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Photoluminescence and Photoconductivity of Lead Halide Perovskite Films Modified with Mixed Cellulose Esters[1]

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We have investigated the photoluminescence (PL) and photoconductivity of lead halide perovskite ($CH_3NH_3PbBr_3$) films modified with different mixed cellulose esters (CEs). It was shown that the absorbance and PL spectra of $CH_3NH_3PbBr_3$: CE films contain contributions of both the $CH_3NH_3PbBr_3$ and CE with the dominant contribution to the PL from perovskite component. The dependences of the integral PL intensities of the $CH_3NH_3PbBr_3$: CE films on the optical excitation power turned out to be sublinear. This indicates that exciton recombination, as well as recombination via impurity levels, occur in $CH_3NH_3PbBr_3$: CE films at high excitation power levels. The conductivity of $CH_3NH_3PbBr_3$: CE films at 300 K increases up to ~ 90 times when illuminated by a solar simulator, and this effect is environmentally stable due to the formation of hydrogen bonds between CE and the lead halide perovskite $CH_3NH_3PbBr_3$. It is expected that appropriate selection of CE and optimization of CE inclusion will improve the optoelectronic properties and stability of composite films based on lead halide perovskite-CE composites.

Keywords: mixed cellulose esters, lead halide perovskites, photoluminescence, conductivity.

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