

**Toshihiro Isobe, Assistant Professor,  
Department of Organic and Polymeic Materials**

## **1. Research Activity of This Year**

### **1-1. Direct measurement of the interaction between solid surfaces**

The interaction on solid surface in aqueous solvents was measured by atomic force microscopy (AFM). Force – distance curves shows the repulsive forces. It originates to the electrical double layer and steric repulsive of the ammonium polyacrylic acid (PAA) adsorbing on the solid surface. The ionic density in an aqueous solvent affects conformation of the polymer and electric double layer of the solid surfaces.

### **1-2. Preparation of Ceramic filters for green house gas separation**

The porous Al<sub>2</sub>O<sub>3</sub> filters for the carbon capture and storage (CCS) were prepared by slip casting method. The gas permeability and the gas separation ability of the obtained samples were estimated. The porosity and the pore size of the obtained filters were controlled by two sintering methods. Gas permeability was measured by differential-pressure method. As a result, it indicated that the CO<sub>2</sub> gas diffused as surface diffusion model in the filters. The gas selectivity and the theoretical gas separation ability were calculated from N<sub>2</sub> and CO<sub>2</sub> gas permeability. The theoretical gas separation ability was in fair good agreement with the gas separation ability estimated from gas filtration test. From these results, the design of filters having high separation ability was indicated.

## **2. List of Original Papers**

- (1) T. Isobe, A. Ooyama, Y. Kameshima, A. Nakajima, K. Okada, "Instrument for Ceramic Particle Dispersion", *Powder Technol.*, in press
- (2) T. Isobe, Y. Nakano, Y. Kameshima, A. Nakajima, K. Okada, "Measurement of Non-DLVO Force on a Silicon Substrate Coated with Ammonium Poly (Acrylic Acid) using Scanning Probe Microscopy", *Appl. Surf. Sci.*, **255**, 8710-8713 (2009)
- (3) T. Isobe, T. Umezome, Y. Kameshima, A. Nakajima, K. Okada, "Preparation and Properties of Negative Thermal Expansion Zr<sub>2</sub>WP<sub>2</sub>O<sub>12</sub> Ceramics", *Mater. Res. Bull.*, **44**, 2045-2049 (2009)
- (4) K. Okada, M. Shimizu, T. Isobe, Y. Kameshima, M. Sakai, A. Nakajima, T. Kurata, "Characteristics of Microbubbles Generated by Porous Mullite Ceramics Prepared by an Extrusion Method using Organic Fibers as the Pore Former", *J. Eur. Ceram. Soc.*, **30**, 1245-1251 (2010)
- (5) T. Furuta, M. Sakai, T. Isobe, A. Nakajima, "Negative Line Tension for an Ionic Liquid on a Hydrophobic Fluoroalkylsilane Coating", *Chem. Lett.*, **38**[11], 1092-1093 (2009)
- (6) Y. Kameshima, H. Sasaki, T. Isobe, A. Nakajima, K. Okada, "Synthesis of Composite of Sodium Oleate/Mg-Al-Ascorbic Acid-Layered Double Hydroxides for Drug Delivery Applications", *Int. J. Pharma.*, **381**, 34-39 (2009)
- (7) T. Furuta, M. Sakai, T. Isobe, A. Nakajima, "Evaporation Behavior of a Microliter and Sub-nanoliter Scale

- Water Droplets on Two Different Fluoroalkylsilane Coatings", *Langmuir*, **25**[20], 11998-12001 (2009)
- (9) Y. Kameshima, H. Sasaki, T. Isobe, A. Nakajima, K. Okada, "Intercalation Behavior of Various Fatty Acids into Mg-Al-Layered Double Hydroxide", *Clay Sci.*, **14**, 87-94 (2009)
- (10) S. Yanagida, A. Nakajima, T. Sasaki, T. Isobe, Y. Kameshima, K. Okada, "Preparation and Photocatalytic activity of Keggin-ion Tungstate and TiO<sub>2</sub> Hybrid Layer-by-Layer Film Composite", *Appl. Catal. A. General*, **366**, 148-153 (2009)
- (11) Y. Kameshima, T. Koike, T. Isobe, A. Nakajima, K. Okada, "Effect of the SiO<sub>2</sub>/TiO<sub>2</sub> ratio on the solid acidity of SiO<sub>2</sub>-TiO<sub>2</sub>/montmorillonite composites", *Mater. Res. Bull.*, **44**, 1906-1909 (2009)
- (12) A. Nakajima, K. Horie, M. Hara, M. Kitano, T. Isobe, Y. Kameshima, K. Okada, "Preparation of Solid Acid Carbon Coating on the Surface of TiO<sub>2</sub> by Photo-CVD of Gaseous Aromatic Hydrocarbons", *Catal. Commun.*, **10**, 1670-1673 (2009)
- (13) T. Furuta, A. Nakajima, M. Sakai, T. Isobe, Y. Kameshima, K. Okada, "Evaporation and Sliding of Water Droplets on Fluoroalkylsilane Coatings with Nanoscale Roughness", *Langmuir*, **25**[10], 5417-5420 (2009)
- (14) T. Furuta, A. Nakajima, M. Sakai, T. Isobe, Y. Kameshima, K. Okada, "Droplet Size Dependence of Line Tension for an Ionic Liquid on a Smooth Silane Coating", *Chem. Lett.*, **38**[6], 580-581 (2009)
- (15) K. Okada, S. Uchiyama, T. Isobe, Y. Kameshima, A. Nakajima, T. Kurata, "Capillary Rise Properties of Porous Mullite Ceramics Prepared by an Extrusion Method using Organic Fibers as the Pore Former", *J. Eur. Ceram. Soc.*, **21**, 2491-2497 (2009)
- (16) A. Nakajima, Y. Akiyama, S. Yanagida, T. Koike, T. Isobe, Y. Kameshima, K. Okada, "Preparation and Properties of Cu-grafted Transparent TiO<sub>2</sub>-nanosheet Thin Films", *Mater. Lett.*, **63**, 1699-1701 (2009)
- (17) K. Okada, A. Ooyama, T. Isobe, Y. Kameshima, A. Nakajima, K.J.D. MacKenzie, "Water Retention Properties of Porous Geopolymers for Use in Cooling Applications", *J. Eur. Ceram. Soc.*, **29**, 1917-1923 (2009)
- (18) K. Okada, F. Ikawa, T. Isobe, Y. Kameshima, A. Nakajima, "Low Temperature Preparation and Machinability of Porous Ceramics from Talc and Formed Glass Particles " *J. Eur. Ceram. Soc.*, **29**[6], 1047-1052 (2009)

### 3. List of Presentations

#### International Conference or Workshop (oral)

- (1) A. Ooyama, T. Isobe, Y. Kameshima, A. Nakajima, K. Okada "Preparation of Porous Ceramics for Greenhouse Gas Separation" Multidisciplinary International Student Workshop, Aug. 5 (2009) Tokyo, Japan
- (2) M. Shimizu, T. Isobe, Y. Kameshima, A. Nakajima, K. Okada "Improvement of Water Environment through Micro-bubbles Generated by Lotus Ceramics" Multidisciplinary International Student Workshop Aug. 5 (2009) Tokyo, Japan
- (3) Y. Kameshima, A. Nakada, T. Isobe, A. Nakajima, K. Okada, "The Effect of UV Radiation on Sodium Cinnamate / Layered Double Hydroxide (LDH) Composites", NM7.Sun.P15, XIV International Clay Conference, Jun 14-20 (2009) Castellana G. Chetani, Italy

- (4) A. Nakajima, N. Arimitsu, T. Isobe, Y. Kameshima, K. Okada, T. Watanabe, "Photoinduced Surface Friction Force Variation of Polycrystalline Anatase Thin Films under Different UV Intensity and Atmosphere", The 3rd International Conference on Science and Technology for Advanced Ceramics (STAC3), June16-18 (2009) Yokohama, Japan
- (5) A. Uematsu, A. Nakajima, T. Isobe, Y. Kameshima, K. Okada, T. Watanabe, Y. Hirose, T. Hasegawa, "Preparation and Properties of Nb-doped Transparent Conductive TiO<sub>2</sub> Thin Films from Metal Alkoxides", 2nd China-Japan Symposium on Advanced Photocatalytic Materials, Nanjing University, Mar. 5-7 (2009) Naging, China
- (6) S. Yanagida, A. Nakajima, T. Sasaki, T. Isobe, Y. Kameshima, K. Okada, "Photocatalytic Activities of Keggin-type Polyacid and Titania Hybrid Thin Film", 2nd China-Japan Symposium on Advanced Photocatalytic Materials, Nanjing University, Mar. 5-7 (2009) Naging, China
- (7) K. Horie, A. Nakajima, M. Hara, M. Kitano, T. Isobe, Y. Kameshima, K. Okada, "Preparation of Solid Acid Carbon Coating by Photo-polymerization of Gaseous Aromatic Hydrocarbon", 2nd China-Japan Symposium on Advanced Photocatalytic Materials, Nanjing University, Mar. 5-7 (2009) Naging, China

#### **International Conference or Workshop (poster)**

- (1) A. Ooyama, T. Isobe, Y. Kameshima, K. Okada, A. Nakajima, "Preparation and Property of CO<sub>2</sub> Gas Separation Filter" Asia-Oceania Top University League on Engineering Postgraduate Student Conference. Asia-Oceania Top University League on Engineering Postgraduate Student Conference. 86. 2009. Dec
- (2) M. Shimizu, T. Isobe, Y. Kameshima, M. Sakai, A. Nakajima, K. Okada "Generation of Micro-bubbles by Lotus Ceramics and Improvement of Water Environment. Generation of Micro-bubbles by Lotus Ceramics and Improvement of Water Environment" Asia-Oceania Top University League on Engineering Postgraduate Student Conference. Asia-Oceania Top University League on Engineering Postgraduate Student Conference. 86. 2009. Dec
- (3) M. Shimizu, T. Isobe, Y. Kameshima, M. Sakai, A. Nakajima, K. Okada, "Generation of Micro-Bubbles by Lotus Ceramics", The 3rd International Conference on Science and Technology for Advanced Ceramics (STAC3), June16 - June18 (2009) Yokohama, Japan
- (4) C. Popa, Y. Kameshima, T. Isobe, A. Nakajima, K. Okada, "Ni<sup>2+</sup> and H<sub>2</sub>PO<sub>4</sub><sup>-</sup> Uptake Properties of Various Compounds in the CaTiO<sub>3</sub>-CaFeO<sub>2.5</sub>", 17pP117, The 3rd International Conference on Science and Technology for Advanced Ceramics (STAC3), June16 - June18 (2009) Yokohama, Japan
- (5) K. Okudaira, Y. Kameshima, A. Nakajima, T. Isobe, K. Okada, "Preparation of Lactate/Layered Double Hydroxide (LDH) Composites by Reconstruction Method and Behavior of Delamination", The 3rd International Conference on Science and Technology for Advanced Ceramics (STAC3), June16 - June18 (2009) Yokohama, Japan