나노구조 덴드리머의 변위전류 특성

송 진원, 최 용성, 이 경섭
동신대학교 전기공학과

Displacement Current Characteristics of Nano-Structural Dendrimer

Jin-Won Song, Yong-Sung Choi, and Kyung-Sup Lee
Department of Electrical Engineering, DongShin University

Abstract : In the Langmuir-Blodgett (LB) technique, a monolayer on the water surface is transferred onto a substrate, which is raised and dipped through the surface. From this, multilayers can be obtained in which constituent molecules are periodically arranged. The LB technique has attracted considerable interest in the fabrication of electrical and electronic devices. Many researchers have investigated the electrical properties of monolayer and multiplayer films. Dendrimers represent a new class of synthetic macromolecules characterized by a regularly branched treelike structure. Multiple branching yields a large number of chain ends that distinguish dendrimers from conventional star-like polymers and microgels. The azobenzene dendrimer is one of the dendritic macromolecules that include the azo-group exhibiting a photochromic character. Due to the presence of the charge transfer element of the azo-group and its rod-shaped structure, these compounds are expected to have potential interest in electronics and ptoelectronics, especially in nonlinear optics. In the present paper, we give pressure stimulation to organic thin films and detect the induced displacement current.

Key Words : Displacement Properties, Langmuir-Blodgett (LB) techniq

1. Introduction

Azobenzene dendrimer is one of the dendritic macromolecules that include the azo-group exhibiting a photochromic character. Due to the presence of the charge transfer element of the azo-group and its rod-shaped structure, these compounds are expected to have potential interest in electronics and ptoelectronics, especially in nonlinear optics [1-3].

Photoisomerization in monolayers of anazobenzene dendrimer was investigated for the first time by means of the absorption spectrum and Maxwell displacement current (MDC) technique. Dendrimers are well-defined macromolecules exhibiting a tree-like structure, first derived by the cascade molecule approach. According to the absorption spectrum, trans-to-cis conversion ratio was estimated to the azobenzene dendrimer generation. Charge with trans-cis isomerization was also measured by means of the MDC technique.

In the present paper, we give pressure stimulation to organic thin films and detect the induced displacement current.

2.Experiment

Monolayers of AZ-G4 were spread from diluted chloroform solutions onto the surface of pure water. The working area of Electrode 1 was 45.6[cm2].The distance d between Electrode 1 and the water surface was 1 mm. The displacement current I was measured by an electrometer (Keithley 6517).

Figure 1 shows displacement current measuring apparatus according to light stimulus transferwater surface. AZ-G4 was spread on pure water (pH 6.0, 18.2 M cm) and maintained at 20[℃]. Once a monolayer was rested for 5 minutes, the monolayer was compressed at a compression speed of 40[mm/min]. MDCs were measured during monolayer compression. Irradiation with UV light (λ_1=365nm) and visible light (λ_2=450nm) regions occurred at AZ-G4 monolayers. The absorption spectra was measured using a UV-visible recording spectrophotometer (Hitachi U-3501 spectrophotometer).

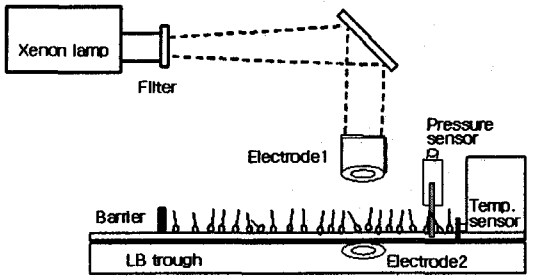

Fig.1. Displacement current measuring apparatus

3.ResultsandDiscussion

Figure 2 indicates the current generated from AZ-G4 molecules during compression with a constant barrier velocity in the area per molecule ranging from 5900[2] to 1800[2]. Surface pressure-area isotherm is also shown in the figure. A current peak appears in the range of molecular area A between 4900[2] and 1800[2] by monolayer compression.

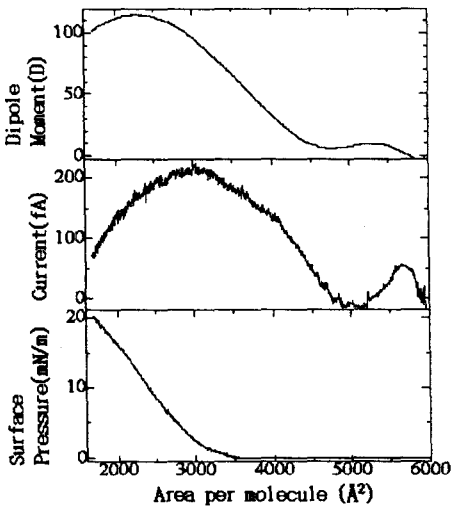

Fig.2. Displacement current of barrier compress

Figures 3 shows typical results of MDC measurements of the AZ-G4 monolayers with estimated induced charge. MDC current is generated with alternating 365[nm] photoirradiation and the direction of the current is alternated.

Photoirradiation was permitted for 30 seconds, following examination for 30 seconds after displacement current amounted to 0. When photoirradiation was 365[nm]'s, displacement current occurred roughly at - 280 [fA] and it took 3 minutes to reach 0.

Also, in the case of photoirradiation, surface pressure changed, and with the size of ensued displacement current at 365[nm], we could know that at 450[nm], surface pressure change shows more noticeably. The charge amount began to increase after photoirradiation, and the charge amount demonstrated that increase continuously occurred during dark conditions. Thisis considered by did not irradiation 250[nm] previous that can look cis-trans feedback. Also, is proportional in displacement current of 365[nm]'s photoirradiation and could know that the bigger charge amount happen.

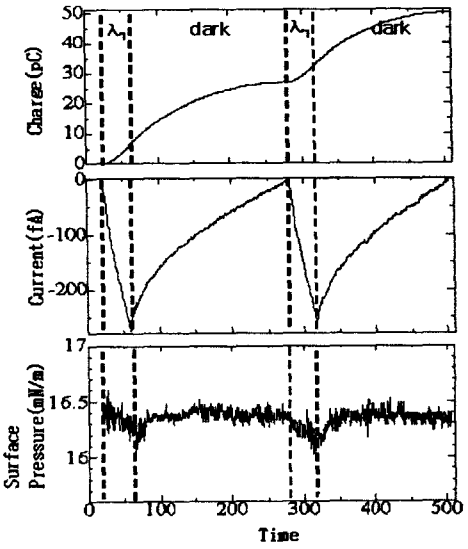

Fig.3. Photoirradiation of AZ-G4($\lambda 1$=365[nm])

4.Conclusion

We have investigated the photoisomerization phenomenon in an azobenzene dendrimer by means of the absorption spectrum and MDC technique. We showed the current generated from AZ-G4 molecules during compression with a constant barrier velocity in the area per molecule. When photoirradiation was 365[nm]'s, displacement current occurred roughly at - 280 [fA] and it took 3 minutes to reach 0.

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