

Simulation study on angular color shift correction of micro-LED displays

Yongzhen Liu¹, Enguo Chen^{1,2,*}, Yun Ye^{1,2}, Sheng Xu^{1,2}, Tailiang Guo^{1,2}

¹National & Local United Engineer Laboratory of Flat Panel Display Technology, Fuzhou University, Fuzhou, Fujian, China

²Fujian Science & Technology Innovation Laboratory for Optoelectronic Information of China, Fuzhou, Fujian, China

* Corresponding author: ceg@fzu.edu.cn

Micro-LED (μ LED) has been widely used in the field of displays in recent years, which has high luminous efficiency, rich color rendering, fast response, long service lifetime, and high peak brightness. The approaches to improve the light extraction efficiency of μ LED has been studied a lot in academia and industry, but research on its angle color shift is still limited. Angular color shift is an important issue for display, because it determines the color accuracy of displays in different directions. A method based on inverted trapezoidal structure and patterned mirror for regulating the spatial light distribution of μ LED is proposed in this paper. The ray tracing software LightTools is used for modeling and simulation. Conventional μ LED structures are shown in Fig. 1, and the normalized light distribution patterns of red, green, and blue lights can be seen in Fig. 2. Then, based on the inverted trapezoidal structure, we adjusted the angle of the bottom conical microstructure and finally obtained the normalized light distribution of red, green, and blue lights as shown in Fig. 3. Based on this light distribution regulation method, the light distribution of red, green, and blue μ LEDs are corrected to Lambertian emission sources, which largely eliminates the angular color deviation of μ LEDs for full-color displays.

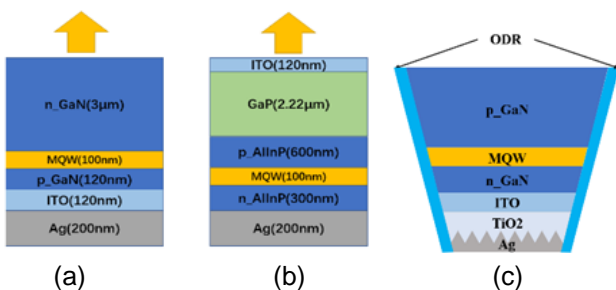


Fig. 1. (a) Conventional structures of green and blue μ LEDs, (b) Conventional structure of red μ LED, (c) Structure for regulation

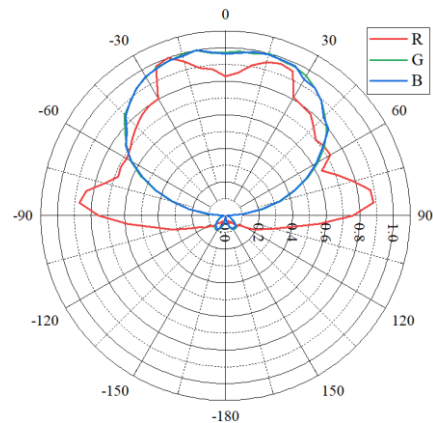


Fig. 2. Normalized light distribution of red, green and blue μ LEDs before regulation

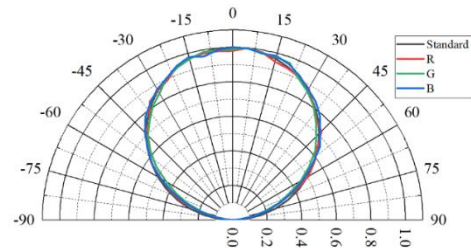


Fig. 3. Normalized light distribution of red, green, and blue μ LEDs after regulation to standard Lambertian source

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