This article was downloaded by: [University of California, San Diego]
On: 15 August 2012, At: 23:21
Publisher: Taylor & Francis
Informa Ltd Registered in England and Wales Registered Number: 1072954
Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK

Molecular Crystals and Liquid Crystals Science and Technology. Section A. Molecular Crystals and Liquid Crystals

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/gmcl19

Application of Photo-Alignment Technique for Low Pretilt Angle Liquid Crystal Cell

Ji-Hye Moon [a], Dong-Mee Song [a], Kwon-Yung Ryu [a], Dong-Myung Shin [a] & Yongbae Kim [b]

[a] Dep. of Chem. Eng., Hong Ik University, Seoul, 121-791, Korea

[b] Dep. of Chem., Konkuk University, Seoul, 143-701, Korea

Version of record first published: 24 Sep 2006

To cite this article: Ji-Hye Moon, Dong-Mee Song, Kwon-Yung Ryu, Dong-Myung Shin & Yongbae Kim (2001): Application of Photo-Alignment Technique for Low Pretilt Angle Liquid Crystal Cell, Molecular Crystals and Liquid Crystals Science and Technology. Section A. Molecular Crystals and Liquid Crystals, 371:1, 439-442

To link to this article: http://dx.doi.org/10.1080/10587250108024778

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: http://www.tandfonline.com/page/terms-and-conditions

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae, and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand, or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Downloaded by [University of California, San Diego] at 23:21 15 August 2012

Mol. Cryst. and Liq. Cryst., 2001, Vol. 371, pp. 439-442 © 2001 Taylor and Francis, Inc.

Downloaded by [University of California, San Diego] at 23:21 15 August 2012

Application of Photo-Alignment Technique for Low Pretilt Angle Liquid Crystal Cell

JI-HYE MOON[1], DONG-MEE SONG[1], KWON-YUNG RYU[1], DONG-MYUNG SHIN[1] and YONGBAE KIM[2]

[1]*Dep. of Chem. Eng., Hong Ik University, Seoul, 121-791, Korea and* [2]*Dep. of Chem., Konkuk University, Seoul, 143-701, Korea*

The photosensitive PI film composing of DOCDA/DAP-Chalcone [5-2,5-dioxotetrahydrofuryl]-3-methyl-3-cyclohexene-1,2-dicarboxylic anhydride/1,4-diaminophenol/4-n-propyl-4-(3-propylene hydroxide) chalcone] induces orientation of liquid crystal alignment perpendicular to the polarization direction. The pretilt angle of liquid crystal was about 1°. It will be applied to the ferroelectric liquid crystal display.

Keywords photoalignment technique; chalcone; liquid crystal; polyimide; pretilt angle

INTRODUCTION

For the photo-alignment layer, the polyimide containing the specific functional groups has been studied recently[1]. Chalcone derivatives were used as a photo reactive moiety for easy formation of dimer by photoreaction[2,3].

In this paper, we report the photosensitive PI film composing of DOCDA/DAP-Chalcone [5-2,5-dioxotetrahydrofuryl]-3-methyl-3-1, 2-dicarboxylic anhydride/1,4-diaminophenol/4-n-propyl-4-(3-propylene hydroxide) chalcone aligns liquid crystal perpendicular to the direction of polarization. The pretilt angle of liquid crystal was

obtained.

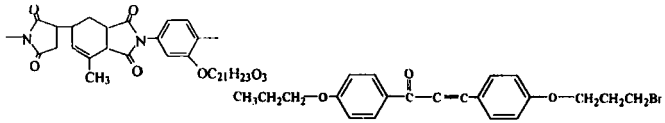

FIGURE 1 Structure of DOCDA-DAP-CH3 and chalcone derivate.

EXPERIMENT

The molecular structure is shown in Figure 1. The PI was deposited onto Si wafer, quartz, and glass by spin coating of 2 wt% solution in NMP. The film baked at 180 °C for 40 min to evaporate the solvent. The film was irradiated with 500 W high-pressure mercury lamp equipped with Glan-Thompson polarizer. The power density at the PI film surface was kept about 10 mW/cm^2. The completion of photoreaction was confirmed by FT-IR and UV/Vis. spectrometry. The UV/Vis. Spectra were measured with HP 8452 spectro-photometer. Infrared spectra were obtained from the Nicolet Magna IR 560 FT-IR spectrophotometer. The AFM images were taken by contact mode at room temperature in air with Autoprobe CP, Park Scientific Instruments. The sandwich type cells were assembled and the thickness was set by 50 μm tape. The LC (BL001, Merck.) was injected above T_{NI} temperature to avoid flow effect. The dichroism of LC cells containing the dichroic dye (violet 0.5 wt%) was obtained. The incident angles of LC cell was measured and the pretilt angle of LC cell was determined by the crystal rotation method[4].

RESULTS AND DISCUSSION

Downloaded by [University of California, San Diego] at 23:21 15 August 2012

Downloaded by [University of California, San Diego] at 23:21 15 August 2012

Figure 2 shows IR absorption spectra before and after linearly polarized(LP) UV irradiation. The decrease of chalcone peak (1620cm^{-1}) indicated that the chalcone double bond dimerized or isomerized as the photoreaction progressed. The change in UV absorbance of chalcone was confirmed in UV absorption spectra as shown in Figure 3.

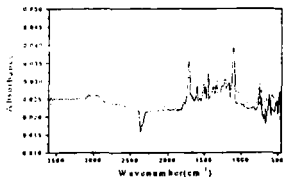

FIGURE 2. FT-IR spectra of PI film.

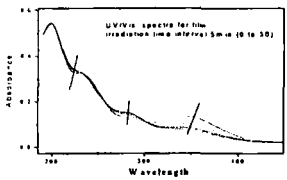

FIGURE 3. UV/Vis. absorption of PI film.

To observe the surface of PI film before and after irradiation, the AFM images were obtained as illustrated in Fig. 4. As the photoreaction underwent, average roughness was increased and the linear grooves were formed perpendicular to the polarization direction.

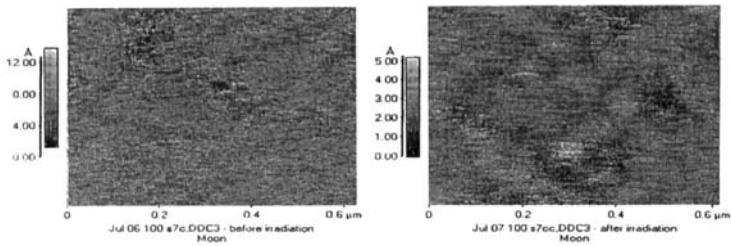

FIGURE 4. AFM images of PI film before and after irradiation.

Figure 5 shows the polar diagram obtained at 552 nm. The LC molecules were uniformly aligned perpendicular to the polarization direction of irradiated LP-UV light on PI layer.

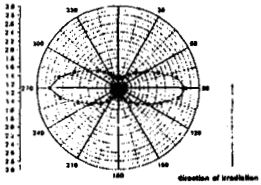

FIGURE 5. UV/Vis. Absorbance for 552 nm against rotation angle of polarizer.

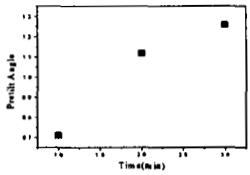

FIGURE 6. Pretilt Angle

The pretilt angles were determined about 1°. As irradiation time increases, the pretilt angle increases.

Acknowledgement

We would like to appreciate KOSEF(Grant number 1999-2-308-005-3) for financial support.

References

[1] A. Rehab, and N. Salahuddin, *Polymer* **40**, 2197(1999).

[2] S. Nakata et al, IDW98, **1**,331.

[3] M. Schadt, K. Schmitt, V. Kozinkov, and V. Chigrinov, *Jpn. J. Appl. Phys.*, **31**, 2155(1992).

[4] G. Bauer, V. Wittwer, and D.W. Berreman, Phys. Lett. A **56**, 143(1976)

Downloaded by [University of California, San Diego] at 23:21 15 August 2012