

Ultrahigh Contrast Light Valve Driven by Electrocapillarity of Liquid Gallium

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Abstract

This letter describes an ultrahigh contrast valve driven by the electrocapillarity of liquid gallium. We demonstrate that a micrometer-sized gallium droplet can be used to fabricate a prototype backlight transmissive pixel cell by transforming the droplet into a flat thin film. This light valve exhibits significantly high backlight utility 96%, an exceptional contrast ratio $10^6:1$, and fast response time (0.49 ms). The high contrast ratio originated from the exceptional reflectivity of gallium, which can block backlight to prevent any transmission in the off state of our device. Without using any polarizer, the backlight utility can be improved dramatically compared to a conventional liquid crystal display. The backlight utility and switching time obtained from this prototype light valve is higher than that of commercial liquid crystal displays. This concept is also applicable to a wide variety of electro-optical devices.