

低驅動電壓和完善排列的表面穩定型鐵電性液晶

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摘要

液晶顯示器已成功取代傳統桌上型映像管顯示器，但其反應時間的極限未能因應大尺寸應用的需求，動態表現因受限於扭轉型液晶較慢的反應速度，而降低了影像品質。因此鐵電型液晶快速應答的特性已成為下一波備受矚目的液晶材料，表面穩定型鐵電性液晶顯示器是目前廣為使用的技術，除了快速應答，其視角也較扭轉型液晶顯示器大；然而配向上不易排列及衍生出的缺陷卻是目前亟欲解決的問題。

鐵電型液晶 R3206，此材料除了具有快速響應特性之外，也具有較低的飽和電壓，約為 3.5V。然而在應用於 LCD 上，受限於排列不佳的問題。本實驗藉由稀釋鐵電型液晶之對掌光學特性 (chirality)，增加其 pitch 的長度，使 FLC 結構能穩定在 uniform 的狀態，因此而改善了排列。接著再針對配向膜的正負極性以及和自發性極化的耦合作用做探討，並依此建構出一混合之液晶盒結構。利用此種液晶盒結構，可形成單一方向排列之層結構，並解決了水平山形袖章結構之缺陷。此外，在 R3206 混合物的量測電光特性實驗結果中，發現 70% R3206 除了能維持低飽和電壓 (~4.3V) 及快速響應 (~1.1 ms) 的特性外，其對比也有較佳的改善。這些改善的特性將使得鐵電型液晶可應用於主動驅動之 TFT-LCD 元件。

Low Driving Voltage with Clean Aligned Surface stabilized Ferroelectric Liquid Crystal

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Abstract

Fast switching LCD technology is necessary for achieving high quality of dynamic image. Because of this reason, ferroelectric liquid crystal (FLC) which has fast response speed is highly concerned. Surface stabilized ferroelectric liquid crystal (SSFLC) is a widely used technique and expecting solution for the next generation of LC displays, but the appearance of alignment defects knock down the practicability.

Poor alignment issue of R3206 was overcome by the diluted pitch of R3206 mixtures and assembled in asymmetric hybrid alignment cells. In the series of diluted pitch mixtures, the contrast and alignment are better than pure compound in pre-made cells. In particular, the 70% R3206 mixture showed the best result with low driving voltage below 5V and fast response time ($\tau_{on} + \tau_{off}$) under 1.1 ms. The horizontal chevron defects can be suppressed by asymmetrical hybrid alignment cell structure and greatly improved the contrast ratio of R3026-70 from 68 to the best result of 750. These results provide promising FLC materials with low driving voltage, clean aligned, and fast switching for TFT-LCD application.

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