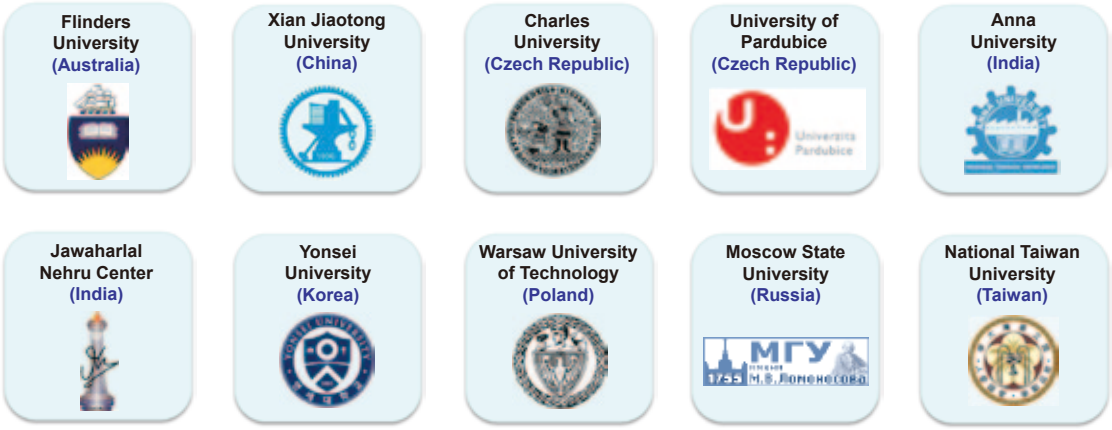


Fig. 5-6: The 10 International Joint Graduate Schools with MANA participation.

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 nanotechnology research. By March 2014, MANA has accepted 263 interns, of which 219 have been foreigners. MANA has welcomed 21 US students from the NSF's National Nanotechnology Infrastructure Network (NNIN) Research Experience for Undergraduates (REU) Program.

5.4 Global Career Advancement

MANA is always aware of its role as a platform for successful career advancement for young researchers. It is MANA's policy to not only attract young researchers from around the world and cultivate them into outstanding scientists, but to enhance their understanding of Japan and help them take the next step in their careers in many countries in the world. Form 179 MANA postdoc alumni over the 6.5 years between October 2007 and March 2014, eight postdocs from MANA have been appointed as NIMS permanent researchers, and 171 have leveled up to universities and research institutions in Japan and around the world. Looking at these former MANA postdocs, 32% have secured positions in Japan, and 68% have found jobs overseas, primarily in Asia but also in the United States, Europe and elsewhere in the world (see Fig. 5-7). In this way, MANA has become the hub for an ever-expanding network of nanotechnology researchers.

Examples of career advancement of MANA Alumni:

- Professor, University of Queensland, Australia
- Professor, Fudan University, China
- Professor, Nanyang Technological University, Singapore
- Research Group Leader, Max Planck Institute for Intelligent Systems, Germany
- Associate Professor, Uppsala University, Sweden

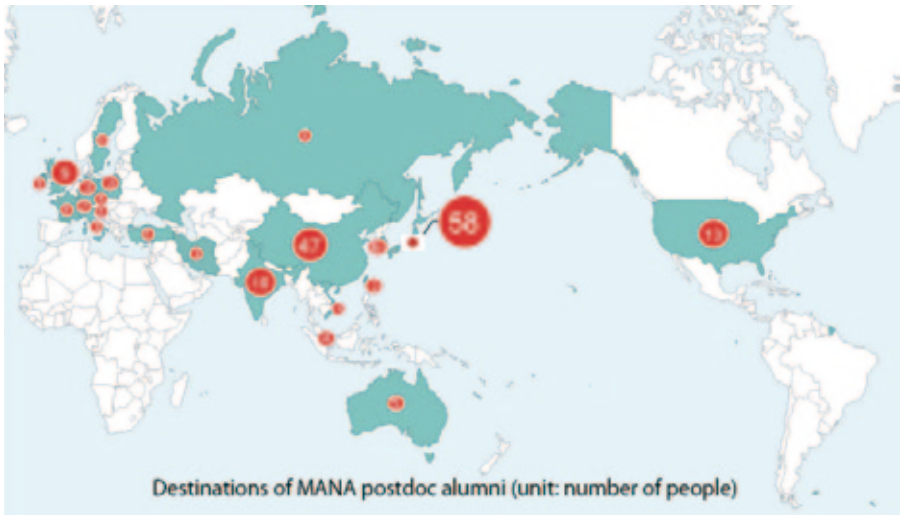


Fig. 5-7: Destinations of the 179 MANA postdoc alumni between October 2007 and March 2014.

6. Enhancement of National and International Recognition

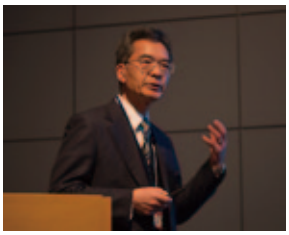
6.1 MANA International Symposium

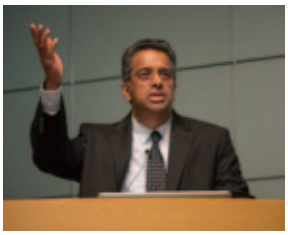
Once per year, MANA hosts the MANA International Symposium intended to disseminate research results to a wider audience. In addition to invited presenters, all the MANA affiliated scientists participate in three days of presentations and poster sessions, covering the latest research activities. The 7th MANA International Symposium was held in Tsukuba on March 5-7, 2014 (see Figs. 6-1 to 6-4) with 425 participants from 27 countries. Invited speakers from outside MANA included two Nobel Prize Laureates and 19 renowned scientists from all over the world.

Fig. 6-1: The 7th MANA International Symposium in March 2014.

Prof. Esaki **Prof. Kobayashi**

Fig. 6-2: Special lectures at the 7th MANA International Symposium by Nobel Prize Laureates. Left: Prof. Leo Esaki (Nobel Laureate in Physics 1973) gave a Special Lecture entitled *What did I explore in half a century of research?* Right: Prof. Makoto Kobayashi (Nobel Laureate in Physics 2008) talked about *50 years of CP violation*.


Prof. Inoue


Prof. Ramesh


Prof. Mao

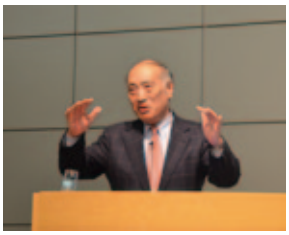

Prof. Hiramoto


Prof. Brochard


Prof. Takahara


Prof. Scherman


Prof. Chen


Prof. Endo


Prof. Yang


Prof. Tenne


Prof. Enoki


Prof. Iyoda


Prof. Miles


Prof. Moriarty


Prof. Yamamoto


Prof. Aono


Prof. Lorente


Prof. Saitoh

Fig. 6-3: Invited lectures at the 7th MANA International Symposium by renowned scientists from outside MANA. Top row from left to right: Prof. Haruo Inoue (Tokyo Metropolitan University, Japan), Prof. Ramamoorthy Ramesh (Oak Ridge National Laboratory, ORNL, USA), Prof. Samuel S. Mao (Lawrence Berkeley National Laboratory, LBNL, USA) and Prof. Masahiro Hiramoto (Institute for Molecular Science, NINS, Japan). Second row from left to right: Prof. Françoise Brochard-Wyart (Institut Curie, Paris, France), Prof. Atsushi Takahara (WPI-I^{2}CNER, Kyushu University, Japan), Prof. Oren Scherman (University of Cambridge, UK) and Prof. Yong Chen (WPI-iCeMS, Kyoto University, Japan). Third row from left to right: Prof. Morinobu Endo (Shinshu University, Japan), Prof. Peidong Yang (UC Berkeley, USA), Prof. Rashef Tenne (Weizmann Institute of Science, Israel) and Prof. Toshiaki Endo (Tokyo Institute of Technology, Japan). Fourth row from left to right: Prof. Tomokazu Iyoda (Tokyo Institute of Technology, Japan), Prof. Mervyn John Miles (University of Bistol, UK), Prof. Phillip Moriarty (University of Nottingham, UK) and Prof. Yoshihisa Yamamoto (Stanford University, USA). Bottom row from left to right: Prof. Masashi Aono (WPI-ELSI, Tokyo Institute of Technology, Japan), Prof. Nicolas Lorente (CIN2, CSIC, Spain) and Prof. Eiji Saitoh (WPI-AIMR, Tohoku University, Japan).


Dr. Ushioda


Dr. Ando


Prof. Ukawa


Prof. Saito

Fig. 6-4: 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 Bureau, MEXT), Prof. Akira Ukawa (Deputy Director of WPI Program) and Prof. Gunzi Saito (WPI Program Officer of MANA).

6.2 MANA/ICYS Reunion Workshop

On March 3-4, 2014, a MANA/ICYS Reunion Workshop was held at the WPI-MANA Building Auditorium (see Fig. 6-5). This workshop, which was the first of its kind, was held to encourage exchanges among fellow former researchers (Alumni) at MANA or the ICYS (International Center for Young Scientists) and current researchers, and to strengthen and enhance the global research network. A total of 21 MANA/ICYS Alumni and current researchers reported on their respective research, which was discussed enthusiastically by the participants. Approximately 113 persons participated over the 2-day period. In addition to renewing old friendships, the participants also exchanged ideas on plans for future exchanges. The meeting concluded with a pledge to hold similar meetings in the future.

Fig. 6-5: The participants of the MANA/ICYS Reunion Workshop.

6.3 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 have been renewed in FY2013. In February 2014, the World Premier International Research Center Initiative (WPI) has launched its official Facebook page. (https://www.facebook.com/wpi.japan).

6.4 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. 6-6) 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 2500 copies of the English and Japanese versions of CONVERGENCE are distributed to domestic and overseas researchers, institutions, government offices and private companies in about 70 countries.

MANA Newsletter CONVERGENCE

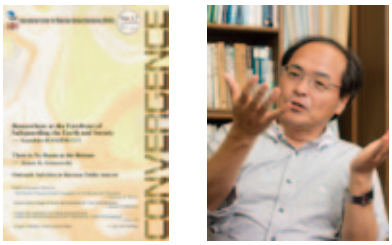
No. 10
February 2012

Prof. Sumio IIJIMA

No. 11
June 2012

Prof. Ei-ichi NEGISHI

No. 12
October 2012

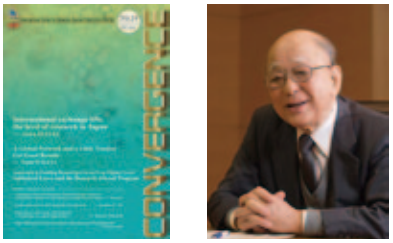


Prof. Kazuhito HASHIMOTO

No. 13
February 2013

Prof. Teruo OKANO

No. 14
June 2013



Prof. Akira SUZUKI

No. 15
October 2013

Prof. J. Georg BEDNORZ

Fig. 6-6: Issues of the MANA newsletter CONVERGENCE published in 2012 and 2013.

6.5 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 2013, MANA has participated in outreach events coordinated by the World Premier International Research Initiative (WPI), organized by the Japan Science and Technology Agency (JST) or sponsored by Tsukuba city.

● **WPI Joint Exhibition at AAAS Annual Meeting 2013**

At the AAAS 2013 Annual Meeting in Boston, USA, on February 14-18, 2013, 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. 6-7). On February 15, the WPI, RIKEN and University of Tsukuba co-organized a press conference entitled *Japan: your next career destination?* In the conference, Mr. Ueda (MEXT WPI director) and other staff introduced *the internationally-opened institutes of the WPI* and job information at 3 new WPI institutes starting from 2012.

● **Summer Science Camp 2013**

For three days (August 6-8, 2013), MANA participated in Summer Science Camp 2013, which is a camp for high school students hosted by the Japan Science and Technology Agency. The camp consisted of programs where universities, public research institutions and private companies involved in advanced research invited students during the summer break and introduced them to cutting-edge science and technology. Twelve high school students from all over Japan joined the program at MANA (see Fig. 6-7). They participated in trainings, which allowed them to experience the nanoscale world through observations using an electronic microscope and development process in a clean room. In addition, they also attended an exchange meeting with young international researchers, which offered the opportunity for students to deepen understanding of nanotechnology and international society.



Fig. 6-7: WPI booth in Japan Pavilion at AAAS Annual Meeting 2013 in Boston, USA (left). Summer Science Camp 2013 at MANA: High school students at a clean room experiment (middle) and using a scanning electron microscope (right).

● **Science Agora 2013**

MANA participated in the Science Agora 2013 event held at Odaiba, Tokyo, over a 2-day period November 9-10, 2013 (see Fig. 6-8). MANA's Smart Biomaterials Group of the Biomaterials Unit, Nano-Life Field, exhibited and gave demonstrations on *Smart polymer, the future materials for diagnosis and treatment of diseases*. To explain smart polymers in an easy-to-understand way, the group created *Smart Rangers – A science manga picture-book*, which MANA researchers handed out and explained while dressed as *Smart polymer rangers*. The MANA researchers also introduced future applications of biomaterials, which include diagnostic materials that will be useful in early discover of diseases, nanofiber mesh as an effective material for treatment of cancer, and others, demonstrating that it's possible to have fun while learning about science.

● **Lecture at Junior High School**

On November 25, 2013, MANA Principal Investigator Dr. Katsuhiko Ariga presented a lecture at Takezono Higashi Junior High School in Tsukuba as one of a series of *Science Q* lectures sponsored by the Tsukuba-Science City Network. The aim of this program, in which leading researchers visit elementary and junior high schools to give science classes, is to reverse *the flight from science* by young people. Dr. Ariga's lecture was delivered in the school gymnasium to third-year students at the school, as well as specially-invited 8th to 10th graders from Tsukuba International School. Dr. Ariga, who is also Unit Director of the MANA Supermolecules Group, made a presentation entitled *New Nanotechnology Changing the Future*. Dr. Jan Labuta (NIMS Postdoctoral Researcher) of the same unit then introduced students from his homeland, the Czech Republic, and discussed his research life at Tsukuba, and Technical Staff member Masaaki Akamatsu gave the students a demonstration of a supermolecular material which makes it possible to visualize the distribution of cesium on the surface of solids. The event concluded with a question-and-answer session, during which students talked intently with the NIMS scientists and expressed their gratitude for the class in both Japanese and English (see Fig. 6-8).



Fig. 6-8: Researchers dressed as *Smart polymer rangers* at Science Agora 2013 (left, middle), and *Science-Q* lecture by MANA PI Dr. Ariga at Takezono Higashi Junior High School in Tsukuba (right).

6.6 Media Coverage

MANA continues to be featured in Japanese newspaper articles and in Japanese television.

Between October 2007 and March 2014, in the first 6 1/2 years of the MANA project, 376 press releases about MANA appeared in Japanese newspapers (see Fig. 6-9). This corresponds to an average number of press releases of 57.8 per year or 4.8 per month. To encourage foreign researchers to issue press releases, MANA has setup a support system.

Research of MANA Scientist Mitsuhiro Ebara about *Development of a nanofiber mesh that makes it possible to realize thermotherapy and chemotherapy of cancer simultaneously* has been featured in Japanese television (see Fig. 6-10).

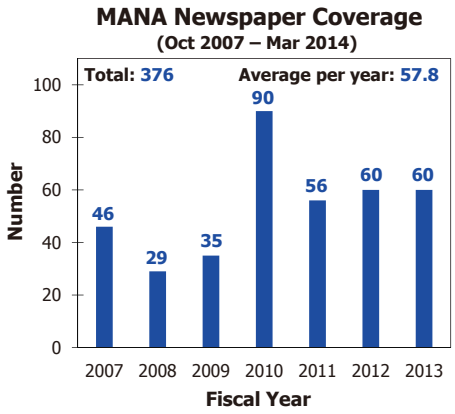


Fig. 6-9: Number of press releases from MANA published in Japanese newspapers.

Fig. 6-10: Research of MANA Scientist Mitsuhiro Ebara has been featured in Japanese television; Yajiuma TV (TV Asahi) on June 28, 2013 (left) and NHK General TV on July 16, 2013 (right).

6.7 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 6-1: Number of short-time visitors to MANA.

	Total of Visitors (a), (b), (c), (d)	General Visitors (d)
FY2013	734	162
FY2012	565	284
FY2011	248	108
FY2010	315	147

In FY2011 (April 2011 – March 2012), the number of visitors to MANA decreased in the wake of the nuclear power plant incident after the Great East Japan Earthquake in March 2011. But it seems that this so-called *Japan allergy* has disappeared almost entirely and, as shown in Table 6-1, we observe a strong increase of visitors to MANA in FY2012 and FY2013. The 734 visitors in FY2013 came from all over the world: Europe (183), America (70), Asia (459, including 311 from Japan), and other regions (22). High-ranked representatives of foreign universities visiting MANA in 2013 are shown in Figs. 6-11 and 6-12.

Fig. 6-11: High-ranked representatives of foreign universities visiting MANA in 2013. Left: Delegation from the Netherlands including Prof. Fred van Keulen (Vice Chairman NanoNext NL, Delft University of Technology) on January 28. Right: Delegation from Temple University, Philadelphia, USA, including Prof. Hai-Lung Dau (Provost, Temple University) and Prof. Michael L. Klein (Dean Science & Technology, Temple University) on November 19.

Fig. 6-12: High-ranked representatives of foreign universities visiting MANA in 2013. Left: Prof. Shushanta Kumar Dattagupta (Vice-Chancellor, Visva-Bharati University, India) on October 31. Middle: Prof. Geoff Stevens (Associate Dean of the University of Melbourne, Australia) on March 13. Right: Prof. Bertrand Girard (President of University of Grenoble, France) on November 12.

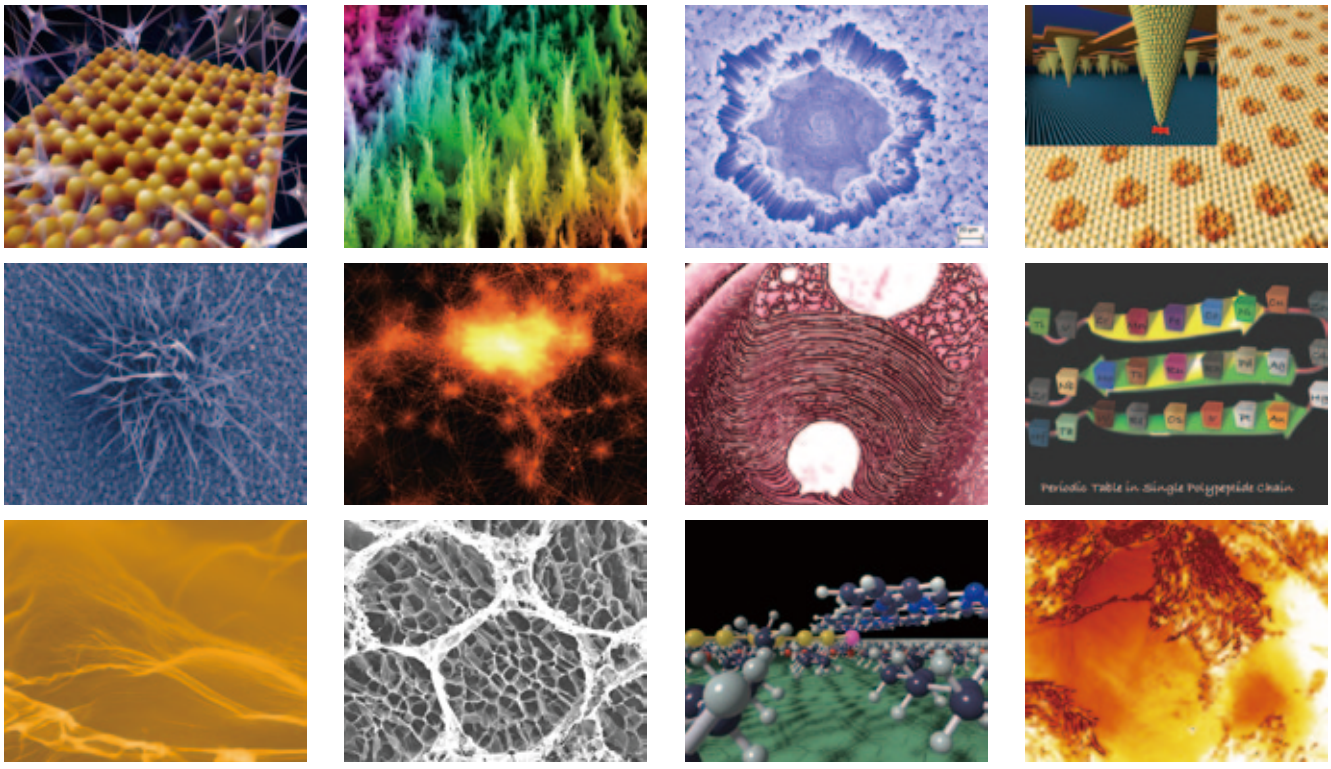


Fig. 6-13: Examples of MANA scientific art pictures.

6.8 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. 6-13 and 6-14). In addition, MANA scientific art pictures have been used in MANA promotion videos, MANA original goods, NIMS brochures and NIMS greeting cards.

Fig. 6-14: MANA scientific art pictures decorating the passage between the MANA Building and the new WPI-MANA Building.

6.9 MANA History

The MANA history between September 2007 and March 2014 can be found in Appendix 7.10.

Appendix 7.10: MANA History

Appendix 7.1: MANA Top Management

Masakazu AONO
Director-General

Yoshio BANDO
Chief Operating Officer

Takahiro FUJITA
Administrative Director

Appendix 7.2: MANA Research Staff

MANA Principal Investigators (22):

Current as of January 1, 2014

Nano-Materials Field (6)

Coordinator

Takayoshi SASAKI
NIMS

Katsuhiko ARIGA
NIMS

Yoshio BANDO
NIMS

Toyohiro CHIKYOW
NIMS

Dmitri GOLBERG
NIMS

Zhong Lin WANG
Georgia Tech (Satellite)

Nano-Power Field (4)

Coordinator

Jinhua YE
NIMS

Kazunori TAKADA
NIMS

Kohei UOSAKI
NIMS

Omar YAGHI
UCB

Nano-System Field (8)

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

Nano-Life Field (4)

Coordinator

Takao AOYAGI
NIMS

Guoping CHEN
NIMS

Yukio NAGASAKI
Univ. Tsukuba (Satellite)

Françoise M. WINNIK
Univ. Montreal (Satellite)

Associate PIs (2), Group Leaders (11), MANA Scientists (50): Current as of January 1, 2014

Nano-Materials Field (26)


Minoru OSADA (Associate PI)


Naoki FUKATA (Group Leader)


Takao MORI (Group Leader)


Takashi SEKIGUCHI (Group Leader)


Jun CHEN


Yasuo EBINA


Masahiro GOTO


Jonathan HILL


Yusuke IDE


Qingmin JI


Jin KAWAKITA


Naoyuki KAWAMOTO


Renzhi MA


Masanori MITOME


Takahiro NAGATA


Takayuki NAKANE


Waka NAKANISHI


Isao OHKUBO


Tadashi OZAWA


Nobuyuki SAKAI


Lok Kumar SHRESTHA


Ryutaro SOUDA


Yutaka WAKAYAMA


Shinjiro YAGYU


Yoshiyuki YAMASHITA


Michiko YOSHITAKE

Nano-System Field (13)

Tadaaki
NAGAO
(Group Leader)

Kazuya
TERABE
(Group Leader)

Hideo
ARAKAWA

Takuto
KAWAKAMI

Song-Ju
KIM

Masanori
KOHNO

Katsumi
NAGAOKA

Shu
NAKAHARAI

Yuji
OKAWA

Makoto
SAKURAI

Yoshitaka
SHINGAYA

Tohru
TSURUOKA

Takashi
UCHIHASHI

Nano-Power Field (7)

David
BOWLER
(Associate PI)

Yoshitaka
TATEYAMA
(Group Leader)

Ikutaro
HAMADA

Hiori
KINO

Hidenori
NOGUCHI

Tsuyoshi
OHNISHI

Kentaro
TASHIRO

Nano-Life Field (17)


Nobutaka HANAGATA (Group Leader)


Masanori KIKUCHI (Group Leader)


Hisatoshi KOBAYASHI (Group Leader)


Akiyoshi TANIGUCHI (Group Leader)


Akiko YAMAMOTO (Group Leader)


Mitsuhiro EBARA


Sachiko HIROMOTO


Yoshihisa KAIZUKA


Chiho KATAOKA


Kohsaku KAWAKAMI


Naoki KAWAZOE


Piotr KUJAWA


Tamaki NAGANUMA


Yasushi SUETSUGU


Tetsushi TAGUCHI


Tomohiko YAMAZAKI


Chiaki YOSHIKAWA

MANA Independent Scientists (12):

Current as of January 1, 2014

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 (10):

Current as of January 1, 2014

ICYS-MANA Researchers


Sudipta DUTTA


Fengxia GENG


Hicham HAMOUDI


Shinsuke ISHIHARA


Yohei KOTSUCHIBASHI


Song-Lin LI


Huynh Thien NGO


Liwen SANG


Daiming TANG

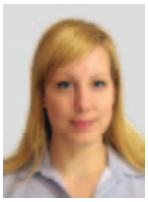

Xi WANG

MANA Research Associates (51):

Current as of January 1, 2014

Nano-Materials Field (17)


Batu GHOSH India


Barbara HORVATH Hungary


Kazuhiro HOSONO Japan


Xiangfen JIANG China


Hirokazu KOMATSU Japan


Xia LI China


Amir PAKDEL Iran

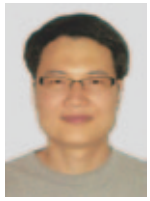

Chinnamuthu PAULSAMY India


Pathik SAHOO India


Rahul Raghunath SALUNKHE India


Hoon Seok SEO Korea


Chengxiang WANG China


Junzheng WANG China


Xuebin WANG China


Jinghua WU China


Zhi XU China


Jun ZHANG China

Nano-System Field (19)

ARRAMEL
Indonesia

Chanchal
CHAKRABORTY
India

Kai
CHEN
China

Rhiannon
CREASEY
Australia

Haiyao
DENG
China

Xu
GAO
China

Hironori
ITO
Japan

Pradyot
KOLEY
India

Meng-Fan
LIN
China

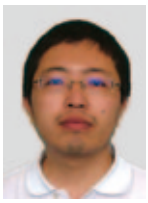
Yen-Fu
LIN
Taiwan

Marina
MAKAROVA
Russia

Seungjun
OH
Korea

Kota
SHIBA
Japan

Takashi
TSUCHIYA
Japan



Qi
WANG
China

Mahito
YAMAMOTO
Japan

Yiping
YAO
China

Shunsuke
YOSHIKAWA
Japan

Rui
YU
China

Nano-Power Field (12)

Indrajit
BHATTACHARYYA
India

Kun
CHANG
China

Maryam
JAHAN
Iran

Qing
KANG
China

Sajna
KAPPAM VEETTIL
India

Lequan
LIU
China

Yuki
MORITA
Japan

Lakshminarayanan
PIRAMUTHU
India

Lucie
SZABOVA
Czech

Tao
WANG
China

Ke-Cai
XIONG
China

Ya
ZHANG
China

Nano-Life Field (3)


Lingfeng GUO
Hong Kong


Masao KAMIMURA
Japan


Jasmine LI
Singapore

JSPS Fellows (8):

Current as of January 1, 2014

Nano-Materials Field (5)


Bishnu Prasad BASTAKOTI
Nepal


Dominic GERLACH
Germany


Cuiling LI
Taiwan


Kosuke MINAMI
Japan


Taizo MORI
Japan

Nano-System Field (1)


Puneet MISHRA
India

Nano-Power Field (2)


Congping WU
China


Satoru SATO
Japan

Appendix 7.3: MANA Advisors and International Cooperation Advisors

MANA Advisors (3):

Current as of January 2014

Advisors including Nobel Laureates and prominent researchers provide valuable advice to MANA scientists, drawing on their extensive experience.

Sir Harry W. Kroto
(Nobel Laureate in Chemistry 1996)
Professor,
Florida State University
USA

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

Teruo Kishi
Former President,
National Institute for
Materials Science
Japan

MANA International Cooperation Advisors (2):

Current as of January 2014

International Cooperation Advisors including prominent researchers provide MANA with advice on joint research with overseas research institutes and the formation of a global nanotech network.

Sir Mark E. Welland
Professor,
University of Cambridge
UK

Louis Schlapbach
Former CEO,
Swiss Federal Laboratories for
Materials Testing and Research
Switzerland

Appendix 7.4: MANA Evaluation Committee

MANA Evaluation Committee Members (8):

Current as of January 2014

Evaluation Committee Members provide MANA with their critical comments and expert recommendations on the operation and research strategy of MANA projects.

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,
Karlsruhe Institute
of Technology,
Germany

Kazuhito Hashimoto
Professor,
University of Tokyo,
Japan

Yoshio Nishi
Professor,
Stanford University,
USA

Rodney S. Ruoff
Professor,
University of Texas,
USA

Joachim P. Spatz
Professor,
Max Planck Institute for
Intelligent Systems,
Germany

Appendix 7.5: MANA Seminars

List of MANA Seminars (January – December 2013):

1	2013 Jan 18 *Self Assembled Monolayer (SAM): Applications* **Dr. Hicham Hamoudi** ICYS-MANA Researcher, NIMS, **Japan**
2	2013 Jan 18 *Synthesis, Characterization and Application of Mesoporous Transition-Metal Oxides* **Dr. Norihiro Suzuki** ICYS-Sengen Researcher, NIMS, **Japan**
3	2013 Jan 25 *Epitaxial growth and spin properties of III-nitride semiconductor low dimensional quantum structures* **Prof. Bo Shen** Research Center of Wide Bandgap Semiconductors, School of Physics, Peking University, **China**
4	2013 Jan 25 *DFT modified Poisson-Boltzmann calculations on electrode reactions in fuel cells technology* **Dr. Ryousuke Jinnouchi** Electrochemistry Division, Toyota Central R&D Laboratories, **Japan**
5	2013 Jan 28 *The Dutch Micro and Nanotechnology Consortium, NanoNextNL* **Prof. Fred van Keulen** Vice Chairman, NanoNextNL, **The Netherlands**
6	2013 Jan 28 *TNO: The Dutch Approach for Applied Scientific Research* **Mr. Dick Koster** Business Director, NanoNextNL/TNO-Nano Instrumentation, **The Netherlands**
7	2013 Jan 28 *Syntens: The Enterprise Europe network* **Dr. Rim Stroeks** Innovation Advisor, Syntens, **The Netherlands**
8	2013 Jan 28 *Introduction of DELMIC* **Dr. Sander den Hoedt** Chief Executive Officer, DELMIC, **The Netherlands**
9	2013 Jan 30 *A theoretical approach to Nanotechnology and synthesis of CNT by renewable natural precursor and their applications studied at our center* **Prof. Maheshwar Sharon** NSNR Center for Nanotechnoogy & Bionanotechnology, SICES Degree College, **India**
10	2013 Feb 1 *Development of High Coercivity Anisotropic Hot Deformed Nd-Fe-B Magnets* **Dr. Hossein Sepehri Amin** ICYS-Magne Researcher, NIMS, **Japan**
11	2013 Feb 1 *Templated Synthesis of Nanoporous Materials from Nanostructured Microporous Coordination Compounds* **Dr. Ming Hu** ICYS-MANA Researcher, NIMS, **Japan**
12	2013 Feb 4 *Growing Integration Layer [GIL] Strategy: Direct Fabrication of Compositionally, Structurally and Functionally Graded Ceramic Coatings and/or Films from Mother Materials in Solution* **Prof. Masahiro Yoshimura** Materials Science & Engineering, National Cheng Kung University, **Taiwan**
13	2013 Feb 8 *Data driven approaches to combinatorial discovery of functional materials* **Prof. Ichiro Takeuchi** Department of Materials Science and Engineering, University of Maryland, **USA**
14	2013 Feb 14 *Transition Metal-Containing Macromolecules: En Route to New Functional Materials* **Prof. Alaa Abd-El-Aziz** President of University of Prince Edward Island, **Canada**
15	2013 Feb 15 *SiAlON-based phosphors for low-energy consumption light emitters* **Dr. Benjamin Dierre** ICYS-MANA Researcher, NIMS, **Japan**
16	2013 Feb 15 *Years of SAXS, the old and the new* **Dr. Brian Richard Pauw** ICYS-Sengen Researcher, NIMS, **Japan**
17	2013 Feb 22 *How to understand hierarchically organized structures of complex fluid systems: from globular proteins to cellular structure of artificial red cells (HbV) and gel network of thermo-responsive microgels* **Prof. Takaaki Sato** Division of Chemistry and Materials, Faculty of Textile Science and Technology, Shinshu University, **Japan**
18	2013 Mar 5 *Self Surface Replenishing hydrophobic networks* **Prof. Rolf van Benthem** DSM Ahead Materials Sciences R&D and Eindhoven University of Technology, **The Netherlands**
19	2013 Mar 5 *Towards an Atomically Precise H Lithography Process* **Dr. James Owen** Zyvex Labs LLC, **USA**
20	2013 Mar 6 *Topological phases and bulk-edge correspondence* **Prof. Yasuhiro Hatsugai** Institute of Physics, University of Tsukuba, **Japan**
21	2013 Mar 12 *In-situ Formation of Conducting Polymer/Radical Polymer Layer for Rapid Charge-Storage Devices* **Prof. Takeo Suga** Waseda University, **Japan**
22	2013 Mar 12 *Unique Photoresponsive Materials: Photochromism and Maglev* **Prof. Jiro Abe** Department of Chemistry, Organic Functional Material Laboratory, Aoyama Gakuin University, **Japan**

23	2013 Mar 13 *Metal Nanoparticles for Conversion of Material and Energy* **Prof. Naoki Toshima** Department of Applied Chemistry & Advanced Materials Institute, Tokyo University of Science Yamaguchi, **Japan**
24	2013 Mar 15 *Polyelectrolyte-Silicate Nanobrick Wall Thin Films for Flame Suppression, Gas Barrier and So Much More* **Prof. Jaime C. Grunlan** Department of Mechanical Engineering and Department of Chemical Engineering & Materials Science and Engineering Program, Texas A&M University, **USA**
25	2013 Mar 15 *Mechanics of Individual Nanostructures by In Situ TEM: Role of Geometry and Defects* **Dr. Dai-Ming Tang** ICYS-MANA Researcher, NIMS, **Japan**
26	2013 Mar 15 *Exciton-polaritons in organic-dye nanofibers with optical anisotropies* **Dr. Hiroyuki Takeda** ICYS-Sengen Researcher, NIMS, **Japan**
27	2013 Mar 18 *Modulation of cell behavior by surface topography* **Dr. Wei-Bor Tsai** National Taiwan University, **Taiwan**
28	2013 Mar 18 *Molecular Design and Development of Zwitterionic Biomaterials for Advanced Biomedical Applications* **Dr. Yung Chang** Chung Yuan Christian University, **Taiwan**
29	2013 Mar 22 *N3L: Exploring Structure-Property-Application Relationship at the Nanoscale* **Dr. Jun Lou** Rice University, **USA**
30	2013 Mar 22 *Nanometric resolved cathodoluminescence on few layers h-BN flakes* **Dr. Alberto Zobelli** Paris Sud University, **France**
31	2013 Mar 29 *Size control of nano-particles formed by amphiphilic polymers in aqueous solution* **Prof. Takahiro Sato** Osaka University, **Japan**
32	2013 Apr 5 *Spin characterization of next-generation electronic materials* **Dr. Andrew Pratt** ICYS-Sengen Researcher, NIMS, **Japan**
33	2013 Apr 5 *Rapid, Reversible, and Ultra-Precise Actuation of Layered Clay Material* **Dr. Shinsuke Ishihara** ICYS-MANA Researcher, NIMS, **Japan**
34	2013 Apr 15 *Synergetics in Silicon Electronics and Spintronics* **Dr. Kazuki Nakada** Kyushu University, **Japan**
35	2013 Apr 19 *Nanoscale and Edge Effects in Graphene and Modified Graphene Nanoribbons* **Dr. Sudipta Dutta** ICYS-MANA Researcher, NIMS, **Japan**
36	2013 Apr 19 *How Addition of Multi-Walled Carbon Nanotubes Could Improve the Ceramic Mechanical Properties in a Wide Range of Temperature?* **Dr. Mehdi Mazaheri** ICYS-Sengen Researcher, NIMS, **Japan**
37	2013 Apr 22 *Material transformations under pressure beyond Diamond-Anvil-Cell (DAC) limits (Theory and experiments)* **Prof. Eugene G. Gamaly** Laser Physics Centre, Research School of Physics and Engineering, The Australian National University, **Australia**
38	2013 Apr 24 *Core-Shell-Corona Polymeric Micelles as a Smart Template for the Synthesis of Inorganic Hollow Nanoparticles* **Prof. Kenichi Nakashima** Saga University, **Japan**
39	2013 Apr 26 *Spin Fluctuations in Fe-based superconductors* **Prof. Andrew Boothroyd** University of Oxford, Vice Provost of Oriel College, Oxford, **UK**
40	2013 May 10 *Graphene, Few Layer Graphene (FLG) and Carbon Nanotubes* **Dr. Sharali Malik** Institute of Nanotechnology, Karlsruhe Institute of Technology, **Germany**
41	2013 May 14 *Project of MANA Grand Challenge Fund, MANA Theory-Experiment Fund –Part 1* **Dr. Naoki Fukata** (Group Leader) **Dr. Xiao Hu** (MANA Principal Investigator) **Dr. Takashi Uchihashi** (MANA Scientist) **Dr. Dmitri Golberg** (MANA Principal Investigator) **Dr. Katsuhiko Ariga** (MANA Principal Investigator) **Dr. Tadashi C. Ozawa** (MANA Scientist) MANA, NIMS, **Japan**
42	2013 May 15 *Recent Advances of Nanocomposites Consisting of Organic and Inorganic Materials* **Prof. Toyoko Imae** National Taiwan University of Science and Technology, **Taiwan**
43	2013 May 17 *Recent Advances of Nanocomposites Consisting of Organic and Inorganic Materials* **Prof. Pierre Rabu** IPCMS (Institut de Physique et de Chimie des Matériaux de Strasbourg), **France**
44	2013 May 17 *The reasons why layered double hydroxides are potentially so interesting as polymer filler* **Prof. Fabrice Leroux** ICCF (Chemical Institute of Clermont-Ferrand), Blaise Pascal University, **France**
45	2013 May 21 *Peptide and protein assembly to fibres and tubes, and their wetting by water* **Prof. Alexander Bittner** CIC nanoGUNE, San Sebastian, **Spain**
46	2013 May 21 *Photocatalytic and photoelectrochemical water splitting based on oxynitride materials* **Prof. Kazunari Domen** Department of Chemical System Engineering, University of Tokyo, **Japan**

47	2013 May 24 *Modification of Metal Oxide Surfaces* **Dr. Gunther Andersson** Flinders University, **Australia**
48	2013 May 31 *How edge geometry and chemical structure affect the electronic structure of nanographene?* **Prof. Toshiaki Enoki** Japan Science and Technology Agency, **Japan**
49	2013 May 31 *Microscopic understanding of solid-aqueous interfaces based on long-time first-principles MD calculations* **Prof. Kazuto Akagi** Tohoku University (WPI-AIMR), **Japan**
50	2013 Jun 3 *Chemical Love at Surfaces: Optimization towards the one and only!* **Prof. Han Zuilhof** Laboratory of Organic Chemistry, Wageningen University, **The Netherlands**
51	2013 Jun 5 *Rational Design of Nanostructure Materials toward Energy Applications* **Dr. Jung Ho Kim** University of Wollongong, **Australia**
52	2013 Jun 7 *Discriminating Atomic Species at the TiO_2(101) Anatase Surface Using Single Water Molecules and Simultaneous AFM/STM* **Dr. César Moreno Sierra** ICYS-Sengen Researcher, NIMS, **Japan**
53	2013 Jun 7 *One-Dimensional CdS Nanostructures: Synthesis, Properties and Applications* **Dr. Tianyou Zhai** ICYS-MANA Researcher, NIMS, **Japan**
54	2013 Jun 12 *Project of MANA Grand Challenge Fund, MANA Theory-Experiment Fund –Part 2* **Dr. Minoru Osada** (MANA Associate Principal Investigator) **Dr. Yusuke Yamauchi** (MANA Independent Scientist) **Dr. Genki Yoshikawa** (MANA Independent Scientist) **Dr. Kazuhiko Tsukagoshi** (MANA Principal Investigator) **Dr. Jinhua Ye** (MANA Principal Investigator) **Dr. Jun Nakanishi** (MANA Independent Scientist) MANA, NIMS, **Japan**
55	2013 Jun 14 *Self-Assembly of Green Nonionic Surfactants* **Dr. Kenji Aramaki** Yokohama National University, **Japan**
56	2013 Jun 14 *Magnesium-based Biodegradable Biomaterials* **Dr. Bobby Kannan Mathan** James Cook University, **Australia**
57	2013 Jun 19 *Organic/Inorganic Hybrid Architectures* **Prof. Marcel Mayor** University of Basel, **Switzerland**
58	2013 Jun 21 *Carrier Injection and Scattering in Atomically Thin MoS_2 Field-Effect Transistors* **Dr. Songlin Li** ICYS-MANA Researcher, NIMS, **Japan**
59	2013 Jun 21 *The Rational Design of Molecular Electronic Devices* **Dr. Christian A. Nijhuis** National University of Singapore, **Singapore**
60	2013 Jun 21 *Self Assembly of Dithiols on Surfaces* **Prof. Vladimir Esaulov** Director of Researcher in CNRS, Institute of the Molecular Sciences of Orsay, **France**
61	2013 Jun 24 *Supramolecular Analytical Chemistry* **Prof. Eric V. Anslyn** University of Texas at Austin, **USA**
62	2013 Jun 24 *Solid Supported Membranes to probe Membrane-Protein Interactions* **Dr. Ingo Koeper** Flinders University, **Australia**
63	2013 Jun 24 *Nanosafety (Nanotoxicology) and Nanomedicine* **Prof. Yuliang Zhao** Deputy Director-General, National Center for Nanoscience and Technology of China, **China**
64	2013 Jun 25 *Two-dimensional Ordering in Langmuir monolayer and LB films* **Prof. Milan Sanyal** Director of Saha Institute, **India**
65	2013 Jun 25 *A Generalized Route for Fabricating Ultra-thin Two-dimensional Sheets Using Semiconductor Nanowires* **Dr. Somobrata Acharya** Centre for Advanced Materials, Indian Association for the Cultivation of Science, **India**
66	2013 Jul 5 *Interlayer interaction dependence of latent heat in frustrated spin systems* **Dr. Ryo Tamura** ICYS-Sengen Researcher, NIMS, **Japan**
67	2013 Jul 5 *Secondary ion mass spectrometry for functional metal oxides* **Dr. Ken Watanabe** ICYS-MANA Researcher, NIMS, **Japan**
68	2013 Jul 9 *Functional Organic Molecules and Conjugated Polymers for Optoelectronic and Biodendor Application* **Prof. Jinsang Kim** WCU Invited Professor, Hybrid Materials for Sustainability, Seoul National University, **Korea**
69	2013 Jul 19 *Multilevel intermediate-band solar cells based on III-Nitrides* **Dr. Liwen Sang** ICYS-MANA Researcher, NIMS, **Japan**
70	2013 Jul 19 *Growth and Characterization of Single- and Few-layer of Graphene on Metal Substrates* **Dr. Jianhua Gao** ICYS-Sengen Researcher, NIMS, **Japan**
71	2013 Jul 23 *Synthesis and Properties of Cellulose Nanomaterials with Polymer Brushes* **Dr. Keita Sakakibara** Institute for Chemical Research, Kyoto University, **Japan**

72	2013 Jul 26 *Electronic devices based on gold nanoparticles: device fabrication, charge conduction mechanism and applications* **Prof. Watson Kuo** National Chung Hsing University, **Taiwan**
73	2013 Jul 31 *Role of Nepal Academy of Science and Technology in National Development* **Prof. Surendra Raj Kafle** Nepal Academy of Science and Technology, **Nepal**
74	2013 Aug 23 *Molecular Dynamics Study of Lipid Bilayers and Real Cell Plasma Membranes* **Prof. Susumu Okazaki** Department of Applied Chemistry, Nagoya University, **Japan**
75	2013 Aug 23 *Computational Modeling of New Materials for Electrochemical Solar-to-Fuel Energy Conversion* **Dr. Stefano Fabris** CNR-IOM DEMOCRITOS and SISSA, Trieste, **Italy**
76	2013 Aug 28 *Ion probes based on pyrrolyl and pyridyl moieties* **Prof. Yongshu Xie** East China University of Science and Technology, Shanghai, **China**
77	2013 Aug 28 *CNT-Alumina nanocomposites and their applications* **Prof. Yanqiu Zhu** College of Engineering, Mathematics and Physical Science, University of Exeter, **UK**
78	2013 Sep 2 *Plasmonic Nanoparticles: Strategies to increase the Electromagnetic Field on the surface* **Prof. Santiago Sanchez-Cortes** Institute of Structure of the Matter. CSIC, **Spain**
79	2013 Sep 2 *Densely Packed Monolayer of Metal Complexes on Gold Surface: Application in Selective Catalysis* **Prof. Kenji Hara** Catalysis Research Center, Hokkaido University, **Japan**
80	2013 Sep 5 *Rabi Oscillations Between Majorana Qubits and Quantum Dot Qubits* **Prof. Zhi Wang** Sun Yat-Sen University, **China**
81	2013 Sep 6 *Multi-Stimuli-Responsive Nanogels by Material Design* **Dr. Yohei Kotsuchibashi** ICYS-MANA Researcher, NIMS, **Japan**
82	2013 Sep 6 *Atomic Scale Characterization of Solar Cell Materials Using a Simultaneous STM/AFM System* **Dr. Nobuyuki Ishida** ICYS-Sengen Researcher, NIMS, **Japan**
83	2013 Sep 13 *Topological defects in 2D materials: graphene, h-BN, metal-disulfides* **Prof. Boris I. Yakobson** Rice University, Houston, **USA**
84	2013 Sep 18 *Symmetry protected zero-modes of massless Dirac fermions in a magnetic field* **Prof. Toru Kawarabayashi** Toho University, **Japan**
85	2013 Sep 20 *Mapping nanomechanical and nanothermal phenomena in low-dimensional materials using scanning probe microscopy* **Dr. Oleg Kolosov** Lancaster University, **UK**
86	2013 Sep 20 *Reversible and Instantaneous Swelling of Layered Materials* **Dr. Fengxia Geng** ICYS-MANA Researcher, NIMS, **Japan**
87	2013 Sep 20 *Synthesis of Nanostructured $SrTiO_3/BaTiO_3$ Composites: For Enhancement of Curie Temperature of $BaTiO_3$* **Dr. Norihiro Suzuki** ICYS-Sengen Researcher, NIMS, **Japan**
88	2013 Sep 20 *Structural Investigation of Soft Matter with Small-Angle Neutron Scattering –High-Performance Polymer Gels-* **Prof. Mitsuhiro Shibayama** University of Tokyo, **Japan**
89	2013 Sep 24 *AIP Publishing* **Dr. Stella Kafka** Journal Manager at AIP Publishing, **USA**
90	2013 Sep 26 *Advanced electron microscopy: from femtosecond MeV electrons to atomically resolved secondary electrons* **Dr. Yimei Zhu** Center for Functional Nanomaterials, Brookhaven National Lab, **USA**
91	2013 Oct 4 *Enhanced Oxidation of Nanoparticles through Strain-Mediated Ionic Transport* **Dr. Andrew Pratt** ICYS-Sengen Researcher, NIMS, **Japan**
92	2013 Oct 4 *Porphyrinoid conjugates - Potential Toward Supramolecular Applications, Molecular Switches and Smart Materials?* **Dr. Huynh Thien Ngo** ICYS-MANA Researcher, NIMS, **Japan**
93	2013 Oct 8 *Structure Control and Phase Selection of Non-Porous Inorganic-Organic Frameworks* **Dr. Hamish Yeung** University of Cambridge, **UK**
94	2013 Oct 17 *New Fluorescent Molecules and Assemblies for Sensing and Imaging* **Dr. Ayyappanpillai Ajayaghosh** National Institute for Interdisciplinary Science and Technology (NIIST), **India**
95	2013 Oct 17 *Supramolecular Origami: Transforming Paper into Twisted Structures* **Prof. Mark J. MacLachlan** University of British Columbia, **Canada**
96	2013 Oct 18 *Advanced anode materials and their storage mechanism at atomic level* **Dr. Xi Wang** ICYS-MANA Researcher, NIMS, **Japan**

97	2013 Oct 18 *Recent Advances in Multi-Walled Carbon Nanotube-Reinforced Ceramic and Metal Matrix Nanocomposites* **Dr. Mehdi Estili** ICYS-Sengen Researcher, NIMS, **Japan**
98	2013 Oct 24 *Building biomedical materials via layer-by-layer technique* **Dr. Wei Qi** Qufu Normal University, **China**
99	2013 Oct 24 *Bioinspired materials and its applications* **Dr. Shenmin Zhu** Shanghai Jiao Tong University, **China**
100	2013 Oct 24 *Enhancement in the electromagnetic field of highly conductive nanoparticles* **Dr. Volodymyr I. Chegel** Institute of Semiconductor Physics, **Ukraine**
101	2013 Oct 29 *High performance thin film transistor based on nanomaterials* **Prof. Lei Liao** Wuhan University, **China**
102	2013 Nov 1 *Irreversible Capacity Fade Mechanism in SiO Anode Materials* **Dr. Hossein Sepehri Amin** ICYS-Magne Researcher, NIMS, **Japan**
103	2013 Nov 1 *Toward the Large-Scale Simulations of Spin Materials: Accurate Simulations of Spin-Orbit Interactions for Molecules and Improvement of Computational Efficiency for Large-Scale Calculations* **Dr. Ayako Nakata** ICYS-Namiki Researcher, NIMS, **Japan**
104	2013 Nov 15 *Dynamic Breathing of CO_2 by Hydrotalcite* **Dr. Shinsuke Ishihara** ICYS-MANA Researcher, NIMS, **Japan**
105	2013 Nov 15 *Atomic-scale Characterization of Pentacene and C_{60} on TiO_2 by Simultaneous Bimodal AFM/STM and Kelvin Probe Force Microscopy* **Dr. César Moreno Sierra** ICYS-Sengen Researcher, NIMS, **Japan**
106	2013 Nov 20 *Creation of nanomaterials via self-assembly and their application to biomedical studies* **Prof. Toru Maekawa** Toyo University, **Japan**
107	2013 Nov 21 *Single-spin control in industry-compatible MOSFET devices* **Dr. Keiji Ono** Advanced Science Institute, RIKEN, **Japan**
108	2013 Nov 22 *Systematic Manipulations of Ion/Electron Transport at Small Length Scales for Maximizing the Yield of Electrochemical Energy* **Dr. Aninda Jiban Bhattacharyya** Indian Institute of Science, **India**
109	2013 Nov 25 *Nanogenerators as new energy technology and piezotronics for functional systems* **Prof. Zhong Lin Wang** Georgia Institute of Technology, **USA**
110	2013 Nov 27 *Contraol of Biomineralization and Nanoparticle Arrangement via Peptide Self-assembly and Oligomerization* **Prof. Kazuyasu Sakaguchi** Hokkaido University, **Japan**
111	2013 Nov 28 *Energy Storage Materials for Rechargeable Batteries: Eminence and Prospect* **Dr. Vilas G. Pol** Purdue University, **USA**
112	2013 Nov 29 *Mössbauer spectroscopy of iron-based layered systems with competing magnetic interactions* **Prof. Igor Presniakov** Moscow State University, **Russia**
113	2013 Dec 6 *It's a Small World: Applications of Advanced SAXS* **Dr. Brian Richard Pauw** ICYS-Sengen Researcher, NIMS, **Japan**
114	2013 Dec 6 *Effect of Electronic Correlation in Honeycomb Ribbons* **Dr. Sudipta Dutta** ICYS-MANA Researcher, NIMS, **Japan**
115	2013 Dec 9 *Open Access, Open Data, Improving the dissemination of scientific research* **Dr. Ed Gerstner** Executive Editor of Nature Communications, Shanghai Office, **China**
116	2013 Dec 18 *Electrochemistry: Building the Energy Highway* **Dr. Nenad M. Markovic** Argonne National Laboratory, **USA**
117	2013 Dec 18 *Low-temperature CO Oxidation Catalysis of Au/TiO_2 and Cathodoluminescence of Plasmonic Structures* **Dr. Takayuki Tanaka** Tokyo Institute of Technology, **Japan**
118	2013 Dec 20 *Fabrication of Single Polymer Nanowire Using STM: Fundamentals and Applications* **Dr. Swapan Kumar Mandal** Visva-Bharati University, **India**
119	2013 Dec 20 *Exploration of Nanobiomaterials in Cellular Environment* **Prof. Bing Xu** Brandeis University, **USA**

Appendix 7.6: MANA Research Papers 2013

List of MANA affiliated research papers in English published 2013 in scientific journals (479 papers):

1	S. Acharya, B. Das, U. Thupakula, K. Ariga, D.D. Sarma, J. Israelachvili, Y. Golan, *A Bottom-Up Approach toward Fabrication of Ultrathin PbS Sheets*, Nano Letters **13**(2), 409 (2013). doi: 10.1021/nl303568d WOS:000315079500014
2	H. Ago, K. Kawahara, Y. Ogawa, S. Tanoue, M.A. Bissett, M. Tsuji, H. Sakaguchi, R.J. Koch, F. Fromm, T. Seyller, K. Komatsu, K. Tsukagoshi, *Epitaxial growth and electronic properties of large hexagonal graphene domains on Cu(111) thin film*, Applied Physics Express **6**(7), 075101 (2013). doi: 10.7567/APEX.6.075101 WOS:000321699300033
3	M. Aikawa, M. Miyazawa, K. Okamoto, K. Okada, N. Akimoto, S. Yamaguchi, I. Koyama, T. Taguchi, Y. Ikada, *Novel pancreatoenteric reconstruction using a bioabsorbable polymer sheet and biocompatible bond*, Journal of Surgical Research **183**(1), 1 (2013). doi: 10.1016/j.jss.2012.11.049 WOS:000320599600004
4	S. Aikawa, P. Darmawan, K. Yanagisawa, T. Nabatame, Y. Abe, K. Tsukagoshi, *Thin-film transistors fabricated by low-temperature process based on Ga- and Zn-free amorphous oxide semiconductor*, Applied Physics Letters **102**(10), 102101 (2013). doi: 10.1063/1.4794903 WOS:000316501200028
5	S. Aikawa, T. Nabatame, K. Tsukagoshi, *Effects of dopants in InO_x-based amorphous oxide semiconductors for thin-film transistor applications*, Applied Physics Letters **103**(17), 172105 (2013). doi: 10.1063/1.4822175 WOS:000326455100037
6	C. Anand, S.V. Priya, G. Lawrence, G.P. Mane, D.S. Dhawale, K.S. Prasad, V.V. Balasubramanian, M.A. Wahab, A. Vinu, *Transesterification of ethylacetoacetate catalysed by metal free mesoporous carbon nitride*, Catalysis Today **204**, 164 (2013). doi: 10.1016/j.cattod.2012.07.025 WOS:000314825900023
7	M.S. Anwar, T. Nakamura, S. Yonezawa, M. Yakabe, R. Ishiguro, H. Takayanagi, Y. Maeno, *Anomalous switching in Nb/Ru/Sr_2RuO_4 topological junctions by chiral domain wall motion*, Scientific Reports **3**, 2480 (2013). doi: 10.1038/srep02480 WOS:000323303900005
8	R. Arafune, C.L. Lin, K. Kawahara, N. Tsukahara, E. Minamitani, Y. Kim, N. Takagi, M. Kawai, *Structural transition of silicene on Ag(111)*, Surface Science **608**, 297 (2013). doi: 10.1016/j.susc.2012.10.022 WOS:000312615500039
9	K. Aramaki, K. Tawa, L.K. Shrestha, T. Iwanaga, M. Kamada, *Formation and Cleansing Performance of Bicontinuous Microemulsions in Water/Poly (oxyethylene) Alkyl Ether/Ester-Type Oil Systems*, Journal of Oleo Science **62**(10), 803 (2013). doi: 10.5650/jos.62.803 WOS:000325196400006
10	K. Ariga, Q. Ji, T. Mori, M. Naito, Y. Yamauchi, H. Abe, J.P. Hill, *Enzyme nanoarchitectonics: organization and device application*, Chemical Society Reviews **42**(15), 6322 (2013). doi: 10.1039/C2CS35475F WOS:000321570200010
11	K. Ariga, K. Kawakami, J.P. Hill, *Emerging pressure-release materials for drug delivery*, Expert Opinion on Drug Delivery **10**(11), 1465 (2013). doi: 10.1517/17425247.2013.819340 WOS:000326042900001
12	K. Ariga, H. Komatsu, J.P. Hill, *Nanophotonics and supramolecular chemistry*, Nanophotonics **2**(4), 265 (2013). doi: 10.1515/nanoph-2013-0025 WOS:000333958900003
13	K. Ariga, T. Mori, J.P. Hill, *Interfacial Nanoarchitectonics: Lateral and Vertical, Static and Dynamic*, Langmuir **29**(27), 8459 (2013). doi: 10.1021/la4006423 WOS:000321793400003
14	K. Ariga, Y. Yamauchi, T. Mori, J.P. Hill, *25th Anniversary Article: What Can Be Done with the Langmuir-Blodgett Method? Recent Developments and its Critical Role in Materials Science*, Advanced Materials **25**(45), 6477 (2013). doi: 10.1002/adma.201302283 WOS:000330106800001
15	A. Arshi, Y. Nakashima, H. Nakano, S. Eaimkhong, D. Evseenko, J. Reed, A.Z. Stieg, J.K. Gimzewski, A. Nakano, *Rigid microenvironments promote cardiac differentiation of mouse and human embryonic stem cells*, Science and Technology of Advanced Materials **14**(2), 025003 (2013). doi: 10.1088/1468-6996/14/2/025003 WOS:000318267000005
16	H. Asanuma, Z. Jiang, K. Ikeda, K. Uosaki, H.Z. Yu, *Selective dehybridization of DNA-Au nanoconjugates using laser irradiation*, Physical Chemistry Chemical Physics **15**(38), 15995 (2013). doi: 10.1039/c3cp52771a WOS:000324412300038
17	H. Ataee-Esfahani, M. Imura, Y. Yamauchi, *All-Metal Mesoporous Nanocolloids: Solution-Phase Synthesis of Core-Shell Pd@Pt Nanoparticles with a Designed Concave Surface*, Angewandte Chemie - International Edition **52**(51), 13611 (2013). doi: 10.1002/anie.201307126 WOS:000328437200022
18	H. Ataee-Esfahani, J. Liu, M. Hu, N. Miyamoto, S. Tominaka, K.C.W. Wu, Y. Yamauchi, *Mesoporous Metallic Cells: Design of Uniformly Sized Hollow Mesoporous Pt–Ru Particles with Tunable Shell Thicknesses*, Small **9**(7), 1047 (2013). doi: 10.1002/smll.201202539 WOS:000317019800014

19	A.V. Avizienis, C. Martin-Olmos, H.O. Sillin, M. Aono, J.K. Gimzewski, A.Z. Stieg, *Morphological Transitions from Dendrites to Nanowires in the Electroless Deposition of Silver*, Crystal Growth & Design **13**(2), 465 (2013). doi: 10.1021/cg301692n WOS:000314795300011
20	S.H. Bae, S. Lee, H. Koo, L. Lin, B. Hyun, C. Park, Z.L. Wang, *The Memristive Properties of a Single VO_2 Nanowire with Switching Controlled by Self-Heating*, Advanced Materials **25**(36) 5098 (2013). doi: 10.1002/adma.201302511 WOS:000327686700014
21	H. Bai, N. Su, W. Li, X. Zhang, Y. Yan, P. Li, S. Ouyang, J. Ye, G. Xi, *$W_{18}O_{49}$ nanowire networks for catalyzed dehydration of isopropyl alcohol to propylene under visible light*, Journal of Materials Chemistry A **1**(20), 6125 (2013). doi: 10.1039/c3ta10835j WOS:000318303100002
22	S. Bali, T.T. Chen, W. Chaikittisilp, C.W. Jones, *Oxidative stability of amino polymer-alumina hybrid adsorbents for carbon dioxide capture*, Energy & Fuels **27**(3), 1547 (2013). doi: 10.1021/ef4001067 WOS:000318264400042
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Appendix 7.7: MANA Journal Cover Sheets

Journal cover sheets related to MANA affiliated papers (October 2007 – December 2013):

	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/PhysRevLett.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	Bulletin of the Chemical Society of Japan *Journal Front Cover*	2012	85	1	10.1246/bcsj.20110162
38	Chemical Communications *Journal Inside Back Cover*	2012	48	33	10.1039/C2CC31118F
39	Chemical Communications *Journal Inside Front Cover*	2012	48	40	10.1039/C2CC30643C
40	Chemistry - A European Journal *Journal Frontispiece*	2012	18	6	10.1002/chem.201102013
41	Inorganic Chemistry *Journal Front Cover*	2012	51	19	10.1021/ic300557u
42	Journal of Materials Chemistry *Journal Inside Back Cover*	2012	22	14	10.1039/C2JM00044J
43	Journal of Materials Chemistry *Journal Back Cover*	2012	22	21	10.1039/C2JM16629A
44	Nanoscale *Journal Front Cover*	2012	4	8	10.1039/C2NR11835A
45	Nanoscale *Journal Front Cover*	2012	4	10	10.1039/C2NR00010E
46	Oyo Buturi (in Japanese) *Journal Front Cover*	2012	81	12	(not available)
47	Physica Status Solidi: RRL *Journal Front Cover*	2012	6	5	10.1002/pssr.201206082
48	Physical Chemistry Chemical Physics *Journal Back Cover*	2012	14	17	10.1039/C2CP24010F

	Journal name *Type of cover sheet*	Year	Volume	Issue	doi number (of related paper)
49	Polymer Journal *Journal Front Cover*	2012	44	6	10.1038/pj.2012.30
50	Advanced Materials *Journal Inside Front Cover*	2013	25	8	10.1002/adma.201204434
51	Angewandte Chemie – International Edition *Journal Back Cover*	2013	52	31	10.1002/anie.201303035
52	Chemical Communications *Journal Inside Front Cover*	2013	49	35	10.1039/c3cc40398j
53	Chemical Communications *Journal Inside Front Cover*	2013	49	36	10.1039/C3CC39273B
54	Chemical Society Reviews *Journal Inside Front Cover*	2013	42	15	10.1039/C2CS35475F
55	Chemistry – An Asian Journal *Journal Frontispiece*	2013	8	8	10.1002/asia.201300247
56	Chemistry – An Asian Journal *Journal Inside Front Cover*	2013	8	12	10.1002/asia.201300940
57	CrystEngComm *Journal Inside Front Cover*	2013	15	45	10.1039/C3CE41150H
58	Journal of Materials Chemistry A *Journal Front Cover*	2013	1	13	10.1039/c2ta00450j
59	Journal of Materials Chemistry B *Journal Inside Front Cover*	2013	1	26	10.1039/C3TB20461H
60	Journal of Materials Chemistry C *Journal Front Cover*	2013	1	11	10.1039/C3TC00930K
61	Journal of Materials Chemistry C *Journal Front Cover*	2013	1	14	10.1039/C3TC00952A
62	Langmuir *Journal Front Cover*	2013	29	24	10.1021/la401652f
63	Langmuir *Journal Front Cover*	2013	29	27	10.1021/la4006423
64	Physical Chemistry Chemical Physics *Journal Back Cover*	2013	15	26	10.1039/c3cp50620g

Appendix 7.8: 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 (January 2013 - December 2013):

Between October 2007 and December 2012, MANA has made 377 Japanese Patent Applications. They are listed in Appendix 8.9 of the report *Facts and Achievements 2012*.

No.	Date of Application / *Name of Invention*	Application Number
378	2013 Jan 11 *Self-heating nanofibers with drug release function, fabrication method of the sane, and fabrication method of the nonwoven material*	2013-003341
379	2013 Jan 18 *Fabrication method of adhesion for tissues*	2013-006961
380	2013 Jan 24 *Fluorescence probe and detection method for materials containing Cs*	2013-011300
381	2013 Jan 25 *Electric field-tunable topological insulator utilizing perovskite structure*	2013-011584
382	2013 Jan 28 *Multi-functional device for electric conductivity*	2013-012848
383	2013 Feb 1 *Green light emissive germanium nanoparticles and fabrication method of the same*	2013-018245
384	2013 Feb 6 *Perovskite nano-sheets based on homologous layered provskite-oxide, and their applications*	2013-021150
385	2013 Feb 13 *Conductive polymer-metal composites and materials adhered by them, and fabrication method of the same*	2013-025154
386	2013 Feb 27 *Thermoelectric semiconductors of rare-earth alumino-borides, and fabrication method of the same and thermoelectric devices using the same*	2013-036757
387	2013 Mar 1 *Nano carbon and graphene or carbon composite materials with graphene, and fabrication method of the same*	2013-040445
388	2013 Mar 13 *Adhesive bone filling agents and kits of the same*	2013-050139
389	2013 Mar 18 *Resettable optical sensors and resetting methods of optical sensors*	2013-054733
390	2013 Mar 21 *Adhesive agents for cells and clusters of aggregate cells*	2013-057544
391	2013 Mar 21 *Sensor devices for measurement of very small amount of samples*	2013-057649
392	2013 Mar 22 *Nanoparticles with high sensitivity for light emission and light amplifiers using laser media*	2013-060077
393	2013 Mar 28 *Organic EL devices*	2013-067782
394	2013 Mar 28 *Organic EL devices and fabrication method of the same*	2013-067801
395	2013 Mar 28 *Organic EL devices and fabrication method of the same*	2013-068164
396	2013 Apr 11 *Production and controlling method of surface areas where crystal orientation, crystal structure or composition varies with position and optimization of abrasive coefficient*	2013-083027
397	2013 Apr 12 *Freestanding organometallics nanomembrane and fabrication method of the same*	2013-083992
398	2013 Apr 26 *Equipment for molecular measurement and fabrication method of the same*	2013-094200
399	2013 Apr 26 *Mesoporous materials of inorganic oxides and fabrication method of the same*	2013-094728
400	2013 May 2 *Holders for sensor tips*	2013-096690
401	2013 May 9 *Thin film transistors and fabrication method of the same*	2013-099284
402	2013 May 13 *Conductive polymer-metal composites and materials adhering them, and fabrication method of the same*	2013-100815
403	2013 May 13 *Fabrication method of substrates for cell culture, substrates for cell culture and method of cell culture*	2013-101259
404	2013 May 27 *Self assembling peptides*	2013-110898
405	2013 Jun 4 *Transistor of dual gate polymer thin film*	2013-117654
406	2013 Jun 5 *Model surface stress sensors fixing antibodies or antigens and fabrication methods of the same, and immunity measurement method using the same*	2013-119299
407	2013 Jun 7 *Contact probe and fabrication method of the same, non-destructive forming method for contacts, the measurement method in fabrication process of multi-layers*	2013-120634
408	2013 Jun 13 *Nanoparticles of platinum alloy, and fabrication method of the same, electrodes using nanoparticles of platinum alloy and fuel cells*	2013-124873
409	2013 Jun 13 *Thin film transistors, fabrication method of the same and semiconductor equipment*	2014-521410
410	2013 Jun 27 *Devices for variable electric conductivity using all solid electric double layers and electric equipment using the same*	2013-134534

No.	Date of Application / *Name of Invention*	Application Number
411	2013 Jun 27 *Substrates for surface enhancement Raman spectroscopy (SERS), fabrication method of the same, and biosensors and devices of micro flow channel using the same*	2013-135565
412	2013 Jul 1 *Chiral shift agents for NMR, and method for determination of photo purity and absolute arrangement using the same*	2013-137744
413	2013 Jul 3 *Thin film transistor and fabrication method of the same*	2013-139425
414	2013 Jul 11 *Apparatus for electron back scattering*	2013-145573
415	2013 Jul 26 *High proton conductive polymer films and fabrication method of the same, and humidity sensors*	2014-528113
416	2013 Jul 30 *Inactive bio membranes, liquids for coating and fabrication method of the same, and substrates for bio inactive treatment*	2013-157967
417	2013 Aug 8 *Fabrication method for recombined proteins using non protein/non lipid conditioned cell strain*	2013-164837
418	2013 Aug 23 *Equipment for measurement of micro heat conductivity, and measurement method*	2013-172783
419	2013 Aug 26 *Blood purification membranes, fabrication method of the same and dialyzers*	2013-174636
420	2013 Aug 27 *Adhesion membranes of cancer cells, devices for adhesion of cancer cells and fabrication method of the same, and equipment for removing cancer cells*	2013-175387
421	2013 Sep 26 *Layered resist films of high sensitive metal layers and method for improving photo sensitivity of resist layers*	2013-199700
422	2013 Sep 27 *Metal electrodes and semi-conductive device using the same*	2013-201187
423	2013 Sep 30 *Aromatic amine adsorbents, quartz resonator using the same, and fabrication method of the same*	2013-203943
424	2013 Oct 1 *Adhesive bone filling agents and kit of the same*	2013-206357
425	2013 Oct 3 *Materials of three dimensional graphene foam and fabrication method of the same*	2013-208464
426	2013 Nov 6 *Mesoporous metallic nanoparticles, fabrication method of the same, and catalysts containing the same*	2013-230655
427	2013 Nov 11 *Electric conductive devices using oxidized graphene, graphene and/or ion conductive materials, electric equipment of electric conductive devices using electric conductive devices, and handling method of electric conductive devices*	2013-233226
428	2013 Nov 15 *Signal inducing functional polymers for information transfer molecules among cells and fabrication method of the same*	2013-236845
429	2013 Nov 22 *Cell adhesive porous membranes, fabrication method of the same and tissue adhesive porous membrane tapes*	2013-241764
430	2013 Nov 26 *Thin film transistors and fabrication method of the same*	2013-243413
431	2013 Nov 26 *Photo catalytic materials and fabrication method of the same*	2013-243826
432	2013 Nov 28 *Nanoparticles of platinum alloy, fabrication method of the same and electrodes and fuel cells containing the same*	2013-245982
433	2013 Dec 2 *Memory media and memory equipment using the same, method for recording and erasing of information*	2013-249601
434	2013 Dec 11 *Single crystal silicon wafers of rectangular shape*	2013-255895
435	2013 Dec 20 *Method of fractionating nanomaterial comprising elongated elements of different lengths*	2013-264489

2. List of Japanese Patent Registrations (January 2013 – December 2013):

Between October 2007 and December 2012, MANA has made 232 Japanese Patent Registrations. They are listed in Appendix 8.9 of the report *Facts and Achievements 2012*.

No.	Date of Registration / *Name of Invention*	Registration Number
233	2013 Jan 11 *Cell attaching/culturing base material capable of imparting cell attaching property by irradiation of light*	5167738
234	2013 Jan 11 *Manufacturing method of silicon carbide nanowire*	5170609
235	2013 Jan 11 *Method for forming cone emitter*	5170653
236	2013 Jan 11 *Electron source, and manufacturing method of electron source*	5173516
237	2013 Feb 1 *Method for peeling layered double hydroxide, double hydroxide nanosheet, composite thin film material thereof, method for producing the same, and method for producing layered double hydroxide thin film material*	5187797
238	2013 Feb 1 *Supramolecular structure and its production method*	5187812
239	2013 Feb 15 *Crystalline nano structure consisting of strontium aluminate and its producing method*	5196361
240	2013 Feb 15 *Ribbon-like beta Ga_2O_2 tube with cylindrical internal passage filled up with thin nanowire*	5196363

No.	Date of Registration / *Name of Invention*	**Registration Number**
241	2013 Feb 22 *Thermosetting resin composite composition, resin molded body, and method for producing the composition*	**5201367**
242	2013 Feb 22 *Surface cleaning method for biocompatible material and cleaning apparatus used for the same*	**5201507**
243	2013 Feb 22 *Cathodic photo-protection coating structure, and its production method*	**5201707**
244	2013 Mar 1 *Method of injecting molecule by beam, method of processing material by beam, and devices therefor*	**5205669**
245	2013 Mar 1 *Solid-state device structure, and electric/electronic device and electric/electronic appliance using it*	**5205670**
246	2013 Mar 1 *Collagen sponge and method of manufacturing the same*	**5205673**
247	2013 Mar 1 *Photocatalyst nanosheet, photocatalyst material, and their manufacturing methods*	**5205675**
248	2013 Mar 1 *Blended polymer fibers and nonwoven fabric thereof and their production method*	**5207265**
249	2013 Mar 15 *Magnetic semiconductor and its production method*	**5218953**
250	2013 Mar 15 *Porous scaffold material for regeneration and its production method*	**5218955**
251	2013 Mar 15 *Artificial opal film production device*	**5218961**
252	2013 Mar 15 *BN thin film having sp3-bonded BN high density phase, and method for producing the same*	**5218969**
253	2013 Mar 29 *Electronic spectroscopic measuring apparatus under voltage impression*	**5229848**
254	2013 Mar 29 *Heteronanowire structure having trunk part and branch-shaped part, and its producing method*	**5229851**
255	2013 Mar 29 *Method for producing MgB_2 superconductor*	**5229868**
256	2013 Apr 12 *Method for producing fiber-reinforced composite*	**5240754**
257	2013 Apr 12 *Optical electric field amplifying element and probe using the same*	**5241730**
258	2013 Apr 12 *Heat-resistant resin composition with excellent mechanical properties and method for producing the same*	**5242888**
259	2013 Apr 19 *Iodide-based single crystal materials, method of producing the same, and scintillator based on the same*	**5245176**
260	2013 Apr 19 *Current-perpendicular-to-plane giant magnetoresistance (CPP-GMR) element*	**5245179**
261	2013 Apr 26 *Manufacturing method for SiC nanoparticle by nitrogen plasma*	**5252460**
262	2013 Apr 26 *Dope for forming*	**5255284**
263	2013 May 2 *Metal nanoparticles, method for producing the same, and electrolyte using the same*	**5258117**
264	2013 May 24 *N-type thermoelectric conversion element utilizing carbon- and nitrogen-doped rare-earth polyboride-based high-temperature acid-resistant n-type thermoelectric material*	**5273685**
265	2013 Jun 14 *Solar cell*	**5288368**
266	2013 Jun 21 *Dielectric element and method for producing the dielectric element*	**5294201**
267	2013 Jun 21 *Nitrogen-doped mesoporous carbon (N-KIT-6) and its production method*	**5294234**
268	2013 Jun 21 *Electronic element*	**5294238**
269	2013 Jun 21 *Oxide layered illuminant and oxide nanosheet illuminant*	**5294246**
270	2013 Jun 21 *Display element*	**5294301**
271	2013 Jul 5 *Probe for scanning type probe microscope, and scanning type probe microscope*	**5306015**
272	2013 Jul 12 *Lithium ion conductive solid electrolyte, its manufacturing method, solid electrolyte for lithium secondary battery using the solid electrolyte, and whole solid lithium battery using the solid electrolyte for secondary battery*	**5311169**
273	2013 Jul 12 *Resin composition and method for producing same*	**5311298**
274	2013 Jul 19 *Regular mesoporous fullerene having large specific surface area and method for producing the same*	**5316988**
275	2013 Jul 19 *Lead-free magneto-optical element and method for manufacturing the same*	**5317065**
276	2013 Jul 19 *Method for producing anion-exchanging layered double hydroxide*	**5317293**
277	2013 Jul 26 *Scaffold material for living body*	**5322146**
278	2013 Jul 26 *Co based Heusler alloy*	**5322209**
279	2013 Aug 9 *Method of preparing decellularized soft tissue, graft and culture material*	**5331960**
280	2013 Aug 9 *Magnesium-based biodegradable metal material*	**5333886**
281	2013 Aug 9 *Porous body and production method of the same*	**5334081**
282	2013 Aug 16 *Porous article and method for producing the same*	**5339323**
283	2013 Aug 16 *Method for producing layered rare earth hydroxide*	**5339330**
284	2013 Aug 16 *Layered hydroxides and mono-layered nano sheets, and fabrication methods of the same*	**5339331**

No.	Date of Registration / *Name of Invention*	Registration Number
285	2013 Aug 16 *Medical biological absorbent member and method of manufacturing the same*	5339347
286	2013 Sep 6 *Superconducting wire rod*	5356132
287	2013 Sep 13 *Electronic device and manufacturing method therefor*	5360739
288	2013 Sep 27 *Layered rare earth hydroxide, thin film thereof and method of manufacturing them*	5370740
289	2013 Sep 27 *Surface increasing Raman scattering reactive nanoscale pH sensor*	5370995
290	2013 Sep 27 *Switching element and application of the same*	5371010
291	2013 Oct 11 *Cerium oxide nanotube and method for producing the same*	5382673
292	2013 Oct 11 *Nanoscale pH sensor*	5382690
293	2013 Oct 11 *Nanorod formulation for liquid crystal display for polarization control-type electro-optical apparatus*	5382691
294	2013 Oct 11 *Thermoelectric semiconductor, and thermoelectric power generation element using the same*	5382707
295	2013 Oct 18 *Layered rare earth hydroxide and anion-exchange material and fluorescent material using it*	5386687
296	2013 Oct 18 *Mesoporous carbon (MC-MCM-48) and method for producing the same*	5388051
297	2013 Oct 18 *Reduced hydrogen water-forming agent*	5388215
298	2013 Oct 25 *All-solid lithium ion secondary battery*	5395258
299	2013 Nov 1 *Detection device and biosenser*	5398017
300	2013 Nov 1 *Vapor-deposition apparatus and vapor-deposition method*	5401130
301	2013 Nov 8 *Substrate for crystal growth and crystal growing method using the same*	5403497
302	2013 Nov 8 *Cage-type mesoporous silica (SNC-2), method for producing the same and adsorbent using the same*	5403502
303	2013 Nov 8 *Electrospun fiber mat composite and glucose sensor*	5403520
304	2013 Nov 8 *Device for forming polarization inversion region*	5403521
305	2013 Nov 8 *Magnesium alloys with high strength and high ductility*	5404391
306	2013 Nov 15 *Amorphous base material*	5408564
307	2013 Nov 15 *Surface enhanced infrared absorption sensor and process for producing it*	5408565
308	2013 Nov 15 *Rare earth multi-boride thermoelectric element, and thermoelectric element using the same*	5408567
309	2013 Nov 22 *Dye-sensitized solar cell*	5413770
310	2013 Nov 22 *Microscale ultraviolet sensor and method of manufacturing the same*	5414050
311	2013 Nov 22 *Metal electrode and semiconductor element using the same*	5414053
312	2013 Nov 29 *Magnesium alloy*	5419061
313	2013 Nov 29 *Magnesium alloy*	5419062
314	2013 Dec 13 *Organic field effect transistor*	5429848
315	2013 Dec 13 *Thermoelectric element*	5429863
316	2013 Dec 20 *Ultrathin boron nitride nanosheet, method for production thereof, and optical material containing the nanosheet*	5435559
317	2013 Dec 20 *Production method of group IV semiconductor nano thin wire*	5435600
318	2013 Dec 20 *Polymer brush-solid composite material, and method for producing the same*	5437256

3. List of International Patent Applications (January 2013 – December 2013):

Between October 2007 and December 2012, MANA has made 198 International Patent Applications. They are listed in Appendix 8.9 of the report *Facts and Achievements 2012*.

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

No.	Date of Application / Country *Name of Invention*	Application Number
199	2013 Apr 17 PCT *Double-sided coated surface stress sensor*	PCT/JP2013/061404
200	2013 Apr 19 PCT *Biomaterial coated with HAp/Col composite*	PCT/JP2013/061666
201	2013 Jun 13 Korea *Thin-film transistor, method for producing a thin-film transistor, and semiconductor device*	2014-7012459
202	2013 Jun 13 PCT *Thin-film transistor, method for producing a thin-film transistor, and semiconductor device*	PCT/JP2013/066384
203	2013 Jul 26 PCT *Highly proton-conductive polymer film, method for producing same, and humidity sensor*	PCT/JP2013/070299

No.	Date of Application **Application Number** **Country** *Name of Invention*	No.	Date of Application **Application Number** **Country** *Name of Invention*
204	2013 Oct 21 **PCT/JP2013/078486** **PCT** *Adhesive body between conductive polymer-metal complex and substrate and method for forming adhesive body, conductive polymer-metal complex dispersion liquid, method for manufacturing and applying same, and method for filling hole using conductive material*	205	2013 Nov 22 **PCT/JP2013/081559** **PCT** *Tissue adhesive film and method for producing same*

4. List of International Patent Registrations (January 2013 – December 2013):

Between October 2007 and December 2012, MANA has made 72 International Patent registrations. They are listed in Appendix 8.9 of the report *Facts and Achievements 2012*.

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

No.	Date of Registration **Registration Number** **Country** *Name of Invention*	No.	Date of Registration **Registration Number** **Country** *Name of Invention*
73	2013 Jan 29 **8361203** **US** *Carbon porous body and adsorbent using the same*	87	2013 Sep 25 **ZL200980118276.7** **China** *Dielectric film, dielectric element, and process for producing the dielectric element*
74	2013 Feb 6 **1825868** **EPC, France, Germany, UK** *Process for producing porous object comprising apatite/collagen composite fiber*	88	2013 Sep 25 **1314031** **Korea** *All-solid battery*
75	2013 Feb 27 **2184793** **EPC, Germany, UK** *Switching element and application of the same*	89	2013 Oct 22 **8563975** **US** *Hetero pn junction semiconductor and process for producing the same*
76	2013 Apr 9 **8414855** **US** *Spherical boron nitride nanoparticles and synthetic method thereof*	90	2013 Nov 5 **8575038** **US** *Method for reducing thickness of interfacial layer, method for forming high dielectric constant gate insulating film, high dielectric constant gate insulating film, high dielectric constant gate oxide film, and transistor having high dielectric constant gate oxide film*
77	2013 May 1 **I395360** **Taiwan** *All-solid battery*	91	2013 Nov 5 **8575674** **US** *Ferromagnetic tunnel junction structure, and magneto-resistive element and spintronics device each using same*
78	2013 May 7 **8435910** **US** *Preparation method for anion-exchangeable, layered double hydroxides*	92	2013 Nov 6 **140391** **France, Germany, UK** *Thin film device with a MnS intermediate layer and its fabrication method*
79	2013 May 28 **2585577** **Canada** *Process for producing porous object comprising apatite/collagen composite fiber*	93	2013 Nov 28 **2009323792** **Australia** *All-solid battery*
80	2013 Jun 20 **2485635** **Russia** *All-solid battery*	94	2013 Dec 3 **8601610** **US** *Optical electric field enhancement element and probe using the same*
81	2013 Jul 1 **I400288** **Taiwan** *Resin composition*	95	2013 Dec 17 **1345390** **Korea** *Interface layer reduction method, method for forming high dielectric constant gate insulating film, high dielectric constant gate insulating film, high dielectric constant gate oxide film, and transistor having high dielectric constant gate oxide film*
82	2013 Jul 3 **ZL200580010769.0** **China** *Process for producing porous object comprising apatite/collagen composite fiber*	96	2013 Dec 17 **8609235** **US** *Porous ceramic material and method of producing the same*
83	2013 Jul 5 **HK1141821** **Hong Kong** *Resin composition*	97	2013 Dec 24 **8613611** **US** *Electrically conductive polyrotaxane*
84	2013 Jul 10 **2423242** **EPC, France, Germany** *Electrically conductive polyrotaxane*	98	2013 Dec 24 **8613811** **US** *Graphene-coated member and process for producing same*
85	2013 Aug 27 **8518584** **US** *Production method for electrode for battery, electrode produced by production method, and battery including electrode*		
86	2013 Sep 18 **ZL201080005817.8** **China** *Mg-based structured member*		

Appendix 7.9: International Cooperation

List of MOU agreements of MANA with overseas institutions signed between October 2007 and March 2014:

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 (Expired: 2013 May 6)
5	CNRS, Centre d'élaboration de matériaux et d'études structurales (CEMES), **France** Signed: 2008 May 30 (Expired: 2013 May 30)
6	University of Cambridge, Nanoscience Centre, **UK** Signed: 2008 Jun 20 (Expired: 2013 Jun 20)
7	Indian Institute of Chemical Technology (IICT), **India** Signed: 2008 Jul 3 (Expired: 2013 Jul 3)
8	University of Basel, Institute of Physics, National Center of Competence for Nanoscale Science, **Switzerland** Signed: 2008 Jul 20 (Expired: 2013 Jul 20)
9	Yonsei University, Seoul, **Korea** Signed: 2008 Sep 1 (Expired: 2013 Sep 1)
10	Indian Institute of Science, Education and Research, **India** Signed: 2008 Dec 19 (Expired: 2013 Dec 19)
11	University of Karlsruhe, Institute for Inorganic Chemistry, Supramolecular Chemistry Group, **Germany** Signed: 2009 Jan 29 (Expired: 2014 Jan 29)
12	Fudan University, Department of Chemistry, New Energy and Materials Laboratory (NEML), **China** Signed: 2009 Mar 16 (Expired: 2014 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
40	Centre Interdisciplinaire de Nanoscience de Marseille (CINaM-CNRS), **France** Signed: 2013 May 2
41	National Center for Nanoscience and Technology (NCNST), Beijing, **China** Signed: 2013 Jun 24
42	Huazhong University of Science and Technology (HUST), **China** Signed: 2013 Jul 29

No.	Organization, **Country** Signed (Expired)	No.	Organization, **Country** Signed (Expired)
43	Georgia Institute of Technology (GIT), Center for Nanostructure Characterization, **USA** (Renewal) Signed: 2013 Nov 25	45	St. Petersburg State Electrotechnical University (LETI), **Russia** Signed: 2014 Feb 28
44	CNRS, Centre d'élaboration de matériaux et d'études structurales (CEMES), **France** (Renewal) Signed: 2013 Dec 10	46	University of Bristol, Bristol Centre for Nanoscience and Quantum Information (NSQI), **UK** Signed: 2014 Mar 7

Appendix 7.10: MANA History

MANA History between October 2007 and March 2014:

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 3	MANA signed a Memorandum of Understanding (MOU) with Indian Institute of Technology (IICT), Hyderabad, India
2008 Apr 16	1st MANA Site Visit by the WPI Program Committee	2008 Jul 9	Dr. Kenji Kitamura (MANA PI) received the "Inoue Harushige Prize" given by the Japan Science and Technology Agency
2008 May 6	MANA signed a Memorandum of Understanding (MOU) with Georgia Institute of Technology (GIT), USA	2008 Jul 16	Dr. Takayoshi Sasaki (MANA PI) and Dr. Minoru Osada (MANA Scientist) received the "2008 Tsukuba Prize"
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 Jul 19	Prof. Sir Harry W. Kroto visited MANA
2008 May 20	1st Follow-up Meeting by the WPI Follow-Up Committee	2008 Jul 20	MANA signed a Memorandum of Understanding (MOU) with University of Basel, Switzerland
2008 May 30	MANA signed a Memorandum of Understanding (MOU) with CNRS, France	2008 Jul 28 – Aug 1	The 5th NIMS-IRC-UCLA Nanotechnology Summer School was held at NIMS
2008 Jun 2	NIMS Overseas Operation Office opened at the University of Washington, USA	2008 Sep 1	MANA signed a Memorandum of Understanding (MOU) with Yonsei University, Seoul, Korea
2008 Jun 20	MANA signed a Memorandum of Understanding (MOU) with University of Cambridge, UK	2008 Sep 11	Dr. Kohei Uosaki (MANA PI) was named "International Society of Electrochemistry Fellow"

Date	Event
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 Oct 1	Celebration of 1st Anniversary of MANA. Organizational Reform of MANA
2008 Oct 6	Dr. Yoshio Bando (MANA Chief Operating Officer) was named "American Ceramic Society Fellow"
2008 Nov 27-28	2nd MANA Site Visit by the WPI Program Committee
2008 Dec 11	MANA activities were introduced in the NHK Program "Ohayou Nippon (Good Morning Japan)"
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 Dec 19	MANA signed a Memorandum of Understanding (MOU) with Indian Institute of Science, Education and Research, India
2009 Jan 29	MANA signed a Memorandum of Understanding (MOU) with University of Karlsruhe, Germany
2009 Feb 25-27	The 2nd MANA International Symposium was held in Tsukuba
2009 Mar 16	MANA signed a Memorandum of Understanding (MOU) with Fudan University, China
2009 Mar 17	2nd Follow-up Meeting by the WPI Follow-Up Committee
2009 Mar 28	Dr. Ajayan Vinu (MANA Independent Scientist) received the "CSJ Award for Young Chemists" given by the Chemical Society of Japan

Fiscal Year 2009

Date	Event
2009 Apr 5	MANA signed a Memorandum of Understanding (MOU) with Indian Institute of Technology, Madras, India
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 May 8	Dr. Kazuhiro Hono (MANA PI) received the "2009 Honda Frontier Award" given by the Honda Memorial Foundation
2009 May 19	Prof. James K. Gimzewski (MANA PI) was elected as "Fellow of the Royal Society"
2009 May 28	MANA signed a Memorandum of Understanding (MOU) with University of Cologne, Germany
2009 Jun 15-17	The 8th Japan-France Workshop on Nanomaterials held at NIMS
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 Jul 14	A delegation from U.S. Department of Energy (DOE) and U.S. Department of Defense (DOD) visited MANA
2009 Jul 20	MANA signed a Memorandum of Understanding (MOU) with EPFL, Switzerland
2009 Jul 30	MANA signed a Memorandum of Understanding (MOU) with University of Rome Tor Vergata, Italy
2009 Jul 27-31	The 6th MANA-NSC-CNSI Nanotechnology Students' Summer School was held at the UCLA MANA Satellite, Los Angeles, USA
2009 Aug 31	MANA signed a Memorandum of Understanding (MOU) with University of Heidelberg, Germany
2009 Sep 20-22	XJTU-NIMS/MANA Workshop on Materials Science 2009 was held at Xi'an Jiaotong University, China
2009 Sep 25	Dr. Jun Nakanishi (MANA Independent Scientist) received the "Japan Society for Analytical Chemistry Award for Younger Researchers"
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
2009 Oct 2	Prof. Svante Lindqvist, Nobel Museum Director and Chair at the Royal Institute of Technology, Stockholm, visited MANA
2009 Oct 5	Dr. Kohei Uosaki (MANA PI) received the "ECS Fellow Award" given by the Electrochemical Society
2009 Oct 9	Prof. Sir Harry W. Kroto visited MANA for one-on-one meetings with young scientists
2009 Oct 10-12	Tsukuba-Shinchu Bilateral Symposium on "Advanced Materials Science and Technology" was held at National Tsing Hua University, Taiwan
2009 Oct 13	MANA-URTV Joint Workshop on Nanostructured Materials for Sustainable Development was held at University Rome Tor Vergata, Italy
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 Oct 26	Dr. Naoki Ohashi (MANA PI) received the "Richard M. Fulrath Award" given by the American Ceramics Society
2009 Oct 28	MANA signed a Memorandum of Understanding (MOU) with Loughborough University, UK
2009 Nov 10	Nanjing University-Anhui Normal University-Hokkaido University-MANA Joint Symposium was held at Nanjing University, China
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 Dec 10	The Osaka University-MANA/NIMS Joint Symposium on "Advanced Structural and Functional Materials Design" was held at Osaka University
2009 Dec 18	Visit of the MANA Satellite at UCLA by WPI Program Director Prof. Toshio Kuroki

Date	Event
2010 Jan 7-8	3rd MANA Site Visit by the WPI Program Committee
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
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)"
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)"
2010 Feb 4	Dr. Yusuke Yamauchi (MANA Independent Scientist) received "Inoue Research Aid for Young Scientists"
2010 Feb 9	MANA signed a Memorandum of Understanding (MOU) with Lawrence Berkeley National Laboratory (LBNL), USA
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)
2010 Mar 3	Dr. Masayoshi Higuchi (MANA Independent Scientist) received the "Marubun Academy Award"
2010 Mar 3-5	The 3rd MANA International Symposium was held in Tsukuba
2010 Mar 5	2nd MANA Evaluation Committee Meeting
2010 Mar 21	Dr. Masanori Kohno (MANA Scientist) received the "Young Scientist Award" given by the Physical Society of Japan (PSJ)
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
2010 Mar 27	Dr. Kohei Uosaki (MANA PI) received the "Chemical Society of Japan Award"

Fiscal Year 2010

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 Apr 1	Dr. Yusuke Yamauchi (MANA Independent Scientist) received the "Ceramic Society of Japan Award"
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 May 20	MANA signed a Memorandum of Understanding (MOU) with University of Valenciennes, France
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 Jun 14-15	The joint IBM and NIMS/MANA symposium on "Characterization and manipulation at the atomic scale" was held in Tsukuba
2010 Jun 21	MANA signed a Memorandum of Understanding (MOU) with Friedrich-Alexander University Erlangen-Nürnberg, Germany
2010 Jul 14	3rd Follow-up Meeting by the WPI Follow-Up Committee
2010 Jul 23	MANA signed a Memorandum of Understanding (MOU) with Fudan University, China
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 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 Aug 27	MANA signed a Memorandum of Understanding (MOU) with EWHA Womans University Seoul, Korea
2010 Aug 27	The 1st NIMS-EWHA workshop on " Advanced Functional Materials" (NEWAM-10) was held in Tsukuba
2010 Sep 9	Dr. Kohei Uosaki (MANA PI) received the "Japanese Photochemistry Association Lectureship Award 2010"
2010 Sep 16	MANA signed a Memorandum of Understanding (MOU) with Karlsruhe Institute of Technology, Germany
2010 Sep 20	MANA signed a Memorandum of Understanding (MOU) with Université de la Méditerrannée, Marseille, France
2010 Oct 6	MANA signed a Memorandum of Understanding (MOU) with Anhui Key Laboratory of Nanomaterials and Nanostructures, China
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 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 Oct 26	MANA signed a Memorandum of Understanding (MOU) with Multidisciplinary Center for Development of Ceramic Materials, Brazil

Date	Event
2010 Oct 28	The 1st MANA Science Café "Melting Pot Club" on "What is nanotechnology?" was held at Frontier Hotel Okura, Tsukuba
2010 Nov 11	Outreach activities of MANA were featured in the NHK program "Ohayou Nippon (Good Morning Japan)
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 Nov 24-26	The 9th Japan-French International Workshop was held in Toulouse, France
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 Dec 15	Mr. Lim Chuan Poh, Chairman, Agency for Science, Technology and Research (A*STAR), Singapore, visited MANA
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
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 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 Jan 19	The satellite workshop "Dirac Electron Systems 2011" of the workshop "Graphene Workshop in Tsukuba 2011" was held at NIMS Namiki-site
2011 Jan 24	MANA signed a Memorandum of Understanding (MOU) with Vietnam National University Ho Chi Minh City, Vietnam
2011 Jan 25	MANA signed a Memorandum of Understanding (MOU) with King Saud University, Saudi Arabia
2011 Jan 27-28	The 1st MANA Grand Challenge Meeting was held in Miura Peninsula, Kanagawa prefecture
2011 Jan 29	Mr. Yoichiro Genba, Minister of State for Science and Technology Policy, visited MANA
2011 Feb 1	Launch of the new MANA Website in Japanese
2011 Feb 1	MANA signed a Memorandum of Understanding (MOU) with LMPG, Grenoble, Fance
2011 Feb 4	Research of Dr. Jinhua Ye (MANA PI) was introduced in the NHK Eco Channel
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 Feb 18	Dr. H.E. Virachai Virameteekul, Minister of Science and Technology, Thailand, visited MANA
2011 Feb 18	Dr. Masayoshi Higuchi (MANA Independent Scientist) received the "Gottfried Wagener Prize 2010" given by German Innovation Award
2011 Feb 28	The workshop on "Advanced Functional Nanomaterials" was held in Chennai, India
2011 Feb 28	Research of Dr. Tsuyoshi Hasegawa (MANA PI) was introduced in the NHK English radio program "Japan and World Update"
2011 Mar 2-4	The 4th MANA International Symposium was held in Tsukuba
2011 Mar 5	MANA hosted "Prof. Rohrer's Science Class" for junior high-school students
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
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 Jun 28-29	4th MANA Site Visit by the WPI Program Committee
2011 Jul 4	MANA signed a Memorandum of Understanding (MOU) with Université de Montréal (UdeM), Canada
2011 Jul 19	MANA signed a Memorandum of Understanding (MOU) with Flinders University, Australia
2011 Sep 5-8	The 7th Japan-UK-USA Nanotechnology Students' Summer School was held at the MANA Satellite at University of Cambridge, UK
2011 Sep 17	MANA hosted "Prof. Kroto's Science Class 2011" for preliminary school students and their parents
2011 Sep 21	MANA signed a Memorandum of Understanding (MOU) with University of Melbourne, Australia
2011 Oct 7	The Osaka University-MANA/NIMS Joint Symposium on "Advanced Structural and Functional Materials Design" was held at Osaka University
2011 Oct 19	4th Follow-up Meeting by the WPI Follow-Up Committee
2011 Oct 31	The NIMS/MANA-Flinders University Joint Symposium on "Nanoscience and Nanotechnology" was held at NIMS
2011 Nov 1	The 3rd Waseda University-MANA/NIMS Joint Symposium was held at Waseda University
2011 Nov 19	MANA Visit of Minister Masaharu Nakagwa (MEXT)
2011 Dec 1	MANA signed a Memorandum of Understanding (MOU) with Shanghai Institute of Ceramics, China

Date	Event	Date	Event
2011 Dec 14	MANA was given the grade "A" in the WPI Program Interim Evaluation	2012 Feb 8	Dr. Takayoshi Sasaki (MANA PI) received the "29th CSJ Academic Prize" given by the Chemical Society of Japan (CSJ)
2011 Dec 17-18	MANA exhibited a booth at "Science Festa in Kyoto 2011"	2012 Feb 14	Dr. Yoshio Bando (MANA Chief Operating Officer) and Dr. Dmitri Golberg (MANA PI) received the "3rd Thomson Reuters Research Front Award"
2012 Jan 10	MANA was featured in a special issue of the journal Advanced Materials (IF 10.88) published by John Wiley & Sons, Inc.	2012 Feb 16-20	MANA participated in the WPI Joint Exhibition at the 2012 AAAS Annual Meeting in Vancouver, Canada
2012 Jan 23	Prof. Françoise Winnik (MANA Satellite PI) won the 2012 Macromolecular Science and Engineering Award of the Chemical Institute of Canada (CIC)	2012 Feb 29 – Mar 2	The 5th MANA International Symposium was held in Tsukuba
2012 Jan 28	MANA signed a Memorandum of Understanding (MOU) with Tsinghua University, China	2012 Mar 2	3rd MANA Evaluation Committee Meeting
2012 Feb 7	MANA signed a Memorandum of Understanding (MOU) with Hanoi University of Science and Technology, Vietnam		

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 Jan 29-30	The 2nd Canada-Japan Nanotechnology Workshop was held at Tokyo Big Sight.
2012 Aug 21-22	5th MANA Site Visit by the WPI Program Committee	2013 Feb 14-18	MANA participated in the WPI Joint Exhibition at the 2013 AAAS Annual Meeting in Boston, USA
2012 Aug 27-31	The 8th MANA-Cambridge/UCL-UCLA Nanotechnology Summer School was held at MANA	2013 Feb 27 – Mar 1	The 6th MANA International Symposium was held in Tsukuba
2012 Sep 5	Prof. Chung-Yuan Mou, Deputy Minister of the National Science Council, Taiwan, visited MANA	2013 Mar 11	The 4th NIMS/MANA-Waseda International Symposium 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 18	The Osaka University-NIMS/MANA Joint Symposium on "Advanced Structural and Functional Materials Design" was held at MANA
2012 Oct 1	The PCCP-MANA Symposium on "Nanotechnology, Materials and Physical Chemistry" was held at NIMS	2013 Mar 19	The International Symposium MASA 2013 on "Material Architectonics for Sustainable Action" was held at MANA
2012 Oct 3	The MANA 5th Anniversary Memorial Symposium was held at NIMS		

Fiscal Year 2013

Date	Event
2013 Apr 2	MANA Independent Scientist Yusuke Yamauchi received the 7th PCCP Prize 2013.
2013 Apr 5	MANA PI Katsuhiko Ariga has been admitted as a Fellow of the Royal Society of Chemistry
2013 Apr 16	MEXT Commendations for Science and Technology for FY2013 have been awarded to 3 MANA researchers: Principal Investigator Takayoshi Sasaki (Science and Technology Prize for Research), Independent Scientist Alexei A. Belik (Young Scientist's Prize) and Independent Scientist Yusuke Yamauchi (Young Scientist's Prize)
2013 May 2	MANA signed a Memorandum of Understanding (MOU) with Centre Interdisciplinaire de Nanoscience de Marseille (CINaM-CNRS), France
2013 May 16	MANA Advisor Dr. Heinrich Rohrer (Nobel Laureate in Physics 1986) passed away
2013 May 29	MANA PI Francoise M. Winnik received the Society of Polymer Science Japan (SPSJ)'s International Award 2013
2013 Jun 24	MANA signed a Memorandum of Understanding (MOU) with National Center for Nanoscience and Technology (NCNST), Beijing, China
2013 Jun 28	Research of MANA Scientist Mitsuhiro Ebara has been featured in Japanese television (Yajiuma TV, TV Asahi)
2013 Jun 28-29	The International Workshop on "Thermoelectric Research & Thermal Management Technology" was held at MANA
2013 Jul 16	Research of MANA Scientist Mitsuhiro Ebara has been featured in the program "Ohayo-Nippon" of Japanese NHK General TV
2013 Jul 29	MANA signed a Memorandum of Understanding (MOU) with Huazhong University of Science and Technology (HUST), China
2013 Aug 6-8	MANA participated in the "Summer Science Camp" for high school students
2013 Aug 19-20	6th MANA Site Visit by the WPI Program Committee
2013 Sep 3	Independent Scientist Genki Yoshikawa from MANA received a Tsukuba Encouragement Prize 2013
2013 Oct 9-11	The Swiss-Japanese Nanoscience Workshop on "Materials Phenomena at Small Scale" was held at MANA
2013 Oct 29	6th Follow-up Meeting by the WPI Follow-Up Committee
2013 Nov 7	MANA Director-General Prof. Masakazu Aono wins the Nanoscience Prize 2013
2013 Nov 9-10	MANA represented by MANA's Smart Biomaterials Group participated in the event "Science Agora 2013" held at Odaiba, Tokyo
2013 Nov 25	MANA Principal Investigator Katsuhiko Ariga presented a lecture at Takezono Higashi Junior High School in Tsukuba within the "Science Q lectures" sponsored by the Tsukuba-Science City Network
2013 Dec 20	MANA Independent Scientist Yusuke Yamauchi receives a Chemical Society of Japan (CSJ) Award for Young Chemists FY2013
2014 Jan 29-31	The first edition of the TNT Japan (Trends in Nanotechnology) conference was held at Tokyo Big Site with a "MANA Day" on January 30
2014 Feb 28	MANA signed a Memorandum of Understanding (MOU) with St. Petersburg State Electrotechnical University (LETI), Russia
2014 Mar 3-4	The MANA/ICYS Reunion Workshop was held at MANA
2014 Mar 5-7	The 7th MANA International Symposium was held in Tsukuba
2014 Mar 7	MANA signed a Memorandum of Understanding (MOU) with University of Bristol, Bristol Centre for Nanoscience and Quantum Information (NSQI), UK
2014 Mar 11-12	The Japan-Taiwan Joint Workshop on "Nanospace Materials" was held at Fukuoka Institute of Technology
2014 Mar 24	The 5th NIMS/MANA-Waseda International Symposium was held at NIMS
2014 Mar 24-25	The International Symposium on Smart Biomaterials was held at MANA

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International Center for Materials Nanoarchitectonics (MANA)
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