Supporting information

Optimal intermediate adducts regulate low-temperature $CsPbI_2Br$ crystallization for efficient inverted all-inorganic perovskite solar cells

Jinpei Wang, Libao Chen, Zongyao Qian, Guoqi Ren, Jie Wu, Hui Zhang*

J. Wang, L. Chen, Z. Qian, G. Ren, J. Wu, Dr. H. Zhang

Key Laboratory of Flexible Electronics (KLOFE) and Institute of Advanced Materials (IAM), Jiangsu National Synergetic Innovation Center for Advanced Materials (SICAM), Nanjing Tech University (NanjingTech), 5 Xinmofan Road, Nanjing 210009, P. R. China

Corresponding Email: iamhuizhang@njtech.edu.cn

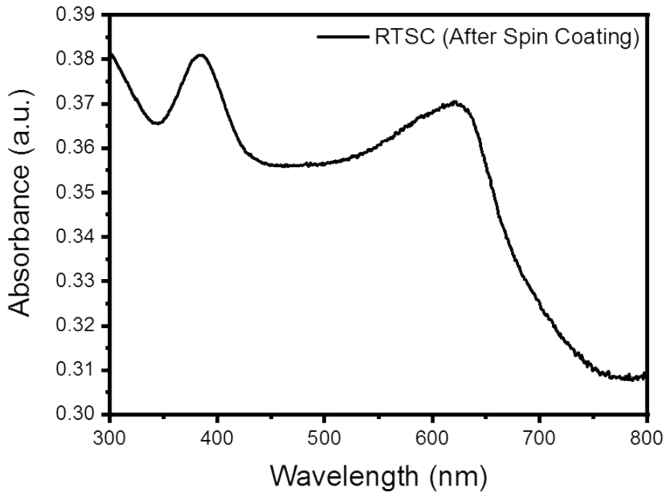

Fig. S1. Absorption spectra of the perovskite precursor film prepared via RTSC.

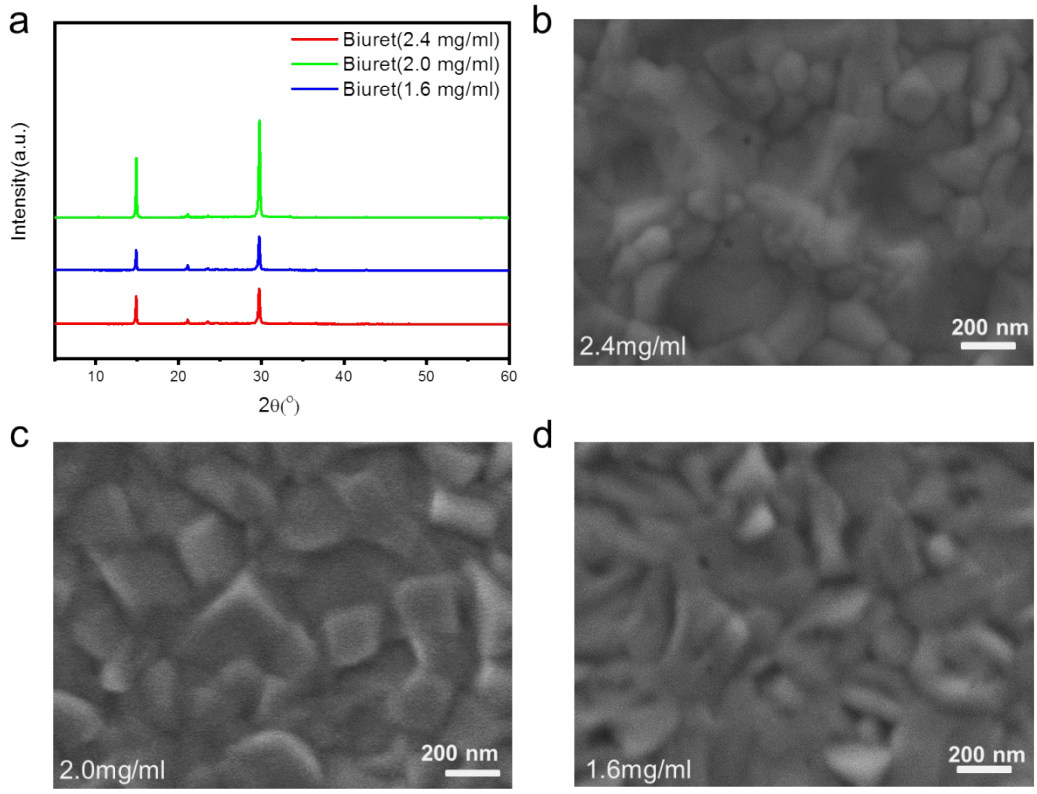

Fig. S2. (a) the XRD spectra of the perovskite films with the different concentration of biuret. SEM images of perovskite thin films obtained by the different concentration of biuret :(b) 2.4 mg/ml, (c) 2.0 mg/ml and (d) 1.6 mg/ml.

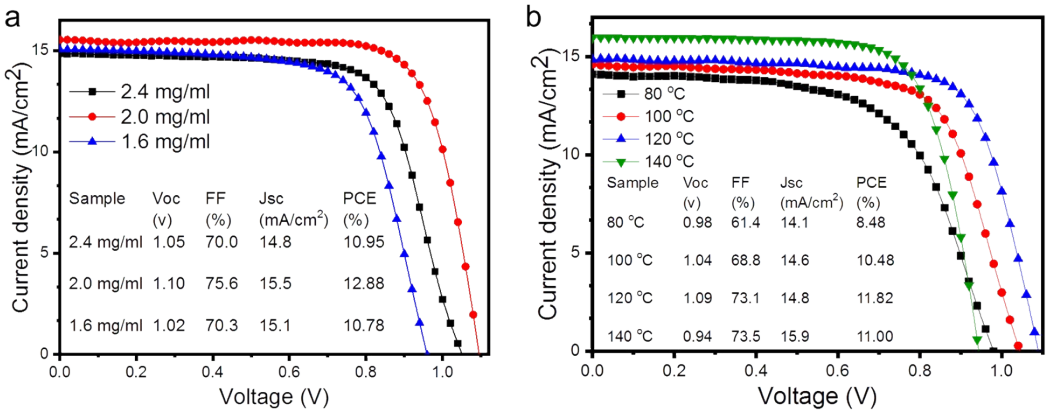

Fig. S3. *J-V* curves of devices with different biuret concentrations and different annealing temperatures.

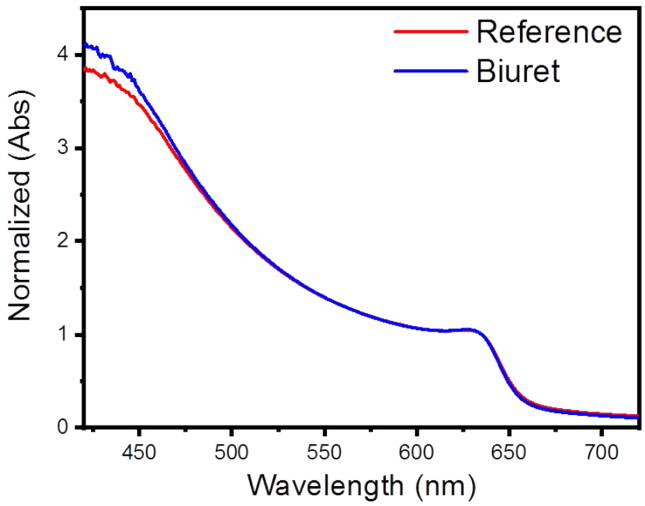

Fig. S4. Absorption spectra of the pristine $CsPbI_2Br$ perovskite (reference) and $CsPbI_2Br$-biuret (Biuret) after annealing

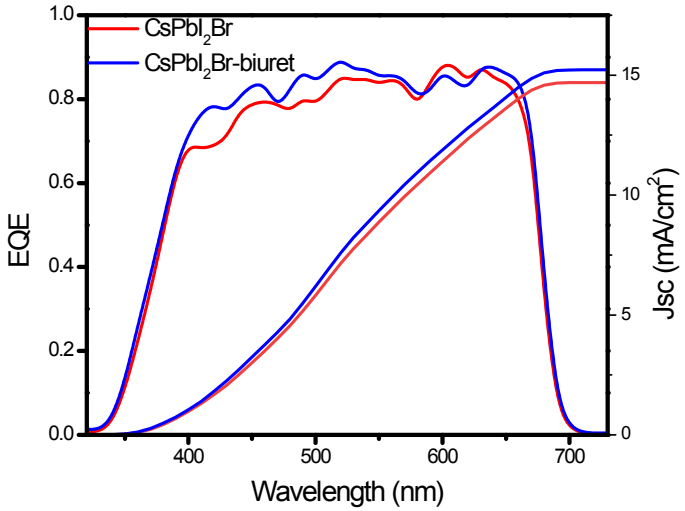

Fig. S5. External quantum efficiency (EQE) spectra of perovskite solar cells prepared via HSSC (red) and HSSC-Biuret (blue), respectively.

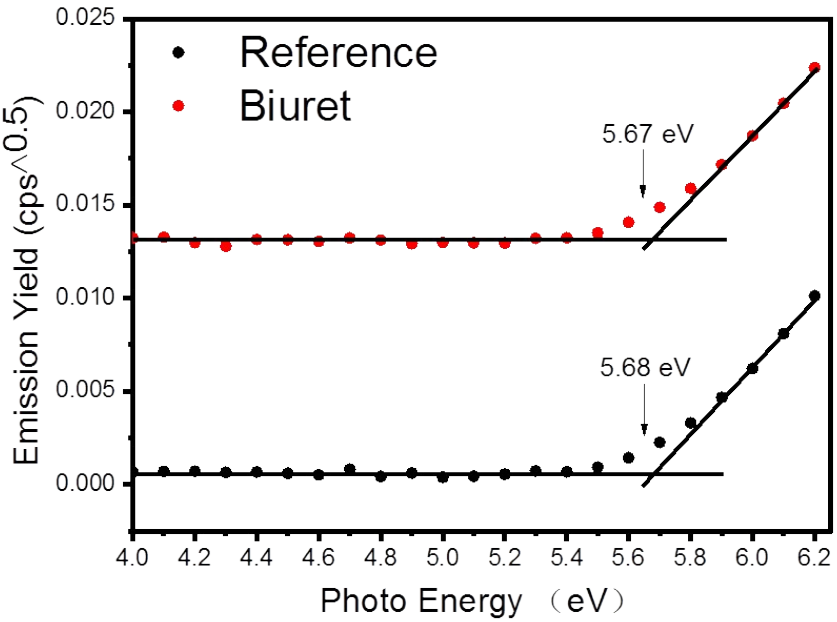

Fig. S6. ionization energy spectra of the pristine $CsPbI_2Br$ perovskite (reference) and $CsPbI_2Br$-biuret (Biuret) perovskite.

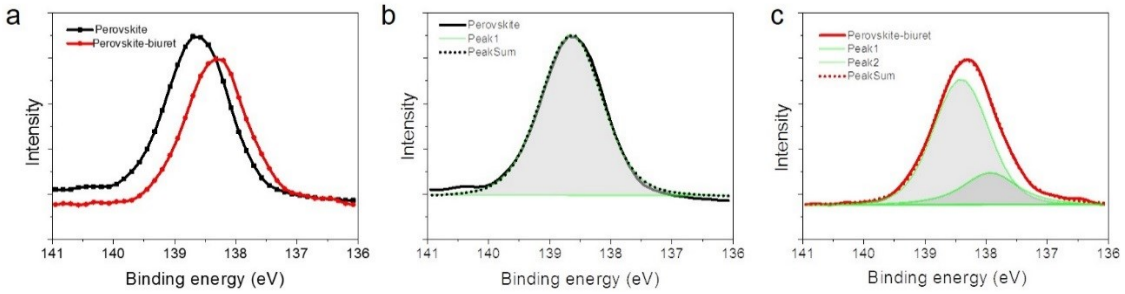

Figure S7 XPS spectrum of Pb $4f_{7/2}$ of the pristine perovskite and biuret doped perovskite: (a) the overall spectra and their fitting of (b) pristine perovskite and (c) biuret doped perovskite. The peak at 138.6 eV was ascribed to the binding energy of Pb in perovskite. And a new peak at 138.0 eV, assigned to Pb-O bond

Table S1. Carrier fluorescence lifetime obtained from the TRPL spectra

Sample	τ_1(ns)	τ_2(ns)
Reference	6.47	20.79
Biuret	13.09	28.83

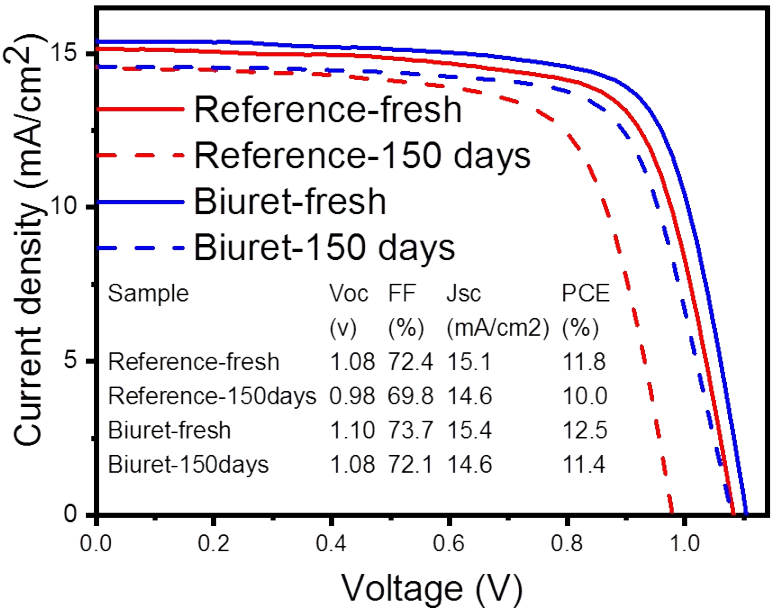

Fig. S8. J-V curve of the device based on pristine CsPbI2Br perovskite (reference) and CsPbI2Br-biuret (Biuret) perovskite after 150 days in nitrogen atmosphere

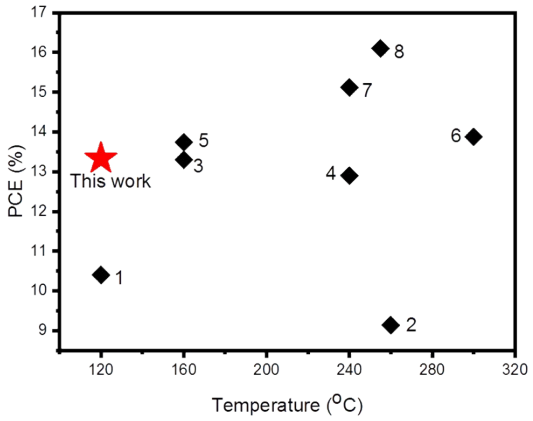

Fig. S9. The PCEs of the reported inverted $CsPbI_2Br$ PSCs that prepared at different temperatures.

Reference

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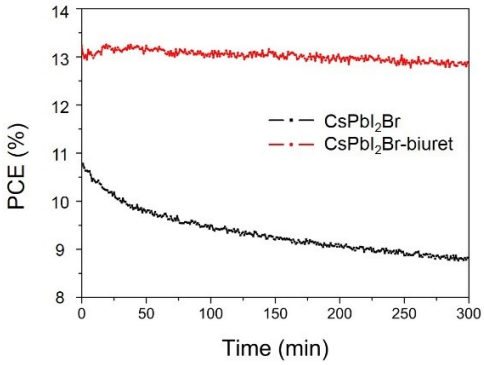

Fig. S10 Power conversion efficiency of the devices based on pristine $CsPbI_2Br$ and $CsPbI_2Br$-biuret measured at maximum power point.