

Supporting information

Carbon Black /Silicon Nitride Nanocomposites as High-Efficiency Counter Electrodes for Dye-Sensitized Solar Cells

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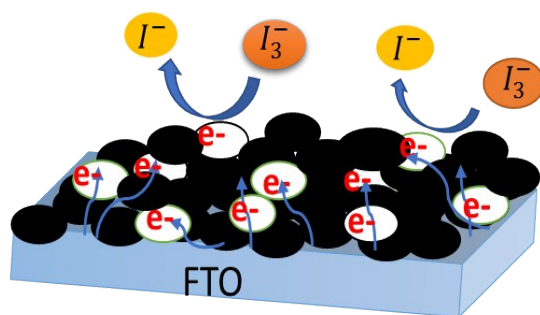
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● Carbon black ○ Si₃N₄

Scheme 1. CB-Si₃N₄ composite CE for Triiodide Reduction

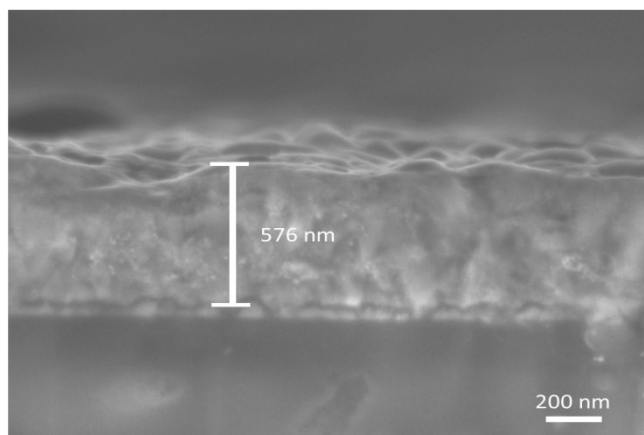


Fig. S1 Cross-section image of Pt CE.

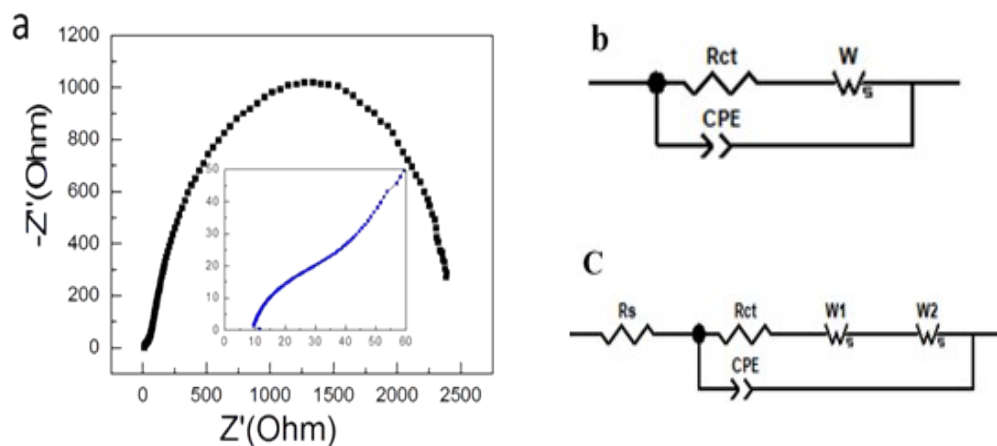


Fig. S2 (a) Nyquist plot of the CB-Si₃N₄-3% with 1.4 μm thickness and (b and C) Equivalent circuits used for fitting the electrochemical parameters for Pt and CB-Si₃N₄ dummy cells respectively.

Table S1 Corresponding parameters of CV, Bode EIS, and Tafel of CB, Si₃N₄ and CB-Si₃N₄-x based CEs and the corresponding DSSCs

CE	I_{PC} (mAcm ⁻²)	E_{pp} (V)	R_s (Ω)	R_{ct} (Ω)	CPE-T (μF)	W_1 (Ω)	W_2 (Ω)	Log J_0 (mA cm ⁻²)	Log J_{lim} (mA cm ⁻²)	R_{ct} Tafel (Ω)
Bare CB	-0.14	620	8.73	18.10	6.75	92.77	110.60	0.28	23.44	32.22
CB-Si ₃ N ₄ -1%	-0.69	600	7.21	4.25	14.20	37.70	68.55	0.51	45.71	1.89
CB-Si ₃ N ₄ -3%	-1.30	560	7.42	2.34	21.98	21.16	29.62	0.87	60.26	0.83
CB-Si ₃ N ₄ -5%	-1.15	560	9.86	2.48	28.30	43.95	55.11	0.08	14.45	5.10

I_{PC} is the cathodic current density, R_{ct} is the charge transfer resistance at the cathode- electrolyte interface, R_s is the series resistance, CPE-T is the capacitance at the cathode-electrolyte interface; W_1 , mass transport impedance, W_2 is the Nernst diffusion impedance of the redox couple (I_3^-/I^-), E_{pp} is the peak –peak separation of cyclic voltamogram, J_0 the exchange current density; J_{lim} the limiting diffusion current density.

Table S2 Corresponding parameters of CV, Bode EIS, and Tafel of Pt and CB-Si₃N₄-3% CEs with different thickness and the corresponding DSSCs

CE Thickness	I _{PC} (mAcm ⁻²)	E _{pp} (mV)	R _s (Ω)	R _{ct} (Ω)	CPE-T (μF)	W ₁ (Ω)	W ₂ (Ω)	Log J ₀ (mAcm ⁻²)	Log J _{lim} (mAcm ⁻²)	R _{ct} Tafel (Ω)
1.4μm	-0.33	640	9.08	53.52	14.40	1580	2817	-1.45	-0.07	172.45
2.4μm	-0.41	620	7.96	2.62	17.95	68.69	107.30	-0.49	0.66	18.89
4.7μm	-1.30	560	7.42	2.34	21.98	21.16	29.62	0.87	1.78	0.83
9.4μm	-1.35	500	9.07	2.26	31.85	15.49	20.75	1.20	1.98	0.39
14.1μm	-1.60	620	8.85	0.85	38.60	06.06	07.33	1.30	2.12	0.31
Pt (0.58 μm)	-1.93	320	6.28	3.19	47.76	---	02.03	1.50	33.11	0.12