Modification of PEDOT: PSS to enhance device efficiency and stability of the Quasi-2D perovskite light-emitting diodes

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Abstract: Poly(3,4-ethylenedioxy thiophene): poly(styrene sulfonate) (PEDOT: PSS) is a hole transport layer (HTL) that is often employed in a diverse array of optoelectronic devices, such as perovskite solar cells and perovskite light-emitting diodes (PeLEDs). By simply doping lithium fluoride (LiF) into PEDOT: PSS, we demonstrate that the electrical characteristics of the HTL can be modified. Especially in quasi-2D perovskite LEDs, the crystallization process is regulated by LiF modification, leading to reduced phase impurity defects and improved carrier transport in the perovskite emission layer. Therefore, the luminance and efficiency of the quasi-2D PeLEDs are notably enhanced. The optimized PeLED with LiF modification exhibits a peak luminance of 21517 cd m^{-2} with 317% higher than the standard PeLED; and a high current efficiency of 39.8 cd A^{-1} with 237% higher than the standard PeLED. Moreover, the device stability is also improved with a nearly doubled half lifetime due to the reduced phase impurities. The work demonstrates a facile yet effective method for altering PEDOT: PSS hole transport layer, emphasizing the critical role of the underneath layer in the crystallization of quasi-2D perovskites.

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