

Supporting Information for
Centimeter-scale 2D perovskite (PEA)₂PbBr₄ single crystal plate
grown by seeded solution method for photodetector

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Fig. S1 Fitted XRD curves.

Fig. S2 Single crystal growing rate in a typical growing process.

Table S1 Crystallographic data.

Table S2 Comparisons of photodetector performance.

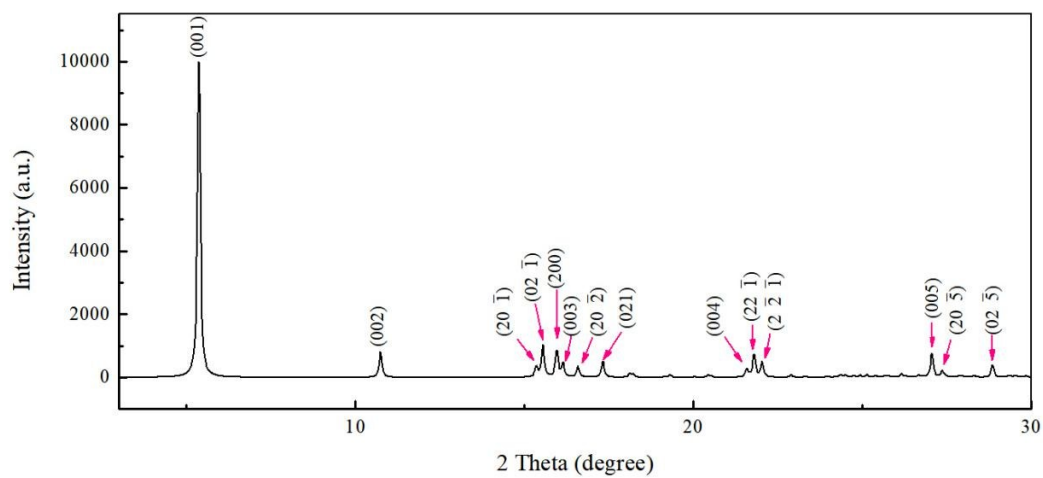


Fig. S1 XRD curve fitted from the unit cell data.

The XRD curves in Fig. S1 are fitted based on the unit cell structural data.

Beside the assigned main (00*l*) peaks, the other peaks at 15.36°, 15.54°, 15.96°, 16.58°, 17.32°, 21.80°, 22.02°, 27.36° and 28.84° are assigned to the (20 $\bar{1}$), (02 $\bar{1}$), (200), (20 $\bar{2}$), (021), (22 $\bar{1}$), (2, $\bar{2}$, $\bar{1}$), (20 $\bar{5}$) and (02 $\bar{5}$) lattice planes, respectively.

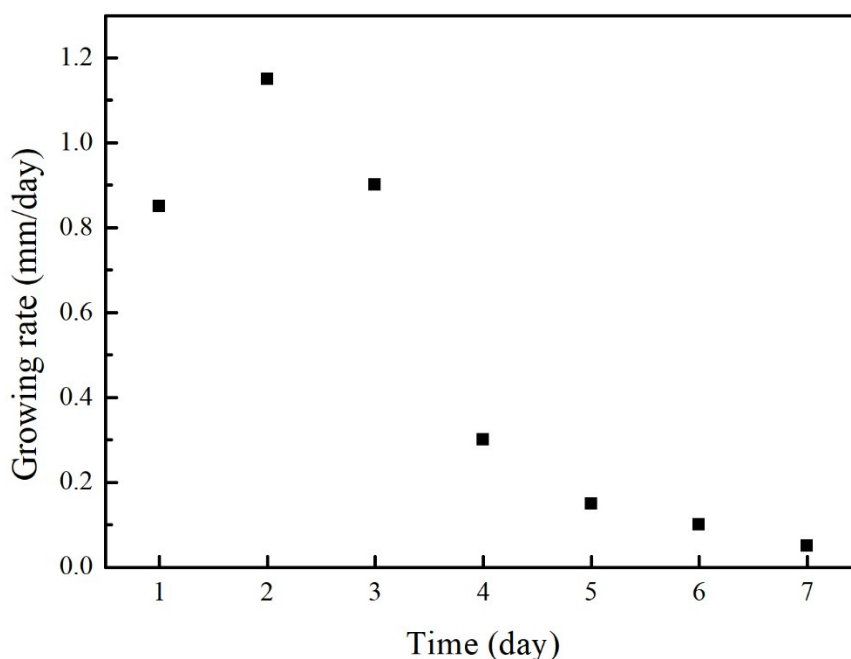


Fig. S2 The single crystal growing rates in a typical 7-days growing process.

The growing rates of the crystal in a typical growing process (not the actual experiment process) are provided in Fig. S2.

The growth conditions are as follows: The longest diagonal length of the seed crystal is about 3.50 mm at first, and the seed crystal is put in a 1 ml sealed vial with 500 μ L saturated precursors solution in it. The vial is kept in room temperature atmosphere without disturbing, and no additional precursors solution was injected to the reaction vial in the 7 days.

As shown in Fig. S2, the growing rates reaches a maximum in one day. The growing rate in the second day is the fastest because the seed crystal has a larger size after a day's growth, and the solution concentration doesn't drop largely. After that, the growing rate declines very much due to the low precursors concentration. In an improved growing process, the saturated precursors solution should be constantly added for keeping the growing rate at a stable and high level.

Table S1 Crystallographic data for single crystal plates with two shapes.

Shape	Quasi-rectangle	Hexagon
Crystal system	Triclinic	Triclinic
Space group	$P\bar{1}$	$P\bar{1}$
Cell length_a(Å)	11.5583(6)	11.55078(18)
Cell length_b(Å)	11.5673(6)	11.56663(16)
Cell length_c(Å)	17.3832(10)	17.3835(5)
Cell angle_α(°)	99.581(5)	80.4311(18)
Cell angle_β(°)	105.900(5)	74.165(2)
Cell angle_γ(°)	90.006(4)	89.9946(12)
Cell Volume(Å ³)	2201.5(2)	2200.77(8)
Cell formula units Z	2	2

We determined the single crystal plates with two shapes by using the Single Crystal XRD crystallographic analysis, as listed in Table S1. Their unit cell parameters are same in the range of the experimental errors. The results can safely conclude that they have an identical crystal structure.

Table S2 Comparisons of the photodetector characteristic parameters made by (PEA)₂PbBr₄ single crystal and other perovskite.

	Perovskite	λ (nm)	Dark current	Responsivity	Reference
2D	(PEA) ₂ PbBr ₄ SC	405	5.56×10^{-13} A	0.4 mA/W	Present work
	(PEA) ₂ PbBr ₄ SC	365	2.2×10^{-13} A	31.48 mA/W	1
	(C ₄ H ₉ NH ₃) ₂ (CH ₃ NH ₃) ₂ Pb ₃ I ₁₀ thin film	White	1×10^{-12} A	12.78 mA/W	2
	PEA ₂ PbI ₄ · (MAPbI ₃) _{n-1} SC	White	$\sim 10^{-13}$ A	150 mA/W	3
3D	MAPbBr ₃ SC	525	1×10^{-9} A	16 A/W	4
	MAPbI ₃ SC	515	1×10^{-6} A	~ 2.5 A/W	5
	FAPbI ₃ SC	635	—	~ 4.5 A/W	6

References

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