Supporting Information

Ambient Pressure Aerosol-Assisted Chemical Vapour Deposition of $(CH_3NH_3)PbBr_3$, an Inorganic-Organic Perovskite Important in Photovoltaics

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S1. General

Solvents were purchased from Fisher and used without further purification. $PbBr_2$, methylamine and hydrobromic acid was purchased from Sigma-Aldrich. Reactions were performed under nitrogen.

S2. Instrumentation

Microanalysis was performed using a Thermo Scientific Flash 2000 Organic Elemental Analyser by the University of Manchester analytical service. p-XRD patterns of thin films deposited on glass substrate were measured using a Bruker AXS D8 Discover diffractometer, using copper K_α radiation ($\lambda = 1.54178$ Å). Films were scanned over the range $2\theta = 10 - 60^\circ$ using a step size of 0.02° with a dwell time of 0.5 s.

SEM analysis was performed using a Philips XL-30 scanning electron microscope in secondary electron mode. EDX was carried out using a DX4 instrument. EDX analysis and Q-mapping were performed Espirit software.

S3. Synthesis – CH_3NH_3Br

Hydrobromic acid (62%, 26 mL) was added dropwise to a stirred solution of methylamine (38 mL) at 0 – 5 ºC followed by stirring for 2h. The solution was then stripped to dryness at 60 ºC *in vacuo*, leading to white microcrystalline CH_3NH_3Br solid in quantitative yield. Anal. Calc. for CH_3NH_3Br (%) C 10.7 H 5.4 N 12.5. Found (%) C 10.3 H 5.6 N12.4.

S4. Precursor solution

$PbBr_2$ (1.53 g, 4.2 mmol, 1.0 eq.) was added to CH_3NH_3Br (0.46 g, 4.2 mmol, 1.0 eq.) in *N,N*-dimethyl formamide (25 mL) and the solution heated at 60 ºC for 2 h. The solution was cooled to room temperature and stirred for a further hour.

S5. Aerosol-assisted chemical vapour deposition of $(CH_3NH_3)PbBr_3$

An aliquot (1.3 mL) of the precursor solution above was diluted with acetonitrile (11.7 mL). Slight precipitation was noted and solids were removed by decantation. The resulting solution was then used for AACVD. The apparatus used for AACVD in this laboratory has been previously described by Ramasamy *et al.* (Ramasamy, *Chem. Mater.* **2013**, *25*, 266-276). The flow rate of the argon carrier gas was 200 sscm and the oven temperature was set to 250 ºC. Glass substrates of ca. 1 cm × 3 cm were used for the deposition. The AACVD run lasted 1 h 30 min upon which time the samples coated with yellow-orange films of $(CH_3NH_3)PbBr_3$ were cooled to room temperature and removed from the furnace tube for further analysis.