Stable four-domain twisted nematic structure with high pretilt angle using mixed alignment layer

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Recently, various liquid crystal (LC) modes which have multi-domain structures such as in-plane switching (IPS), multi-domain vertical alignment (MVA) and patterned vertical alignment (PVA) modes have been developed and commercialized to improve the viewing angle characteristics of liquid crystal displays (LCDs). However, these modes have problems such as complicated manufacturing processes and lower transmittance due to low aperture ratio than twisted nematic (TN) mode. TN mode has been most popular LC mode due to their high transmittance characteristics, wide cell gap margin, simple fabrication process and so on. However, narrow and asymmetric viewing angle characteristics need to advanced TN mode such as four-domain structure for high display performance. The four-domain TN structures have been developed by many research groups, but the stability is not enough for display devices, especially low and zero voltage range [1-4]. For stable four-domain structure, high pretilt angle characteristics are needed depending on the cell parameters such as cell gap (d) and pixel dimension (L) [3].

In this paper, we proposed a stable four-domain TN structure with high pretilt angle using mixed alignment layers consisted of planar and vertical alignment materials. The pretilt angle was precisely and simply controlled in full range (0° ~ 90°) by changing the mixing ratio of alignment layers and solvents [5]. In our cell condition (L = 200 μm, d = 5 μm), we controlled the pretilt angle to 18° with mixed alignment layers of which mixing ratio of vertical, planar alignment material and solvent was 3:50:47 wt%. The cell was rubbed reversely for generating the multi-directional alignment on alignment layers with rubbing mask. As a result, the stable four-domain TN structure is realized at even low and zero voltage regimes during voltage switching. And the wide viewing angle characteristics are revealed and there is no gray inversion over whole gray levels.

References

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