

Summary of Proposal

Host institution name	National Institute for Materials Science
Head of host institution	Teruo Kishi
Center director	Masakazu Aono
Administrative director	Takahiro Fujita
Title of center project	International Center for Materials Nanoarchitectonics Project
Center name	International Center for Materials Nanoarchitectonics (MANA)
Project Summary	<p>“Sustainable development” is the biggest issue for the 21st century of humanity. The most probable field of research that Japan can make significant contributions regarding this issue will be materials science. The center project is designed from the viewpoints of the essential importance of materials science and the necessity for an international cooperation in effectively promoting materials science. The purpose of the center is to develop innovative materials that contribute to sustainable development, based on a new technology system for materials development called “nanoarchitectonics”, and offer them to the world. For this purpose, a multinational and interdisciplinary group of researchers is organized to conduct cutting-edge research in a relaxed international environment, and making up of total workforce of about 200 staff.</p>
Research fields	<p>Main research field: Materials science Fused other research fields: Chemistry, Physics</p> <p>Material is a base that supports the foundation of all fields of science and technology and is the area where Japan can best show its abilities. It is self-evident that industries and society of Japan will depend on materials in the 21st century, and it is also obvious that “sustainable development” is not possible without an innovation in materials. Materials science is actually the lifeblood for human beings. For the development of new materials required in the 21st century, the center will work to realize a paradigm shift in materials development through a new technology system for materials development that we call “nanoarchitectonics”. Nanoarchitectonics is a technology system to arrange nanoscale functional structural units as a group of atoms or molecules in an intended configuration. The technology system is critical for practical applications of nanotechnology, beyond the stage of nanoscience. Nanoarchitectonics is also a typical interdisciplinary field that relates widely to such fields as materials science, physics, and chemistry.</p>
Research objectives	<p>The development of new materials required in the 21st century can not be realized without a paradigm shift in materials development. The center will realize the paradigm shift through “nanoarchitectonics”, which is a new technology system to arrange nanoscale functional structural units as a group of atoms or molecules in an intended configuration. The research objective to be achieved by materials development based on nanoarchitectonics is:</p> <p>“Development of innovative materials required for the realization of a sustainable society in the 21st century”.</p> <p>To be more specific, we set the following three objectives (issues to be studied intensively are shown as examples).</p> <p>1) Development of innovative materials related to environment, energy</p>

	<p>and resource</p> <ul style="list-style-type: none"> - Superconducting materials (superconducting diamond thin film, etc.) - Battery materials (materials for solid state rechargeable batteries, etc.) - Catalysts (visible light active photocatalyst, etc.) <p>2) Development of innovative materials for nanoelectronics that lead to innovations in information and communication technology</p> <ul style="list-style-type: none"> - Quantum information device materials (novel quantum-bit materials, etc.) - Atomic electronics materials (materials for novel atomic switches, etc.) - Photonic device materials (quasi phase matching element material, etc.) <p>3) Development of innovative materials that enable the development of new technologies for diagnosis, treatment and renaturation.</p> <ul style="list-style-type: none"> - NT chip materials (nanopiller array, etc.) - Biomaterials (regenerative materials, etc.)
Outline of management	<p>The center, as a basic principle, intends to establish the decision-making system that can support strong leadership of the center director, and therefore, it will give him the substantial authority of the center's operation in general. On the other hand, it is an important characteristic concerning managerial operation in the center that the center succeeds and develops the concepts through the International Center for Young Scientists (ICYS) program, which is now on operated by NIMS. Utilizing the experience gained from ICYS, the center will establish a research environment which is likened to a "melting pot", gathering excellent young researchers from various countries. The center aims to stimulate research and bring an innovation to the fundamental and basic field of materials science, respecting as much as possible the free thinking of young researchers, generated by the stimulation in the melting pot environment. The center also utilizes this melting pot environment to foster young researchers, positioning the center as a place to foster young researchers with tenure who will create the future for NIMS.</p>
Researchers and other center staffs	<p>Principal Investigators 27 (foreigners 10) ; Total Researchers 167 (foreigners 84) Total Staff at Core-Center 209 (foreigners 90) All achieved by 2011</p> <p>Satellite Univ. Tsukuba, Tokyo Univ. of Science, Cambridge Univ., CNRS, Univ. California (UCLA), Georgia Inst. Tech.</p> <p>Collaboration Inst. Physics CAS (China), KAIST (Korea), Max Planck Inst., Charles Univ. (Czech), Univ. California (UCSB) etc.</p>
Outline of research environment	<p>We will take the following measures to arrange a research environment in the center: (1) establish an environment where researchers can devote themselves to research, enriching assistance related to various clerical procedures and assistance in experiments. Particularly at the center where half of the researchers come from abroad, we will develop a perfect system to manage the use of English as the official language so that foreign researchers can devote themselves to research without having to deal with a language barrier; (2) provide start-up research funds to researchers invited from external organizations so that they can launch their own laboratories immediately; (3) secure capable young researchers from all over the world by utilizing ICYS' accumulated recruiting know-how. We also secure researchers including graduate students through relationships with the University of Tsukuba, International Joint Graduate Schools and other institutions as well as enrich the content of research education; (5) develop a flexible salary system different from that of NIMS's main body, and establish a flexible compensation package to provide appropriate treatment for excellent researchers; (6) provide total space of approximately 10,000m² for the research activities at the center; (7) hold an international research conference once a year, to show that the center is one of the world's top-level centers in the material science field.</p>
Outline of indicators for evaluating a center's global standing	<p>We can cite such indicators as research outputs (number of papers accepted by renowned journals), ratio of researchers that are considered worthy of being named the world's top level researchers, the number of foreign researchers employed, the total amount of external funds obtained, the number of cooperative research projects with private sector corporations, the</p>

	<p>number of patents applied and granted, the conditions of patents exploited, the number of invited lectures, and conditions relating the number of academic society awards received. The ranking of the number of citations of papers in the field of materials science presented by ISI can be a strong indicator to evaluate research institutions, although it is not absolute.</p> <p>NIMS, of the host institution, now ranks 12th in the world for the number of citations of papers over the past 10 years in the materials science field; however, if taken statistics for the past 5 years, we rank 6th in the world, which obviously shows that the research activities in NIMS became remarkably active after it changed its organizational system to that of an independent administrative institution. We set the final goal to be the top-three of the world ranking (No. 1 in Japan) at the time of the ex-post evaluation, to get higher than the current rank, by leading the main body of NIMS, carrying out these objectives at the center in a radically accelerated manner. The rank order can be deemed sufficient to position NIMS as the world's top material research institute.</p>
<p>Securing research funding</p>	<p>It would be of particular note that we have acquired an average of one billion yen every year for the past 3 years as the total amount of external funds that were obtained for research by those researchers who are the principal investigators of the center. It is also worth of mentioning that we have allocated a total average of approximately 800 million yen to those researchers from operational subsidies. Both of these facts verify that we have reasonable direct costs to conduct world's top-level research. In 2007, we also succeeded in obtaining external funds from other MEXT projects, and therefore we believe we can keep the current level of average funds obtained, or it may exceed the current level.</p>
<p>Summary of host institution's commitment</p>	<p>The center in this concept has two aspects: (1) an advanced research implementation agency to conduct fundamental and basic research for materials, fusing fields with chemistry and physics, (2) an institution to foster researchers who create the future for material research, in an international and interdisciplinary atmosphere. Looking from the viewpoint of NIMS's main body, the center is expected to play two roles: to strongly lead NIMS in research and to provide NIMS with young researchers. Therefore, the center is definitely incorporated into the long-term strategies of NIMS's main body, and the activities are extremely effective for stimulating the whole of NIMS. For these reasons, we are willing to make efforts for the center's smooth operation to the fullest, including, for example, offering of human resources, allocation of research funds, supply of research space and transfer of administration authority to the center director.</p>