Electronic Supplementary Material (ESI) for Journal of Materials Chemistry

Direct Application of Commercial Fountain Pen Ink to Efficient Dye-sensitized Solar Cells

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†Electronic Supplementary Information (ESI)

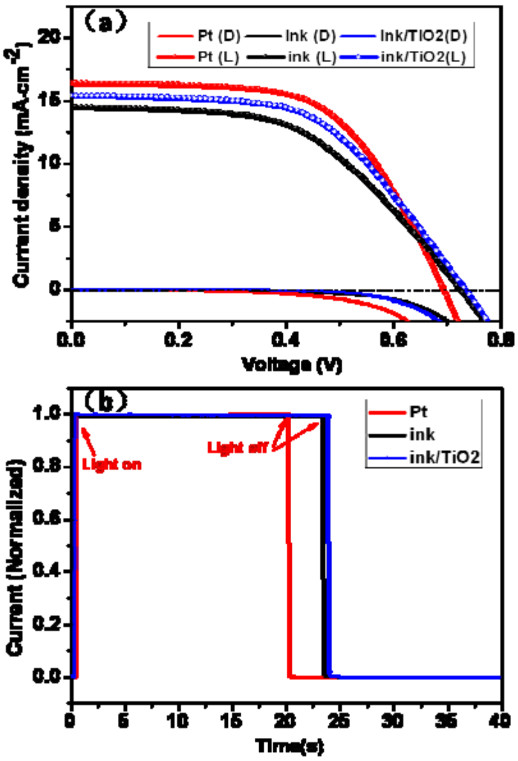

Fig. S1 (a) *J-V* characteristics of FTO/Pt, FTO/ink and FTO/ink-TiO_2 CE-based PDSSCs under dark condition and standard illumination (AM 1.5G, 100mW cm^{-2}). (b) Normalized short-circuit current-time response of FTO/Pt, FTO/ink and FTO/ink-TiO_2 CE-based PDSSCs during 40s.

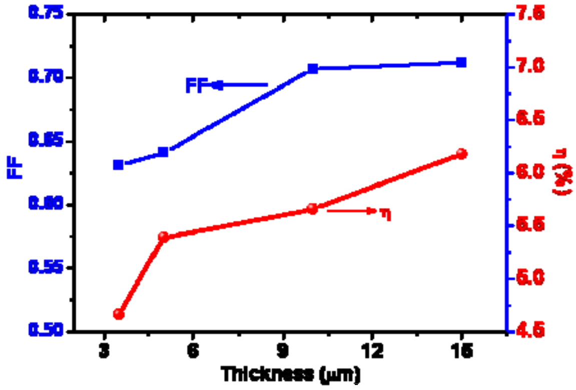

Fig. S2 The change of fill factor (FF) and η of SS/ink CE-based FDSSCs as the thickness of ink film varied.

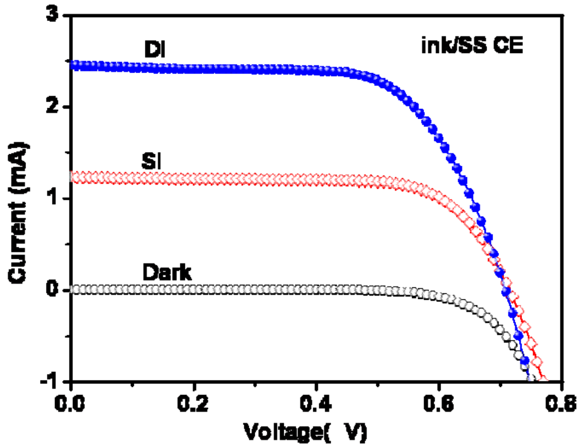

Fig. S3 *J-V* characteristics of FDSSCs based on stainless steel (SS)wire/ink counter electrode (CE). Dark: without irradiation. SI: single-sided irradiation with 100mW cm^{-2} light intensity. DI : double-sided irradiation mode with a diffuse reflector at the bottom of the device.

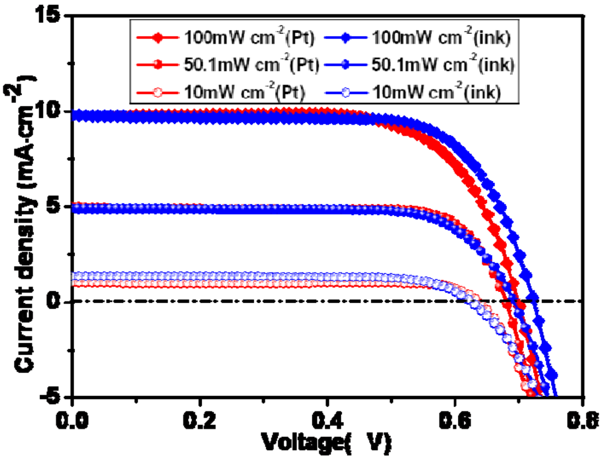

Fig. S4 *J-V* curves of CF/ink CE-based FDSSCs ($D_{ink/CF}$) and Pt wire CE-based FDSSCs ($D_{Pt\ wire}$) with I_3^-/I^- electrolyte under different light intensities.

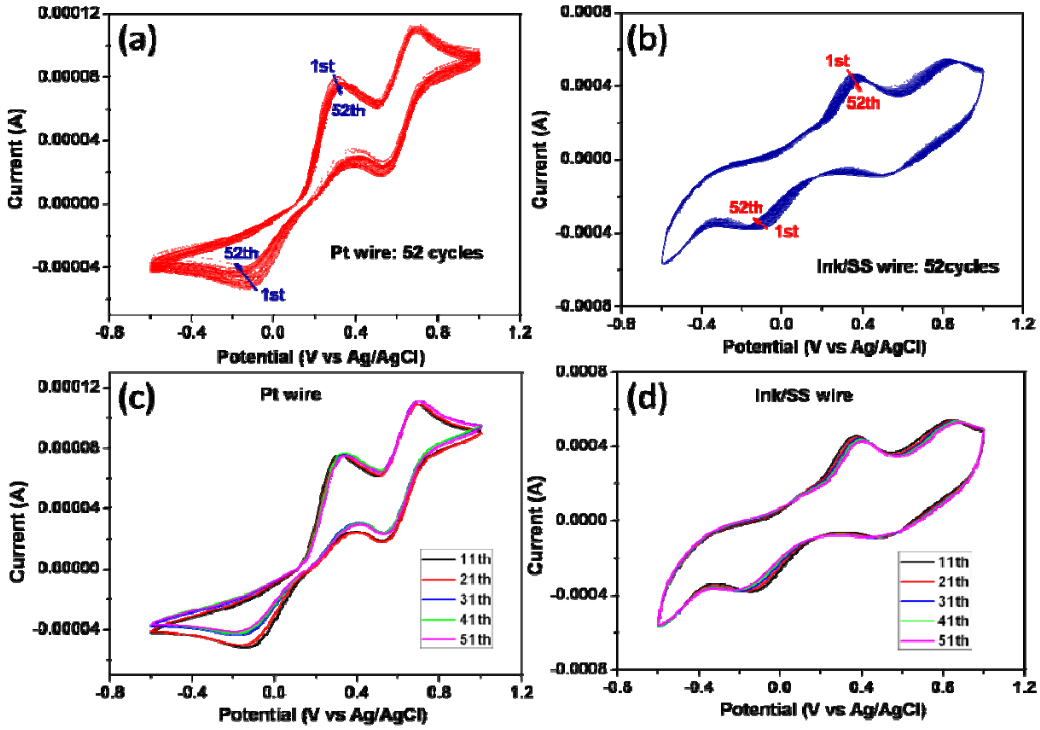

Fig. S5 (a) 52 continuous electrochemical cycles *via* cyclic voltammetry of platinum wire electrode (diameter: 80μm). (b) 52 continuous electrochemical cycles *via* cyclic voltammetry of ink coating on stainless steel wire (diameter: 250μm). (c) Five cycles selected from (a). (d) Five cycles selected from (b). Cyclic voltammetry were performed using a three-electrode setup with Pt as the counter electrode, AgCl/Ag as the reference electrode, and target electrode as the working electrode at a potential scan rate of 100 mV s^{-1}. Composition of electrolyte: 10 mM BMII, 1 mM I_2, and 0.05M $LiClO_4$ in acetonitrile solution. The stability of ink electrode is significantly better than Pt electrode for the reduction peak of I_3^- to I^- [(a), (b)], which is closely linked to the device performance of DSSC. Besides, it is obvious that ink electrode shows much more stability than Pt after 10 continuous cycles [(c), (d)], mainly due to the tendency of Pt to react with electrolyte species and surface adsorption of impurities.

Table S1. Parameters of the photovoltaic performances for ink/stainless steel wire CE-based FDSSCs with different thickness of ink film, the influence of annealing and double irradiation on device performance.

Devices	Voc（V）	Jsc（mA/cm^2）	FF	η（%）
3.5μm	0.734	10.07	0.631	4.66
5μm	0.716	11.75	0.641	5.39
5μm-120℃[a]	0.720	11.61	0.600	5.01
10μm	0.717	10.90	0.708	5.54
15μm	0.715	12.15	0.712	6.18
15μm-DI[b]	0.709	24.14	0.664	11.4

[a]Note: ink film only dried at 120℃ without further sintering at 350℃; [b]Note: double irradiation with a diffuse reflector at the bottom of device.

Table S2. Parameters of the photovoltaic performances of ink/carbon fiber CE-based FDSSCs ($D_{ink/CF}$) and Pt wire CE-based FDSSCs ($D_{Pt\ wire}$) with I_3^-/I^- electrolyte under different light intensities.

Intensity ($mW\ cm^{-2}$)	Devices	V_{oc} (V)	J_{sc} (mA/cm^2)	FF	η (%)
100	$D_{ink/CF}$	0.722	9.79	0.714	5.05
	$D_{Pt\ wire}$	0.698	9.78	0.692	4.73
50.1	$D_{ink/CF}$	0.692	4.88	0.735	4.95
	$D_{Pt\ wire}$	0.679	4.94	0.772	5.16
31.6	$D_{ink/CF}$	0.667	2.96	0.741	4.62
	$D_{Pt\ wire}$	0.679	4.94	0.772	5.16
10	$D_{ink/CF}$	0.625	1.33	0.748	6.24
	$D_{Pt\ wire}$	0.636	1.03	0.823	5.4
5	$D_{ink/CF}$	0.598	0.833	0.753	7.50
	$D_{Pt\ wire}$	0.620	0.693	0.835	7.18

Table S3. Parameters of the photovoltaic performances for Pt wire CE, ink/carbon fiber CE-based FDSSCs with I_3^-/I^- electrolyte (I) or T_2^-/T^- (T) electrolyte. Light intensity: 100 $mW\ cm^{-2}$.

Devices	V_{oc} (V)	J_{sc} (mA/cm^2)	FF	η (%)
Pt wire-I	0.749	9.34	0.719	5.03
CF/ink-I	0.742	9.63	0.732	5.23
Pt wire-T	0.628	8.22	0.646	3.33
CF/ink-T	0.636	8.41	0.758	4.05