from Tsukuba, Japan to the world

NIMS NOW International

National Institute for Materials Science

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Special Features
- Introduction of 20 New Projects and Recent Achievements - Nano Ceramics Center -

Toward the Creation of Innovative Ceramics

Yoshio Sakka
Managing Director
Nano Ceramics Center

The Nano Ceramics Center was launched as a research center belonging to the Nanoscale Materials Field at NIMS. In recent years, the development of novel devices and equipments that support advanced industries such as IT/semiconductors, the environment, nuclear power, aerospace, and others, and the achievement of higher efficiency, and reduction of environmental loads have been strongly demanded. We intend to fabricate innovative ceramics that show novel individual property and/or multi-functional properties among electric, dielectric, thermal, optical, chemical and mechanical properties through the development of nanoparticle processing. The Center consists of the following six groups.

- Fine Particle Processing Group
- Non-Oxide Ceramics Group
- Nitride Particle Group
- Fine-Grained Refractory Materials Group
- Plasma Processing Group
- Functional Glass Group

In the 2nd Mid-Term Program target period (FY2006-2010), the Nano Ceramics Center is responsible for the project "Fabrication of innovative ceramics through advanced nanoparticle processings." Here, our aims are to develop several types of nanoparticle processings originally developed in NIMS and to develop the techniques of evaluation and design in the grain-boundary nanostructure. Furthermore, by the organic collaborative work among each sub-project, we intend to create the innovative ceramics. The fundamental technologies which are key to this are (1) synthesis of nanoparticles with uniform composition and controlled crystallite size, (2) arrangement/assembly and dispersion control of nanoparticle with controlled particle size, (3) precise structural control at all levels from the micrometer to the nanometer order, and (4) nano structural design based on theoretical/experimental studies of the correlation between the local structure and functions of interest. The relationships among these elements are shown in the **figure**. In particular, it is now understood that application of external stimulations, such as magnetic energy, electric energy and/or stress to a reaction field is effective in realizing advanced nanoparticle processing.

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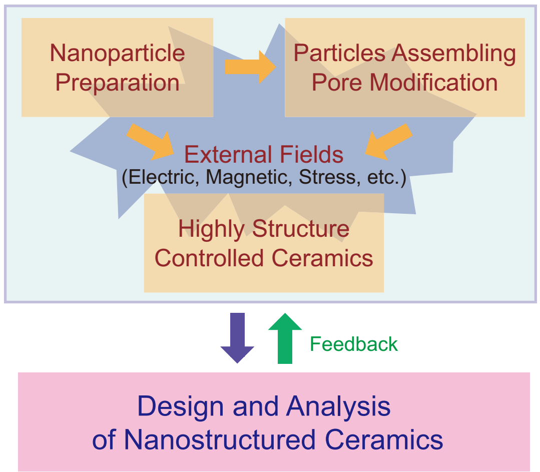

Fig. Relationships among research elements.

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Fabrication of Highly Structure Controlled Ceramics through Nanoparticle Processing in Liquid Phase

Yoshio Sakka, Tetsuo Uchikoshi
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Naoto Shirahata, Noriyuki Hirota
Seiichi Furumi
Fine Particle Processing Group
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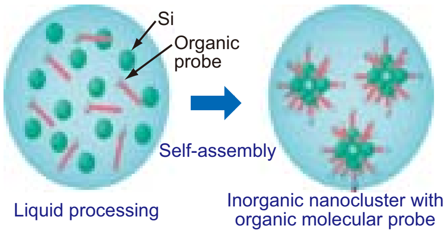

Fig. 1 Schematic illustration for surface functionalization of a nanocluster through a liquid processing.

In the Fine Particles Processing Group, our objectives are to establish the basic technologies for fabricating controlled structures from the nano to the micrometer order by bottom-up methods using nanoparticles in solution and nanospace, and to fabricate precisely-controlled structures with outstanding properties at various levels from the 0-dimensional to the 3-dimensional. To achieve these objectives, we are conducting research including (1) fabrication and assembly of nanoparticles, (2) microspace control and creation of laser oscillation devices using nanoparticles and organic/macromolecules, (3) arrangement, assembly, and pseudo-single crystal techniques for feeble magnetic ceramics by advanced use of strong magnetic fields, (4) fabrication of highly controlled structures by external field-controlled colloidal processes and sintering process, and others. Some recent results are introduced in the following.

We construct a system which enables synthesis, manipulation, and assembly of nanoparticles in a liquid phase in order to assemble nanoparticles and create novel fusion interfaces with heterogeneous functions. As shown in **Fig. 1**, a nanocluster with an organic probe is synthesized in the first stage. Such organic probe enables the nanocluster to be manipulated based on its specific molecular recognition event.

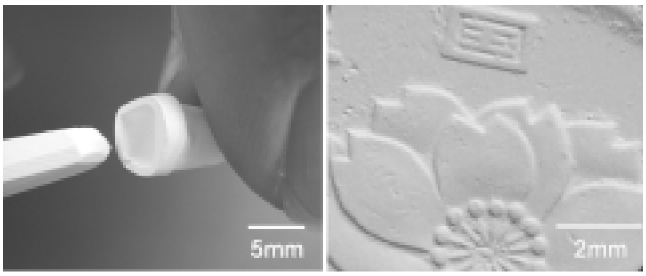

Fig. 2 An alumina cap in which the outer shape of substrate is transcribed and a free-standing film on which a surface pattern of coin was transcribed.

We fabricate the self-organized photonic crystal (PhC) structures to develop the laser devices by utilizing the photonic bandgap effect. Chiral liquid crystal molecules and monodispersed polymer microparticles form 1-dimensional and 3-dimensional PhC structures in a bottom-up manner, respectively. The current objective is devoted to the highly efficient generation of laser emission by combining the self-organized PhCs with light-emitting materials such as organic dyes or inorganic fine particles.

When an electrical field is applied to charged particles in a solvent, the particles migrate by electrophoresis to the electrode of the opposite polarity and then coagulate on the surface of the electrode. This is termed the electrophoretic deposition (EPD). By applying electrical conductivity by coating or patterning conductive polymer films on pre-shaped insulating ceramics, we succeeded in direct shaping of colloidal ceramic particles on the substrates by the EPD process. An example of fabricated ceramics is shown in **Fig. 2**.

We discovered that crystallographic orientation occurs even in feeble magnetic ceramics such as alumina when particles dispersed in a solvent are solidified/molded in a strong magnetic field, and applied this discovery to various materials. Electrophoretic deposition can be performed in a strong magnetic field. By changing the direction of the substrate relative to that of the magnetic field, we succeeded in fabricating oriented laminated ceramics, as shown in **Fig. 3**.

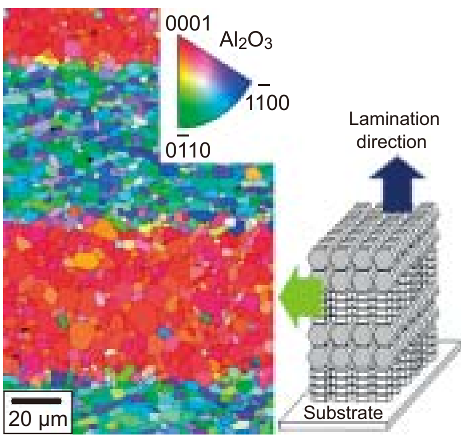

Fig. 3 EBSD (Electron Backscatter Diffraction) map and schematic diagram of an alumina oriented laminated ceramic prepared by changing the angle formed by the electrical field and magnetic field to 0° and 90° at set time intervals.

NIMS News

MOU with China's State Key Laboratory for Advanced Metals and Materials, University of Science and Technology Beijing

(February 2, NIMS) -- The NIMS Fuel Cell Materials Center (FCMC) signed a memorandum of understanding (MOU) on "Fundamental studies on the microstructures and mechanical properties of intermetallic compounds" with the State Key Laboratory for Advanced Metals and Materials, University of Science and Technology Beijing (SKLAMM-USTB). Both parties will plan to exchange researchers and students and host a workshop for promoting researches for the microstructure control and mechanical-property improvement of intermetallic foils/sheets. The collaboration has just started by inviting Mr. Wang, Ph. D. student of USTB, to NIMS as a one-year visiting researcher from January 23, 2007.

From the left, Dr. Hirano (Group Leader, FCMC), Dr. Demura (NIMS), Prof. Lin (Deputy Director, SKLAMM-USTB), Dr. Nishimura (Managing Director, FCMC-NIMS), Dr. Xu (NIMS), and Mr. Wang.

Development of Advanced Non-Oxide Ceramic Materials
- Powder/Sintering and Basic Theory of Advanced Ceramics -

Hidehiko Tanaka,
Toshiyuki Nishimura
Non-Oxide Ceramics Group
Nano Ceramics Center

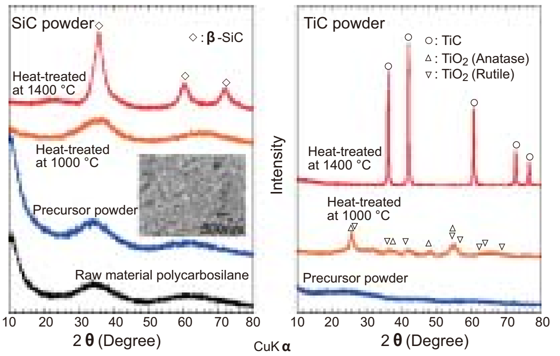

Fig. 1 Synthesis of non-oxide ceramics by the precursor method. In all cases, a crystalline ceramic material (orange → red) is obtained from an amorphous precursor (blue) as the heat-treating temperature increases. The precursor is a nanoparticle material (see photo in inset).

Novel applications as precision equipment and semiconductor production materials have been discovered for non-oxide ceramics such as silicon carbide (SiC) and silicon nitride (Si_3N_4), and active research is in progress. In such applications, high purity fine powders and a large-scale, complete densification sintering technique are required. The central theme of our work is advanced powder synthesis and sintering processes and fundamental research related to material synthesis.

In powder synthesis, we use organic liquid raw materials in place of the conventional mineral raw materials. We synthesized resin precursors by the sol-gel process and succeeded in converting these to SiC and other ceramic powders at high temperature. This process makes it possible to produce powders having extremely high purity which are sufficiently fine for sintering at low cost (**Fig. 1**).

We also discovered that an Al-B-C compound is effective as a sintering aid for SiC and succeeded in reducing the sintering temperature by using this additive. This made it possible to use the hot isostatic pressing (HIP) process at the industrial level, and we synthesized completely densified sintered compacts of SiC (**Fig. 2**). On the other hand, it is possible to obtain a powder with a particle size of several 10 nm by high-energy milling of commercial Si_3N_4 powder. A nanoceramic can be produced by rapid sintering of this powder, which enables the powder to be densified without grain growth.

Completely densified fine-grained ceramics have excellent corrosion resistance and precision machining properties. Because Japan possesses a high level of international competitiveness in the advanced industrial fields mentioned above, these research results will contribute to strengthening research and development in these areas.

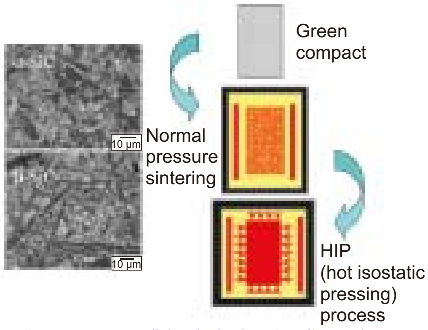

Fig. 2 Pores (black holes in figure) remain in an SiC sintered compact (left) with an added Al-B-C sintering additive when sintered at normal pressure (relative density: approx. 97 %), but complete densification is possible using HIP at a temperature of 1850 °C (density: 3.20 g/cm³; relative density: >99 %).

Materials development must be supported by fundamental theory. Because it is known experimentally that grain boundaries play an important role in the sintering of ceramics, the Non-Oxide Ceramics Group is constructing a new theory of sintering which uses the free energy possessed by powders as a driving force including grain boundary energy. This has the potential to revolutionize the conventional theory and open the way to a new paradigm (**Fig. 3**).

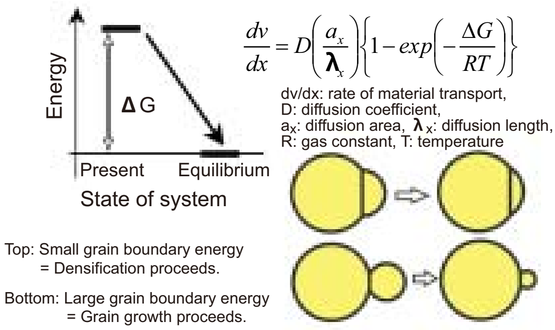

Fig. 3 New sintering theory in which system free energy ΔG is the driving force. As free energy, the theory considers surface energy and grain boundary energy. The simulations by use of this theory show that densification proceeds when grain boundary energy is small and, conversely, grain growth proceeds when grain boundary energy is large.

Special Features

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Toward the Creation of Innovative Ceramics

NIMS has a history of pioneering research and boasts high potential in the respective areas. Concrete element technologies include nanoparticle synthesis by thermal plasma, precursor preparation, functional non-oxide nanoparticle synthesis using gas phase reactions, advanced sintering techniques, nanostructure design by simulation, fabrication of nanoparticles and/or amorphous particles by high-energy ball milling, orientation of feeble magnetic ceramics under strong magnetic field, layer formation by electrophoretic deposition, nanoparticle assembling, nanopore arrays by anodic oxidation, and grain boundary evaluation techniques.

This Special Feature introduces the research activities and missions of each group.

For more details: http://www.nims.go.jp/ncc/

SiAlON Powder Phosphors for LEDs

Naoto Hirosaki, Rong-Jun Xie
Nitride Particle Group
Nano Ceramics Center

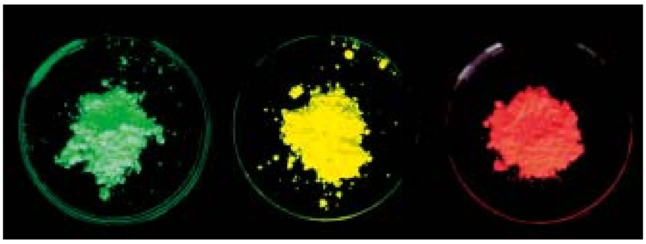

Fig. 1 SiAlON Phosphors.

The lighting and display methods which are indispensable to our daily life are changing significantly. Lighting is changing from fluorescent to LED lighting, while CRT displays are being replaced by flat-panel televisions. In these new methods, high performance phosphors with excellent durability are highly required. SiAlON phosphors are considered as next-generation phosphors which meet these requirements.

SiAlONs are solid solutions of silicon nitride which contains Si-Al-O-N, and have been studied as heat-resistant ceramics before. The Nitride Particle Group has proposed a new concept phosphor using SiAlONs as host crystals, and synthesized these phosphors with high emission efficiency and excellent stability. In comparison with conventional oxide phosphors, SiAlON phosphors have the following advantages.

(1) Excellent durability: As a host crystal of phosphor, a large number of substances in the SiAlON system have been developed as structural materials and heat resistant materials, and these have excellent chemical stability over the long term. In particular, these materials are suitable for application to LEDs, which are subject to long-term exposure to high energy excitation lights.

(2) Satisfactory thermal properties: One advantage of SiAlON is small temperature dependency of emission intensity (stable emission characteristics with respect to temperature change), which is due to strong chemical bonding. It is an important feature for use in LED lights if considering the temperature change when a light is on.

(3) Visible light excitation: The covalent bonding increases by the introduction of nitrogen, and as a result, the excitation and emission wavelengths of SiAlON phosphors are red-shifted in comparison with oxide phosphors. This means that we have obtained SiAlON phosphors which can be excited efficiently under 450 nm light emitted by blue LEDs, and emit colors suitable for LED applications.

(4) Large flexibility in material design: As a solid solution, SiAlON has a wide range of chemical compositions. It enables to tune excitation/emission properties by tailoring the chemical composition.

Using the developed phosphors (**Fig. 1**), the manufacture of white LEDs with various color temperatures has been attempted in cooperation with Fujikura Ltd., and natural white lights have been obtained which has excellent color reproducibility (average color rendering index) and superior color rendering index to that of existing white LEDs and fluorescent lights (**Fig. 2**). In the future, we are going to search for novel SiAlON-based phosphors, develop related processes, and elucidate the mechanism of luminescence, and finally to provide materials with high levels suitable for industrial applications.

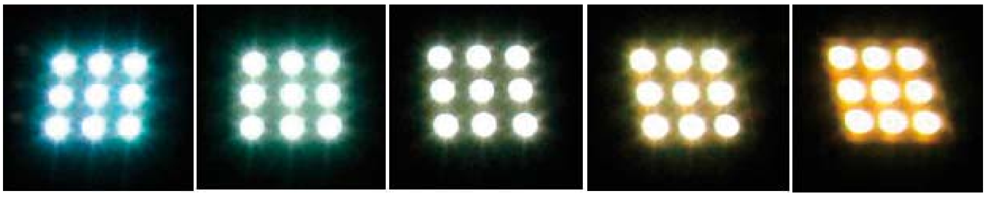

Fig. 2 White LEDs using developed red, green, and yellow phosphors.

NIMS News

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Research Cooperation Agreement in Biodevice and Semiconductor Material Fields with Belgium's IMEC

(January 25, NIMS) -- The NIMS Biomaterials Center and Advanced Electronic Materials Center signed a memorandum of understanding (MOU) with the Belgian organization IMEC (Interuniversity MicroEletronics Center).

IMEC, established in 1984, is a nonprofit research organization in the field of microelectronics with financial support from local governments, universities, and industry in the Flanders region of Belgium. It is engaged in research and development which anticipate industrial needs by 3 to 10 years and promotes the popularization of microelectronics and nanotechnology in society. It is also involved in the search for and cultivation of research "seeds" through joint research with research institutes in a number of countries. As part of these efforts, during a visit to NIMS, the Vice-President of IMEC, Dr. Deferm, and IMEC's representative in Japan, Dr. Ishitani, signed an MOU aiming at an ongoing exchange of views and technical exchanges.

In the future, the two Centers will jointly conduct development of biodevices that integrate semiconductor micro-fabrication technology and biotechnology and the material development demanded by next-generation integrated circuits, and will promote an interdisciplinary cooperative relationship taking advantage of the strengths of the two institutes, including training of human resources by mutual visits by researchers and other activities.

Front page photo (From the left): Dr. Chikyo (Managing Director, Advanced Electronic Materials Center), Dr. Kitagawa (Vice President, NIMS), Dr. Ishitani (IMEC), Dr. Tateishi (Managing Director, Biomaterials Center), Dr. Miyahara (Group Leader, Bioelectronics Group, Biomaterials Center), Dr. Kanda (General Manager, International Affairs Office), and Dr. Takemura (Assistant General Manager, International Affairs Office).

Creation of High-Function Bulk Materials by Nano Grain Boundary Design

Keijiro Hiraga, Byung-Nam Kim
Koji Morita, Hidehiro Yoshida
Fine-grained Refractory Materials Group
Nano Ceramics Center

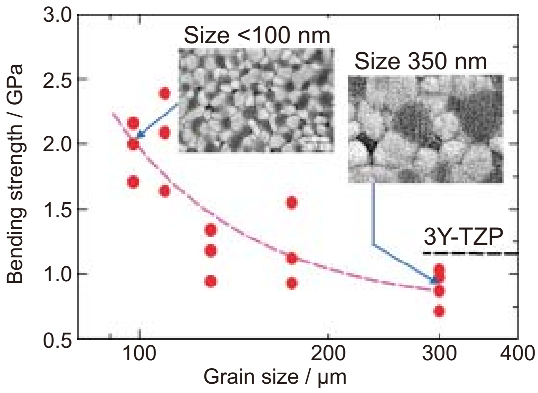


Fig. 1 Nano-ceramic material that satisfies both room temperature strengthening and superplasticity. When the grain size is refined from the normal 350 nm to 100 nm, bending strength increases greatly, from 1 GPa to 2 GPa.

Ceramics comprising Al_2O_3, ZrO_2, Y_2O_3, MgO, and other compositions are widely used as high hardness/high strength materials with high temperature/corrosion resistance in energy-related equipment, beginning with various mechanical industries, chemical plants, and engines. Nevertheless, the functional properties of these oxides have not reached a mature stage, and it is conceivable that they still conceal numerous potential functions which have yet to be explored.

The objective of this group is to discover these unexplored functions by controlling the local structure and composition at grain boundaries, the geometrical configuration and dimensional distribution of voids and crystal grains in the component phases, and other characteristics. In particular, our aim is to create materials in which optimized physical properties (electrical conductivity, optical properties, thermal properties), chemical properties (high temperature corrosion resistance), or mechanical properties (high temperature strength, superplasticity) are superposed on high strength as the basic property.

Fig. 1 is an example which aims at satisfying both superplasticity (property enabling plastic molding like that in metals at high temperature) and strength at room temperature to medium-to-high temperatures, at which the material will actually be used. Ultra-fine-grained densification with a grain size of <100 nm has been realized with tetragonal ZrO_2 (3Y-TZP) containing 3 mols of added Y_2O_3, in which $MgAl_2O_4$ is dispersed, through a crystallization/densification process involving high energy mixing of the raw material powders → formation of an amorphous substance → spark plasma sintering. In addition to the fact that the bending strength increases to approximately double that of 3Y-TZP, superplasticity can be obtained at a high strain rate of $10^{-2}s^{-1}$.

In order to create materials with such dramatically enhanced multifunctional properties, a design based on an elucidation of the local structure at grain boundaries and the state of existence of trace amounts of added cations is indispensable. For this, we are carrying out a combined study of grain boundaries with various species of added cations, which includes experimental analysis of high temperature deformation, ion conduction, and sintering, high resolution analysis of grain boundary structures, and a study of chemical bonding states using first-principles molecular orbit calculations (**Fig. 2**). By this, we hope to be able to elucidate the nanostructures at grain boundaries, the transport phenomena involved in both synthesis and properties, and the interrelationships of chemical bonding states, and to establish a foundation for materials design.

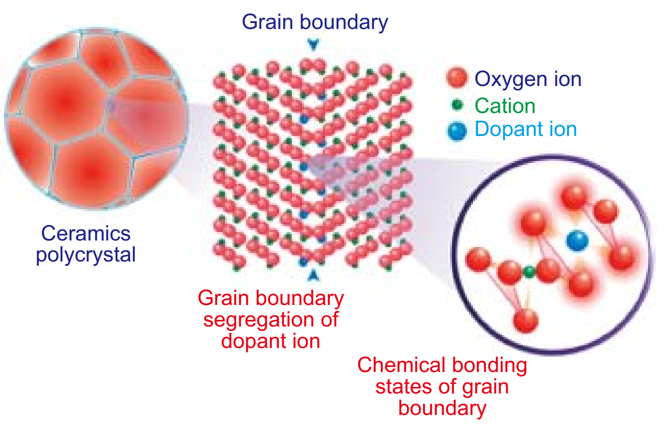
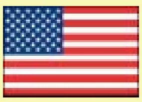


Fig. 2 Elucidation of the relationship between grain boundary bonding phenomena and transport phenomena.

NIMS News

Joint Workshop on Corrosion Science with University of Virginia, USA



Workshop participants.

(January 14-16, USA) -- The University of Virginia (UVa; Charlottesville, Virginia, USA) and NIMS held a UVa-NIMS Joint Workshop on Corrosion Science at UVa. This workshop was planned based on an MOU with UVa. From the NIMS side, a total of 8 researchers in corrosion science participated, including members of the Structural Metals Center, Material Reliability Center, Innovative Materials Engineering Laboratory, and the Corrosion Cluster in the Composites and Coatings Center. Participants from the UVa side included Prof. Gangloff, Prof. Scully, Prof. Kelly, Prof. Fuentes, Dr. Murayama, and others. The workshop featured mutual research presentations and discussions on atmospheric corrosion, hydrogen embrittlement, localized corrosion, and other subjects. Mutually-complementary research topics were presented in all fields, and the significance of strengthening collaboration was recognized.

This workshop was held in the Dean's Conference Room of UVa's new Wilsdorf Hall, which was completed at the end of last year, and was the first memorable workshop to be held in this room.

Synthesis of Functional Nanoparticles by Controlled Reactive Thermal Plasma Processing

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Katsuyuki Okada, Ji-Guang Li
Plasma Processing Group
Nano Ceramics Center

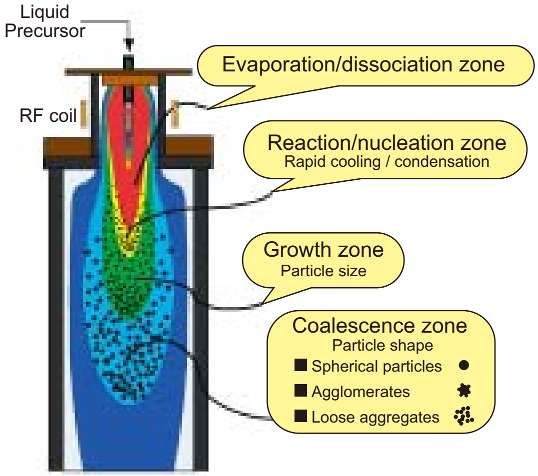


Fig. 1 Synthesis of nanoparticles by spray decomposition of liquid precursor mists.

The Plasma Processing Group is engaged in the development of unique plasma generating methods, plasma synthesis of nano-sized particles, and the development of techniques for assembling functional structures from nanoparticles.

In particular, because high expectations are placed on nanoparticles for creating practical materials, our aim is to synthesize ceramic nanoparticles which cannot be obtained with conventional methods in order to give concrete form to applications of nanoparticles. For this, we are synthesizing nanoparticles with high crystallinity by a one-step process using an advanced liquid precursor spray decomposition method in thermal plasma (**Fig. 1**). When a mist with a size on the order of 10 μm is fed into a plasma having a high temperature exceeding 10,000 °C, the mist vaporizes instantaneously, enabling mass production of nanoparticles. Oxides with the cation ratio of the adjusted liquid precursor itself can be synthesized by this technique, and it is also possible to control the chemical composition, which is linked to the appearance of functions. As a non-equilibrium composition and non-equilibrium structure formed as a result of rapid cooling at the plasma tail flame, phenomena which are extremely interesting from the scientific viewpoint were also observed. In the titanium oxide particle shown in **Fig. 2**, the Fe solubility approaches 20 mol%, which is more than 5 times that of nanoparticles obtained by ordinary solution synthesis. This example displays a unique crystal structure, which is due to oxygen vacancies concentrated in designated crystal planes of a rutile-type structure.

Plasma-synthesized nanoparticles are spherical and have a good dispersion property, showing little agglomeration (**Fig. 3**). Our objective is to fabricate micropatterns and structures using nanoparticles perfectly dispersed in liquids, aiming at applications, such as functional optical/magnetic devices, and molecular recognition sensors, which utilize the light-emitting, magnetic, and surface properties of the individual particles.

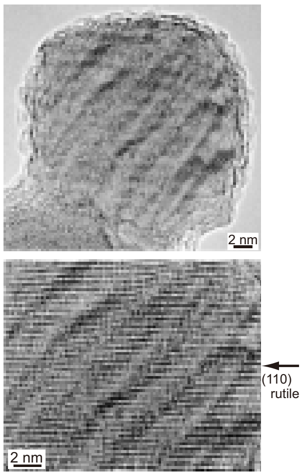


Fig. 2 Highly Fe-doped TiO_2 nanoparticle with a non-equilibrium structure containing ordered oxygen vacancies.

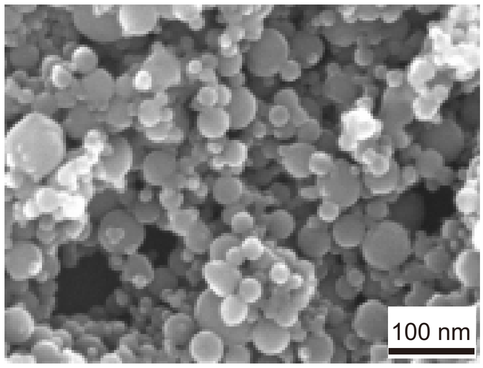


Fig. 3 Plasma-synthesized spherical TiO_2 nanoparticles with satisfactory dispersion property.

For more details:http://www.nims.go.jp/plasma/

NIMS News

Report on 2nd International Advanced Materials Forum (IAMF) and ICYS Workshop 2007

(February 19-21, NIMS) -- The NIMS International Center for Young Scientists (ICYS) held the 2nd International Advanced Materials Forum (IAMF) and ICYS Workshop simultaneously at the NIMS Sengen Site. A total of 21 young researchers recommended by 15 research institutes and others belonging to the World Materials Research Institute Forum (WMRIF), which is led by NIMS, and 42 young researchers from ICYS/NIMS attended and gave presentations on advanced research (26 oral presentations, 42 poster presentations). This event, which focused on training and exchanges of young scientists, was extremely productive in the creation of an international network of young researchers, for example in actual promotion of joint research plans with researchers from institutes in countries outside of Japan.

The scene at the poster session.

Number of participants: 108, invited from oversea institutes: 21 (USA: 9, Germany: 3, China: 2, Russia: 1, France: 1, India: 1, Switzerland: 1, Czech Republic: 1, Korea: 1, Spain: 1), NIMS/ICYS researchers: 42, participants on the day (NIMS researchers): 30, ICYS staff and NIMS officers: 15.

For more details:http://www.nims.go.jp/icys/

Aiming at the Development of Functional Materials Utilizing Micro Holes

- Research on Mass Production Nanostructure Manufacturing Methods and Applications -

Satoru Inoue
Functional Glass Group
Nano Ceramics Center

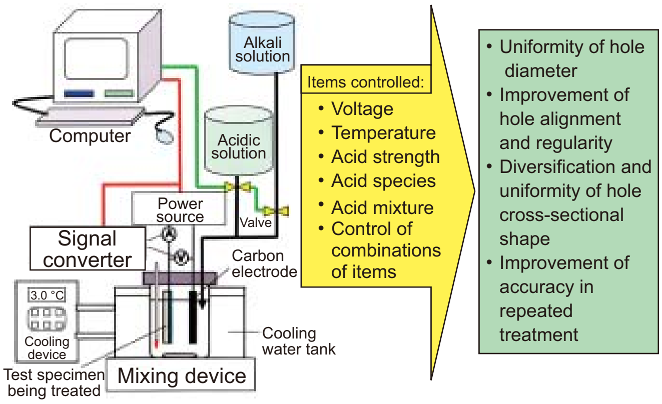


Fig. 1 Image of intelligent anodic oxidation technique.

The Functional Glass Group is researching various methods of imparting functions to glass materials. In the method introduced here, we use an anodic oxidation technique which changes a metallic foil film surface applied to a glass surface to a regularly-ordered structure of micro holes with sizes from several nanometers (nm) to several 100 nm by an electrochemical reaction, combined with a method of introduction of various chemical compounds into those holes.

Anodic oxidation is a technique which is used to apply color and improve the durability of aluminum products, and has long been referred to as the alumite technique. In the present project, our objective is to develop an "intelligent anodic oxidation technique" which expands the conventional alumite technique to nanotechnology.

The Functional Glass Group is leading the world in research on the intelligent anodic oxidation technique. An image of this technique is shown in **Fig. 1**. Hole size uniformity, hole cross-sectional shape, and improvement of reproduction accuracy in repeated treatment are achieved by computer control of the voltage, temperature, types of acids, blending ratios, and strengths of acids used in reactions, and multiple combinations of these items.

Two methods are mainly used to introduce chemical compounds into micro holes. In one method, which is used with comparatively large holes (>50 nm), solubility and surface tension are the important elements. This method is used to introduce substances in liquid form into holes. A high performance photocatalyst in which TiO_2 was introduced was prepared using this method. The second method is an electroplating technique. This is a method of collecting and building up an electrically-charged compound in the bottom of the holes by setting electrodes at the bottoms. Because this technique utilizes electrical force, compounds can be introduced into very small holes (several nm). We have produced ultra-compact magnetic assemblies by introducing magnetic metals. This technique is suitable for producing magnets with ultra-fine, comparatively long shapes (diameter: several nm, length: several μm). The ability to produce microscopic structures with this kind of large aspect ratio is a strong point of this technique. **Fig. 2** shows a photograph of TiO_2 nanotube and nanorod Ni assemblies prepared by this technique.

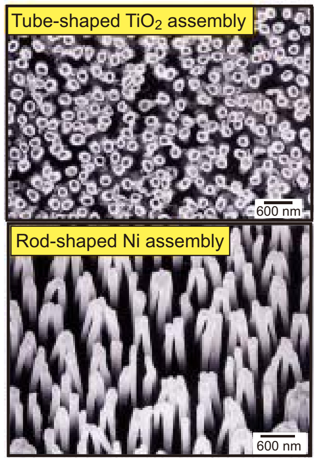


Fig. 2 Nanorod and nanotube prepared using an anodic oxidation film as a mold.

We also use a technique which creates a regular arrangement of micro holes. Considering applicability to industrial mass production, the method used is a technique which causes a reaction simply by applying a high voltage. One example is shown in **Fig. 3**. Holes approximately 50 nm in size are ordered regularly on an aluminum oxide material. We are conducting research with the aim of developing functional materials which will be useful in the environmental, energy, and telecommunications fields, including catalysts, electrical cells, and recording media, among others.

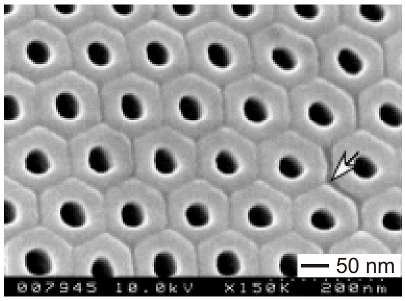
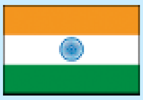


Fig. 3 Example of an ordered micro hole structure (arrow shows cell boundary).

For more details: http://www.nims.go.jp/glass-lab/index_e.html

NIMS News



MOU with India's National Institute of Technology, Trichy (NITT)

(Feb. 25, India) -- NIMS and the Departments of Chemistry and Physics, National Institute of Technology, Trichy (NITT), India, signed a memorandum of understanding (MOU) on collaboration for study of hybrid materials. Both institutions plan to exchange researchers, to promote research collaborations and to host seminars to propel the partnership between the institutions. The MOU signing was carried out at NITT and the news of the signing MOU was introduced by Indian newspapers.

Prof. Chidambaram, Director of NITT (right), and Dr. Kitagawa, Vice-President of NIMS.

Hello from NIMS

Hello from the Nano Quantum Electronics Group at NIMS. My name is Huabing Wang, and my specialty is superconducting electronics. I first heard about Tsukuba as the "City of Science" many years ago when I was a student in Nanjing University, China, and wished to be able to visit it someday. And now . . . I am honored to be here, to live and do research in Tsukuba! I will describe to you what is like to live and work here.

Tsukuba has all a research scientist needs - a great infrastructure, top of the line research facilities, and the possibility to exchange ideas. You can find everything in Tsukuba. As most researchers here are material-based, I have lots of interaction and collaborations, which are at the same time promising and very challenging. The intellectual interaction with other scientists, like those from the greater Tokyo area, is promoted by a newly-opened railway, the Tsukuba Express, and the proximity to Narita Airport makes traveling abroad and international collaborations so much more enjoyable.

Now a bit about my life. I often gaze upon Mount Fuji (150 km away) from the office window when the weather is clear. Cycling along the tree-lined roads in Tsukuba is like attending a symphony of colors and scents. To keep both the spirit and body in good shape, I often climb Mt. Tsukuba (850 m) on weekends. And let's not forget the good food you can find here, plenty of great Chinese, Korean, Italian, and French restaurants. Last but not least, my family brings me a lot of joy. Spending time with them in Tsukuba and its surroundings is wonderful.

Huabing Wang (China)
Senior Researcher (February 2004-Present)
Nano Quantum Electronics Group
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[A weekend excursion to Hakone: Travelers and research collaborators, with Mt. Fuji as a backdrop (From left; Yungyuan, Beiyi, Takeshi, Reinhold, and me)]

NIMS News

Recruitment

NIMS is always looking for innovative researchers in various fields!

Field	"Field 1": Specific fields a. Fuel cell materials; Hetero-interface, Electrode, Solid Electrolyte, Separator b. Functional materials and physics, Ferroic materials, Novel piezoelectric materials c. Molecular biology, Cell biology, Nanobiology d. Solid-state electrochemistry, Ionic conduction at hetero-junctions, Ion-conductive solids "Field 2": Any field of materials science We are seeking researchers in metals, ceramics, organics, biomaterials, semiconductors, compound materials, and so on.
Number of employment	"Field 1": One person in each field "Field 2": Several persons
Requirements	Applicants should have a PhD in a related field, and should be no older than 32 years old in principle.
Starting date of work	During September 1, 2007 to April 1, 2008 (negotiable)
Application deadline	"Field 1": June 29, 2007 "Field 2": No deadline (reviewing once in every two month)
Detailed info	Please visit our website at http://www.nims.go.jp/eng/employment/
Inquiries	Human Resources Development Office Email: nims-recruit@nims.go.jp

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