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Light Management in Perovskite Solar Cell by Incorporation of Carbon Quantum Dots

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Perovskite solar cells (PSCs) with a standard sandwich structure suffer from optical transmission losses due to the substrate and its active layers. Developing strategies for compensating for the losses in light harvesting is of significant importance to achieving a further enhancement in device efficiencies. In this work, the down-conversion effect of carbon quantum dots (CQDs) was employed to convert the UV fraction of the incident light into visible light. For this, thin films of poly(methyl methacrylate) with embedded carbon quantum dots (CQD@PMMA) were deposited on the illumination side of PSCs. Analysis of the device performances before and after application of CQD@PMMA photoactive functional film on PSCs revealed that the devices with the coating showed an improved photocurrent and fill factor, resulting in higher device efficiency. Meanwhile, other effective incorporation approaches of CQD in PSCs will be demonstrated. The underlying mechanism for the enhancement in device performance will be investiaged. The obtained results will provide an valuable insignt into the community for future light management during PSC fabrication.

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