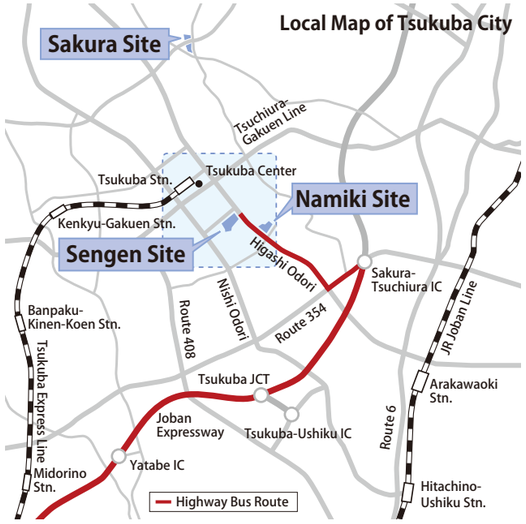
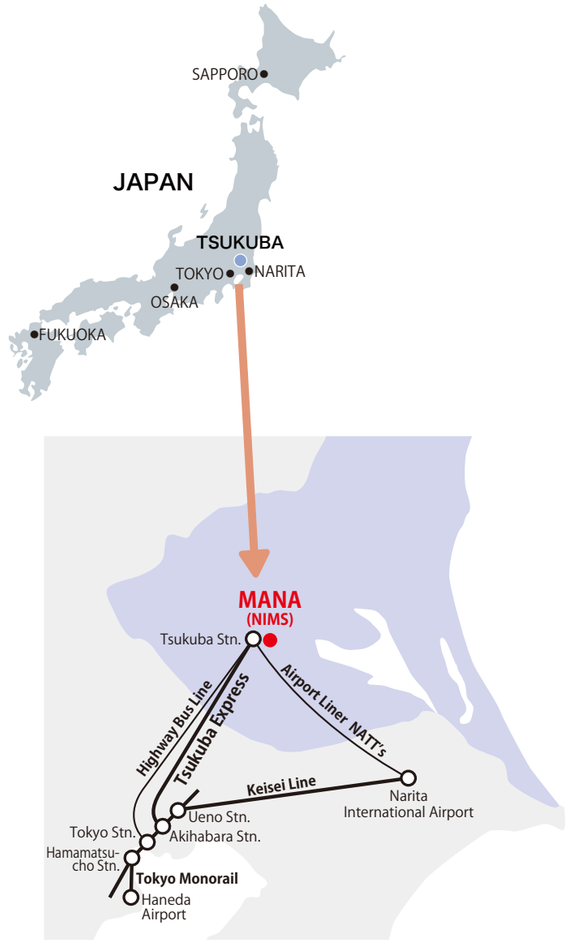
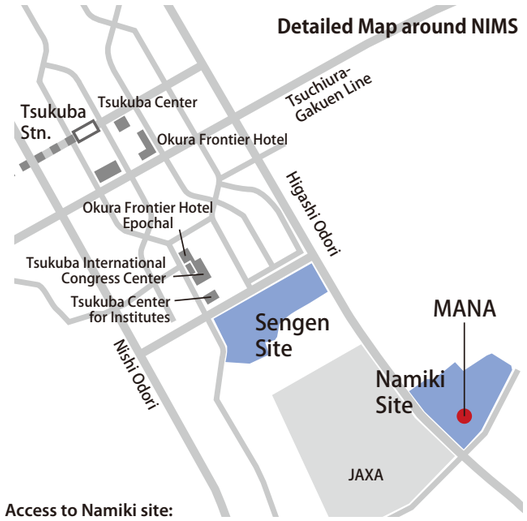
International Center for Materials Nanoarchitectonics

Access to MANA and Contact Information







Access to Namiki site:

- **By Tsukuba Express Line**
  Get off at Tsukuba Station. Take the bus for "Arakawaoki Station" and get off at "Busshitsu Kenkyujo mae". 1 minute walk.
- **By Highway Bus**
  Take the Highway bus from JR Tokyo Station for "Tsukuba Center" and get off at "Namiki 1-chome". 1 minute walk.
- **By Airport Liner NATT's**
  Take the Airport Liner NATT's from Narita Airport for "Tsuchiura Station" and get off at "Tsukuba Center". Take the bus for "Arakawaoki Station" and get off at "Busshitsu Kenkyujo mae". 1 minute walk.

WPI Research Center
International Center for Materials Nanoarchitectonics (MANA)

National Institute for Materials Science

International Center for Materials Nanoarchitectonics
1-1 Namiki, Tsukuba, Ibaraki, 305-0044
TEL : +81-(0)29-860-4709 FAX : +81-(0)29-860-4706
E-mail : mana@nims.go.jp

http://www.nims.go.jp/mana/

MANA Building

2010-04

International Center for Materials Nanoarchitectonics

WPI Research Center

MANA

International Center for Materials Nanoarchitectonics

National Institute for Materials Science

“Towards a World-Top Level Fundamental Research Institute in Nanotechnology and Materials Science”

Prof. **Sukekatsu Ushioda**
NIMS President

Reaching the World's Highest Summit with MANA

After being nominated in 2007 as the only independent administrative institution to receive a grant from the World Premier International Research Center Initiative Program, the National Institute for Materials Science (NIMS) established the International Center for Materials Nanoarchitectonics (MANA) in October of the same year. MANA was created with the vision of being a recognized focal center that would attract the participation of various levels of researchers from across the globe––not only global leading and renowned scientists but also young researchers, postdoctoral fellows, and both graduate and undergraduate students.

NIMS being equipped with cutting-edge research facilities and instrumentation enjoys a front-line research environment that very few other Japanese research institutes can match. MANA uses the slogan 'CONVERGENCE,' thus pointing the way toward the integration and rearrangement of differing research fields. And by continuing to serve as an internationally diverse academic 'melting pot' for researchers, MANA also aspires to be a front-runner in the fields of nanotechnology and materials.

The host institution NIMS offers every possible support for MANA's programs and activities. The NIMS headquarter proactively supports the MANA management by providing human, financial, technological and infrastructural resources. I am determined to make my best effort in leading NIMS to reach with the MANA project the world's highest summit, which we envision as being one of the world's leading state-of-the-art research center.

Prof. **Masakazu Aono**
MANA Director-General

Pioneering a New Paradigm

It is now indispensable for us humans living in the 21st century to develop groundbreaking technologies that will enable sustainable development to take place across a wide range of areas encompassing environmental protection, a supply of energy, information and telecommunications, and medicine and biotechnology. Advances being made in nanotechnology are envisaged to possibly greatly contribute to these fields. However, those types of demands will not be met if we remain stuck in the conventional paradigm of nanomaterials development and processes. The urgent requirement now is to pioneer a new paradigm of nanotechnology-based development of new materials across the conventional disciplinary framework of metallurgy, materials science, solid state physics, and so on, as well as with the division of inorganic, organic, and biological materials.

'Materials nanoarchitectonics' is a new research paradigm under the concept of which epitomizes nanotechnology-based creation of epoch-making materials and systems with novel functions that surpass ordinary imaginations and expectations, and which can only be achieved through complete control of the arrangement and interactions of nano-structures.

Researchers from different parts of the world have gathered at the International Center for Materials Nanoarchitectonics (MANA). And through encouraging their creativity and originality MANA is promoting challenging cuttiing-edge research projects that integrate and make full use of the five key technologies bolstering the conceptual framework. MANA intends to make positive contributions to sustainable human development through achieving scientific and technological innovations with the creation of new materials, new devices, and new systems. I would also like to take the chance to cordially request your continued support.

What is WPI Program?

The WPI Program (World Premier International Research Center Initiative Program) by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) provides concentrated support for projects to establish and operate research centers that have at their core a group of very high-level investigators. These centers are to create a research environment of a sufficiently high standard to give them a highly visible presence within the global scientific community — that is, to create a vibrant environment that will be of strong incentive to frontline researchers around the world to want to come and work at these centers.

In 2007 NIMS and four national universities were selected for grants, and the International Center for Material Nanoarchitectonics (MANA) was launched on October 1st of the same year.

Host institution	WPI research center	Research fields
Tohoku University	Advanced Institute for Materials Research (AIMR)	Materials Science
University of Tokyo	Institute for the Physics and Mathematics of the Universe (IPMU)	Astrophysics
Kyoto University	Institute for Integrated Cell-Material Sciences (iCeMS)	Meso-Control Stem Cells
Osaka University	Immunology Frontier Research Center (IFReC)	Immunology
National Institute for Materials Science	**International Center for Materials Nanoarchitectonics (MANA)**	**Nanotechnology & Materials Science**

Aiming to be highly visible research centers

The WPI Program has four basic objectives: advancing leading edge research, creating interdisciplinary domains, establishing international research environments and reforming research organizations. To achieve these objectives, WPI research centers are required to tackle the following challenges:

■ Critical mass of outstanding researchers

- Bringing together top-level researchers within a host research institution
- Inviting top-notch researchers from around the world

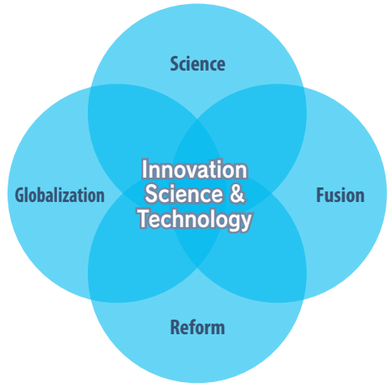
■ Attractive research and living environment of top international standard

- Strong leadership by center director
- English as the primary language
- Rigorous system for evaluating research and system of merit-based compensation
- Strong support function
- Facilities and equipment appropriate for a top world-level research center
- Housing and support for child education and daily living

To assist the WPI research centers in carrying out this mandate, the Japanese government provides them with long-term, large-scale financial support.

■ Long-run financial support from the government

- Annually average of 1.4 billion JPY per center
- 10 – 15 years of financial support



Science: leading-edge research
Globalization: international research environments
Reform: research organizations
Fusion: interdisciplinary domains

Mission and Research Target

What is MANA?

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

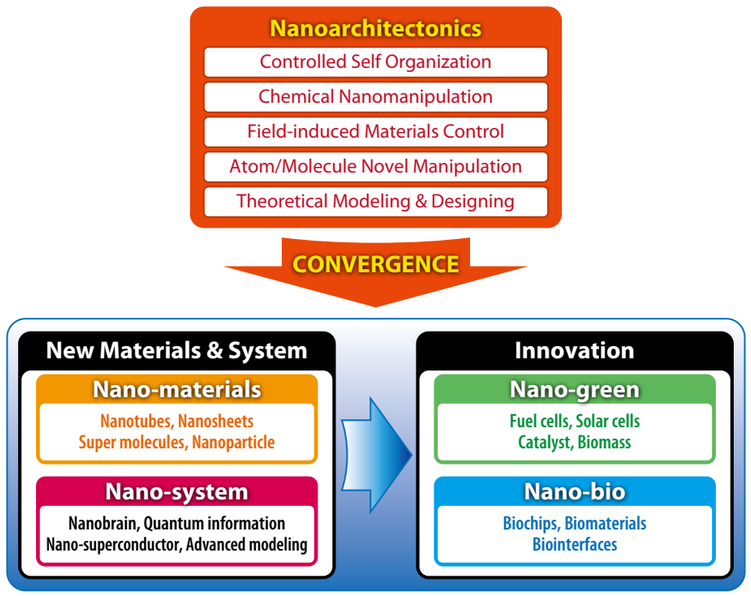
Mission of MANA

To achieve the goals of the WPI program, MANA aims to develop innovative materials by using nano-technology as a fundamental research center, especially for next-generation nano-science and technology.

- **To promote interdisciplinary research by materials nanoarchitectonics**
- **To serve as a "Melting Pot" where top-level researchers gather from around the world**
- **To secure and cultivate outstanding, innovative young scientists**
- **To construct a network of nanotechnology centers throughout the world**

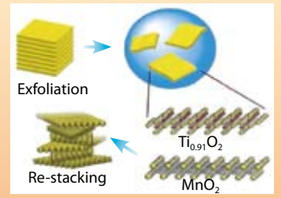
Research Target of MANA

By converging the five key technologies of Materials Nanoarchitectonics, the center focuses on the four researchfields, Nano-materials, Nano-system, Nano-green and Nano-bio, to develop novel materials and systems at the nanometer scale and create epoch-making innovations in materials science and technology and contributes to the development of various new technologies necessary for the realization of sustainable society.
The center aims to become a unique hub of materials nanoscience and nanotechnology.

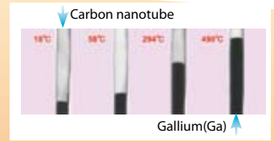


Nano-Materials

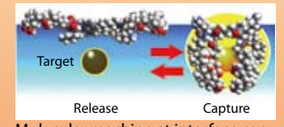
By utilizing various new synthetic methods, novel nanoscale materials such as nanotubes/nanowires (1D), nanosheets (2D), nanoparticles (0D) and supermolecules in inorganic/organic/metal systems will be explored and then artificially assembled to produce new innovative functions for energy and environmental applications.



Free layer-stacking nanosheets by chemical nanostructure manipulation.



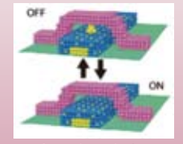
Nano-thermometer by injection of Ga atoms into carbon nanotubes.



Molecular machine at interface captures and release a target molecule.

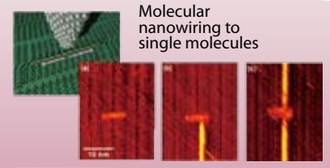
Nano-System

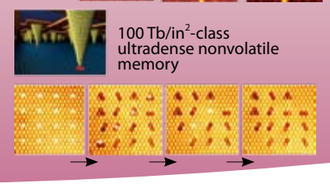
In order to create novel functionality as a system through systematic organization of nanostructures, various novel methods for fabrication/organization, property measurement, and theoretical modeling will be developed and utilized practically.



Atomic switch

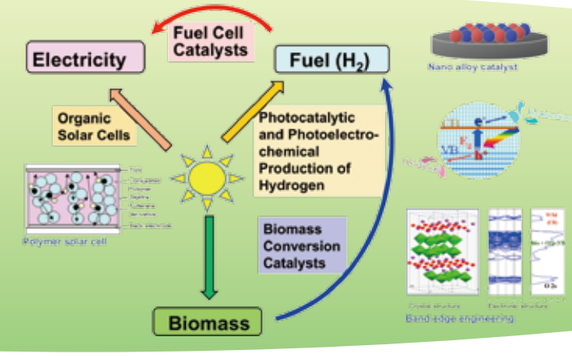
Atomic-switch-based brain-type circuit





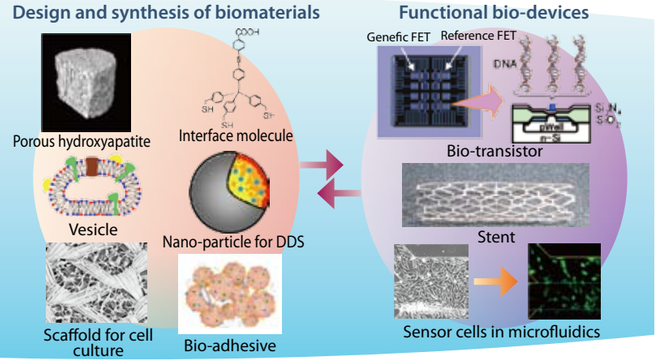
Nano-Green

Highly efficient energy conversion systems from solar energy to electricity and chemical fuel, i.e., hydrogen, from fuel to electricity, and from biomass to fuel, which are essential for sustainable society, will be developed by controlled arrangement of atom and molecules based on rational design, i.e., nanoarchitecture.



Nano-Bio

By integrating materials science and biological science, an interdisciplinary area is explored and developed. Novel biocompatible materials and functional bio-devices are developed for regenerative medicine, cell therapy, minimum-invasive surgery and clinical diagnostics.



Attractive Research Environment

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

Melting Pot

Multinational researchers from different fields and with different cultural backgrounds all gather at MANA to create a melting pot environment. Diverse research fields come together in the melting pot to breed new research seeds for innovation.

As of April 2010, 100 of MANA's 185 researchers, or 54%, are foreign nationals hailing from 16 different countries. MANA has already cleared the "30% foreign researcher threshold"—one of the conditions for WPI centers.

MANA Cafe : Venue for mutual communication and research integration

Environment in which Researchers can Focus on Research

MANA employs experienced staff who are fluent in English and has a wide variety of administrative support systems in place to ensure that researchers of all nationalities can focus on their research without difficulty.

The official language of MANA is English. Seminars and meetings are held in English, and all email communication, intranet content, research plans and administration documentation are in English, thus allowing all researchers—foreign nationals and Japanese alike—to devote themselves to their research.

Full support for researchers of all nationalities

New Research Building

The construction of a new MANA building will start in FY 2010. The building is designed so that scientists of different fields can gather together and interact freely with each other. The building is also designed to achieve the country's highest level of energy efficiency and environment-friendliness through the installation of solar panels on the roof and LED array lighting on the ceilings among other approaches.

Architectural illustration of the new building

Thorough Support for Foreign Researchers

MANA provides thorough assistance to foreign researchers for matters such as registration procedures, finding housing, and emergencies to get them established in Japan. MANA also offers regular Japanese culture and Japanese language classes for foreign researchers.

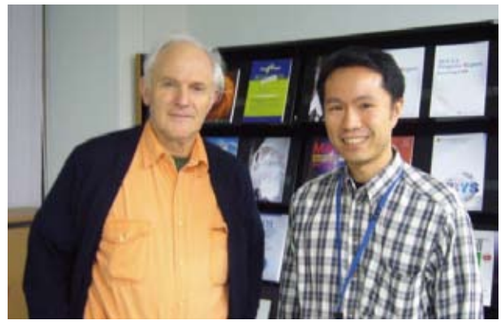
There are also public accommodation facilities nearby for foreign researchers who work at MANA, making for an ideal environment.

Yukata (Japanese summer kimono) class for foreign researchers

Fostering Young Researchers

Young researchers at MANA are encouraged to work under the tutelage of external non-NIMS mentors, some of whom are stationed overseas. Young researchers typically have 2 mentors (Double-mentor), are affiliated to 2 research institutions, (Double-affiliation) and research in 2 fields (Double-discipline). This is called the 3D, or Triple Doubles System.

Many young researchers spend some time of the year working with their overseas mentors. This encourages them to undertake discipline-integrated research and serves to cultivate a global perspective in them.



Professor Kroto, winner of the Nobel Prize in Chemistry, advises a young researcher

Cutting-Edge Research Facilities

MANA researchers have full access to the world's most advanced, high-performance research facilities at NIMS. MANA is home to the MANA Foundry, a collection of top-class equipment that provides the backup for nanoarchitectonics research ranging from nano-fabrication to nano-characterization.

In addition to the Foundry, MANA houses a large amount of shared equipment and employs experienced technicians to provide maintenance and support.

MANA Foundry
Both sides mask aligner (left), Spattering machine (right)

Tsukuba City

MANA's home base is the city of Tsukuba which boasts approximately 13,000 researchers working at the University of Tsukuba, a national university, and around 300 other government and private research institutions and companies. Tsukuba is Japan's largest international science city. The city is home to many foreign researchers and exchange students. 7,000 residents, or approximately 3% of the population of 210,000, are foreigners. According to the US consulting firm Mercer, Tsukuba ranked 4th behind Singapore, Munich and Copenhagen in its 2009 survey on city infrastructure. Tsukuba is located about 50km northeast of Tokyo and has a direct rail connection to Tokyo's Akihabara on the Tsukuba Express.

A view of Mt. Tsukuba from NIMS

Organization and Members

M. Aono
Director-General

Y. Bando
Chief Operating Officer

T. Fujita
Administrative Director

MANA Workforce

As of April 2010

Position	Number		Non-Japanese
Principal Investigator (NIMS)	20	28	4
Principal Investigator (Satellite)	8		5
MANA Scientist (NIMS)	44	157	8
MANA Independent Scientist (NIMS)	15		3
ICYS-MANA Researcher (Postdoc)	17		11
MANA Research Associate (Postdoc)	56		47
Graduate Student	25		22
Administrative Staff and Technical Staff	34	34	1
Total	**219**		**101**

Proportion of foreign researchers : 54% (100/185)

MANA Principal Investigators (PI)

Principal Investigators are internationally known world-top class scientists, who take the main role to achieve the MANA research targets and serve as mentors for younger researchers.
MANA has selected Principal Investigators from NIMS and other domestic and overseas institutes.

Nano-Materials Field

T. Sasaki* NIMS

K. Ariga NIMS

Y. Bando NIMS

D. Golberg NIMS

K. Hono NIMS

K. Kitamura NIMS

N. Ohashi NIMS

Y. Sakka NIMS

Z. L. Wang*** GIT

9PIs

Nano-System Field

M. Aono* NIMS

D. Fujita NIMS

J. Gimzewski** UCLA

T. Hasegawa NIMS

X.Hu NIMS

C. Joachim*** CNRS

K. Kadowaki*** Univ. Tsukuba

T. Nakayama NIMS

H. Takayanagi*** Tokyo Univ. Sci.

K.Tsukagoshi NIMS

M. Welland** U. Cambridge

11PIs

Nano-Green Field

K. Uosaki* NIMS

L. Han NIMS

K. Takada NIMS

E.Traversa NIMS

O. Yaghi UCLA

J. Ye NIMS

6PIs

Nano-Bio Field

Y. Miyahara* NIMS

Y. Nagasaki*** Univ. Tsukuba

2PIs

* : Field Coordinator ** : Satellite Co-Director *** : Satellite PI

MANA Scientists

MANA Scientists are researchers from NIMS, who perform MANA research together with Principal Investigators.

H. Arakawa

G. Chen

Y. Ebina

E.Fabbri

J. Hill

S. Hiromoto

A. Islam

C. Kataoka

K. Kawakami

J. Kawakita

N. Kawamoto

N. Kawazoe

M. Kikuchi

M. Kohno

O. Kubo

R. Ma

N. Maruyama

T. Minari

M. Mitome

T. Mori

K. Nagaoka

H. Noguchi

T. Ohnishi

Y. Okawa

M. Osada

T. Ozawa

D.Pergolesi

M. Sakurai

N. Satoh

Y. Shingaya

R. Souda

Y. Suetsugu

T. Taguchi

C. Tang

A. Taniguchi

K. Tashiro

K. Terabe

S. Tominaka

T. Tsuruoka

T. Uchihashi

A. Yamamoto

T. Yamazaki

M. Yanagida

C. Zhi

MANA Independent Scientists

MANA Independent Scientists are younger researchers from NIMS, who work full-time at MANA and can perform their own research independently in the 3D system (page 6).

R. Arafune

A. Belik

N. Fukata

M. Higuchi

S. Moriyama

T. Nagao

J. Nakanishi

Y. Tateyama

S. Tsuda

L. Vayssieres

A. Vinu

K. Wakabayashi

E. Watanabe

Y. Yamauchi

C. Yoshikawa

ICYS-MANA Researchers (Postdocs)

ICYS-MANA Researchers are postdoctoral fellows selected from all over the world by open recruitment. ICYS-MANA researchers perform their own research independently by receiving advice from mentors and MANA Principal Investigators.

X. Fang

U. Gautum

F. Hajjaj

R. Hayakawa

M. Imura

M. Lee

C. Liu

S. Sanchez

T. Shibata

Y. Shirai

L. Shrestha

P. Srinivasu

Y. Tsujimoto

J. Wi

J. Williams

G. Yoshikawa

Y. Zhang

MANA Research Associates (Postdocs)

MANA Research Associates are post-doctoral fellows employed by Principal Investigators or MANA Independent Scientists.

Graduate Students

Graduate Students are doctor-course students, who are employed by MANA as part-time researchers.

Advisors:

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

Nobel Prize in Physics (1986)

Prof. Heinrich Rohrer

Nobel Prize in Chemistry (1996)

Prof. Sir. Harry Kroto
Florida State Unieversity

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

Prof. Galen D. Stucky
University of California Santa Barbara

Prof. Teruo Kishi
Former NIMS President

Evaluation Committee Members:

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

Chair

A. Cheetham
U. Cambridge

M. Ruehle
Max-Planck

L. Schlapbach
EMPA

H. Hahn
Karlsruhe

R. Ruoff
U. Texas

Y. Nishi
Stanford U.

M. Endo
Shinshu U.

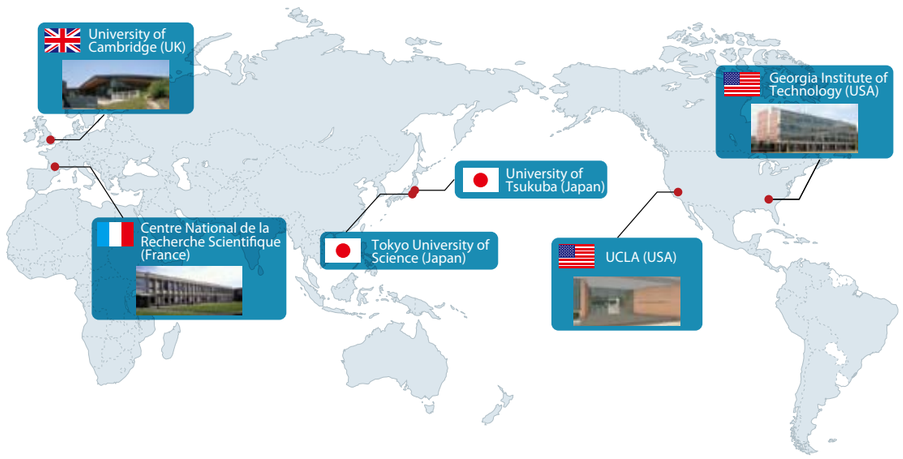
K. Tanaka
JST

K. Hashimoto
U. Tokyo

T. Aida
U. Tokyo

Satellites

The home research institutes of Principal Investigators who are invited to participate in MANA from institutions other than NIMS are called "satellites." MANA efficiently promotes research at the world's highest level through active collaboration with these satellites. At the same time, foreign satellite institutes also function as overseas bases for MANA.



Activities of MANA

MANA conducts a wide variety of activities with the two-fold aim of promoting integrated research and cultivating researchers.

International Symposium

Every year MANA hosts renowned researchers from around the globe for 3 days of presentations and discussions with MANA's own researchers.

MANA International Symposium 2010(March)

MANA Seminar

Weekly presentations and discussions on hot research topics are held every week. Participants include MANA researchers and invited guest researchers.

Workshop

MANA operates workshops with Satellites and other partner research organizations throughout Japan and across the globe. The aim of these workshops is to promote research exchange, make MANA known and develop networks.

Cambridge Workshop (July, 2009)

Summer School

MANA also co-hosts a rotating Summer School with the University of Cambridge and UCLA as part of an educational program for graduate students.

6th Summer School at UCLA (July, 2009)

NIMS

MANA's host institution, the National Institute for Materials Science (NIMS), conducts research and development on new materials under its slogan of "Nanotechnology Driven Materials Science for Sustainability". According to Thomson-Reuter's Essential Science Indicators, NIMS ranks 3rd in the world and 1st in Japan for the number of citations in the field of materials science for the most recent 5 years (as of March 2010).

As MANA's host, NIMS provides the maximum level of support to ensure that MANA becomes a world-class research center.