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Synthesis of Highly Stable Near-Infrared $FAPbI_3$@TEOS Perovskite and its Applications in NIR Light-Emitting Diodes for Bioimaging

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Abstract : The continuously increasing external quantum efficiencies of Perovskite light-emitting diodes (LEDs) have received significant interest in the scientific community. The need for monitoring and medical diagnostics has experienced a steady growth in recent years, primarily caused by older people and an increasing number of heart attacks, tumors, and cancer disorders among patients. The application of Perovskite near-infrared light-emitting diode (PeNIRLEDs) has exhibited considerable efficacy in bioimaging, particularly in the visualization and examination of blood arteries, blood clots, and tumors. PeNIRLEDs exhibit exciting potential in the field of blood vessel imaging because of their advantageous attributes, including improved depth penetration and less scattering in comparison to visible light. In this study, we synthesized $FAPbI_3$ Perovskite doped with different concentrations of 5-Aminovaleric acid (5-AVA) 1-6 mg. The incorporation of 5-AVA as a dopant during the $FAPbI_3$ Perovskite formation influences the FAPbI3 Perovskite's structural and optical properties. While improving the FAPbI3 Perovskite's stability, photoluminescence efficiency, and charge transport characteristics. We found a resulting PL emission peak wavelength of 850 nm and bandwidth of 44 nm, along with a calculated quantum yield of 75%. The incorporation of 5-AVA-modified $FAPbI_3$ Perovskite into LEDs will show promising results, enhancing device efficiency, color purity, and stability. Making it suitable for various medical applications, including subcutaneous deep vein imaging, blood flow visualization, and tumor illumination.

Keywords : $FAPbI_3$ perovskite, near-infrared light-emitting diode, bioimaging, blood flow visualization, radiance, light-emitting diode (LED).
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