亮点报道：面向高效率背光源应用的 RGB 自偏振全彩器件

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开发具有本征偏振发射的发光材料是近年的研究热点。基于半极性蓝色 micro-LED 作为激发光源结合各向异性结构的钙钛矿色转换层有望实现 RGB 全彩偏振器件。

厦门大学半导体照明实验室陈忠教授、吴挺竹副教授和林岳副教授团队开发了一种 RGB 偏振全彩器件。该器件采用具有本征偏振发射特性的蓝色半极性 micro-LED 作为激发光源，色转换层为绿色 $CsPbBr_3$ 钙钛矿纳米棒和红色 $CsPbI_3$-Cs_4PbI_6 纳米晶拉伸聚合薄膜。该器件中，蓝、绿、红三色的偏振度分别达到 0.26、0.48 和 0.38，对应透过偏振器的效率为 63%、74% 和 69%。这意味着该 RGB 偏振器件作为背光源时能够显著提升整体模组的能量利用效率。且由于半极性器件在高注入下有着更高的发光效率，因此该器件应用于大功率显示器的背光源时优势将更明显。研究结果验证了该工作中的 RGB 偏振器件在偏振背光应用中的高效率。

目前，工业薄膜双向同步拉伸设备已具备生产大型拉伸聚合物薄膜的能力。这项工作中的钙钛矿-EVA 薄膜具有良好的延展性，易于拉伸且稳定性高。因此，能够实现用于液晶显示器背光的钙钛矿量子点色彩增强转换拉伸膜的规模化制造。总之，这项研究为 RGB 偏振光电器件的开发提供了新颖的策略。

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Highlights: Self-polarized RGB device realized by semipolar micro-LEDs and perovskite-in-polymer films for backlight applications

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It is expected to realize RGB full-color polarization devices based on semipolar blue micro-LEDs as excitation light sources combined with perovskite color conversion layers with anisotropic structures.

Associate Prof. Tingzhu Wu's team from the Solid-State Lighting Laboratory of Xiamen University proposed a high-performance, stable device designed for RGB polarized emission. The architecture of the device incorporates an array of blue semipolar μLEDs with intrinsic polarization emission that excite stretched composite films of green $CsPbBr_3$ NRs and red $CsPbI_3$-Cs_4PbI_6 hybrid nanocrystals (NCs), acting as the color-conversion layers. The DOLPs of the device were calculated to be 0.26, 0.48, and 0.38 for blue, green, and red, respectively. Compared to current research focusing on the green band, the device in this study can emit stable polarized light containing RGB trichromatic colors. This solution, which employs a blue chip to excite the red and green conversion layers, requires no filtering of the additional UV component and maximizes energy utilization when used in backlighting applications.

Currently, the industrial film bidirectional synchronous tensile equipment is capable of manufacturing large-scale stretched polymer films. The perovskite-EVA films in this work were malleable and easy to stretch with high stability. Therefore, it is capable of realizing large-scale manufacturing of perovskite quantum dot color enhanced color conversion stretched film for backlighting of LCD TVs or displays.

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