액정 디스플레이 배향막을 위한 이온빔 표면조사에 관한 연구

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Ion beam irradiation for surface modification of alignment layers in liquid crystal displays

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Abstract : In general, polyimides (PIs) are used in alignment layers in liquid crystal displays (LCDs). The rubbing alignment technique has been widely used to align the LC molecules on the PI layer.[1-3] Although this method is suitable for mass production of LCDs because of its simple process and high productivity, it has certain limitations. A rubbed PI surface includes debris left by the cloth, and the generation of electrostatic charges during the rubbing induces local defects, streaks, and a grating-like wavy surface due to nonuniform microgrooves that degrade the display resolution of computer displays and digital television. Additional washing and drying to remove the debris, and overwriting for multi-domain formation to improve the electro-optical characteristics such as the wide viewing angle, reduce the cost-effectiveness of the process. Therefore, an alternative to non-rubbing techniques without changing the LC alignment layer (i.e., PI) is proposed. The surface of LC alignment layers as a function of the ion beam (IB) energy was modified. Various pretilt angles were created on the IB-irradiated PI surfaces. After IB irradiation, the Ar ions did not change the morphology of the PI surface, indicating that the pretilt angle was not due to microgrooves. To verify the compositional behavior for the LC alignment, the chemical bonding states of the IB-irradiated PI surfaces were analyzed in detail by XPS. The chemical structure analysis showed that ability of LCs to align was due to the preferential orientation of the carbon network, which was caused by the breaking of C=O double bonds in the imide ring, parallel to the incident IB direction. The potential of non-rubbing technology for fabricating display devices was further conformed by achieving the superior electro-optical characteristics, compared to rubbed PI.

Key Words : LC alignment layer, Polyimide, Ion beam, Non-rubbing techniques

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