

Supporting Information

Surface-assisted synthesis of perovskite nanosheets with bivalent aromatic cation

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The preparation of reference sample.

The single crystals used as references for GIWAXS and SAED measurements were prepared according to previously published procedure.¹

Briefly, a 57% w/w aqueous HI solution was diluted to 47% w/w. A 0.3 M solution of PbI₂ in freshly prepared HI (47%) was kept at 120 °C. At the same time, a 0.03 M solution of 1,5-naphthalenammonium iodide was prepared with stirring at 130 °C. Then 224 mL of amine precursor solution was rapidly added to the 448 μL of PbI₂ solution. Single crystals were obtained by slowly cooling the mixture to room temperature. The crystals were isolated, gently washed with Et₂O, and dried under reduced pressure.

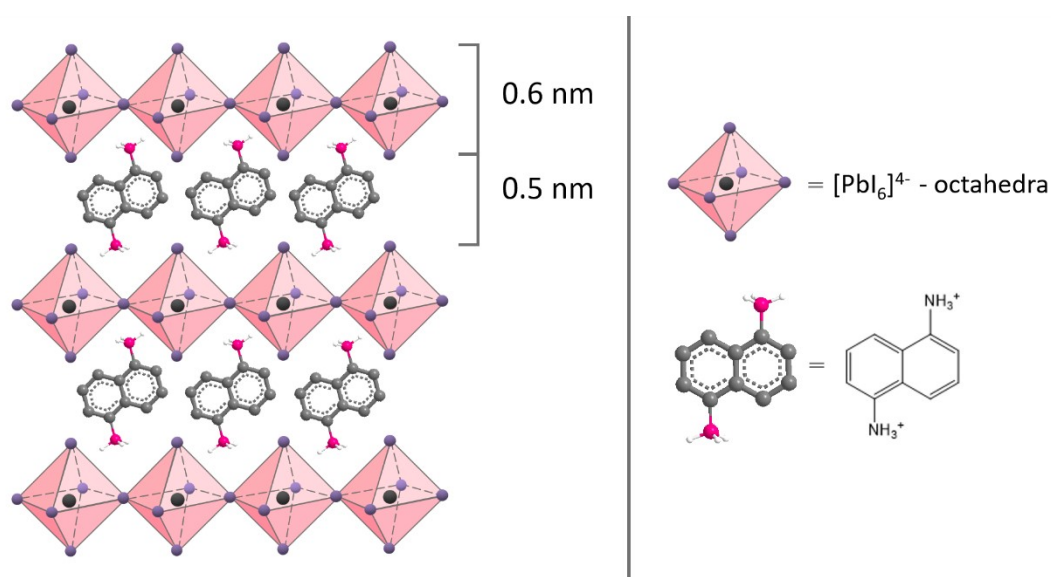


Figure S1. The schematic layered structure of (1,5-DAN)PbI₄ perovskite.

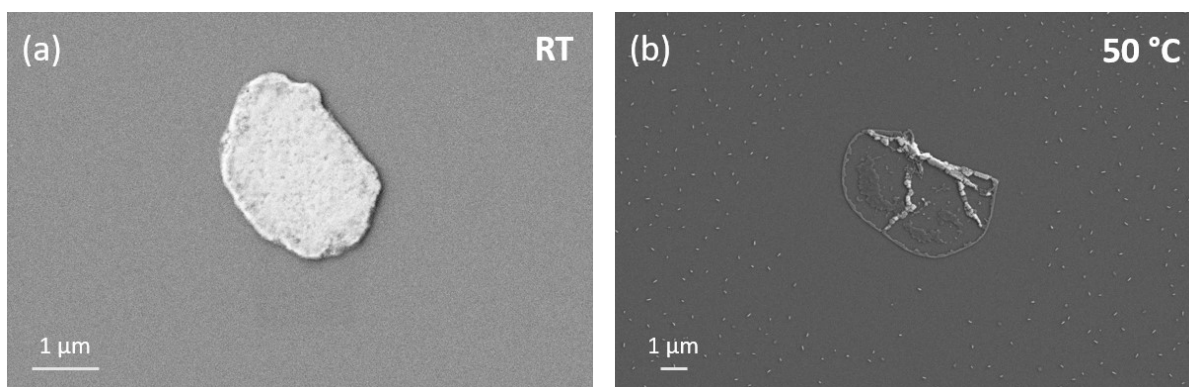


Figure S2. SEM images of perovskite nanosheets on Si wafer grown at room temperature (a) and at 50 °C (b) (Note: Fig. S1 is identical to Fig. 2d).

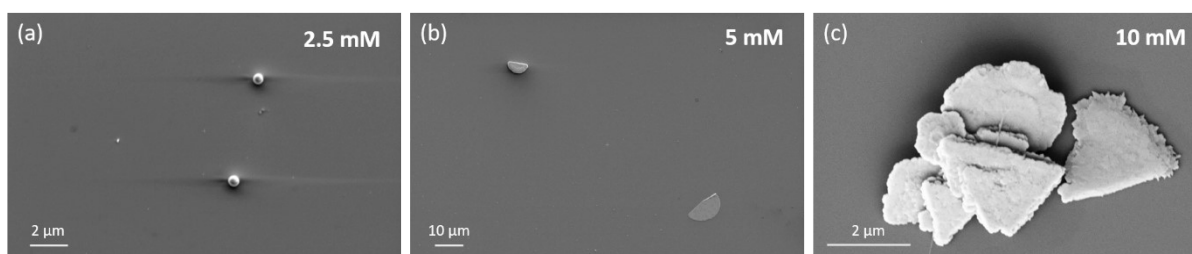


Figure S3. SEM images of perovskite nanosheets on Si wafer grown at room temperature from solutions of different precursor concentrations (a) 2.5 mM, (b) 5 mM, and (c) 10 mM.

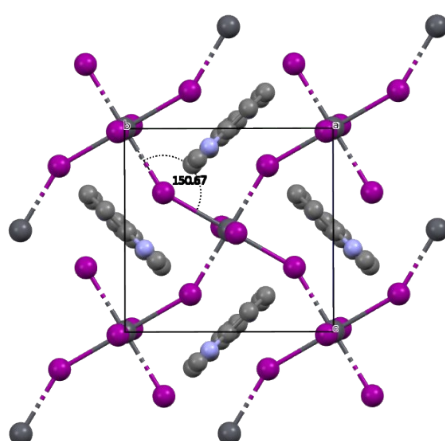


Figure S4. Single crystal X-ray structure of bulk (1,5-DAN)PbI₄ (view along a axis). The Pb-I-Pb bond angle is 150.67°, which indicates a strong distortion. For clarity, all hydrogen atoms were removed. Violet balls, iodine atoms; dark gray balls, lead atoms; light grey balls, carbon atoms; blue balls, nitrogen atoms.

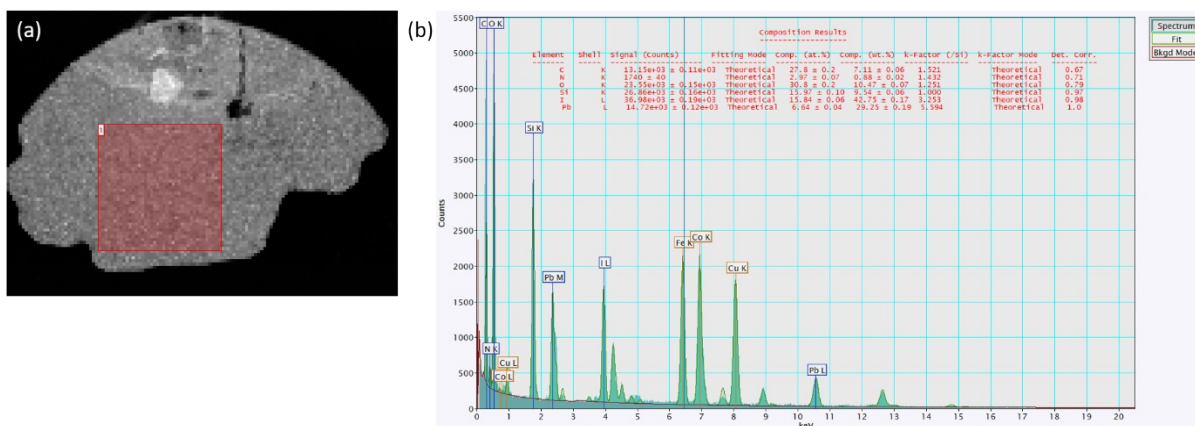


Figure S5. (a) STEM image of a perovskite particle grown directly on a TEM grid. (b) EDX spectrum of the area marked with red square in (a).

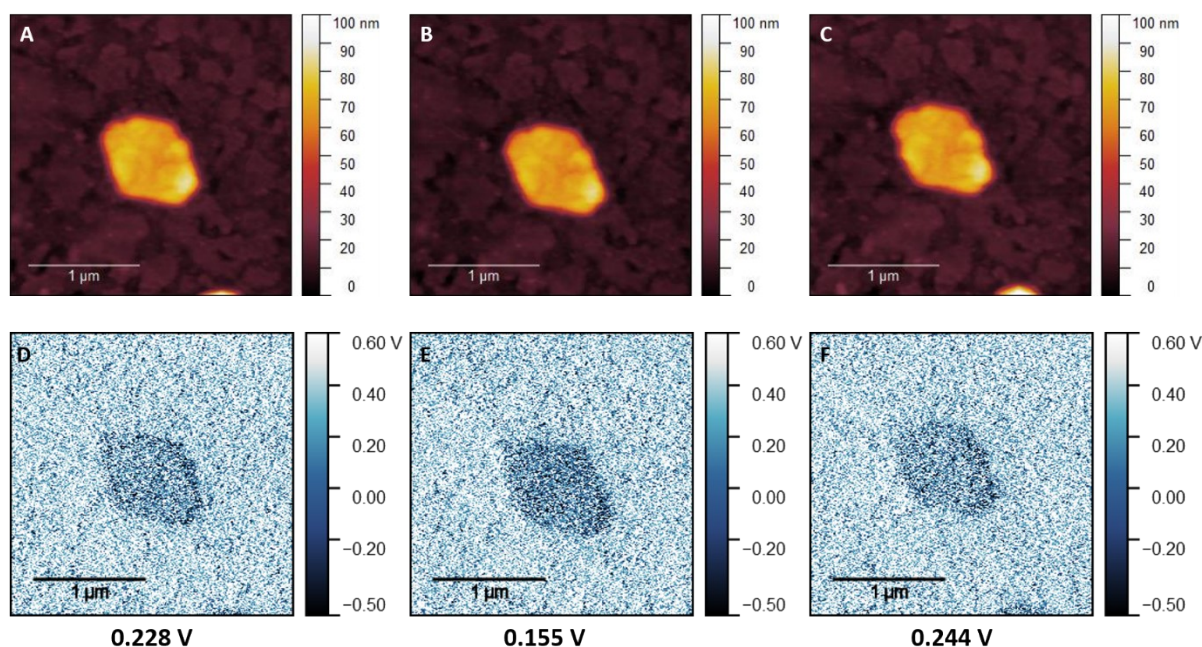


Figure S6. (A)-(C) represent the topography images recorded with the KPFM images of the particle prior to the illumination (A), during 405 nm illumination (B), and after the illumination (C). D-F represent the corresponding KPFM images: prior to the illumination (D), during 405 nm illumination (E), and after the illumination (F).

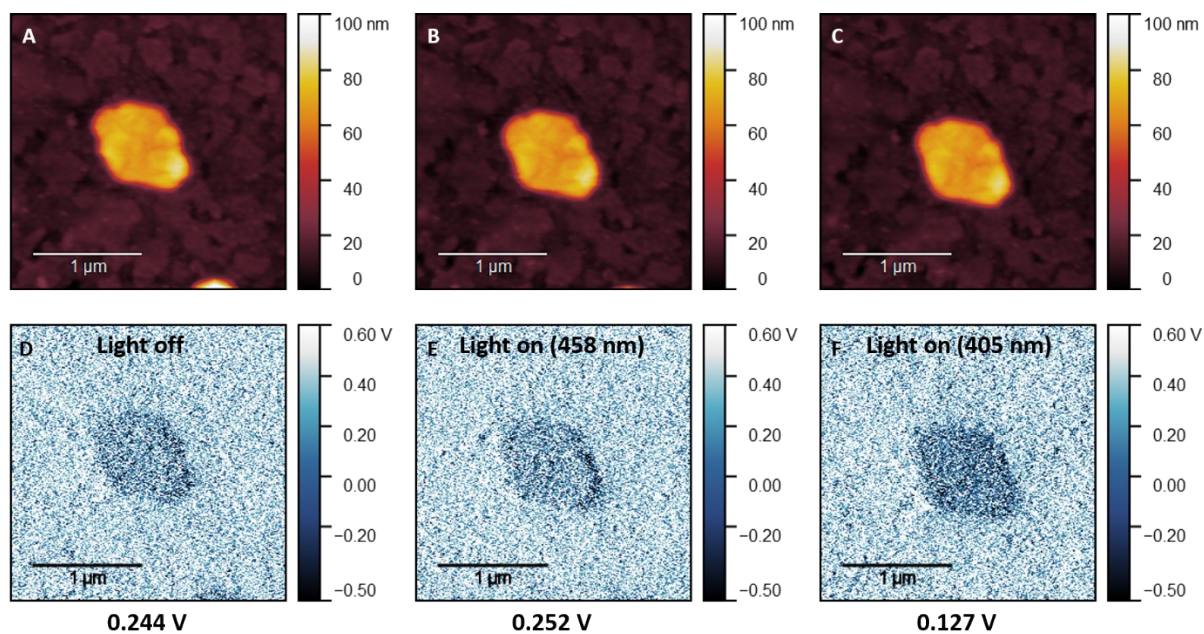


Figure S7. (A)-(C) represent the topography image recorded with the KPFM images prior to the illumination (A), during 458 nm illumination (B), and during 405 nm illumination (C). (D)-(F) represent the KPFM images prior to the illumination (D), during 458 nm illumination (E), and during 405 nm illumination (F).

References

- (1) A. Mitrofanov, Y. Berencén, E. Sadrollahi, R. Boldt, D. Bodesheim, H. Weiske, F. Paulus, J. Geck, G. Cuniberti, A. Kuc and B. Voit, *J. Mater. Chem. C*, 2023, **11**, 5024–5031.