Structural and Morphological Control of Siloxane-Based Nanomaterials

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Siloxane-based materials, including both silica- and organosiloxane-based nanomateirals, have found potential applications in various fields. Alkoxysilanes have been used most widely as precursors for Si-based nanomaterials. Fine structural control of siloxane-based nanomaterials has been important for tuning their properties and for creating new functions. In this paper, the preparation of structurally and morphologically controlled siloxane-based nanomaterials will be presented. Several methods, including self-organization of siloxane based monomers and oligomers, novel use of alkoxysilyl groups for precise design, dimensional conversion of layered silicates, and controlled preparation of mesoporous silica nanoparticles.

References

1. Shigeru Sakamoto, Yasuhiro Tamura, Hideo Hata, Yasuhiro Sakamoto, Atsushi Shimojima and Kazuyuki Kuroda, "Molecularly Designed Nanoparticles by Dispersion of Self-Assembled Organosiloxane-Based Mesophases", *Angew. Chem. Int. Ed.*, 53, 9173-9177 (2014).

2. Yusuke Asakura, Yasuhiro Sakamoto, Kazuyuki Kuroda, "Silylation of Layered Silicate RUB-51 with SiCl4 and Conversion of the Silylated Derivative to a Crystalline Microporous Material", *Chem. Mater.*, **26**, 3796-3803 (2014).

3. Eisuke Yamamoto, Masaki Kitahara, Takuya Tsumura, Kazuyuki Kuroda, "Preparation of Size-Controlled Monodisperse Colloidal Mesoporous Silica Nanoparticles and Fabrication of Colloidal Crystals", *Chem. Mater.*, **26**, 2927-2933 (2014).

4. Yusuke Asakura, Shimon Osada, Nami Hosaka, Taichi Terasawa, Kazuyuki Kuroda, "Optimal topotactic conversion of layered octosilicate to RWR-type zeolite by separating the formation stages of interlayer condensation and elimination of organic guest molecules", *Dalton Trans.*, **43**, 10392-10395 (2014).

5. Hironori Yamada, Chihiro Urata, Sayuri Higashitamori, Yuko Aoyama, Yusuke Yamauchi and Kazuyuki Kuroda, "Critical Roles of Cationic Surfactants in the Preparation of Colloidal Mesostructured Silica Nanoparticles: Control of Mesostructure, Particle Size, and Dispersion", *ACS Appl. Mater. Interfaces,* **6**, 3491-3500 (2014).

Reviews

1. Kazuyuki Kuroda, Atsushi Shimojima, Kazufumi Kawahara, Ryutaro Wakabayashi, Yasuhiro Tamura, Yusuke Asakura and Masaki Kitahara, "Utilization of Alkoxysilyl Groups for the Creation of Structurally Controlled Siloxane-Based Nanomaterials", *Chem. Mater.*, **26**, 211-220 (2014).

2. Ryutaro Wakabayashi, Kazuyuki Kuroda, "Siloxane-Bond Formation Promoted by Lewis Acids: A Nonhydrolytic Sol-Gel Process and the Piers-Rubinsztajn Reaction", *ChemPlusChem*, **78**, 764-774 (2013).

3. Nobuyuki Takahashi, and Kazuyuki Kuroda, "Materials Design of Layered Silicates through Covalent Modification of Interlayer Surfaces", *J. Mater. Chem.*, **21**, 14336-14353 (2011).