Akira Nakajima, Professor
Department of Metallurgy and Ceramic Science,

1. Research Activity of This Year

1) **Study of Fluid Control on Solid Surface**
Effects of surface composition and structure on the water sliding or freezing under various external conditions were investigated. Visualization of the internal fluidity in the droplet during moving under electric field on a superhydrophobic surface was succeeded. Moreover, it was revealed that sustainability of Cassie-mode in hydrophobicity under dew condensation depends on the chain length of silane coupling agent.

2) **High-performance Materials Development for Environmental Purification**
We prepared various heteropolyacids (PW_{12}, PMo_{12})-TiO_2 hybrid thin films by layer-by-layer method, and clarified their properties. Moreover, the respective influences of calcination, drying methods, and washing conditions on the morphologies, surface properties, and photocatalytic activities of TiO_2 powders prepared from acid treatments of $BaTiO_3$ were investigated. It was revealed that various TiO_2 with unique morphologies are obtainable by controlling processing conditions.

2. List of Papers

2-1. Original Papers

1) "Characteristics of Microbubbles Generated by Porous Mullite Ceramics Prepared by an Extrusion Method using Organic Fibers as the Pore Former"
K. Okada, M. Shimizu, T. Isobe, Y. Kameshima, M. Sakai, A. Nakajima, T. Kurata
J. Eur. Ceram. Soc., 30, 1245-1251 (2010).

2) "Water Droplets' Internal Fluidity during Horizontal Motion on a Superhydrophobic Surface with an External Electric Field"
M. Sakai, H. Kono, A. Nakajima, H. Sakai, M. Abe, A. Fujishima,
Langmuir, 26 [3], 1493-1495 (2010).

3) "Porous Properties of Mesoporous Silicas from Two Silica Sauces (Acid-leached Kaolinite and Si-Alkoxide)"
K. Okada, H. Yoshizaki, Y. Kameshima, A. Nakajima, K.J.D.Mackenzie
J. Porous Mater., 17, 19-25 (2010)

4) "Instrument for Ceramic Particle Dispersion"
T. Isobe, A. Ooyama, Y. Kameshima,. A. Nakajima, K. Okada
Powder Tech., 200 [1], 25-29 (2010).

5) "Various Factors Affecting Photodecomposition of Methylene Blue byIron-oxides in an Oxalate Solution"
F. Gulshan, S. Yanagida, Y. Kameshima, T. Isobe, A. Nakajima, K. Okada
Water Research, 44, 2876-2884 (2010).

6) "Nanoparticles of Nickel Oxide: Growth and Organization on Zinc Substituted Anionic Clay Matrix by One-pot Route at Room Temperature",
G. Carja, A. Nakajima, C. Dranca, K. Okada

J. Nanoparticle Res., DOI:10.1007/s11051-010-9899-0 (2010)

7) "Removing an Air Layer from a Superhydrophobic Surface in Flowing Water",
M. Sakai, A. Nakajima, A. Fujishima
Chem. Lett, 39[5], 482-484 (2010)

8) "Preparation and Photocatalytic Activity of TiO_2 Powders from Titanium Citrate Complex using Two-Step Hydrothermal Treatments",
K. Yasui, T. Isobe, A. Nakajima,
Mater. Lett., 64, 2036-2039 (2010).

9) "Effect of Dew Condensation on the Wettability of Rough Hydrophobic Surfaces Coated with Two Different Silanes",
T. Furuta, M. Sakai, T. Isobe, A. Nakajima,
Langmuir, 26[16], 13305-13309 (2010).

10) "Preparation and Photocatalytic Activity of $[PW_xMo_{12-x}O_{40}]^{3-}/TiO_2$ Hybrid Film Composites",
A. Nakajima, T. Koike, S. Yanagida, T. Isobe, Y. Kameshima, K. Okada,
Appl. Catal. A. Gen., 385[1-2], 130-135 (2010).

11) "Water Vapor Adsorption of $CaCl_2$ Impregnated Activated Carbon"
K. Okada, M. Nakanome, Y. Kameshima, T. Isobe, A. Nakajima,
Mater. Res Bull., 45[11], 1549-1553 (2010).

12) "TiO_2/ZnLDH as Self-Assembled Nanocomposite with Photoresponsive Properties"
G. Carja, A. Nakajima, S. Dranca, C. Dranca, K. Okada
J. Phys. Chem. C.,114[35], 14722-14728 (2010).

13) "Sliding Behavior of Water Droplets on Smooth Hydrophobic Fluoroalkylsilane Coatings with Different Surface Coverage Ratio"
S. Suzuki, M. Sakai, N. Yoshida, A. Hashimoto, Y. Kameshima, K, Okada, A. Nakajima
J. Jpn. Soc. Colour Mater.,83, 499-504 (2010).

14) "Freezing Behavior of a Water Droplet on a Rough Hydrophobic Surface Coated with a Short-chained Fluoroalkylsilane"
T. Furuta, M. Sakai, T. Isobe, A. Nakajima
Chem. Lett., 39, 1090-1092 (2010)

2-2. Reviews and Books

1) M. Sakai, A. Nakajima,
"Fluid bBehaviors on Superhydrophobic Surfaces: Sliding of a Water Droplet, Removing an Air layer in Flowing Water"
J. Jpn. Soc. Colour Mater., 83, 522-529 (2010) [in Japanese]

2) A. Nakajima, M. Nishimura, M. Sakai
"Decrease of Frictional Drag by Photoinduced Hydrophilicity of TiO_2 Surface"
HikariShokubai(Photocatalysts), 32, 20-23 (2010) [in Japanese]

3) A. Nakajima,
"Design of Hydrophobicity and Its Function"
Sangyo-gijyutsu sabisu senter, 81-89 (2010) [in Japanese]

3. List of Invited Presentations

3-1. International Conference or Workshop

1) A. Nakajima, "Improvement of Photocatalytic Activity by Designing Reaction Field of TiO_2 Coatings" Abstract of the Joint Conference of NIMS International Wprkshop on Photocatalysis and Environmental Remedation Materials 2010, & 3rd Japan-China Symposium on Advanced Photocatalytic Materials, 24Ab1, Feb 21-24 (2010) Tsukuba, Japan.

2) A. Nakajima, "Wettability and Evaporation of Nanoliter-Scale Droplets on Hydrophobic Silane Coatings" S11-026, 3rd International Congress on Ceramics, Nov. 15-18 (2010) Osaka, Japan.

3) A. Nakajima, M. Sakai, T. Furuta, T. Isobe, Y. Kameshima, K. Okada, “Direct Evaluation of the Sliding Motion of Water Droplets on Various Hydrophobic Coatings” PHYS1115, 2010 International Chemical Congress of Pacific Basin Society, Dec. 15-20 (2010) Honolulu, Hawaii

3-2. Domestic Conferences

1) A. Nakajima,
“Decrease of Frictional Drag in a Circular Pipe by Photoinduced Hydrophilicity of TiO_2 Surface”
The 10th Symposium of Photocatalyst Research, The University of Tokyo, July 14, (2009)

2) A. Nakajima,
“Design of Super-wettability”
Annual Meeting of the Machining Research Committee in the Japan Society for Precision Engineering, Chuo University, September 22, (2010)