

Potonic Crystals Enhanced Fluorescence for Sensing and Display Applications

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The effect of photonic crystal films and laser-carved photonic crystal films as Bragg reflection mirrors on the fluorescence of quantum dots was investigated. Quantum dots have vast application prospects in several fields, especially lead halide perovskite quantum dots, which have many advantages, such as good luminescence performance, low cost, and compatibility with industrial printing technology. Photonic crystals reveals Bragg reflection, which can reduce the loss of fluorescence caused by transmission, it is a good way to enhance the fluorescence efficiency of quantum dots. Firstly, the photonic crystals with different photonic bandgaps were fabricated by vertical deposition. Secondly, the reflection spectra of photonic crystal films were measured by optical fiber spectrometer, and the transmission spectra were obtained by UV-Vis spectrophotometer. Finally, the emission spectra of perovskite quantum dots were tested by a fluorescence spectrometer, and the effects of photonic crystal films on the fluorescence intensity of quantum dots were tested and analyzed with the quantum dots directly coated on the surface of glass substrate as a reference, in order to infer the general results. The results confirmed that the fluorescence of quantum dots is significantly enhanced by photonic crystal films, which might due to the effective reflection of fluorescence by photonic crystals. However, excessively thick photonic crystal films can cause fluorescence quenching, block the reflection of fluorescence, and weaken the fluorescence intensity. This study is anticipated to contribute to the development of novel photonic crystal-quantum dot sensors and high brightness display materials.

Keyword: photonic crystal, quantum dot, fluorescence