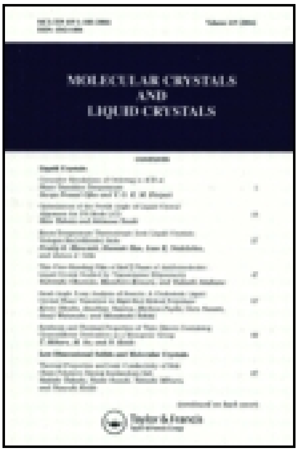

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Jung Myoung Kim [a] , Hoon Kyu Shin [a] , Eunmi Park [b] , Chung Kyun Kim [b] & Young-Soo Kwon [a]

[a] Dept. of Electrical Eng., Dong-A University, Busan, 604-714, Korea

[b] Dept. of Chemistry, Dong-A University, Busan, 604-714, Korea

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The Study on the Optical Characteristics of G4-48 Azo Dendrimer by Langmuir-Blodgett Method

JUNG MYOUNG KIM[a], HOON KYU SHIN[a], EUNMI PARK[b], CHUNG KYUN KIM[b] and YOUNG-SOO KWON[a]

[a]*Dept. of Electrical Eng., Dong-A University, Busan 604-714, Korea and*
[b]*Dept. of Chemistry, Dong-A University, Busan 604-714, Korea*

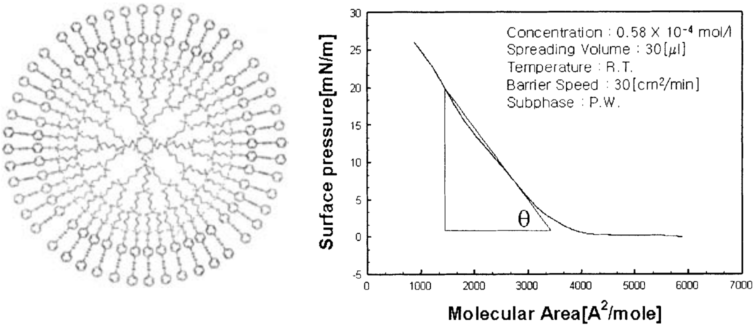
In this study, we synthesized dendrimers containing light switchable units, azobenzene group(G4 48-Azo dendrimer). Their chemical structure was verified by using NMR study and UV spectroscopy. To apply to the molecular level switching device or data storage system using Langmuir-Blodgett(LB) film, we investigated the monolayer behavior using π-A isotherm at air/water interface. The surface pressure was also measured during light irradiation. As a result, the G4 48-Azo dendrimer monolayer showed the reversible photo- switching behavior by the isomerization of azobenzene group in their periphery.

Keywords: dendrimer, azobenzene, LB method,

INTRODUCTION

Many approaches to control of particle size and their physical properties have been attempted for the application to the molecular electronic devices. Dendrimers are new a class of macromolecules constructed with highly regular branching, having a tree-like structure that emanates from a central core. The unique structure of these three-dimensional polymers is a result of the control of their size, shape, molecular weight, topology, and surface chemistry to an extent unprecedented in polymer science[1]. Also dendrimers have been recently recognized as a promising candidate for a building unit of the organized nanostructures[2-3]. Furthermore, surface groups of dendrimers can be chemically functionalized through the synthetic manipulation, and the resulting dendrimers expanding their application in the related areas. In this study, we synthesized the dendrimer functionalized with azobenzene group in their periphery and investigated its characteristics as a photo-switching device.

RESULTS AND DISSCUSION



(a) Molecular Srtucture (b) π-A isotherm

FIGURE 1. The chemical structure of the fourth generation dendrimer bearing 48 azobenzene units and its π-A isotherm at air/water interface.

The forth generation dendrimer contained in photoisomerizable 48 azobenzene units (G4-48 Azo) in the periphery was synthesized in an attempt to construct photoswitchable molecular device system. ^{1}H, ^{13}C-NMR spectra was significant for the dendrimer structure, the synthesized dendrimer was identified with the MAILD-TOF-Mass, GPC, and elemental analysis. Figure 1 represents the chemical structure of G4-48 Azo dendrimer and its π-A isotherm at air/water interface. The π-A isotherm of the G4-48 Azo dendrimer are shown in Fig. 1 and display a linear increase in surface pressure upon compression, indicating the formation of monolayer at air/water interface. The stability of the monolayers was further supported by the fact that no change in the total surface area at constant pressure for at least 1 h was observed.

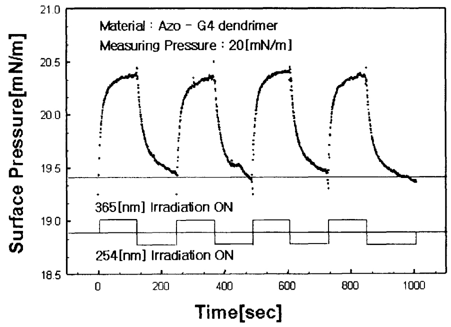


FIGURE 2. The optical response of G4-48 Azo dendrimer at air/water interface. (measuring interval : 2[min], surface pressure : 20 [mN/m])

Figure 2 represents the photo-switching process of G4-48 Azo dendrimer monolayer at air-water interface. By irradiation of 365[nm] light, the surface pressure was increased, which was originated by photo-isomerization process of azobenzene group in the periphery from trans to cis form. Isoemrization of azobenzene group involves a large structural rearrangement. Also, the isomerization is always accompanied by significant changes of physical properties such as dipole moment, melting and boiling points, and refractive index. In going from the trans to the cis form, the distance between the para carbon atoms of azobenzene decreases from 9 to 5.5 Å and the dipole moment increases from 0 to 3.0 D[4]. In this study, The increase of diopole moment(μ), which may increase the interaction among G4-48

Azo dendrimer molecules, made an important role on surface pressure shift. The surface pressure was fully recovered by irradiating 254 [nm] wavelength light and the photo switching was reproducible. This result includes the possible application to photo-switching device using azo-dendrimer LB film.

CONCLUSION

In this study, we synthesized dendrimers containing light switchable units, azobenzene group. Their chemical structure was verified by using NMR study and UV spectroscopy. We measured the surface pressure shift originated from photo-isomerization of azobenzene unit in the periphery of dendrimer. As a result, the monolayer of dendrimer with azobenzene group showed the reversible photo-switching behavior by the isomerization of azobenzene group. This result includes the possible application to photo-switching device using G4-48 Azo dendrimer LB film.

Acknowledgement

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