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Supplementary Materials

Effect of Low-Concentration Rb^+ Mixing on Semiconductor Majority Charge Carriers Type of Perovskite Light-Absorption Layer by Using Two-Step Spin-Coating Method

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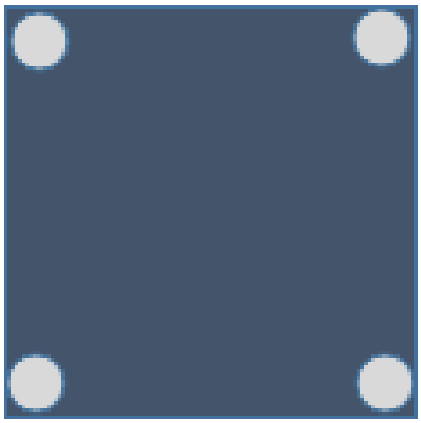

Figure S1. The diagram of sample with the electrode.

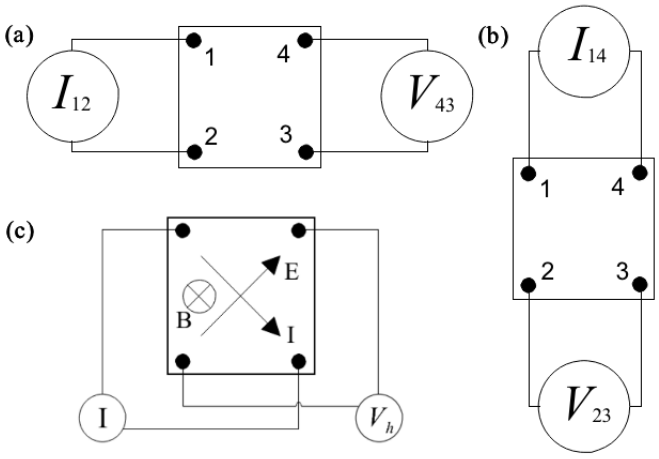

Figure S2. The schematic diagram of basic test circuit of hall. (**a**) contact position: 1,2 and 3,4; (**b**) contact position: 1,4 and 2,3; (**c**) balancing magnetic and electrostatic forces on a mobile charge.

$$\rho = \frac{\pi t}{2\ln 2} \cdot \left[\frac{V_{43}}{I_{12}} + \frac{V_{23}}{I_{14}} \right] \cdot F(Q) \tag{1}$$

$$\rho_s = \frac{\rho}{t} \tag{2}$$

$$\mathrm{Q} = \frac{V_{43} \cdot I_{14}}{I_{12} \cdot V_{23}} \tag{3}$$

$$R_H = \frac{1}{\mathrm{q}N} = \frac{V_h t}{IB} \tag{4}$$

$$N_s = \frac{1}{qR_{Hs}} \tag{5}$$

$$R_{Hs} = \frac{R_H}{t} = \frac{V_h}{IB} \tag{6}$$

t = thickness

F = Correction for Sample Geometry and is a function of Q, the Symmetry Factor

E = electric field

B = magnetic field

V = carrier velocity

I = current

W = the separation between the two contac

q = elementary charge of an electron or hole

Vh = measured Hall voltage (Vh = E.W)

RH = Hall coefficient

The mobility can be obtained from the above formula.

$$\mu_H = \frac{R_{Hs}}{\rho_s} \tag{7}$$

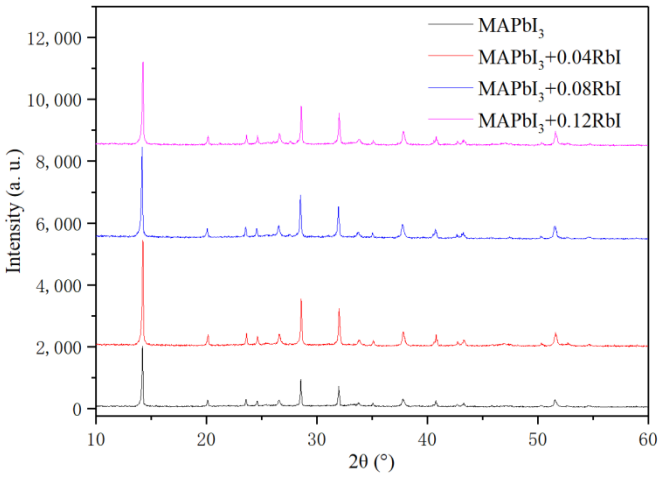

Figure S3. XRD patterns of perovskite films with different Rb^+ concentrations.

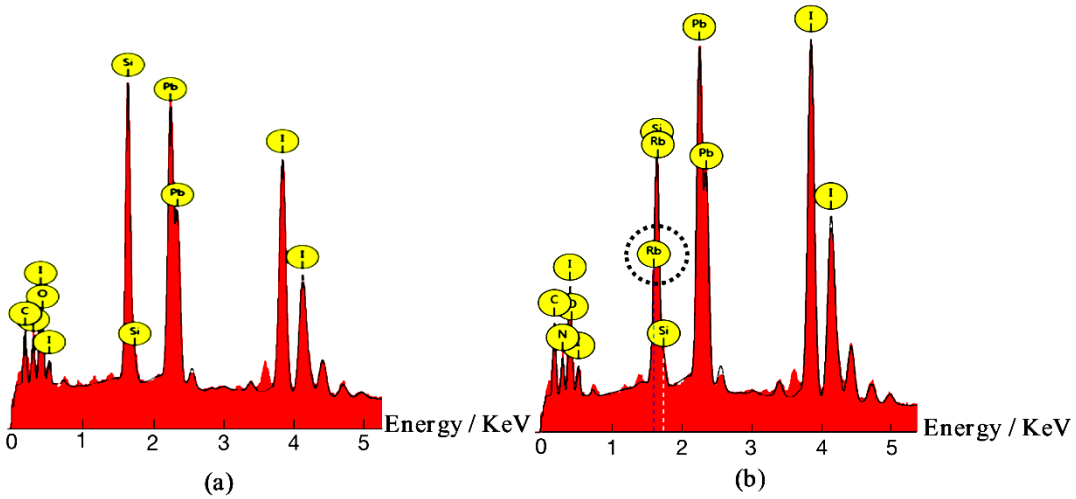

Figure S4. EDS of perovskite films with different Rb^+ concentrations. (**a**) $MAPbI_3$ (Un-mixed); (**b**) $MAPbI_3$ (Rb-mixed).