Enhancing LiFi and Lighting: CsPbBr3 Zero-Dimensional Perovskite and Quantum Dot Based Color Converters

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Light Fidelity (LiFi), a multi-functional tool that provides high-speed secure data transmission through lighting, is currently being developed to substitute WiFi. However, its dependency on phosphor-based LEDs and LDs with long excitation lifetime hinders its potential for commercial use. In this work, CsPbBr3 zero-dimensional (0-D) perovskites and quantum dots (QD) were introduced to reduce the excitation lifetime of the phosphor. If successful, it would result in an increase in the frequency of data transmission and would produce warm white light. Accordingly, synthesized 0-D and pre-made QDs were distributed at different ratios onto PolyDiMethylSiloxane (PDMS) bases, producing 12 testable strips to be used as color converters for a blue laser diode. The strips were then characterized for white light properties using the Color Rendering Index (CRI) and the Color Correlated Temperature (CCT). Afterwards, modulation frequency was examined through the frequency of data transmission and its stability. White light was produced at a CRI of 91.2 and a CCT of 2703K falling within the warm white light range. Frequencies were obtained between 10-12.6 MHz, measuring double the frequency of commercial phosphor (~ 5MHz), with varying rates of stability. It was concluded that the addition of the 0-D and QD has a positive effect on the white light and modulation frequency. The produced strips have the potential to be implemented in LDs to fortify commercial LiFi, which in turn may pave the way for overall high-performance computing and high-security data transmission for government and private facilities.

Awards Won:

Third Award of $1,000