Electronic Supporting Information (ESI)

Poly(vinyl pyrrolidone)：a superior and general additive in polysulfide electrolyte for high efficiency quantum dot sensitized solar cells

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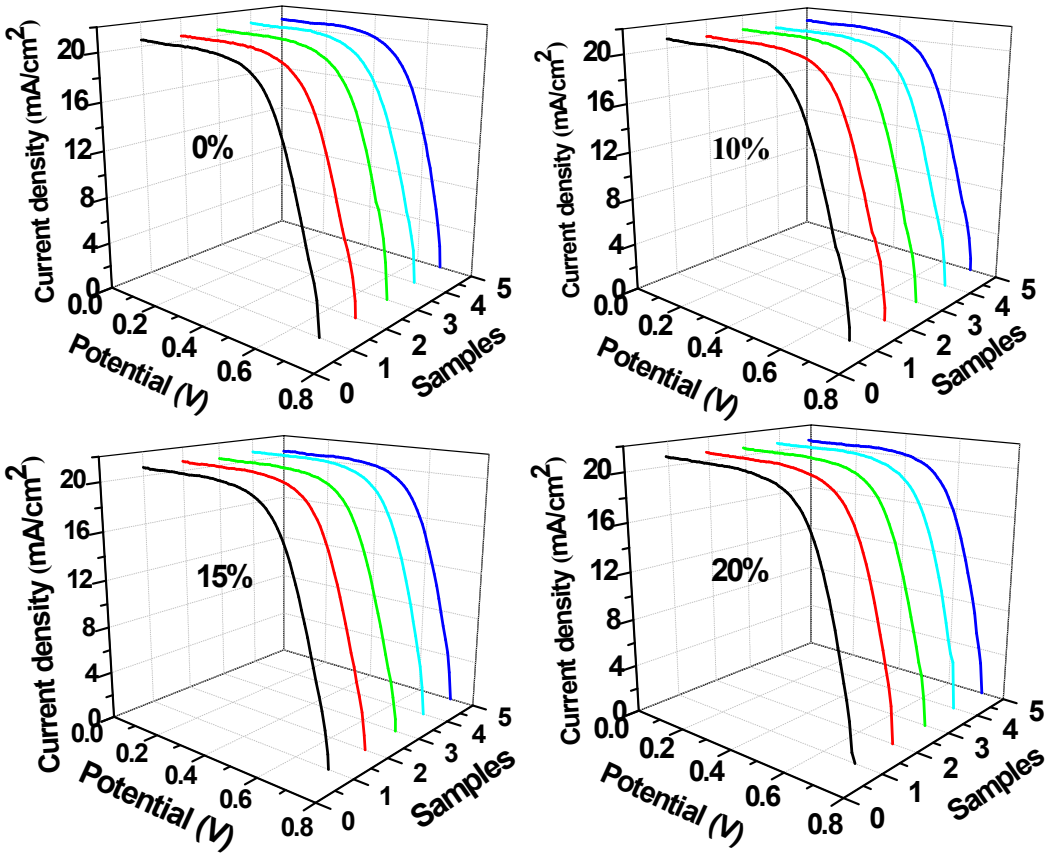

Fig. S1 *J*−*V* curves of CdSeTe based QDSCs with different PVP concentrations in electrolyte under the illumination of 1 full sun intensity (AM 1.5G, 100 mW/cm^2).

Table S1 Individual photovoltaic parameters of CdSeTe based QDSCs with different PVP concentrations in electrolyte under the illumination of 1 full sun intensity (AM 1.5G, 100 mW/cm^2).

PVP Concentration (wt%)	J_{sc} (mA·cm^{-2})	V_{oc} (V)	FF	PCE (%)
0	20.74	0.690	0.621	8.89
	20.44	0.695	0.618	8.78
	20.58	0.694	0.634	9.06
	20.73	0.688	0.614	8.76
	20.70	0.685	0.635	9.00
Average	20.64±0.13	0.690±0.004	0.624±0.009	8.90±0.13
10	20.71	0.708	0.623	9.13
	20.56	0.710	0.625	9.12
	20.75	0.710	0.632	9.30
	20.51	0.711	0.632	9.22
	20.75	0.707	0.628	9.21
Average	20.66±0.11	0.709±0.002	0.628±0.004	9.20±0.07
15	20.69	0.715	0.637	9.42
	20.80	0.722	0.636	9.55
	20.59	0.719	0.634	9.39
	20.82	0.715	0.645	9.60
	20.49	0.719	0.652	9.61
Average	20.68±0.14	0.718±0.003	0.641±0.007	9.51±0.10
20	20.71	0.720	0.650	9.75
	20.61	0.719	0.653	9.67
	20.55	0.720	0.648	9.58
	20.61	0.718	0.656	9.70
	20.49	0.723	0.660	9.77
Average	20.59±0.08	0.720±0.002	0.653±0.005	9.68±0.08

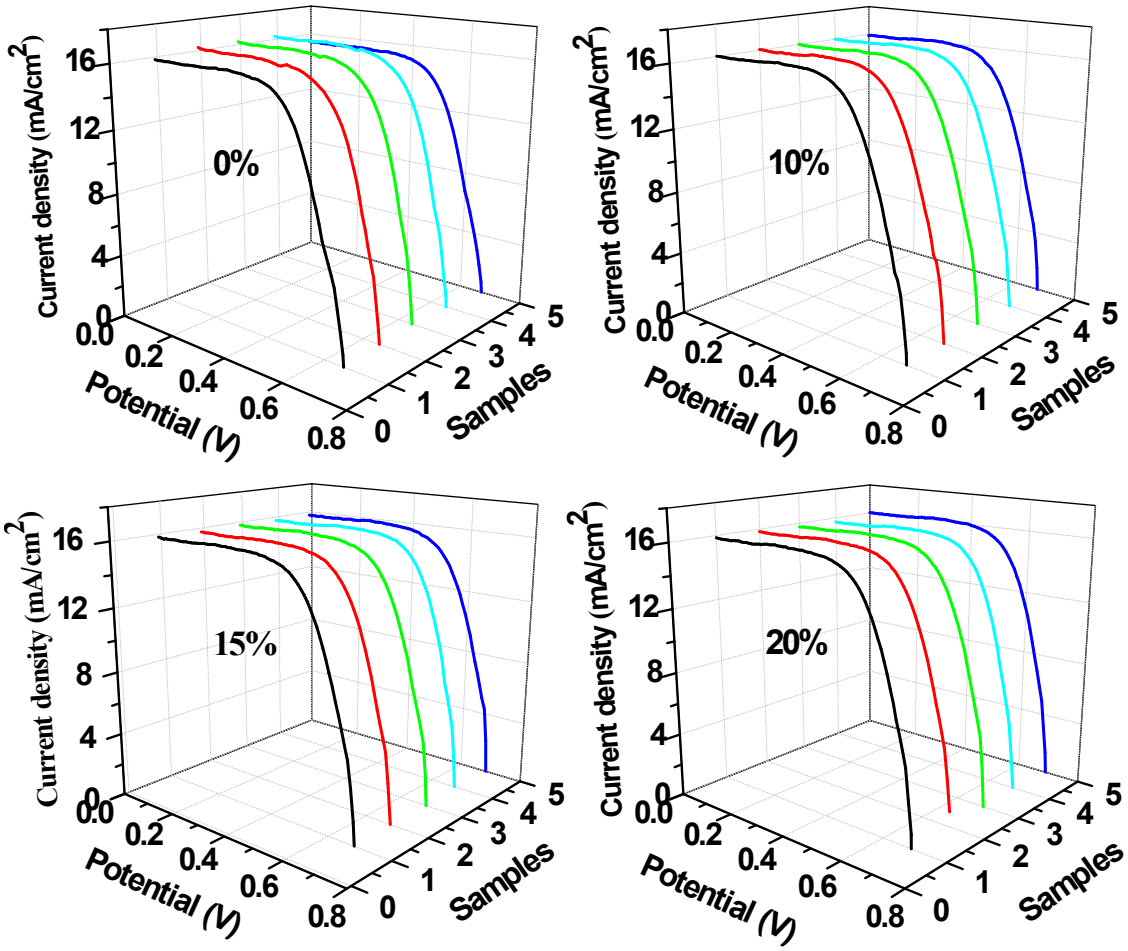

Fig. S2 *J*−*V* curves of CdSe based QDSCs with different PVP concentrations in electrolyte under the illumination of 1 full sun intensity (AM 1.5G, 100 mW/cm^2).

Table S2 Individual photovoltaic parameters of CdSe based QDSCs with different PVP concentrations in electrolyte under the illumination of 1 full sun intensity (AM 1.5G, 100 mW/cm^2).

PVP Concentration (wt%)	J_{sc} (mA·cm^{-2})	V_{oc} (V)	FF	PCE (%)
0	15.80	0.662	0.643	6.73
	16.10	0.653	0.644	6.75
	16.11	0.646	0.654	6.81
	16.16	0.652	0.648	6.83
	15.45	0.673	0.639	6.65
Average	15.92±0.30	0.657±0.010	0.645±0.006	6.75±0.07
10	16.02	0.681	0.652	7.12
	16.03	0.680	0.649	7.08
	15.98	0.676	0.650	7.03
	15.98	0.678	0.657	7.10
	15.94	0.675	0.656	7.06
Average	15.99±0.04	0.678±0.003	0.653±0.004	7.01±0.03
15	15.74	0.684	0.669	7.20
	15.67	0.680	0.668	7.13
	15.75	0.686	0.667	7.21
	15.73	0.677	0.688	7.32
	15.93	0.686	0.668	7.22
Average	15.76±0.10	0.683±0.004	0.672±0.009	7.23±0.07
20	15.83	0.691	0.678	7.42
	15.80	0.690	0.675	7.35
	15.79	0.688	0.676	7.34
	15.71	0.680	0.689	7.36
	16.01	0.693	0.680	7.54
Average	15.83±0.11	0.688±0.005	0.680±0.005	7.40±0.08

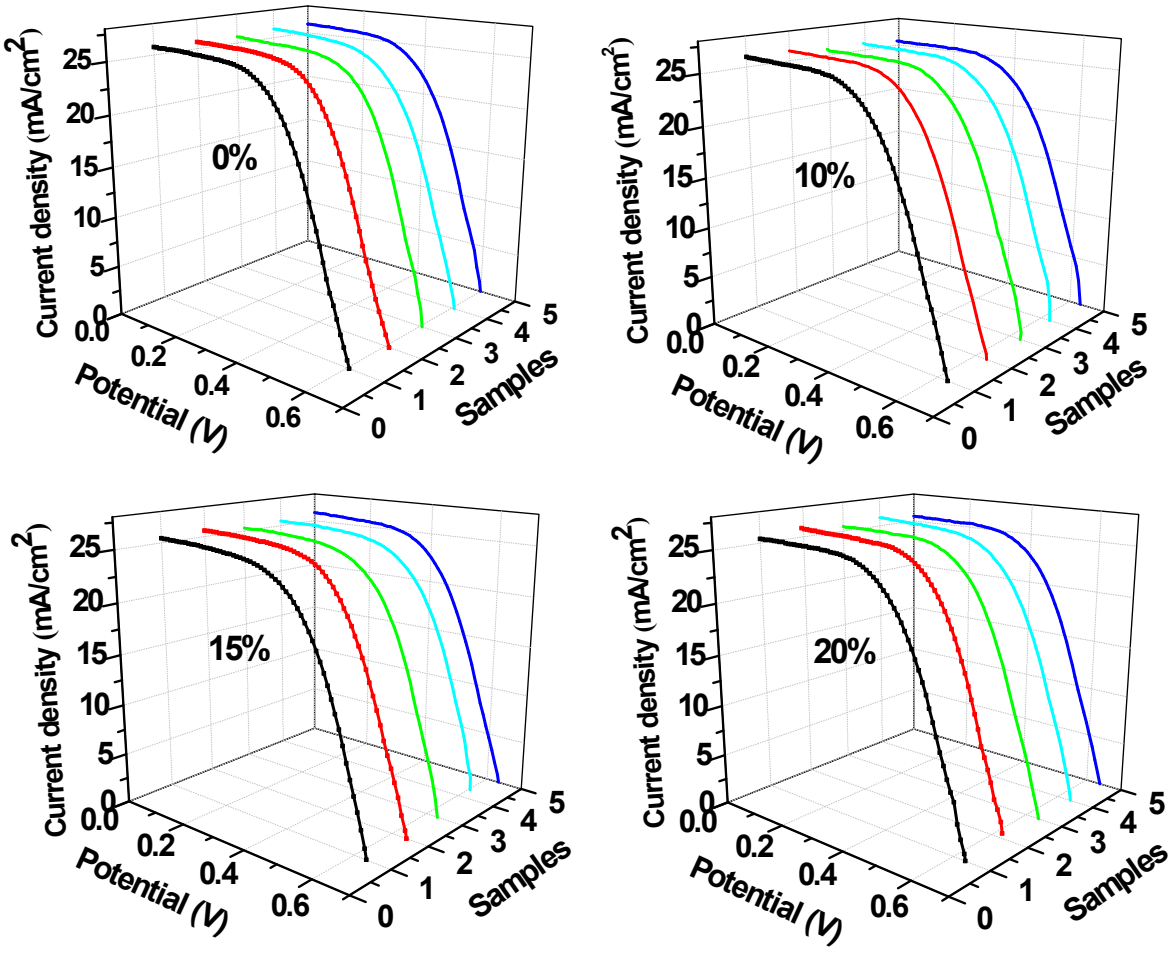

Fig. S3 *J*−*V* curves of ZCISe based QDSCs with different PVP concentrations in electrolyte under the illumination of 1 full sun intensity (AM 1.5G, 100 mW/cm^2).

Table S3 Individual photovoltaic parameters of ZCISe based QDSCs with different PVP concentrations in electrolyte under the illumination of 1 full sun intensity (AM 1.5G, 100 mW/cm^2).

PVP Concentration (wt%)	J_{sc} (mA·cm^{-2})	V_{oc} (V)	FF	PCE (%)
0	25.76	0.606	0.559	8.72
	25.64	0.611	0.553	8.66
	25.50	0.606	0.568	8.77
	25.94	0.607	0.549	8.64
	25.96	0.599	0.558	8.68
Average	25.76±0.20	0.606±0.004	0.557±0.007	8.69±0.05
10	25.89	0.628	0.554	9.01
	25.94	0.631	0.552	9.04
	25.33	0.630	0.567	9.05
	25.59	0.625	0.574	9.18
	25.42	0.631	0.567	9.09
Average	25.63±0.27	0.629±0.002	0.563±0.009	9.07±0.07
15	25.42	0.634	0.571	9.20
	25.59	0.640	0.565	9.25
	25.32	0.631	0.576	9.20
	25.32	0.631	0.576	9.20
	25.90	0.634	0.554	9.10
Average	25.55±0.24	0.634±0.004	0.568±0.009	9.19±0.05
20	25.41	0.633	0.565	9.08
	25.71	0.630	0.571	9.24
	25.50	0.635	0.567	9.18
	25.92	0.637	0.557	9.20
	25.53	0.639	0.566	9.23
Average	25.61±0.20	0.635±0.003	0.565±0.005	9.19±0.06

Table S4 Impedance parameters under the forward bias of −0.65 V. series resistance R_s, counter electrode charge transfer resistance R_{CE}, recombination resistance R_{rec}, chemical capacitance C_μ, and electron lifetime $\tau_n = R_{rec} \cdot C_\mu$.

PVP (wt%)	R_s W • cm^2	R_{CE} W • cm^2	R_{rec} W • cm^2	C_m mF • cm^{-2}	τ_n ms
20%	17.37	4.47	171.1	5.92	1012
15%	16.27	8.02	169.1	5.73	968
10%	17.63	3.08	160.1	5.94	950
0%	15.21	7.17	113.0	5.11	577