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LUMINESCENT POLYMER COATINGS: ENCAPSULATING PEROVSKITE QUANTUM DOTS ON GLASS SURFACE

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The increasing popularity of renewable sources has led to a heightened focus on the development and research of technologies aimed at enhancing the efficiency of energy conversion. Halide perovskite quantum dots (PQDs) have garnered significant scientific attention as promising luminescent materials with the potential to increase the efficiency of solar cells. This is attributed to their exceptional optical and electronic properties, including a high absorption coefficient and a tunable bandgap [1]. However, the broader application of these materials is limited due to their poor optical stability under exposure to environmental conditions like moisture, oxygen, light and heat [2]. Addressing this issue includes the approach to establish a physical barrier between the PQDs and their surroundings through embedding them within a polymer matrix [3].

In this study, all-inorganic metal halide $CsPbBr_3$ PQDs were synthesized via an ultrasound-induced hot-injection route and later immobilized in polymethylmetacrylate (PMMA) matrix on a glass surface using the spin-coating technique. The optimal conditions for the coating formation have been determined by evaluating the effect of rotation speed, number of layers and waiting time between layers. By employing post-synthesis ion exchange modification to adjust the bandgap of PQDs, coatings emitting diverse wavelengths across the visible spectrum were achieved. The structural properties of the synthesized PQDs have been investigated via X-ray diffraction analysis and the quality of formed PQDs-polymeric coatings was evaluated with electronic microscopy. The photoluminescence properties (absorption and emission spectra, quantum yield and temperature dependence of emission intensity) have been also evaluated.

Fig. 1. Color gamut of obtained multicolor PQDs in toluene (top) and immobilized in polymer matrix (bottom) under UV excitation (λ_{ex} 365 nm).

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