

用于光发射和光检测的新型钙钛矿电化学电池

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卤化物钙钛矿发光器件在高效率、高色纯度和宽色域等方面具有优异的性能,但其工业集成通常受到器件多层结构的技术复杂性以及操作中引起的热不稳定性影响。卤化物钙钛矿发光电化学电池 (PeLECs) 是一种新型的钙钛矿光电器件,它与钙钛矿发光二极管的不同之处在于它具有简单的单层结构。

俄罗斯阿尔费罗夫大学 (Alferov) 和圣光机大学 (ITMO) 研究团队合作报道的钙钛矿发光电化学电池,由硅衬底、多功能单一复合钙钛矿层 (卤化物钙钛矿微晶、聚合物支撑基质和添加的可移动离子的混

合物)和透明单壁碳纳米管膜顶部接触组成。由于硅具有良好的导热性,与传统的氧化铟锡 (ITO)/玻璃基板相比,该器件在运行过程中承受的热量降低了 40%。此外,当对器件施加正偏压时,它在 523 nm (绿色)下的亮度超过 7000 cd/m²。当给该器件施加负偏压时,它可作为光电探测器工作,在波长为蓝光和紫外光的区域内,灵敏度高达 0.75 A/W,比探测率为 8.56×10¹¹ Jones,线性动态范围为 48 dB。这种设备的技术潜力已经通过 24 像素指示器显示屏得到了证明,并且通过创建最小特征小于 50 μm 的电致发光图像,成功实现了设备的小型化。

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Researchers report novel design' perovskite electrochemical cell for light-emission and light-detection

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Halide perovskite light-emitting electrochemical cells are a novel type of perovskite optoelectronic device that differs from the perovskite light-emitting diodes by a simple monolayered architecture.

The joint research group from Alferov University and ITMO University reported the perovskite light-emitting electrochemical cell that consists of a silicon substrate, multifunctional single composite perovskite layer (a mixture of halide perovskite microcrystals, polymer support matrix, and added mobile ions), and transparent single-walled carbon nanotube film top contact. Due to silicon's

good thermal conductivity, the device endures 40% lower thermal heating during operation compared to conventional ITO/glass substrate. Moreover, when a positive bias is applied to the device it yields a luminance of more than 7000 cd/m² at 523 nm (green color). When a negative bias is applied to the device it operates as a photodetector with a sensitivity up to 0.75 A/W (for wavelength in blue or UV regions), specific detectivity of 8.56·10¹¹ Jones, and linear dynamic range of 48 dB. The technological potential of such a device is proven by the demonstration of a 24-pixel indicator display as well as successful device miniaturization by the creation of electroluminescent images with the smallest features less than 50 μm.

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