Ideal Photoalignment Technology for Advanced IPS-LCDs

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One of the most important manufacturing processes for high performance IPS-LCDs is the photoalignment process, particularly those with high definition, wide viewing angle and low power consumption [1]. This is because a photoalignment process, compared with a conventional rubbing process, has many merits on both productivity and performance of LCD, such as a higher production yield, an easy process management, a wider viewing angle, and a higher transmittance. However, photoalignment used to have two difficulties in practical application; a weak azimuthal anchoring strength which causes AC image sticking, and a low photosensitivity which causes low production capability, which had been large barriers for mass production.

In order to solve these problems mentioned above, we have developed a new photoalignment technology which is ideal for IPS-LCDs. In that, we have particularly focused on the molecular design of the photoalignment materials and the processes. For the problem of weak azimuthal anchoring strength, we first chose alignment materials which have strong interaction with LC molecules, then designed the materials and processes to reduce the surface rheological deformation of alignment materials [2], and to enlarge the order parameter of the LC interface layer [3]. The problem of photosensitivity was solved by designing the materials and processes which enable the more efficient photoreaction. Consequently, we have succeeded in developing our original photoalignment materials and processes that simultaneously possess a strong azimuthal anchoring strength and a high photosensitivity.

We have also clarified the synergistic effect by the combination between the new photoalignment and LC with a negative dielectric constant (negative LC). Although negative LC is more attractive for LCD transmittance and contrast ratio than positive LC, it is difficult for negative LC to obtain as large an azimuthal anchoring strength as positive LC for the case of rubbing process. This is because the extent of contact between a rubbing pile and an alignment film is smaller for negative LC alignment configuration than for positive LC alignment configuration, due to its larger bias angle between the direction of the interdigital electrodes and the alignment axis. On the other hand, the new photoalignment constantly provides a large azimuthal anchoring strength without depending on the bias angle.

The features of newly developed IPS panel indicate that the combination of our photoalignment and negative LC contributes significantly to lower power consumption and higher contrast ratio than the combination of rubbing and positive LC. We believe that our photoalignment is a key technology for the further evolution of high performance IPS-LCDs.

References

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