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Vapor Deposited and Doped Perovskite Thin Film for LED Applications

Background

Perovskites have widely been considered as promising next-generation materials for future display and solid-state lighting applications. Most current perovskite LEDs are produced using solution processing, and over 20% external quantum efficiencies (EQE) in LEDs have been achieved in recent studies.

Vacuum-based deposition has also attracted tremendous interest for manufacturing perovskite LEDs due to its high reliability and ease of integration with OLED facilities. Vacuum-based deposition is ideal for depositing all inorganic perovskites because it is free from solubility limitation, as well as conformal coating onto rough substrates. It also produces highly reproducible and reliable results due to the controllable vacuum preparation environment, which is essential for manufacturing and building machine learning databases. However, recent studies have shown that LEDs produced by vacuum-based deposition exhibit low device performance.

Invention Description

Researchers at Arizona State University have developed a new class of stable perovskite materials via co-sublimination deposition, which can potentially improve the monochromic and white perovskite-based LEDs with device efficiency and operational lifetime. This invention reduces charge-trapping density in perovskite films by co-sublimation deposition. The ratio between metal halide and perovskite has been optimized in this design, which improves photoluminescence. The integrated perovskite emissive layer in LEDs can enhance radiative recombination and suppress non-radiative recombination.

Potential Applications

- LED displays
- Solid-state lighting

Benefits & Advantages

- Improves device efficiency (removes barriers to device efficiency in current vacuum-based deposition applications)
- Increases operational lifetime
- Improves photoluminescence in monochromic and white perovskite based LEDs