

Several New Methods for Well-defined Silsesquioxane-Based Materials: Workshop on Silicon Chemistry

Masafumi Unno

Department of Chemistry and Chemical Biology, Faculty of Science and Technology, Gunma University, Kiryu, 376-8515, Japan
unno@gunma-u.ac.jp

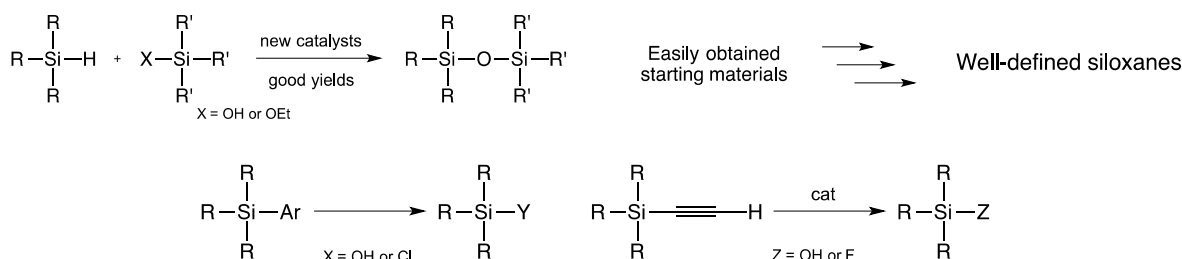
Recently, increasing demand for silicone materials has been observed because of downsizing of the electronic devices (thermal stability; low-*k*; high or low refractivity) as well as mandatory ecological and environmentally benign approach. In the last decade, we focused on the synthesis of well-defined silicone materials including laddersiloxanes,¹ cage silsesquioxanes,² and siloxanes with various structures.³

Most of our target compounds contain T-unit (each silicon atom connects three oxygen atoms), thus selective formation of Si–O bond must be necessary in order to construct well-defined structures. During our project, we recognized that discovery of new synthetic methods must be necessary to explore unknown structures, and investigated on cross-coupling reactions and substituents transfer reactions.

Among these new reactions, here I will describe these two methods:

- (1) Cross-coupling reactions of silanols or alkoxy silanes with hydrosilanes with a new catalyst
- (2) Facile substitution reaction from arylsilanes to chlorosilanes
- (3) Synthesis and applications of fluorosilanes
- (4) Facile synthetic methods for cyclic silanols
- (5) Using fluorosiloxanes as new synthetic starting materials⁴

By applying these methods, we could obtain many structures. Properties and structures of these compounds are also explained.



Keywords: Synthesis, Silicone Materials, Silsesquioxane, Silanol, High-functional Materials

References:

1. Unno, M.; Suto, A. Matsumoto, T. *Russ. Chem. Rev.* **2013**, *82*, 289–302; Unno, M., Suto, A. Matsumoto, H. *J. Am. Chem. Soc.* **2002**, *124*, 1574–1575.
2. Liu, H.; Kondo, S.; Takeda, N.; Unno, M. *J. Am. Chem. Soc.*, **2008**, *130*, 10074–10075.
3. Endo, H., Takeda, N., Unno, M. *Organometallics* **2014**, *33*, 4148–4151, and references cited therein.
4. Oguri, N.; Egawa, Y.; Takeda, N.; Unno, M. *Angew. Chem. Int. Ed.* **2016**, *55*, 9336–9339.



Masafumi Unno (Professor of Chemistry and Chemical Biology)
Molecular Science Division, Faculty of Science and Technology, Gunma University, Japan
b. 1961 in Nishinomiya, Japan
The University of Tokyo, Japan, Organic Chemistry, B.S. 1983
The University of Tokyo, Japan, Organic Chemistry, D.S. 1988
Research field: Organoelement Chemistry, Organosilicon, Silicone Materials, Silanol

Masafumi Unno



Department of Chemistry and Chemical Biology,
and International Education and Research Center for Silicon Science,
Faculty of Science and Technology, Gunma University
Tenjin-cho 1-5-1, Kiryu 376-8515, JAPAN
TEL: +81-277-30-1230
FAX: +81-277-30-1233
E-mail: unno@gunma-u.ac.jp
Date of Birth: March 19, 1961

Education:

1979–1983 B.S. The University of Tokyo
1983–1985 M.S. The University of Tokyo
1985–1988 D.S. The University of Tokyo (Profs. Inamoto and Okazaki)
Thesis Title: Synthesis and Applications of New Steric Protecting Groups

Professional Career:

1988.10–1990.10 Postdoctoral Fellow, University of Nevada-Reno (Prof. L. T. Scott)
1990.10–1992.4 Postdoctoral Fellow, California Institute of Technology (Prof. B. Imperiali)
1992.5–1993.1 Frontier Researcher, PDC, RIKEN (Prof. M. Kira)
1993.1–2002.3 Assistant Professor, Gunma University
2002.4–2005.3 Associate Professor, Gunma University
2005.4–present Professor, Gunma University
2009.8–present Director of Silicon Center, Gunma University

Scientific Activities:

2004– Dean: The Society of Silicon Chemistry, Japan
2009– Director of the International Education and Research Center for Silicon Science (Silicon Center), Gunma University

Research Interests

- 1) Synthesis and Application of Silanols
- 2) Dye-sensitized Solar Cell
- 3) Host-Guest Chemistry of Silanols
- 4) Laddersiloxanes

Honors:

1999.11 Incentive Award, The Society of Silicon Chemistry, Japan
2004. 2 The 7th Yokoyama Scientific Research Award