NDLC박막에 DuoPIGatron 이온소스를 사용한 IPS cell의 전기광학특성

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Electro-Optical Performances of In plane Switching(IPS) Cell on the Inorganic Thin Film by DuoPIGatron Ion Source

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Abstract : We studied the nematic liquid crystal (NLC) alignment capability by the IB(Ion bean) alignment method on a NDLC(Nitrogen Diamond Like Carbon) as a-C:H thin film, and investigated electro-optical performances of the IBaligned IPS(In plane switching)cell with NDLC surface. A good LC alignment by IB exposure on a NDLC surface was achieved. Monodomain alignment of the IB aligned IPS cell can be observed. The goodelectro-optical (EO) characteristics of the IB aligned IPS cell was observed with oblique IBexposure on the NDLC as a-C:H thin film for 1min.

Key Words : NDLC, ion beam, response time, LC alignment, pretilt angle

1. INTRODUCTION

Liquid crystal displays (LCDs) are widely used as information display devices such as monitors in notebooks, desktops,and LCD TV. A rubbing method has been widely used to align liquid crystal (LC) molecules on the polyimide (PI) surface. [1-2]. Rubbed polyimide surfaces have suitable characteristics such as uniform alignment and a high pretilt angle. However, the rubbing method has some drawbacks, such as the generation of electrostatic charges and the creation of contaminating particles. Thus we strongly recommend a non-contact alignment technique for future generations of large, high-resolution LCD.

In this article, we report on LC alignment and pretilt angle generation with IB exposure on the surface of NDLC(nitrogen diamond like carbon) as a-C:H:N thin-film deposited by rf magnetron sputtering, and EO characteristics of the ion beam aligned IPS cell with oblique IB exposure on the NDLC as a alignment layer.

2. EXPERIMENT

The a-C:H:N (NDLC) thin films were prepared by RF magnetron co-sputtering equipped with a 5 N-purity Carbon target.The glass substrates were first cleaned with standard cleaning procedures and then rinsed in deionized water. Cleaned substrates were loaded in the central region of the substrate holder located about 50mm away from the targets. The sputtering chamber was initially evacuated by a turbo molecular pump to the base pressure of about 7.5_10_4 Pa. For the NDLC films deposition, the working pressure was maintained at about 0.67 Pa with Ar-ambient gas. Prior to the film deposition, pre-sputtering was performed for 10 min to remove any contamination on the target surface. The thickness of the NDLC thin film layer was about 20nm.

The IB system is shown in Fig. 1. The IB power was used 1200eV.

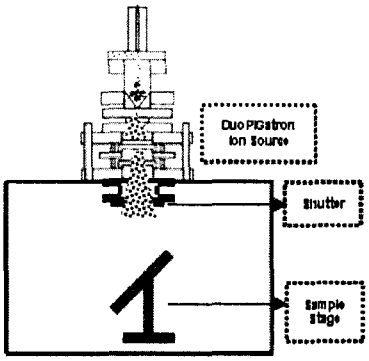

Fig. 1. Ion beam exposure system

The gap of the Ion beam aligned LC cell was 60㎛, and the cell thickness of the Ion beam aligned IPS cell was about 4㎛. The LC cell was filled with a nematic liquid crystal To determine LC alignment condition, a polarization microscope was used and pretilt angle was measured crystal rotation method at room temperature. Voltage-Transmittance (V-T) and response time characteristics of the UV aligned TN-LCD were measured by a LCMS-200 equipment.

3. RESULT AND DISCUSSION

The LC pretilt angle observed with IB exposure on the NDLC thin film as a function of N_2 gas percent are shown in Fig. 2. It is shown that the LC pretilt angle generated was about 3 in the all-incident angle on the NDLC thin film when N_2 gas was 2 and 4 sccm. However, LC pretilt angle generated show decrease with increasing N_2 gas percent. So, NDLC thin film with low pretilt angle was used in the IPS cell.

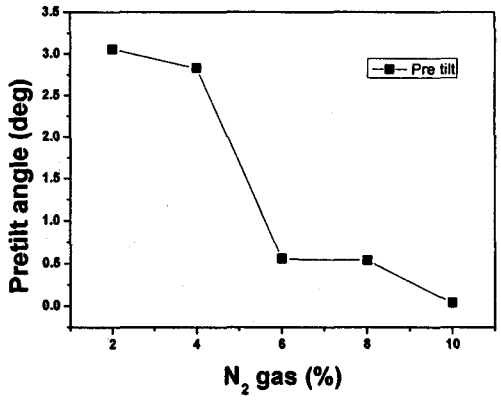

Fig. 2. Generation of pretilt angles in NLC with IB exposure on NDLC thin film surfaces for 1 min as a function of N_2 gas percent.

Figure 3 shows a good transmission of light as a function of applied voltage across IPS cells made of NDLC thin film as alignment layers. A stable V-T curve of IB aligned IPS cell on the NDLC thin film was measured.

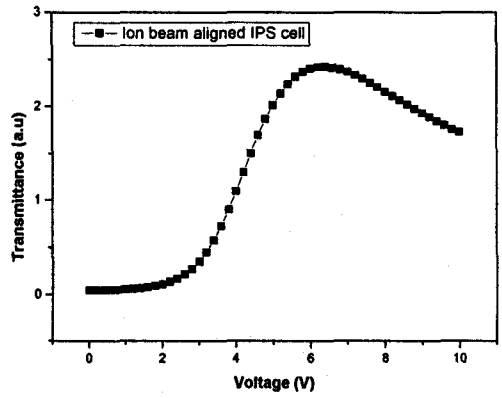

Fig. 3. Voltage-transmittance characteristics of the IB aligned IPS cell on NDLC thin film

Figure 4 shows the response time characteristics of the IB aligned IPS cells made of NDLC thin films, as alignment layers. A stable curve for IB aligned IPS cell on the NDLCthin films is shown.

We show in Figure 5 the Capacitance-Voltage characteristics of the ion beam aligned IPS cell. The residual charge characteristics of ion beam aligned IPS cell using the new type ion beam system have a little the increased value of the residual charge was very small.

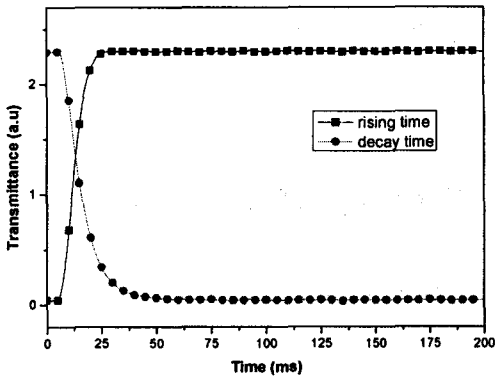

Fig. 4. Response time (RT) characteristics of the IB aligned IPS cell on NDLC thin film

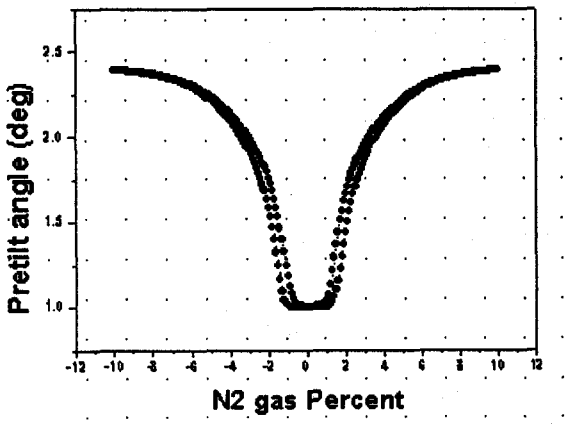

Fig. 5. Capacitance-voltage characteristics of ion beam aligned IPS cell with NDLC thin film

4. Conclusions

In conclusion, we studied about LC alignment effect and the controllability of pretilt angle in a new alignment layer of the NDLC thin film deposited by rf magnetron sputtering and investigated electro-optical performances of the IB aligned IPS cell with NDLC thin film surface. We achieved a good alignment characteristics on the NDLC thin film when N2 gas is from 2sccm to 10sccm at the sputtering. Also, we obtained high pretilt angle on the NDLC, and then NLC alignment capabilities show decrease with increasing N2 gas percent. Finally, the EO characteristics of the IB aligned IPS cell with NDLC thin film are good.

ACKNOWLEDDMENTS

This work was supported by National Research Laboratory program

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