Electronic supplementary information for

**Photo-induced Dual Passivation via Usanovich Acid-Base on Surface Defects of Methylammonium Lead Triiodide Perovskite**

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1. **Original PL decay data of materials before and after p-BQ treatment**

![Graph showing PL decay data](image)

**Figure S1.** Original PL decay data of MAPbI$_3$ in N$_2$ before and after p-BQ treatment.

PL lifetime in N$_2$ of p-BQ treated MAPbI$_3$ (~4 ns) was on average one order of magnitude shorter than that of pristine crystals (~40 ns).

2. **PL spectra of MAPbI$_3$ films in different atmospheres**

![Graph showing PL spectra](image)

**Figure S2.** Spectra of p-BQ treated MAPbI$_3$ in N$_2$, O$_2$, acetone and acetonitrile atmospheres and spectra of pristine MAPbI$_3$ in N$_2$ and O$_2$ atmospheres. No significant spectral change was observed.
3. Passivation effect of acetonitrile

Figure S3. Acetonitrile (denoted AN) showed PL enhancement and passivation effect on p-BQ treated MAPbI$_3$ similar to O$_2$ and acetone.

4. Comparison of PL intensity between illuminated and unilluminated area for acetone passivation

Figure S4. PL intensity comparison between illuminated and unilluminated area after acetone passivation.
5. No passivation effect from petroleum ether

![Graph showing PL intensity over time with atmosphere switched between N\textsubscript{2} and petroleum ether. No PL enhancement was observed.]

**Figure S5.** PL intensity of p-BQ treated MAPbI\textsubscript{3} film with atmosphere switched between N\textsubscript{2} and petroleum ether (denoted PE). No PL enhancement was observed.

6. Degradation of p-BQ treated MAPbI\textsubscript{3} observed under bright field.

![Images showing before and after degradation caused by acetone and O\textsubscript{2} under irradiation.]

**Figure S6.** Image taken under bright field (a) before and (b) after degradation caused by acetone and O\textsubscript{2} under irradiation.

7. Degradation of MAPbI\textsubscript{3} caused by acetonitrile and O\textsubscript{2}
Figure S7. PL intensity of p-BQ treated MAPbI$_3$ film with the atmosphere switched between N$_2$, O$_2$ and acetonitrile-O$_2$ hybrid atmosphere (denoted AN-O$_2$). Significant degradation of MAPbI$_3$ was observed in acetonitrile-O$_2$ hybrid atmosphere.

8. No degradation was observed in petroleum ether and O$_2$ hybrid atmosphere

Figure S8. PL intensity of p-BQ treated MAPbI$_3$ film with atmosphere switched between N$_2$, O$_2$ and petroleum ether-O$_2$ hybrid atmosphere (denoted as PE-O$_2$). No degradation of MAPbI$_3$ was observed in petroleum ether-O$_2$ hybrid atmosphere.