New Vertical Alignment Mode of Liquid Crystal Display with Reduced Gamma Distortions by Periodic Patterns of Reactive Mesogens on Alignment Layer

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A demend for the high image quality has led to the development of various multi-domain modes of liquid crystal displays (LCDs) in twisted nematic [1], in-plane swithcing [2], and vertical alignment (VA) configurations [3]. One of them is the super-patterned vertical alignment (S-PVA) mode where each pixel is divided into two sub-pixels that are independently driven using two distinct circuits [4]. However, compared to the conventional PVA mode, the S-PVA mode suffers from the low aperture ratio and the complexity in the driving scheme. Thus, it is very important to search for a new type of overcoming such demerits of the S-PVA mode while preserving its high image quality, for instance, either through the modification of the surface characteristics of the alignment layer of the LC or the implemetation of rather simple driving circuits.

In this work, we demonstrate a new PVA LCD showing the reduction of the gamma distortions by forming the liquid crystalline polymer (LCP) layer, made of reactive measogens, on the homeotropic alignment surface. Here, the LCP layer was constructed through a spin-coating process of a reactive mesogen mixture, followed by the photo-polymerization and the wash process. It was found that the control of the exposure time during the photo-polymerization plays a key role in realizing the stable and uniform homeotropic alignment of the LC molecules on the LCP layer. This simple technique enables to produce multi-domains where the shift of the threshold voltage is spontaneously achieved domain by domain in the operation of the voltage division [5]. In principle, it would be also applicable for other types of the LCD modes for the improvement of the image quality in a simple way.

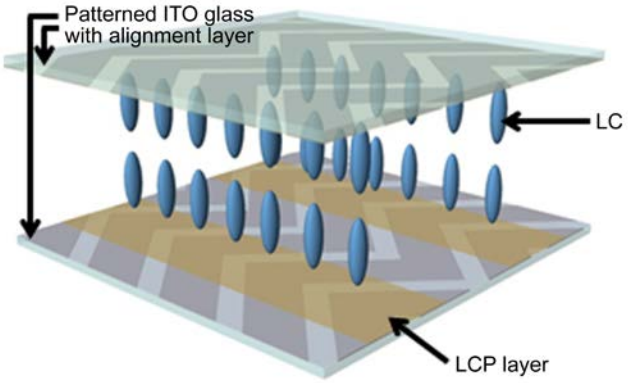

Fig. 1. A schematic diagram of a new PVA mode with the LCP layer on the alignment surface

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