Enhancement of Photoluminescence Quantum Yield of Lead Halide Perovskite using Passivation Layer of Lead Sulfate

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Lead halide perovskite (LHP) has drawn attention in the optoelectronic field because of its bandgap tunability, strong luminescence and a narrow emission wavelength width. However, the application of LHP is still limited because of poor stability, especially in the presence of water. In this work, we report a simple strategy of passivating perovskite with lead sulfate layer by introducing sulfuric acid solution. The synthesized lead halide perovskite, $MAPbBr_3$, reacted with sulfate ion and the perovskite surfaces were passivated with lead sulfate. The bright green-emitting perovskite maintained its luminescence in the liquid water for weeks because water-insoluble lead sulfate strongly bound to the perovskite surfaces by chemical bonds. The passivated LHPs were characterized using scanning electron microscopy (SEM), X-ray diffractometer (XRD) and photoluminescence (PL) spectroscopy. The photoluminescence quantum yield of passivated LHPs was remarkably increased from 2.6% to 80% with narrow full width at half maximum of about 20 nm.