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Supporting Information

Efficient Ag_8GeS_6 Counter Electrode Prepared From Nanocrystal Ink for Dye-Sensitized Solar Cells

Qingquan He,[a] Tianyue Qian,[a] Jiantao Zai,[a] Qiquan Qiao,[b] Shoushuang Huang,[a] Yiran Li[c] and Min Wang[a]*

[a] Shanghai Electrochemical Energy Devices Research Center, School of Chemistry and Chemical Engineering and State Key Laboratory of Metal Matrix Composites, Shanghai Jiao Tong University, Shanghai, 200240, P. R. China

[b] Center for Advanced Photovoltaics, South Dakota State University, Brookings, SD 57007, USA

[c] Department of Materials Science and Engineering, Northwestern University, Evanston, IL 60201, USA

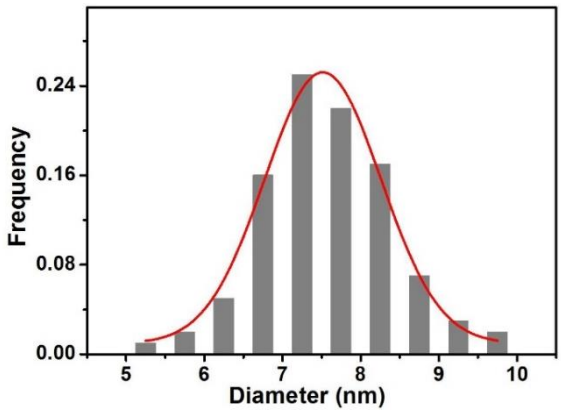

Fig. S1 Size distribution of the obtained Ag_8GeS_6 nanocrystals.

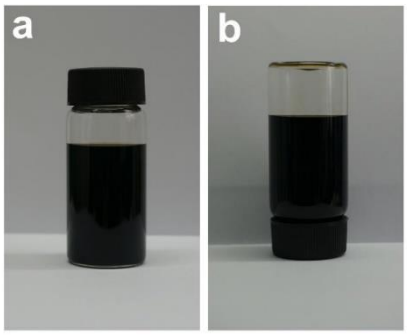

Fig. S2 Photographic images of (a) Ag_8GeS_6 nanocrystal ink and (b) after one month.

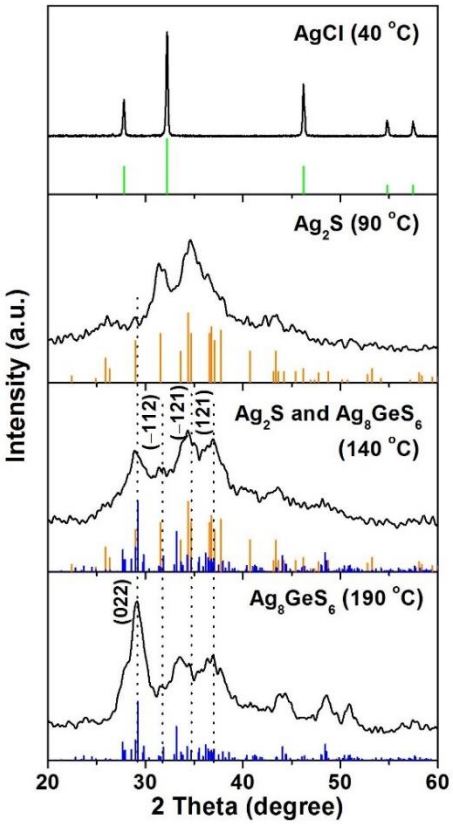

Fig. S3 XRD patterns of the obtained products at a series of reaction phases (green bar: AgCl, JCPDS No. 85-1355; orange bar: Ag_2S, JCPDS No. 14-72; blue bar: Ag_8GeS_6, JCPDS No. 83-1247).

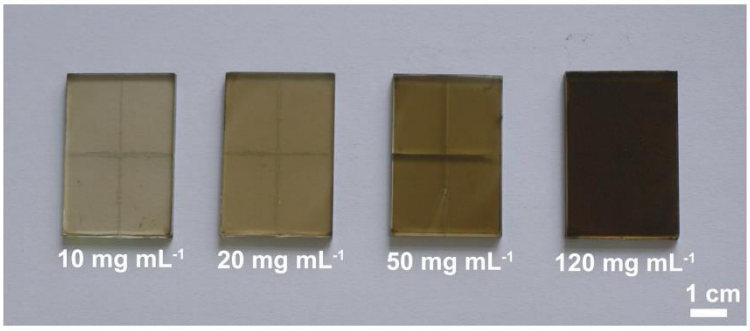

Fig. S4 Photographic images of Ag_8GeS_6 CEs with different concentration of NC inks (four pieces of CEs in a group under spin coating).

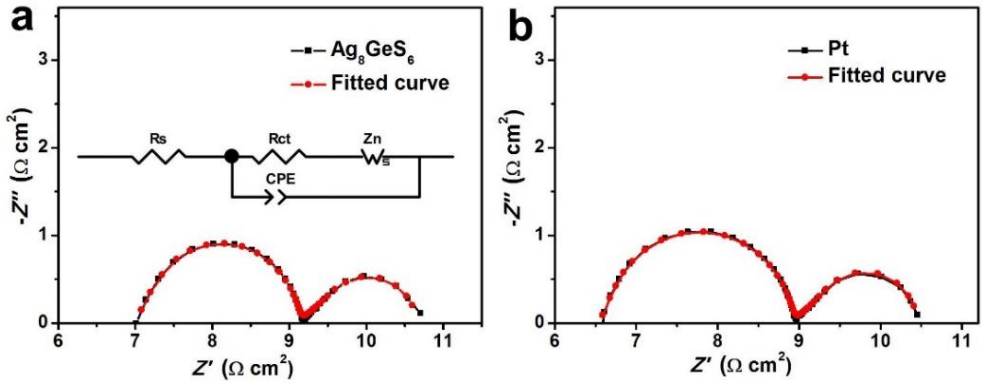

Fig. S5 Nyquist plots and the corresponding fitted curves for symmetrical cells fabricated with (a) Ag_8GeS_6 and Pt CEs. The inset gives the equivalent circuit diagram.

Table S1. Photovoltaic parameters of different CEs simulated from EIS spectra.[a]

Samples	R_s [Ω cm^2]	R_{ct} [Ω cm^2]	Z_N [Ω cm^2]	*CPE* [μF]
Ag_8GeS_6	7.08	2.16	1.55	10.02
Pt	6.59	2.38	1.53	10.41

[a] R_s: series resistance; R_{ct}: charge-transfer resistance between the CE and electrolyte; Z_N: Nernst diffusion impedance of I^-/I_3^- redox couple in electrolyte; *CPE*: constant phase angle element.

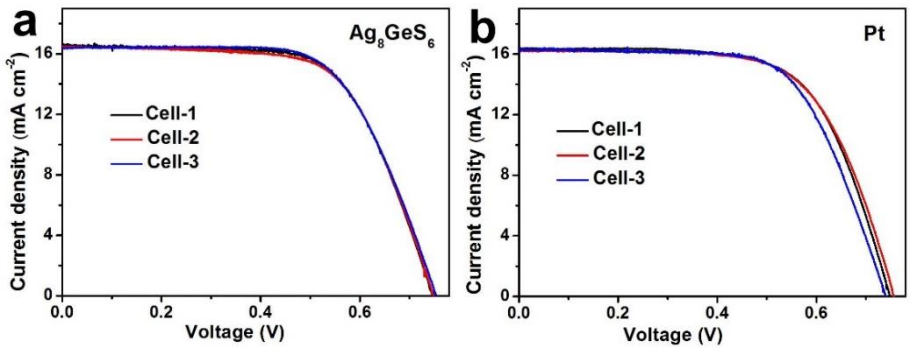

Fig. S6 Current density-voltage (*J-V*) characteristics of DSSCs with (a) Ag_8GeS_6 and (b) Pt CEs, which were measured under AM1.5 illumination (100 mW cm^{-2}).

Table S2. Photovoltaic performance of DSSCs with Ag_8GeS_6 CEs

Sample	J_{sc} [mA cm^{-2}]	V_{oc} [mV]	FF	η [%]
Cell-1	16.59	746	0.65	8.10
Cell-2	16.49	749	0.65	7.99
Cell-3	16.38	753	0.65	8.05

Table S3. Photovoltaic performance of DSSCs with Pt CEs

Sample	J_{sc} [mA cm^{-2}]	V_{oc} [mV]	FF	η [%]
Cell-1	16.34	748	0.66	8.02
Cell-2	16.22	755	0.65	7.99
Cell-3	16.29	740	0.66	7.90

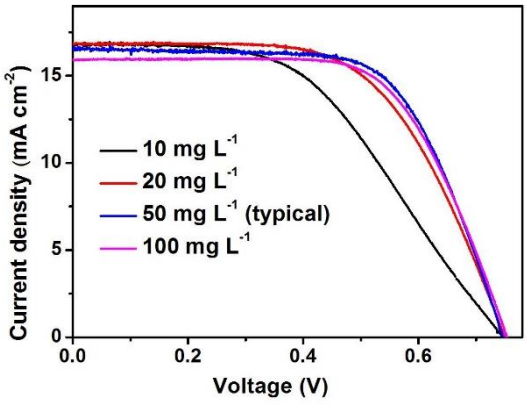

Fig. S7. Current density-voltage characteristics of DSSCs with Ag_8GeS_6 CEs prepared from different concentration of NC inks.

Table S4. Photovoltaic performance of of DSSCs based on Ag_8GeS_6 CEs prepared from different concentration of nanocrystal inks.

Samples [concentration of nanocrystal inks, *mg* L^{-1}]		J_{sc} *[mA* cm^{-2}*]*	V_{oc} *[mV]*	FF	η *[%]*
Ag_8GeS_6	10	16.84	747	0.49	6.09
	20	16.82	753	0.60	7.56
	50 (typical)	16.59	746	0.65	8.10
	120	15.89	745	0.66	7.81

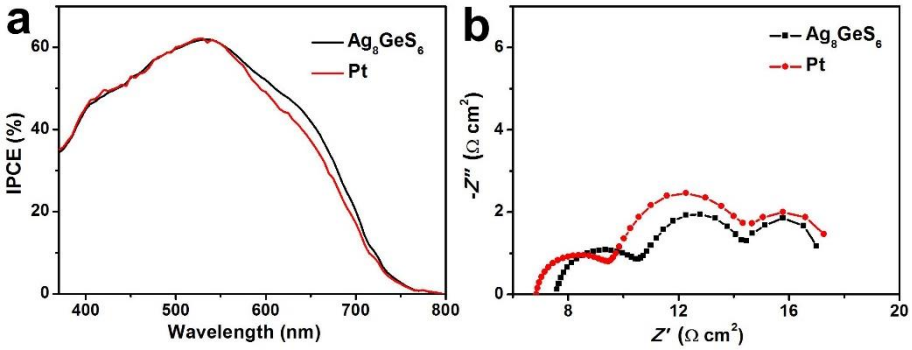

Fig. S8 (a) IPCE spectral action responses and (b) Nyquist plots of DSSCs with Ag_8GeS_6 and Pt CEs.

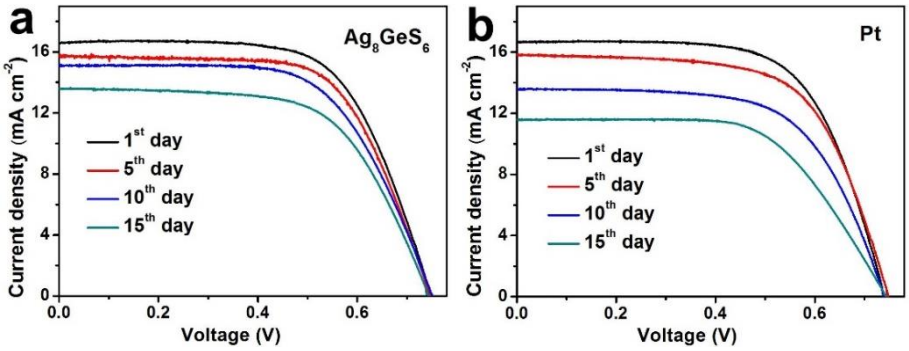

Fig. S9 *J–V* characteristics of DSSCs with (a) Ag_8GeS_6 and (b) Pt CEs, which were measured at different times.

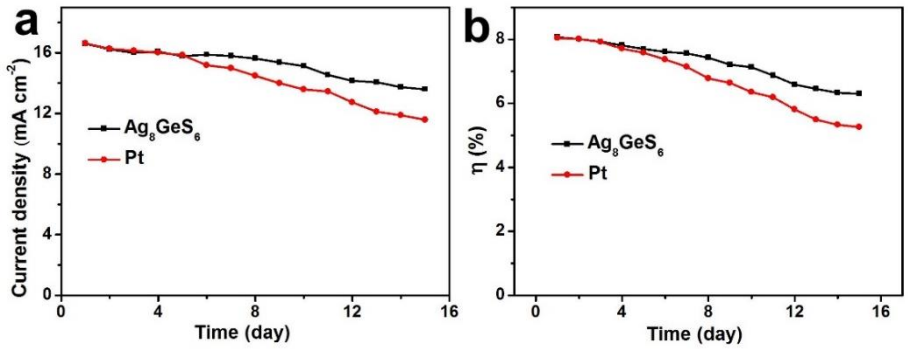

Fig. S10 (a) *J*–*V* and (b) η changes of DSSCs with Ag_8GeS_6 and Pt CEs, which were measured at different times.

Table S5. Photovoltaic performance of DSSCs with Ag_8GeS_6 CEs

Time (day)	J_{sc} [mA cm^{-2}]	V_{oc} [mV]	FF	η [%]
1	16.61	747	0.65	8.07
2	16.23	748	0.66	8.01
3	16.00	751	0.66	7.93
4	16.08	747	0.65	7.81
5	15.78	746	0.65	7.70
6	15.88	749	0.64	7.61
7	15.79	748	0.64	7.56
8	15.63	743	0.64	7.43
9	15.36	745	0.63	7.21
10	15.12	748	0.63	7.13
11	14.54	750	0.63	6.87
12	14.15	751	0.62	6.59
13	14.06	740	0.62	6.45
14	13.74	743	0.62	6.33
15	13.59	745	0.62	6.30

Table S6. Photovoltaic performance of DSSCs with Pt CEs

Time (day)	J_{sc} [mA cm^{-2}]	V_{oc} [mV]	FF	η [%]
1	16.62	740	0.66	8.04
2	16.27	746	0.66	8.01
3	16.14	752	0.65	7.92
4	16.00	742	0.65	7.71
5	15.85	746	0.64	7.58

6	15.18	751	0.64	7.37
7	14.99	742	0.64	7.14
8	14.49	747	0.63	6.78
9	13.99	753	0.63	6.64
10	13.59	740	0.63	6.35
11	13.45	746	0.62	6.19
12	12.73	750	0.61	5.81
13	12.12	748	0.61	5.49
14	11.88	747	0.60	5.33
15	11.58	745	0.61	5.26

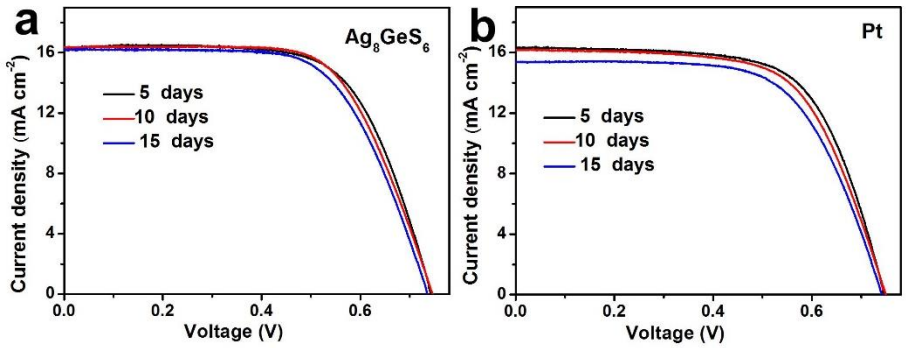

Fig. S11 *J–V* characteristics of DSSCs with Ag_8GeS_6 and Pt CEs which dipped in iodine electrolyte for different time.

Table S7. Photovoltaic performance of DSSCs with Ag_8GeS_6 CEs

Time (day)	J_{sc} [mA cm^{-2}]	V_{oc} [mV]	FF	η [%]
5	16.33	744	0.66	8.08
10	16.35	743	0.65	8.02
15	16.09	735	0.65	7.72

Table S8. Photovoltaic performance of DSSCs with Pt CEs

Time (day)	J_{sc} [mA cm^{-2}]	V_{oc} [mV]	FF	η [%]
5	16.33	746	0.66	8.02
10	16.17	749	0.64	7.77
15	15.40	743	0.64	7.33