

Supplementary Materials

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Table S1. Summarized XPS values of different elements for two types of films

CdTe	C 1s	Cd 3d	O 1s	Te 3d	P 2p
BE (eV)	281.90	401.96	527.20	572.80	129.50
Atomic concentration (%)	36.8	17.7	32.6	12.4	0.4

CdTe with TPP (5000ppm)	C 1s	Cd 3d	O 1s	Te 3d	P 2p
BE (eV)	281.70	401.96	527.20	572.90	135.50
Atomic concentration (%)	43.3	17.5	25.5	10.2	3.6

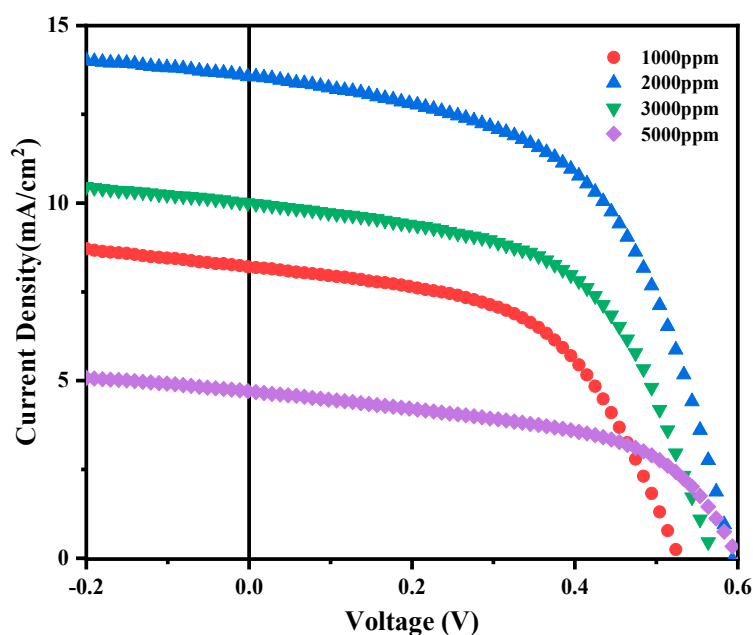


Figure S1. J - V curves of ITO/ZnO/CdSe/CdTe/TPP/Au with different doping concentration.

Table S2. Summarized performance of NC solar cells with different doping concentration. (Figure S1).

Doping (ppm)	V_{oc} (V)	J_{sc} (mA/cm ²)	FF (%)	PCE (%)	R_s ($\Omega \cdot \text{cm}^2$)	R_{sh} ($\Omega \cdot \text{cm}^2$)
1000	0.52	8.21	53.78	2.31	19.12	351.14
2000	0.59	13.55	54.43	4.38	9.91	377.52
3000	0.57	10.00	55.11	3.16	15.24	435.86
5000	0.60	4.70	52.41	1.49	21.27	382.16

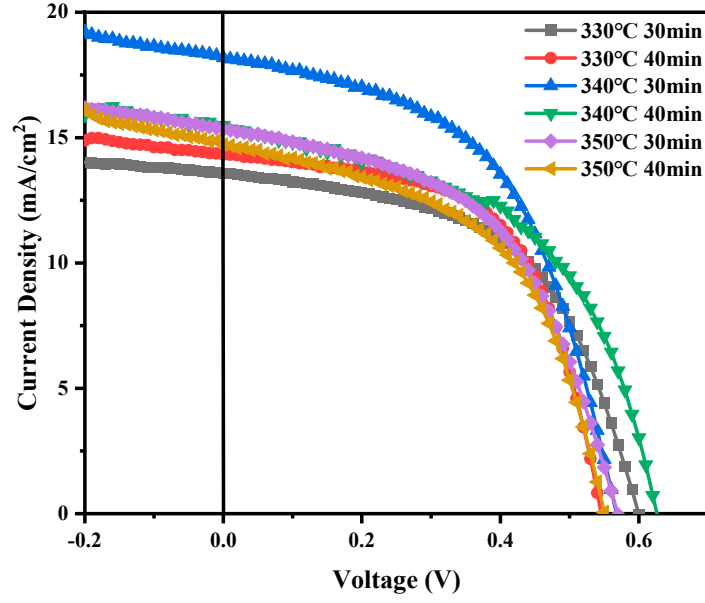


Figure S2. J - V curves of ITO/ZnO/CdSe/CdTe/TPP/Au with different temperature and annealing time.

Table S3. Summarized performance of NC solar cells with different heated time and temperature (Figure S2).

Device	V_{oc} (V)	J_{sc} (mA/cm ²)	FF (%)	PCE (%)	R_s ($\Omega \cdot \text{cm}^2$)	R_{sh} ($\Omega \cdot \text{cm}^2$)
330°C / 30min	0.59	13.55	54.43	4.38	9.91	377.52
330°C / 40min	0.54	14.32	59.53	4.61	7.36	353.02
340°C / 30min	0.56	18.19	53.16	5.41	8.14	182.87
340°C / 40min	0.62	15.49	51.73	4.97	8.30	208.86
350°C / 30min	0.56	15.33	52.59	4.52	10.59	205.06
350°C / 40min	0.55	14.72	52.51	4.23	8.58	156.24

Figure S3. transient photovoltage (TPV) measurements of CdTe NC solar cells with different doping concentration.

