

Supporting Information

7.5% n-i-p Sb₂Se₃ solar cell with CuSCN as hole-transport layer

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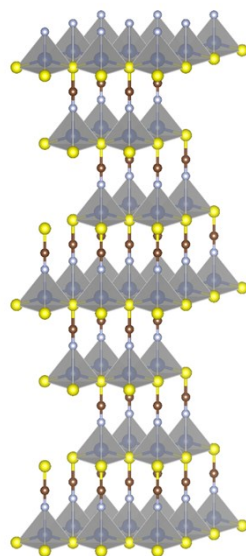


Fig. S1 The crystal structure of CuSCN. Atoms are copper (blue), carbon (brown), sulfur (yellow) and nitrogen (grey).

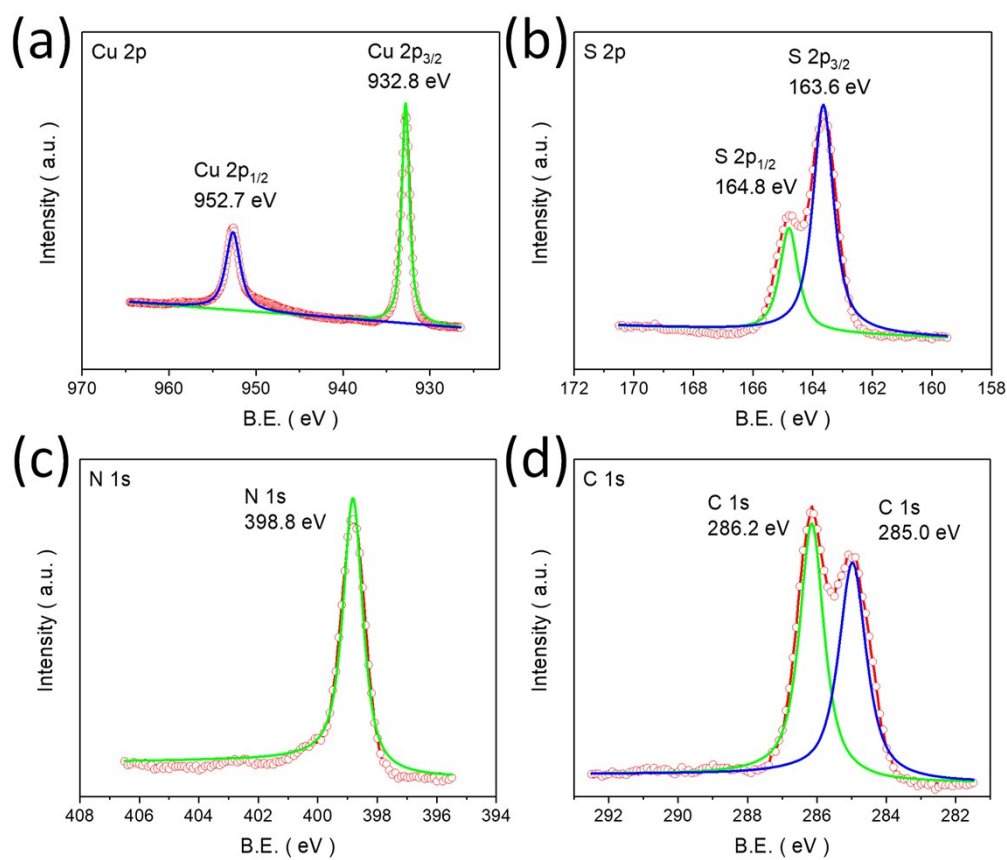


Fig. S2 X-ray photoelectron spectra (XPS) of CuSCN films. Gaussian-Lorentzian fitting was applied to analyze the data.

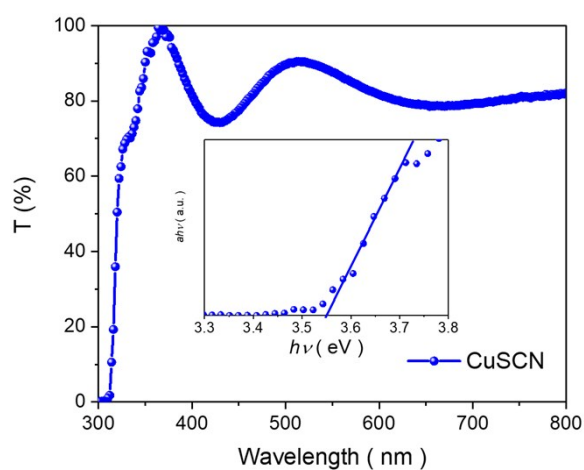


Fig. S3 The transmission spectrum of CuSCN film on ITO conductive glass. Inset is the fitting result.

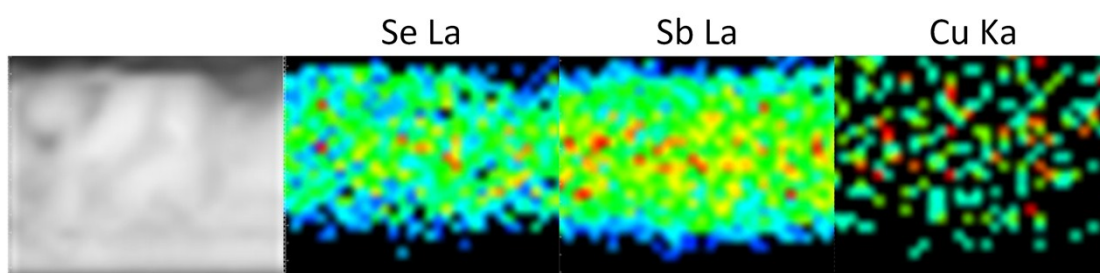


Fig. S4 Cross-sectional Electron Probe Microscope analysis (EPMA) element mapping of the device with CuSCN HTL.

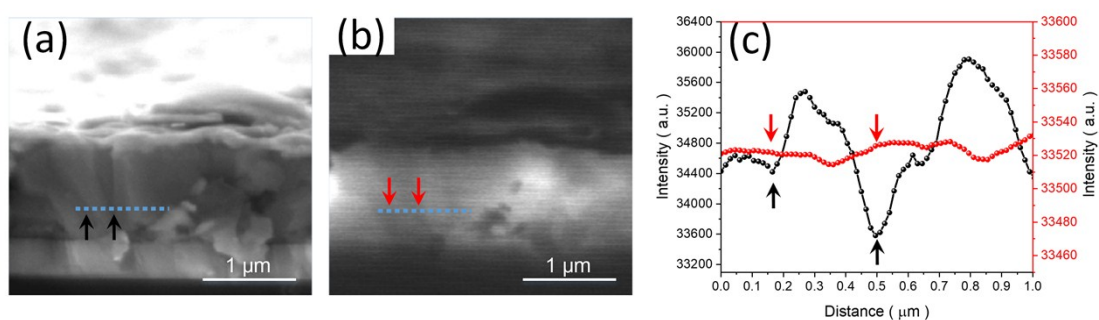


Fig. S5 Cross-sectional SEM (a) and EBIC images (b) for the cleaved Sb_2Se_3 devices without HTL. (c) The intensity profiling along the dashed blue line marked in panel (a) and (b).

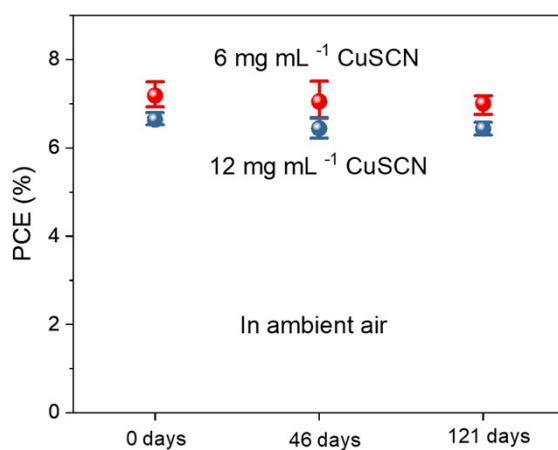


Fig.S6 The stability of Sb₂Se₃ devices with CuSCN as HTL, the red and blue symbol indicate the efficiency variation of devices with thin and thick CuSCN.

Table S1 Hall measurement of CuSCN.

	Temperature (K)	Bulk concentration (cm ⁻³)	Mobility (cm ² V ⁻¹ s ⁻¹)
1	300	2.82×10^{18}	0.34
2	300	1.80×10^{18}	0.54
3	300	1.63×10^{18}	0.60
Mean	300	2.08×10^{18}	0.49

Table S2 Compared device performance before and after thermal treatment at 85 °C.

	V_{oc} (mV)	J_{sc} (mA cm ⁻²)	FF (%)	PCE (%)
W/O	412 ± 1.3	30.1 ± 0.41	58.1 ± 0.89	7.2 ± 0.21
with	423 ± 1.5	30.8 ± 0.35	57.0 ± 0.88	7.4 ± 0.25

Table S3 XPS element content of CuSCN on Sb₂Se₃ before and after thermal treatment at 85 °C.

Peak	Peak BE	Atomic %	
		Before	After
Cu 2p	932.79	16.18	15.93
N 1s	398.79	17.11	17.61
C 1s	286.14	46.30	45.69
S 2p	163.59	20.40	20.77