Electro-Rheological Effect of ''Side-on'' Liquid Crystalline Silsesquioxane Derivative

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Electro-Rheological (ER) fluids of which viscosity is controlled by an applied electric field strength have been widely studied as smart materials for industrial utilities since its discovery by W.M. Winslow in 1949 [1]. Liquid crystalline materials are known as homogeneous type ER fluids, which consist of single fluid. For the mechanism, it is assumed that anisotropic domains made by oriented moieties within the molecules generate resistance to shear flow, resulting in the change in shear stress.

In this study, a "side-on" liquid crystalline silsesquioxane derivative with laterally connected mesogens to a silsesquioxane cube through flexible spacer is investigated using optical polarized microscopy (POM), differential scanning calorimetry (DSC) and X-ray diffraction (XRD) [2]. The silsesquioxane exhibits a columnar hexagonal phase. From the rheological measurement, ER effect in a columnar hexagonal phase was found to show a large increase in shear stress in the presence of the electric field (6kV/mm).

References

(1) W. M. Winslow, *J. Appl. Phys.*, **1949**, *20*, 1137-1140.
(2) P. K. Karahaliou, P. H. J. Kouwer, T. Meyer, G. H. Mehl, and D. J. Photinos, *J. Phys. Chem. B*, **2008**, *112*, 6550-6556.

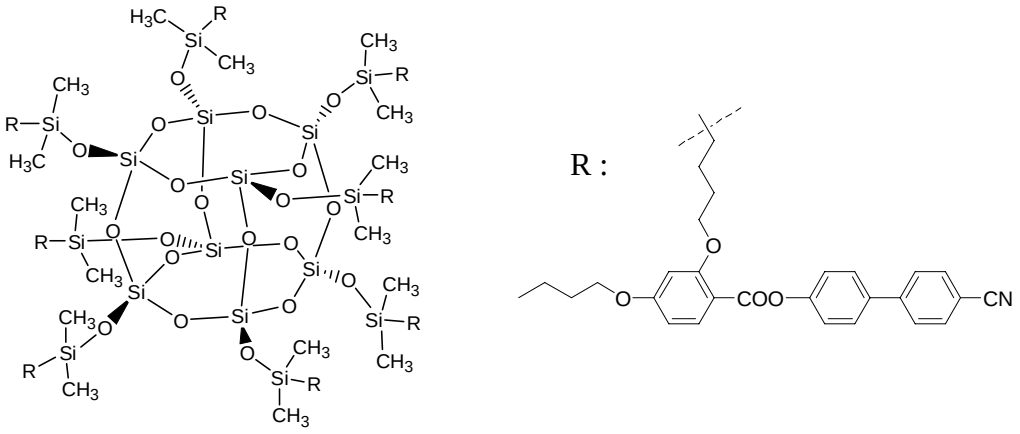

Figure 1 Molecular structure of the liquid-crystalline silsesquioxane derivative.