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Simultaneous UV embossing method for fabricating two parallel organic layers with different hydrophilicity

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Abstract

We developed a simultaneous UV embossing method to fabricate bank-shaped, two parallel layers with different surface properties in a one-step processing using the mold having loop-shaped protrusions. In conjunction with ink-jet technology, the molded pattern could be used as barrier ribs for particular flat panel displays. We choose the layer materials so that the bottom ink-philic one absorb jetted ink and the top ink-phobic one expel jetted ink. Therefore, the structure prevents ink from staining the barrier ribs' surface and from mixing between adjacent pixels. The structure could be an effective barrier ribs for manufacturing of color filter of a liquid crystal display or light emitting layer of an electroluminescent display with high throughput.

Keywords: UV embossing; Barrier rib; Protrusion; Ink-jet; Hydrophilicity

1. Introduction

Recently, the organic light emitting display (OLED) have attracted enormous research interest and boosted industrial activity. They are a strong candidate for advanced flat panel display (FPD) in the near future because of their fascinating

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properties; brightness, wide viewing angle, fast response time, low power consumption, emission spectra cover the entire range of visible light and so forth [1]. There is a possibility they can be used for flexible displays in a rolled form and on curved surfaces, even on the surface of cloth as a wearable display [2]. Therefore, it is plausible that OLED may be the most competitive FPD industry with current leading FPD one, liquid crystal display (LCD) in the near future. However, their success or even survival might strongly depend on a decrease in cost and an increase in display quality such as color purity or long-life time.

The success of large FPD in the field of PC monitors and TVs strongly depends on how we increase the mother glass size and lower the manufacturing and material cost. As a result, recent advances in the ink-jet technology, which originally developed as a printing technology, have taken some of the attention away from the display industry [3]. For LCD, the adaptation of low-cost ink-jet technology for color filter fabrication is strongly being considered [4,5] because it is scalable to large-size mother glass and economical in the material cost. On the basis of this standpoint, the ink-jet technology can also be used in polymer light emitting display (PLED) because PLED is capable of a soluble process.

When we use such ink-jet technology in FPD fabrication, it is inevitable to make the barrier rib on the substrate before ink-jetting step [6,7]. For example, the bank-shaped structure for a color filter of an LCD fabricated by photolithography is shown in Fig. 1. To prevent jetted ink from mixing with adjacent pixels and from remaining on the rib's surface, the bottom layer should be able to absorb ink and the top layer should be able to expel ink.

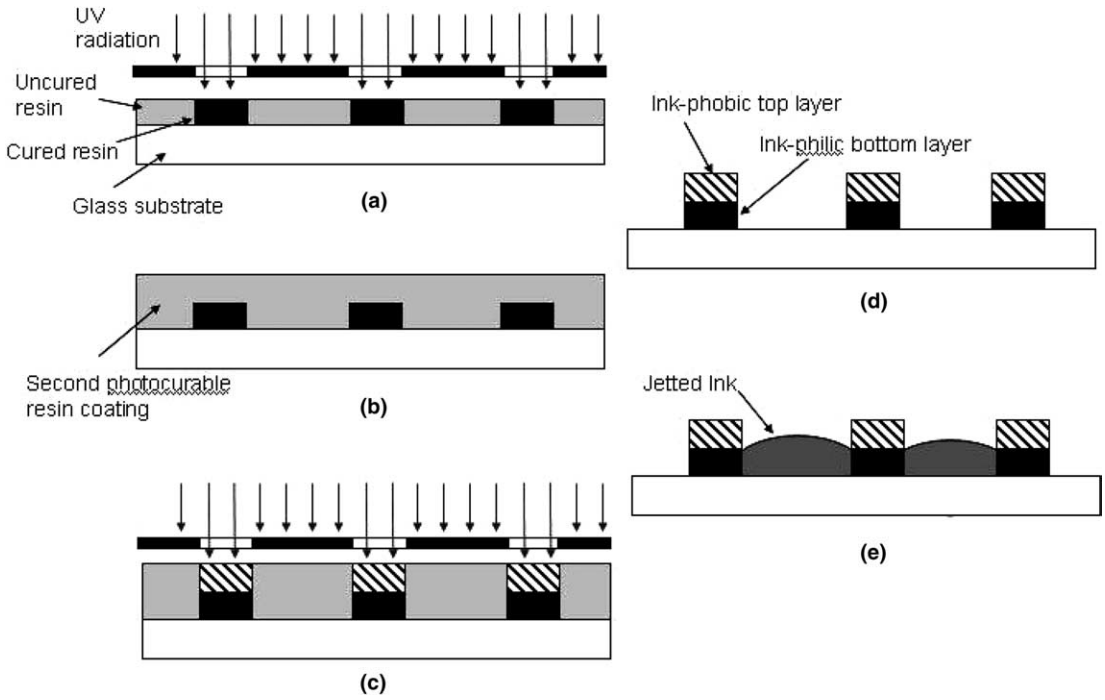

Fig. 1. Conventional manufacturing method and preliminary function of the barrier rib for a flat panel display that uses ink-jet technology. (a) Spin-coating of ink-philic, photocurable resin on a glass substrate and ink-philic bottom structure formed by UV exposure, (b) thick coating of ink-phobic photocurable material, (c) second photo process for ink-phobic barrier rib formation, (d) fabricated barrier rib structure consisting of two parallel layers after wet etching of uncured resin and (e) final shape of ink-jetted flat panel display.