Least stable fluctuation modes prior to lamellar-gyroid transition observed in a nonionic surfactant/water system

Masayuki IMAI[1], Kaori NAKAYA[1], Toshihro KAWAKATSU[2], Hideki SETO[3]

[1] Department of Physics, Ochanomizu University. Tokyo, Japan
[2]Department of Physics, Tohoku University, Sendai, Japan
[3] Department of Physics, Kyoto University, Kyoto, Japan

imai@phys.ocha.ac.jp

The nature of fluctuation modes of lamellar structure in a nonionic surfactant/water system has been investigated using a small angle x-ray scattering and a neutron spin echo technique. Approaching temperature from lamellar phase to double-gyroid phase, a diffuse scattering peak appears in the small angle scattering profile prior to the transition. This diffuse scattering is originated from the least stable fluctuation modes of lamellar structure predicted by Qi and Wang [1]. The intermediate scattering profiles of the lamellar phase just before the transition can be described by a undulation fluctuation mode and a least stable fluctuation mode of the lamellar structure. The relaxation rate of the least stable fluctuation mode decreases with approaching temperature to the double-gyroid phase. However in the vicinity of the lamellar to double-gyroid transition temperature, the decrease of relaxation rate is suppressed and the lamellar structure transforms to the intermediate rhombohedral network structure. The behaviors of fluctuation modes are examined by a time dependent Ginzburg-Landau model using a Leibler free energy functional [2].

[1] S. Qi and Z.-G. Wang, Macromolecules **30**, 4491 (1997).
[2] M. Imai, K. Nakaya, T. Kawakatsu, and H. Seto, J. Chem. Phys. **119**, 8103 (2003).