Supporting Information

Role of Alkyl Chain Length in Diaminoalkane Linked 2D Ruddlesden-Popper Halide Perovskites

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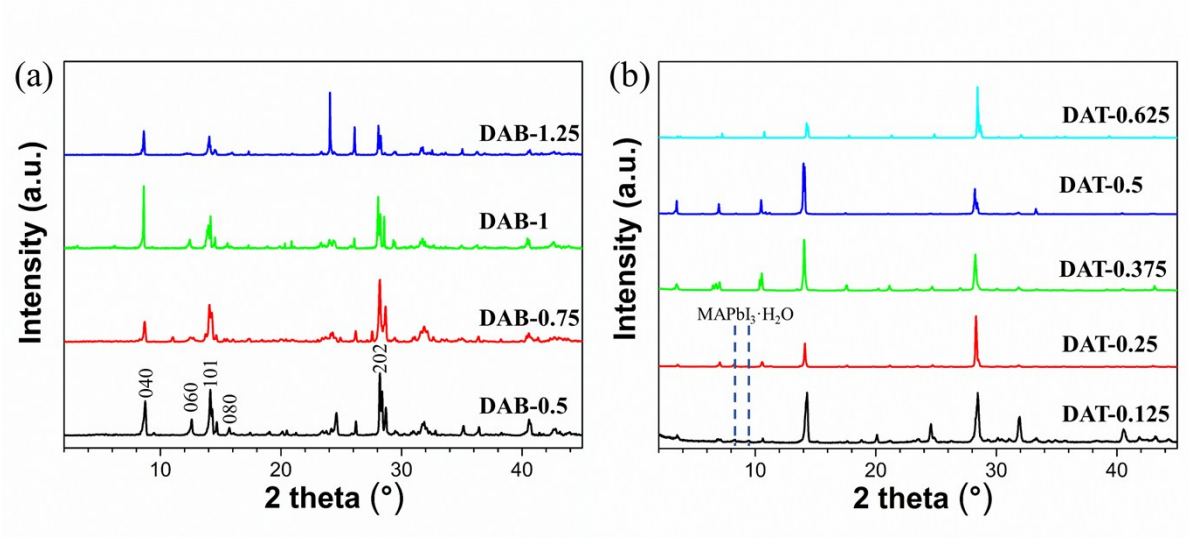

Figure S1. XRD patterns of (a) **DAB** samples synthesized with DAB added by 0.5, 0.75, 1, 1.25 times of the stoichiometric amount of $DAB(MA)_2Pb_3I_{10}$ and (b) **DAT** samples synthesized with DAT added by 0.125, 0.25, 0.375, 0.5 and 0.625 times of the stoichiometric amount of $DAT(MA)_2Pb_3I_{10}$.

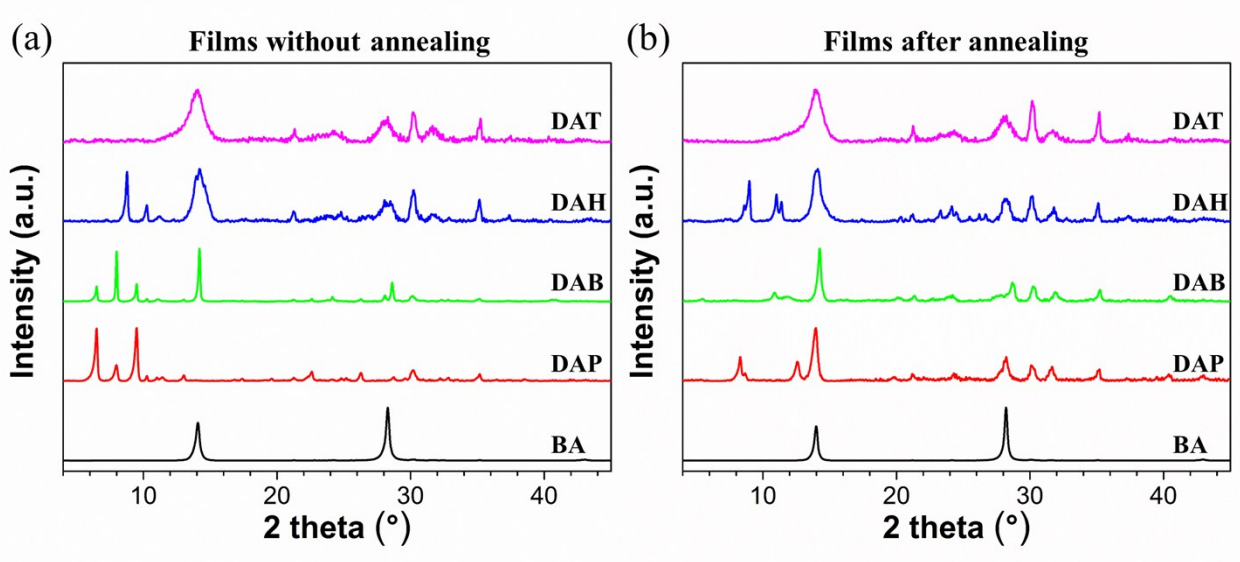

Figure S2. XRD patterns of **BA** and **DAX** films (a) without annealing and (b) after annealing.

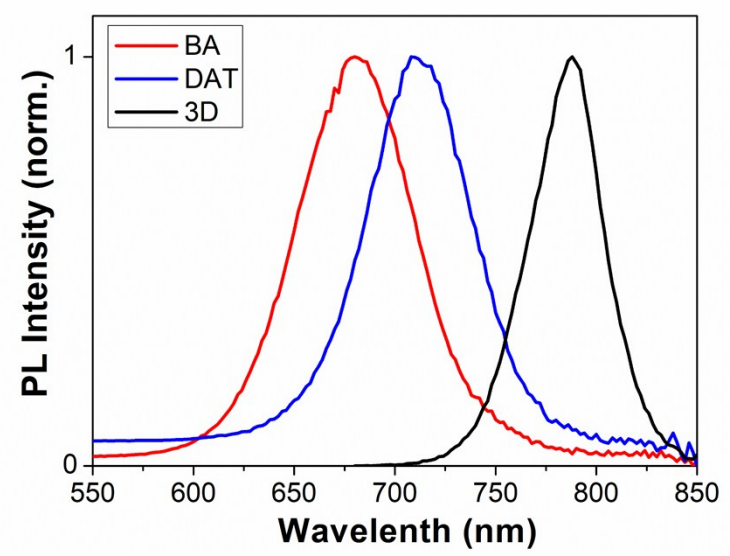

Figure S3. PL spectra of 3D, **DAT**, and **BA** films.

Table S1. Crystal data and calculated interplanar spacing for orthorhombic $MAPbI_3$ and $(BA)_2(MA)_{n-1}Pb_nI_{3n+1}$ ("×" means which crystal plane was not mentioned or detected in the ref.)

Empirical formula	n=∞	n=1	n=2	n=3	n=4	n=5
(020), Å	×	13.78	19.68	25.98	32.19	38.50
(040), Å	×	6.89	9.84	12.99	16.10	19.25
(060), Å	×	4.60	6.56	8.66	10.73	12.84
(080), Å	×	3.45	4.92	6.50	8.05	9.63
(0100), Å	×	×	×	5.20	6.44	7.70
(101), Å	×	×	6.25	6.25	6.25	6.26
(202), Å	×	×	3.17	3.17	3.17	3.17
(222), Å	×	×	3.13	×	×	×
(110), Å	6.26	×	×	×	×	×
(220), Å	3.18	×	×	×	×	×

a, Å	8.84	8.86	8.95	8.93	8.93	8.91
b, Å	8.55	27.57	39.35	51.96	64.38	77.01
c, Å	12.58	8.68	8.86	8.88	8.88	8.93
$\alpha = \beta = \gamma$, deg	90°	90°	90°	90°	90°	90°
ref	1	2	3	3	3	4

Table S2. Summarized XRD peak information for as-made 2D **DAX (**the peak in **red** color could be aligned to the (0k0) 2D perovskite characteristic peak, and the peak in **purple** color could be aligned to the typical perovskite characteristic peaks of (101), (222) and (202))

DAT

2 Theta, °	d, Å	Intensity, %
3.481	**25.3627**	24.7
6.981	**12.6526**	19.5
10.482	**8.4325**	28.3
14.001	**6.3203**	100
14.092	**6.28**	85
17.482	**5.0687**	2.6
28.221	**3.1596**	46.5
28.42	**3.1379**	21.5

DAH

2 Theta, °	d, Å	Intensity, %
7.879	**11.2119**	94
9.202	9.6021	100
11.999	**7.3697**	40.4
13.999	**6.3211**	29.9
14.3	6.1886	22.2
14.94	5.925	76.8
15.677	**5.6479**	19.9
28.12	**3.1707**	21

DAB

2 Theta, °	d, Å	Intensity, %
8.74	**10.1095**	55.3
12.598	**7.0206**	25.5
14.14	**6.2582**	73.8
14.678	6.0299	21.2
15.72	**5.6328**	11.7
24.599	3.6159	35
26.219	3.3962	22.4
28.2	**3.1619**	100

DAP

2 Theta, °	d, Å	Intensity, %
8.199	10.7751	17.2
8.961	**9.8605**	**26.5**

12.76	**6.9320**	**9.8**
14.22	**6.2231**	38
24.663	3.6067	100
25.2	3.5311	31.3
28.382	3.1421	32
28.621	**3.1163**	43.9

Reference:

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3. C. C. Stoumpos, D. H. Cao, D. J. Clark, J. Young, J. M. Rondinelli, J. I. Jang, J. T. Hupp and M. G. Kanatzidis, *Chem. Mater.*, 2016, **28**, 2852-2867.
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