FERROELECTRIC LIQUID CRYSTAL MATERIALS RESEARCH CENTER

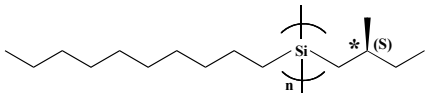
SPECIAL SEMINAR SERIES

Junji Watanabe

Tokyo Institute of Technology, Japan

Well-Defined Phase Sequence Including Cholesteric, SmA and Columnar Phases, Observed in Thermotropic LC System of Simple Rigid-Rod Helical Polysilane

Abstract Polysilanes with chiral side chains assume a helical rigid-rod conformation with the persistent length of around 85 nm that results from severe restriction of their internal rotation by steric hindrance between neighboring side chains.[1,2] Such a polymer chain stiffness is closely correlated to the liquid crystallinity in the lyotropic system. Here, we find that the polysilane with decyl and (S)-2-methyl butyl side chains



can form the thermotropic liquid crystals (LCs) as well as the lyortopic LCs. The ability of the thermotropic LC formation is due to the long flexible side chains that act as solvents in the lyotropic system.[3] The thermotropic phase behavior strongly depends on the polydispersity of molecular length. The materials with the wider distribution of molecular weight form a cholesteric liquid crystal.[4] On the other hand, the carefully fractionated materials with the sharp distribution of molecular weight form a SmA liquid crystal. Some materials with the intermediate distribution show the cholesteric-SmA transition on decreasing temperature. In the lower temperature region than these fluid phases, the columnar liquid crystal like a milky wax exists. This phase sequence including cholesteric, SmA and columnar phases is similar to that predicted theoretically by considering the excluded volume effect of hard-rod molecules.[5] Step-by-step organization of rod-like polymers is of considerable interest on understanding the self organization of molecules in the biological system[6] and manipulating the artificial processing of the nanoscaled materials.

1.Fujiki, M. *J. Am.. Chem*.. Soc. 118, 7424(1996). 2. Terao, K., et. al. *Macromolecules* 34, 2682 (2001). 3. Watanabe, J., et. al. *Macromolecules* 18, 2141(1985). 4. Watanabe, J., et. al., *Polym. J.* 33, 495(2001). 5. Frenkel, D., et. al. *Nature* 332, 822 (1988); Kimura, H., et.al., *J. Phys. Soc. Jpn.* 59, 3563(1990); Hentschke, R., et.al., *Phys. Rev.* A44, 1148(1991). 6. Neville A. C. in Biology of Fibrous Composites (Cambridge University Press,1993)

Wednesday, August 4, 2004 at 3:00 p.m.
Duane Physics, 11th Floor Commons Room

Sponsored by the Ferroelectric Liquid Crystal Materials Research Center,
Department of Physics, University of Colorado.

http://flcmrc.colorado.edu