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Characterizton on the Structure and Ferroelectricity for the LB Film of a Chiral Liquid Crystalline Polysiloxane

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LB films of an newly synthesized chiral SCLC polysiloxane with biphenyl mesogens is prepared to form unique Y-type layer structure. The ferroelectricity of these LB films are measured in sandwich type electrode pattern by Sawyer -Tower method.

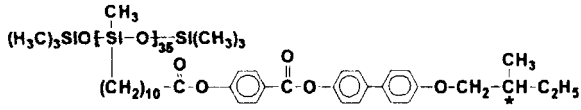
Keywords: ferroelectricity; chiral liquid Crystalline polysiloxane; LB films

INTRODUCTION

Liquid crystal (LC) materials with a chiral smectic C(Sc*) [1-3] phase have received much attention because of their interesting ferroelectric, antiferroelectric, and ferroelectric behaviors. This mesophase has many potential applications in electroactive media such as display, light valves, etc., where the electronic and physical properties are manipulated by an external electric field alternating the alignment of mesogens. From applications point of view the self-organizing materials forming mono- and multilayer assemblies is important for LB technique due to its convenience

to prepare novel supramolecular structures which show better switching speed than that in normal bulk smectic LC systems and other unique property not feasible in bulk system. Ferroelectric liquid crystalline polysiloxanes are the best candidate among the polymeric ferroelectric LCs due to its better thermal and chemical stability, and low Tg which provide better film-forming properties and faster switching speed.

In this paper we have chosen a newly synthesized side-chain LC polymer (P-III)[4-5] to investigate its LB multilayer structure and ferroelectricity (its chemical structure is shown as following)[6]. This candidate contains the chiral center in the head groups and can be induced to smectic C* phase to exhibit ferroelectricity.



P-III: Glass 91 S_B 120 S_C* 225 Iso•

EXPERIMENTALS

The synthesis and characterization of the sample are discussed elsewhere. Monolayer behaviors of P-III and its LC monomer on the pure water subphase have been investigated and discussed elsewhere [6]. The LB films are deposited by vertical dipping method on a computer-controlled NIMA 2000 trough with an alternating mode with transfer ratios of 1.

RESULTS AND DISCUSSIONS

Monolayer for P-III P-III showed greater stability than that of the monomer. P-III also exhibited larger irreversibility and aggregation tendency than that of monomer because of its inherent high viscosity and

low freedom of movement. The stability and reversibility of monolayer is improved when mixed with AA.

The transfer of P-III monolayer is not quantitative because of its relatively high rigidity, so AA is used to mix with P-III to improve the deposition behavior. Different deposition patterns could be observed with the change of the AA's proportion and deposition pressures. Structural characterizations for mixed LB film confirmed that high proportion of AA is beneficial to Y-type film structures with high layer orders, which were characterized by WAXD and polarized FT-IR spectra in our previous paper[6]. The mesogenic side chains were tilted in the film, much similar to that in bulk smectic phases as shown in Figure 1. Following is the model picture for the possible LB film structure.

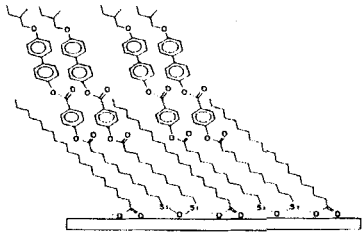


FIGURE 1. Possible model for LB films of PIII and AA.

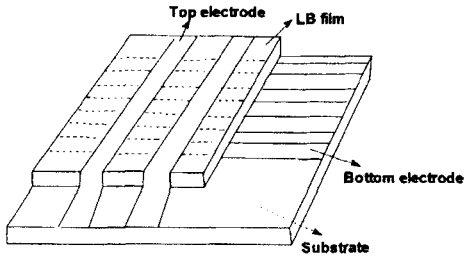


FIGURE 2. The electrode preparation for the measurement of the ferroelectricity of P-III mixed with AA.

The ferroelectricity of the LB film was measured using a sandwich type electrode pattern (as shown in the following) by Sawyer-Tower method. When the electric field is enhanced the loop changed gradually to saturation showing the existence of ferroelectricity as shown in Figure 3.

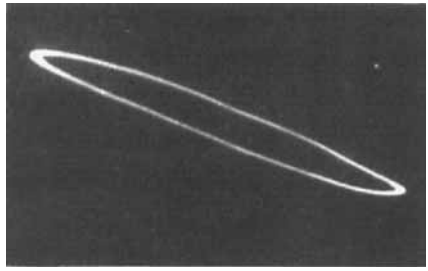


FIGURE 3. The loop that found for the sandwich electrode of LB films of PIII mixed with AA.

Acknowledgements.

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