Short Communication

Preparation of High-Crystallinity and Large-Grain Br-doped Methylammonium Lead Iodide Thin Films at the Temperature Range of 100~140 °C

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Br-doped methylammonium lead iodide ($\text{CH}_3\text{NH}_3\text{PbI}_{3-x}\text{Br}_x$) thin films with high crystallinity and large grain sizes were successfully obtained by converting a PbI_2 -N-methyl-2-pyrrolidone (NMP) complex thin film using a conversion temperature and conversion time of 140 °C and 10 min, respectively. The influence of the conversion temperature on the crystal phase, morphology, optical absorption and chemical composition of the $\text{CH}_3\text{NH}_3\text{PbI}_{3-x}\text{Br}_x$ thin films was systematically investigated, and the photovoltaic performance of the corresponding planar perovskite solar cells was evaluated. The crystallinity of the $\text{CH}_3\text{NH}_3\text{PbI}_{3-x}\text{Br}_x$ thin films was enhanced, and their grain size gradually increased, with an increase in the conversion temperature from 100 °C to 120 °C to 140 °C. The planar perovskite solar cells based on films converted at 140 °C showed the best photoelectric conversion efficiency (PCE) of 13.56 %, with an open-circuit voltage (V_{oc}) of 1.01 V, a short-circuit photocurrent density (J_{sc}) of $18.90 \text{ mA}\cdot\text{cm}^{-2}$, a fill factor (FF) of 0.71, and an average PCE of 12.46 ± 1.10 %, with V_{oc} of 0.99 ± 0.03 V, J_{sc} of $18.31 \pm 1.16 \text{ mA}\cdot\text{cm}^{-2}$ and FF of 0.69 ± 0.04 , all measured at a relative humidity of 50-54 % under illumination by simulated AM 1.5 sunlight ($100 \text{ mA}\cdot\text{cm}^{-2}$).

Keywords: Conversion temperature; Conversion time; PbI_2 -NMP; $\text{CH}_3\text{NH}_3\text{PbI}_{3-x}\text{Br}_x$; Planar perovskite solar cell

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