Ellipsometric study of nematic alignment on Silicon Oxides for displays

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Abstract

Vertical Alignment Nematics (VANs) displays are a form of LCDs in which the liquid crystals naturally align vertically to the glass substrates. In spite of their name, the liquid crystal (LC) director is never exactly vertical, rather it always show a small angle with the normal to the sample plane called tilt that may vary throughout the cell bulk. Its values are ultimately determined by the pretilt, defined as the tilt angle on the surfaces in the absence of voltage. The control of tilt angle distribution inside VAN LC thin films is essential for many applications [1]. Higher pretilts lead to faster displays, because the delay time of the dynamic response decreases. However, increasing the pretilt the quality of the dark state is reduced, for birefringence of the off state increases accordingly. Thus a delicate balance between delay time and contrast has to be sought in the manufacturing of VAN displays. A fine control of the pretilt is crucial for VAN displays performance optimization.

With this aim, we have investigated, by means of variable angle spectroscopic ellipsometry, the pretilt angle in silicon oxides alignment surfaces, focusing on SiO_x and SiO_2. Those vertical alignment layers had been realized by thermal evaporation. Changing the deposition angle it is possible to control the pretilt angle. The director profile inside the sample was inferred by reflection and transmission ellipsometric measurements.

Pretilt measurements were made using an ellipsometric technique, based on recording changes in the state of polarization when a beam light impinges the surface [2]. This technique allowed measuring pretilt angle of the liquid crystal molecules placed next to the SiOx or SiO2 surfaces with more accuracy than on typical mehods (especially for very low pretilt angles). The full comparative study of VANs pretilt angles on SiOx and SiO2 layers and their influence over electrooptic response will be presented.

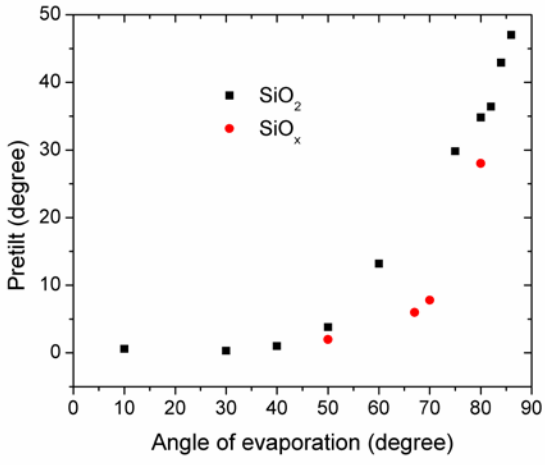

Fig. 1. Pretilt vs. evaporation angle in SiO2 cells (blue) and SiOx cells (green).

References

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