

Electronic Supplementary Information

for

The role of atmospheric conditions in the nonradiative recombination in individual $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite crystals

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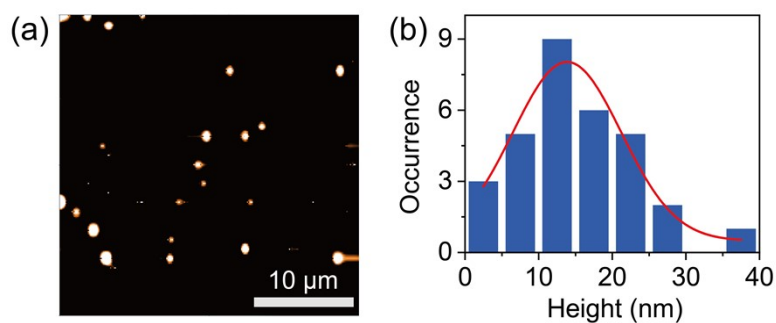


Fig. S1 (a) AFM image of randomly distributed individual MAPbI₃ crystals. (b) Histogram of the height extracted from AFM image.

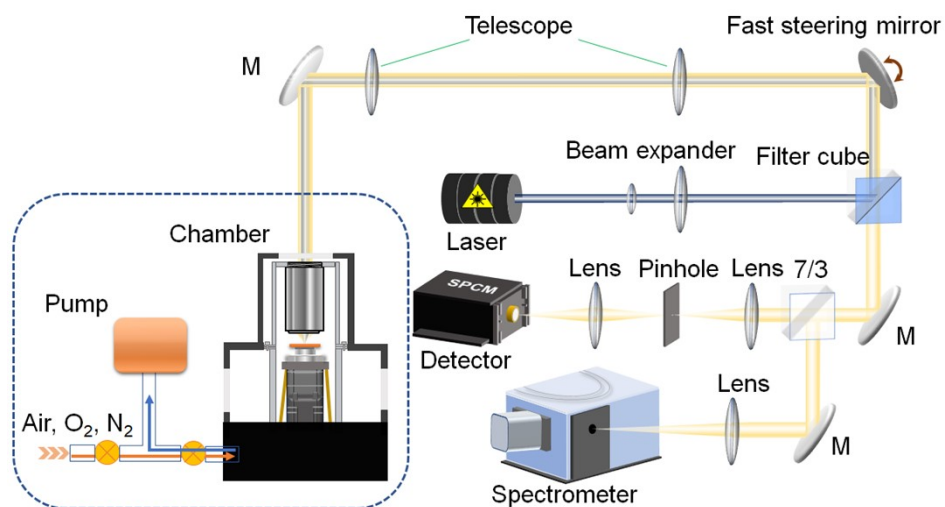


Fig. S2 Schematic view of the experimental setup. A pulsed laser of 485 nm with a repetition rate of 2.5 MHz was used for excitation. The laser passed through an excitation filter, a dichroic mirror and focused by an objective lens onto the sample mounted inside a chamber. The excitation spot was controlled through a fast steering mirror and a telescope. The PL from the sample was collected by the same objective and detected by a single photon detector. The PL lifetime of an individual crystal was got through a time-correlated single-photon counting module. The spectrum of the perovskite crystals was achieved on a spectrometer by separating 70% of the PL.

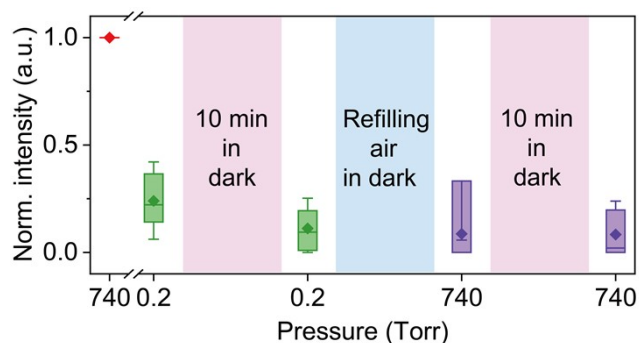


Fig. S3 Statistics of the PL response of individual MAPbI₃ crystals upon exposure to ambient air, vacuum, and refilled ambient air. The evolution of the PL was measured after keeping the crystals in dark for 10 min at 0.2 Torr (vacuum) and 740 Torr (refilled air), respectively.

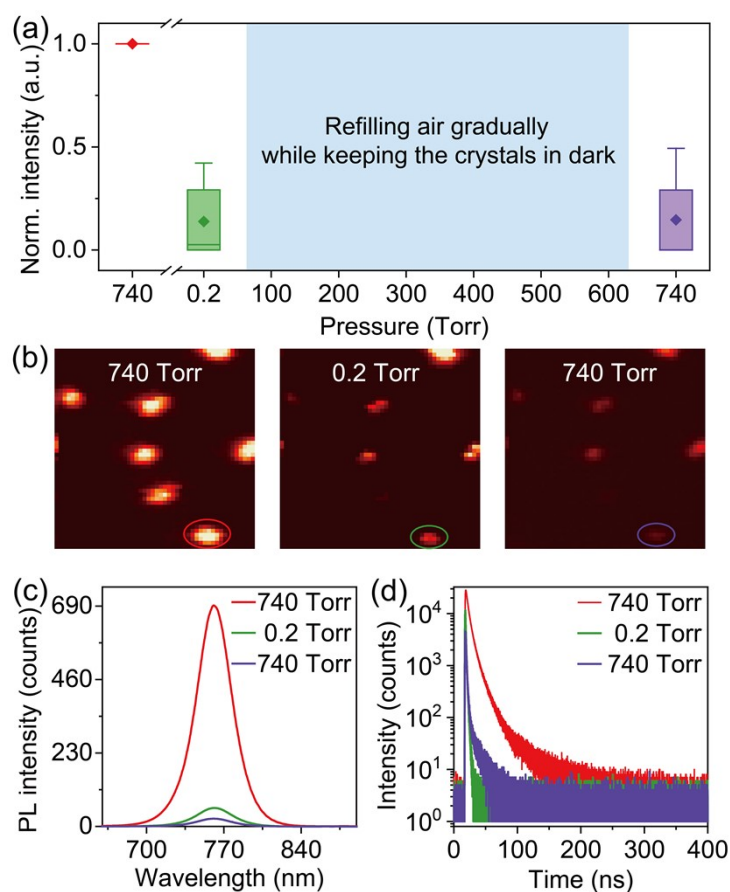


Fig. S4 (a) PL response of individual MAPbI₃ crystals upon exposure to air, vacuum and refilled air. The evolution of the PL of individual perovskite crystals upon vacuum-air exchange was investigated by increasing the pressure stepwise from 0.2 Torr to 740 Torr in dark and measuring the PL when the atmospheric pressure is reached. (b) Typical PL imaging of individual crystal in different conditions. (c) Corresponding PL spectra of the same crystal as shown in (b). (d) PL decay dynamics of the crystal.

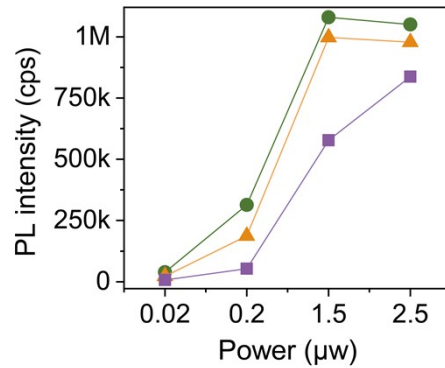


Fig. S5 Excitation power dependence of the PL intensity from individual MAPbI₃ crystals.

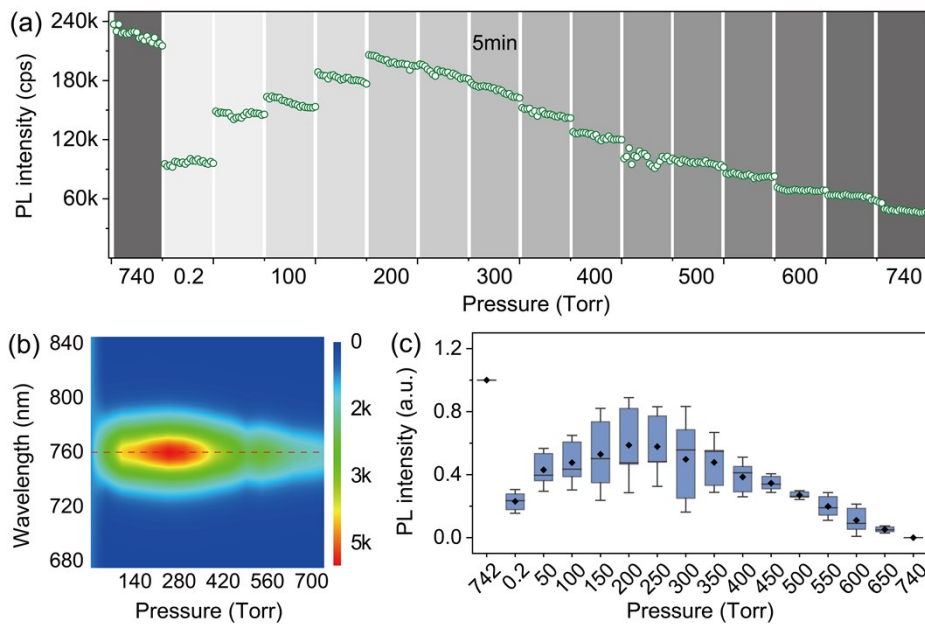


Fig. S6 (a) Evolution of the PL intensity of an individual MAPbI₃ crystal upon air-vacuum-air exchange, where the PL is measured for 5 min for each air pressure. (b) Evolution of the PL spectrum of the same MAPbI₃ crystal as (a) during air refilling. (c) Averaged PL of an ensemble of individual MAPbI₃ crystals as a function of air pressure.