Appendix A

Cell Efficiency Table of DSSCs with Various Counter Electrode Electrocatalysts

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Table A.1 Photovoltaic parameters of DSSCs with Pt-free CEs developed by other groups (AM 1.5, 100 mW cm^{-2}).

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Carbon materials									
Graphite + C_b	11.34	825.9	0.7121	**6.67**	0.40	Ru dye	I^-/I_3^-	1996	[1]
Activated carbon (C_a)	7.93	808	0.607	**3.89**	–	N3	I^-/I_3^-	2003	[2]
Single-wall CNTs	–	–	–	**4.5**	0.25	N719	I^-/I_3^-	2003	[3]
Nano-sized C_b	16.8	790	0.685	**9.1**	0.16	N719	I^-/I_3^-	2006	[4]
Hard carbon spherules	–	–	–	**5.7**	0.15	N3	I^-/I_3^-	2007	[5]
Multiwall CNTs	15.64	783	0.62	**7.59**	0.36	N719	I^-/I_3^-	2008	[6]
Mesoporous carbon (MC)	15.5	605	0.65	**6.18**	0.20	N3	I^-/I_3^-	2009	[7]
Multiwall CNTs	16.20	740	0.64	**7.67**	0.36	N719	I^-/I_3^-	2009	[8]
Screen-printed C	5.6	540	0.39	**1.2**	0.10	Z907	Co^{2+}/Co^{3+}	2010	[9]
Graphene sheets	13.16	640	0.60	**4.99**	0.39	N3	I^-/I_3^-	2010	[10]
Paste printing CNTs	15.27	738.43	0.69	**8.03**	0.25	N719	I^-/I_3^-	2010	[11]
CVD growing CNTs	17.62	755.89	0.73	**10.04**					
Graphite sheet	6.18	717	0.53	**2.33**	0.28	N719	I^-/I_3^-	2011	[12]
Graphite sheet	12.88	634	0.59	**4.79**			T_2/T^-		
Graphene	14.3	540	0.653	**5.69**	–	N719	I^-/I_3^-	2011	[13]
Graphene nanoplatelet	12.7	1030	0.70	**9.3**	0.20	Y123	Co^{2+}/Co^{3+}	2011	[14]

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Table A.1 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Graphene nanoplatelet	14.8	878	0.72	**9.4**	0.20	Y123	Co^{2+}/Co^{3+}	2011	[15]
Graphene nanoplatelet	13.1 11.0	724 673	0.52 0.60	**5.00** **4.38**	0.20	N719	I^-/I_3^- (Z946) I^-/I_3^- (Z952)	2011	[16]
C_a C_b CD	13.41 13.94 12.83	650 630 650	0.57 0.58 0.57	**4.96** **5.09** **4.75**	0.16	N719	T_2/T^-	2011	[17]
C_a C_b C_c CD C_f CNTs MC C_p C_{60}	13.07 12.30 12.41 13.38 13.20 13.25 14.40 12.02 11.60	802 805 805 809 806 808 807 780 750	0.626 0.631 0.668 0.697 0.625 0.656 0.646 0.455 0.323	**6.6** **6.3** **6.7** **7.5** **6.7** **7.0** **7.5** **4.3** **2.8**	0.16	N719	I^-/I_3^-	2011	[18]
Graphene Graphene Graphene	13.4 8.49 9.50	737 813 663	0.69 0.65 0.55	**6.79** **4.51** **3.45**	0.25	N719 D35 D35	I^-/I_3^- Co^{2+}/Co^{3+} T_2/T^-	2012	[19]
All carbon CE (LPAH)	14.1	761	0.80	**8.63**	0.31	N719	I^-/I_3^-	2012	[20]
Aligned single-wall CNTs	12.66	610	0.68	**5.25**	0.16	N719	T_2/T^-	2012	[21]
MC C_a	9.59 8.38	640 630	0.66 0.65	**4.05** **3.43**	0.16	N719	Co^{2+}/Co^{3+}	2012	[22]
Honeycomb-like 3D graphene	27.2	773	0.371	**7.80**	0.50	N719	I^-/I_3^-	2013	[23]
Oriented graphene	12.1	711	0.67	**5.36**	–	N719	I^-/I_3^-	2013	[24]
Reduced graphene oxide	18.77	692	0.74	**9.54**	0.283	C106 TBA	I^-/I_3^- (Z946)	2013	[25]
Aligned CNT fiber	15.49	683	0.69	**7.33**	–	N719	T_2/T^-	2013	[26]
Transparent carbon	10.52 8.64	721 704	0.60 0.62	**6.07** (front) **5.04** (rear)	0.24	N3	I^-/I_3^-	2013	[27]
Carbon (TCO-, Pt-free)	14.26	780	0.73	**8.11**	0.16	N719	I^-/I_3^-	2013	[28]

Table A.1 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
CNT fiber	11.56	707	0.55	**4.47**	Wire-shaped DSSC	N719	I^-/I_3^-	2014	[29]
CNT/RGO nanoribbon	11.30	713	0.70	**5.64**					
CNT/GRO hybrid	10.48	714	0.40	**3.02**					
RGO fiber	9.47	683	0.31	**2.02**					
CNT fiber	13.47	671	0.53	**4.78**			T_2/T^-		
CNT/RGO nanoribbon	11.70	664	0.47	**3.70**					
CNT/GRO hybrid	12.13	672	0.54	**4.42**					
RGO fiber	12.30	641	0.19	**1.46**					
Carbonized egg shell membranes	13.40	795	0.63	**6.71**	0.12	N719	I^-/I_3^-	2015	[30]
Carbon spheres	15.7	753	0.74	**8.7**	0.16	N719	I^-/I_3^-	2015	[31]
H_2-reduced carbon	14.6	710	0.727	**7.5**	0.188	Z991	I^-/I_3^-	2015	[32]
N-doped CNT-Co	16.03	740	0.65	**7.75**	0.25	N719	I^-/I_3^-	2015	[33]
N-doped CNT-Ni	17.22	710	0.69	**8.39**					
N-doped G	13.24	713	0.33	**3.12**	0.16	N719	I^-/I_3^-	2015	[34]
N-doped RGO	11.33	750	0.655	**5.56**	–	N719	I^-/I_3^-	2015	[35]
N-doped C	15.19	707	0.66	**7.09**	0.20	N3	I^-/I_3^-	2015	[36]
S-doped C	14.98	700	0.67	**6.97**	0.16	N719	I^-/I_3^-	2015	[37]
Carbon aerogel	17.80	695	0.65	**8.04**	–	N719	I^-/I_3^-	2015	[38]
MC	12.18	639.48	0.72	**5.58**	–	N719	I^-/I_3^-	2015	[39]
C	10.28	760	0.50	**4.33**	0.25	N3	I^-/I_3^-	2015	[40]
Carbon black	14.70	750	0.67	**7.28**	0.24	N719	I^-/I_3^-	2015	[41]
Carbon microspheres	13.3	740	0.556	**5.5**	0.2	N719	I^-/I_3^-	2015	[42]
Cl-G	14.40	962	0.69	**9.58**	–	N719	Co^{2+}/Co^{3+}	2015	[43]
Br-G	14.59	974	0.72	**10.03**					
I-G	14.81	977	0.71	**10.31**					
GO	19.91	711	0.43	**6.02**	–	N719	I^-/I_3^-	2015	[44]
G	17.88	712	0.37	**4.76**					
GNF	15.56	690	0.33	**3.60**	0.16	N719	I^-/I_3^-	2015	[45]
GNS	14.42	710	0.29	**2.99**					
GNB	16.59	700	0.67	**7.88**					
G nanosheets	14.76	740	0.47	**5.09**	0.126	N719	I^-/I_3^-	2015	[46]
Pt/G nanosheets	18.26	720	0.65	**8.54**					
Pt-doped carbon nanosheet	15.15	770	0.69	**8.05**	0.175	N719	I^-/I_3^-	2015	[47]
N-doped porous carbons	15.51	700	0.64	**6.95**	0.20	D3	I^-/I_3^-	2015	[48]

Table A.1 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
LZ/MWCNTs	7.67	490	0.43	**1.61**	0.25	N719	I^-/I_3^-	2016	[49]
CPC/MWCNTs	8.95	560	0.46	**2.27**					
NaDC/MWCNTs	9.16	530	0.42	**2.02**					
TritonX-100/ MWCNTs	9.23	600	0.49	**2.69**					
CNT/TiO_2	14.9	790	47.9	**5.65**	0.22	N719	I^-/I_3^-	2016	[50]
N-doped G	17.7	720	0.54	**6.8**	–	N719	I^-/I_3^-	2016	[51]
N-doped CNT	14.35	726	0.718	**7.48**	0.16	N719	I^-/I_3^-	2016	[52]
Carbon spheres	14.82	781	0.58	**6.71**	0.16	N719	I^-/I_3^-	2016	[53]
	11.77	690	0.62	**5.04**			T_2/T^-		
	15.43	844	0.66	**8.60**			Co^{2+}/Co^{3+}		
Co/Cr-CNFs	8.784	685	0.54	**3.27**	0.25	N719	I^-/I_3^-	2016	[54]
RGO	15.46	736	0.6435	**7.326**	0.25	N719	I^-/I_3^-	2016	[55]
GOG	16.34	770	0.58	**7.2**	0.28	N719	I^-/I_3^-	2016	[56]
SWCNH	14.48	680	0.42	**4.09**	0.40	N719	I^-/I_3^-	2016	[57]
GNP	13.72	660	0.33	**3.13**					
ECNFs	13.40	800	0.63	**6.75**	–	N719	I^-/I_3^-	2016	[58]
HC-GCF	14.75	660	0.7092	**6.93**	–	N719	I^-/I_3^-	2016	[59]
HCNF	15.51	701	0.62	**6.74**	–	N3	I^-/I_3^-	2016	[60]
CMS	13.23	785	0.6	**6.23**	–	N719	I^-/I_3^-	2016	[61]
	12.63	688	0.61	**5.30**			T_2/T^-		
	15.24	842	0.68	**8.73**			Co^{2+}/Co^{3+}		
Activated-GNP	22.54	730	0.47	**7.7**	0.125	N719	I^-/I_3^-	2016	[62]
CPNP800	12.36	727	0.53	**4.76**	0.25	N719	I^-/I_3^-	2016	[63]
APNP	14.37	735	0.62	**6.54**					
400 °C sintered carbon	8.52	770	0.54	**3.53**	–	N719	I^-/I_3^-	2016	[64]
CNH	16.14	790	0.61	**7.70**	–	N719	I^-/I_3^-	2016	[65]
15% CB 350 °C	14.81	777	0.580	**6.68**	–	N719	I^-/I_3^-	2016	[66]
15% CB 450 °C	14.74	779	0.722	**8.29**					
CNP	13.0	630	0.625	**5.10**	0.25	N719	I^-/I_3^-	2016	[67]
NCS 900	14.40	710	0.608	**6.28**	–	N719	I^-/I_3^-	2016	[68]
CS	13.30	740	0.556	**5.52**					
SWCNH	12.91	820	0.64	**6.76**	0.2	LEG4	$Co^{3+/2+}$	2016	[69]
Oxidized SWCNH	12.84	800	0.66	**6.75**					
GR	20.02	590	0.62	**7.20**	0.09	N719	I^-/I_3^-	2016	[70]
MWCNTs	13.65	719	0.61	**5.95**	0.09	N719	I^-/I_3^-	2016	[71]
CNA	16.17	761	0.68	**8.35**					
CNT (400 °C)	14.0	700	0.61	**6.02**	0.16	N719	I^-/I_3^-	2016	[72]
NGnPs	16.69	921.8	0.74	**11.42**	0.36	SGT-021	$Co(bpy)_3^{3+}$	2016	[73]

Table A.1 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
f-PPy	15.53	759	0.49	**5.78**	0.16	N719	I^-/I_3^-	2017	[74]
h-PPy	16.34	758	0.51	**6.32**					
HPC-900	13.51	710	0.5162	**4.98**	0.25	N719	I^-/I_3^-	2016	[75]
AC	12.11	710	0.5156	**4.45**					
BC	5.2	723	0.083	**0.312**	0.2	N719	I^-/I_3^-	2017	[76]
NBC	10.7	688	0.37	**2.48**					
GNPs	16.6	691	0.54	**6.23**	–		I^-/I_3^-	2017	[77]
Pristine CNT	14.82	648.0	0.465	**4.48**	0.25	N719	I^-/I_3^-	2017	[78]
GT	16.81	786	0.6355	**8.40**	–	N719	I^-/I_3^-	2017	[79]
GCW	17.09	770	0.5367	**7.05**					
GCT	17.62	777	0.6359	**8.70**					
N-CNR	15.01	678	0.58	**5.91**	–	N719	I^-/I_3^-	2017	[80]
N-PCNR	15.85	702	0.63	**7.01**					
MWCNT	11.05	660	0.60	**4.39**	0.36	N719	I^-/I_3^-	2017	[81]
Carbon	17.10	660	0.59	**6.72**	0.25	N3	I^-/I_3^-	2017	[82]
POCNTs	11.95	680	0.556	**4.53**	0.25	N719	I^-/I_3^-	2017	[83]
CNTs	12.47	680	0.557	**4.73**					
C-500	11.20	773	0.16	**1.41**	0.23	N719	I^-/I_3^-	2017	[84]
C-RT	10.80	772	0.16	**1.37**					
SCF-MWCNT/FTO	15.337	722	0.7616	**8.44**	0.2	N719	I^-/I_3^-	2017	[85]
CC-CE	11.042	533	0.4358	**2.56**					
AMWCNTs	12.07	630	0.52	**3.95**	0.25	N719	I^-/I_3^-	2017	[86]
STCB-1-H	11.72	829	0.63	**6.12**	0.25	Z907	Co^{2+}/Co^{3+}	2017	[87]
	6.88	877	0.76	**9.12**		Y123			
Graphite-C	17.99	840	0.73	**10.29**	0.25	N749	I^-/I_3^-	2017	[88]
MWCNT	12.591	714	0.7417	**6.66**	0.2	D719	PVDF-*co*-HFP	2017	[89]
Transition metal compounds (TMCs)									
CoS	11.91	750	0.73	**6.50**	0.159	Z907	I^-/I_3^-	2009	[90]
TiN nanotube arrays	15.78	760	0.64	**7.73**	0.25	N719	I^-/I_3^-	2009	[91]
WC	14.17	763	0.65	**7.01**	0.25	N719	I^-/I_3^-	2010	[92]
CoS	14.38	720	0.61	**6.33**	0.28	N719	I^-/I_3^-	2011	[93]
Honeycomb-like CoS	14.17	730	0.59	**6.01**	0.283	N719	I^-/I_3^-	2011	[94]
NiS	16.2	659	0.64	**6.83**	0.20	N719	I^-/I_3^-	2011	[95]
MoN	11.55	735	0.66	**5.57**	0.25	N719	I^-/I_3^-	2011	[96]
WN	9.75	700	0.54	**3.67**					
Fe_2N	12.20	535	0.41	**2.65**					

Table A.1 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
MoS_2	13.84	760	0.73	**7.59**	0.16	N719	I^-/I_3^-	2011	[97]
WS_2	14.13	780	0.70	**7.73**					
MoS_2	12.52	630	0.63	**4.97**	0.16	N719	T_2/T^-		
WS_2	12.99	640	0.64	**5.24**					
WO_2	14.02	808	0.64	**7.25**	0.16	N719	I^-/I_3^-	2011	[98]
WO_3	12.30	792	0.48	**4.67**					
Ni_3S_2	14.46	730	0.66	**7.01**	0.2826	N719	I^-/I_3^-	2011	[99]
$Co_{8.4}S_8$	12.82	760	0.66	**6.50**					
$Cu_{1.8}S$	14.74	650	0.40	**3.79**					
Mo_2C/P25	13.87	795	0.65	**7.22**	0.16	N719	I^-/I_3^-	2011	[100]
WC/P25	13.59	806	0.65	**7.08**					
H-Nb_2O_5	11.60	790	0.62	**5.68**	0.16	N719	I^-/I_3^-	2011	[101]
O-Nb_2O_5	11.71	770	0.51	**4.55**					
M-Nb_2O_5	12.12	780	0.61	**5.82**					
T-NbO_2	13.90	810	0.70	**7.88**					
Mo_2N	14.09	743	0.61	**6.38**	0.16	N719	I^-/I_3^-	2011	[102]
W_2N	12.96	786	0.57	**5.81**					
$Co_{0.85}Se$	16.98	738	0.75	**9.40**	0.2304	N719	I^-/I_3^-	2012	[103]
$Ni_{0.85}Se$	15.63	739	0.72	**8.32**					
NiS	13.5	750	0.65	**6.8**	0.16	N719	I^-/I_3^-	2012	[104]
Ni_3S_2	13.4	750	0.59	**5.9**					
TaO	12.59	770	0.67	**6.48**	0.16	N719	I^-/I_3^-	2012	[105]
Ta_2O_5	13.01	750	0.42	**4.08**					
CoS nanorod arrays	16.31	710	0.66	**7.67**	0.16	N719	I^-/I_3^-	2012	[106]
CoS nanosheets	16.53	710	0.58	**6.76**					
Honeycomb-like CoS	15.75	710	0.67	**7.45**					
TiN spheres	16.57	759	0.6221	**7.83**	0.16	N719	I^-/I_3^-	2012	[107]
TiC(N)	12.50	778	0.67	**6.52**	0.16	N719	I^-/I_3^-	2012	[108]
TiN	12.83	796	0.61	**6.23**					
TiO_2	3.10	742	0.33	**0.76**					
VC(N)	12.56	782	0.65	**6.38**					
VC	10.94	803	0.56	**4.92**					
VN	11.74	788	0.64	**5.92**					
V_2O_3	10.99	780	0.63	**5.40**					
VC/MC	13.11	808	0.72	**7.63**					
Cr_2C_3	11.31	825	0.62	**5.79**					
CrN	10.39	818	0.64	**5.44**					
Cr_2O_3	8.46	788	0.16	**1.07**					
ZrC	10.91	803	0.44	**3.85**					
ZrN	8.20	733	0.20	**1.20**					

Table A.1 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
ZrO_2	11.88	782	0.28	**2.60**					
NbC(N)	8.22	748	0.40	**2.46**					
NbN	9.81	798	0.47	**3.68**					
Nb_2O_5	9.98	808	0.60	**4.84**					
Mo_2C	12.42	769	0.61	**5.83**					
Mo_2N	11.68	784	0.66	**6.04**					
MoO_2	7.84	765	0.40	**2.40**					
TiC	9.77	640	0.66	**4.13**	0.16	N719	Co^{2+}/Co^{3+}	2012	[22]
NbO_2	9.14	610	0.65	**3.62**					
TiC	13.12	770	0.64	**6.46**	0.16	N719	I^-/I_3^-	2012	[109]
Ti/TiC	13.12	780	0.70	**7.15**	0.16	N719	I^-/I_3^-	2012	[110]
Ti/WO_2	13.78	750	0.69	**7.13**					
Ti/VN	12.42	750	0.75	**6.97**					
TiO_2	5.33	432	0.09	**0.21**	0.16	N719	I^-/I_3^-	2012	[111]
SnO_2	9.81	526	0.36	**1.84**					
WO_3	10.69	578	0.32	**2.00**					
WO_3	10.42	620	0.64	**4.17**	0.283	N719	I^-/I_3^-	2012	[112]
$WO_{2.72}$	11.39	630	0.71	**5.05**					
WO_2	12.48	750	0.62	**5.86**	0.16	N719	I^-/I_3^-	2013	[113]
TiC	12.28	770	0.65	**6.08**					
VN	11.66	730	0.69	**5.85**					
TaO_x	13.17	760	0.68	**6.79**	0.16	N719	I^-/I_3^-	2013	[114]
Ta_3N_5	12.16	760	0.55	**5.03**					
Ta_4C_3	12.92	780	0.74	**7.39**					
WO_3	13.77	730	0.45	**4.6**	0.16	N719	I^-/I_3^-	2013	[115]
$WO_{2.72}$	14.90	770	0.70	**8.03**					
WO_3	10.42	620	0.64	**4.17**			T_2/T^-		
$WO_{2.72}$	11.39	630	0.71	**5.05**					
CoSe	13.72	747	0.71	**7.30**	–	N719	I_3^-/I^-	2013	[116]
$NiSe_2$	15.94	734	0.743	**8.69**	0.484	N719	I^-/I_3^-	2013	[117]
Co_9S_8	14.21	710	0.69	**7.00**	2.00	N719	I^-/I_3^-	2013	[118]
FeS_2	15.14	710	0.68	**7.31**	0.16	N719	I^-/I_3^-	2013	[119]
Fe_3O_4	14.99	711	0.62	**6.61**	0.16	N719	I^-/I_3^-	2013	[120]
FeS_2 nanorod arrays	13.68	653	0.657	**5.88**	0.23	N719	I^-/I_3^-	2013	[121]
RuO_2	16.51	813	0.54	**7.22**	0.25	N719	I^-/I_3^-	2014	[122]
$W_{18}O_{49}$ NFs	17.14	700	0.66	**7.94**	0.16	N719	I^-/I_3^-	2014	[123]
$W_{18}O_{49}$ NFBs	17.08	710	0.63	**7.66**					
$W_{18}O_{49}$ HSs	16.50	710	0.53	**6.20**					
$CoNi_{0.25}$	18.02	706	0.66	**8.39**	0.25	N719	I_3^-/I^-	2014	[124]
SnS_2	16.96	743	0.607	**7.64**	0.16	N719	I^-/I_3^-	2014	[125]

Table A.1 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
$MoSe_2$/Mo	15.07	805	0.67	**8.13**	0.25	N719	I^-/I_3^-	2014	[126]
NiS	12.66	780	0.66	**6.74**	0.16	N719	I^-/I_3^-	2014	[127]
Ni/NiS	15.36	760	0.68	**7.84**					
$Co_{0.85}Se$	16.74	742	0.668	**8.30**	0.25	N719	I^-/I_3^-	2014	[128]
$Ni_{0.85}Se$	16.67	740	0.636	**7.85**					
$Cu_{0.50}Se$	14.55	713	0.620	**6.43**					
FeSe	17.10	733	0.610	**7.64**					
$Ru_{0.33}Se$	18.93	715	0.681	**9.22**					
NiS	–	–	–	**7.37**	0.20	N719	I^-/I_3^-	2014	[129]
RuSe	19.05	673	0.558	**7.15**	0.25	N719	I^-/I_3^-	2014	[130]
$Ru_{0.33}Se$	17.86	722	0.679	**8.76**	0.25	N719	I^-/I_3^-	2014	[131]
Co_3S_4	15.34	700	0.66	**7.19**	–	N719	I^-/I_3^-	2014	[132]
$NiSe_2$	14.30	750	0.68	**7.3**	–	N719	I^-/I_3^-	2014	[133]
$CoSe_2$	13.50	720	0.68	**6.6**					
$MoSe_2$	13.00	670	0.68	**5.9**					
NiS_2	14.70	720	0.52	**5.5**					
Ni_3Se_4	16.27	746	0.69	**8.31**	0.16	N719	I^-/I_3^-	2014	[134]
MoS_2	14.72	745	0.49	**5.41**	0.24	N719	I^-/I_3^-	2014	[135]
$SnO_{2-\delta}$	17.21	533	0.525	**4.81**	–	N719	I^-/I_3^-	2014	[136]
Nitrided Ni foam	9.62	670	0.60	**3.88**	0.20	N719	I^-/I_3^-	2014	[137]
Cu_2S	6.72	700	0.62	**2.88**	0.25	N719	I^-/I_3^-	2014	[138]
MoN	15.26	740	0.65	**7.29**	0.24	N719	I^-/I_3^-	2014	[139]
WO_x	13.44	760	0.51	**5.25**	1.05	N719	I^-/I_3^-	2014	[140]
$FeSe_2$	14.93	744	0.721	**8.00**	0.56	N719	I^-/I_3^-	2014	[141]
$Ni_{0.85}Se$	16.59	741	0.64	**7.85**	0.25	N719	I_3^-/I^-	2014	[142]
Co_9Se_8/CoSe	15.06	700	0.64	**6.75**	0.2	N719	I_3^-/I^-	2014	[143]
$Co_{0.85}Se$	16.27	772	0.673	**8.45**	–	N719	I^-/I_3^-	2014	[144]
	7.82	443	0.455	**1.57**		Z907	Co^{2+}/Co^{3+}		
$Co_{0.85}Se/Ni_{0.85}Se$	15.66	777	0.667	**8.12**		N719	I^-/I_3^-		
	7.37	651	0.530	**2.54**		Z907	Co^{2+}/Co^{3+}		
FeS_2 chain	15.3	720	0.65	**7.16**	–	N719	I^-/I_3^-	2014	[145]
SnS_2	15.66	759	0.53	**6.30**	–	N719	I^-/I_3^-	2014	[146]
$FeCo_2$	12.09	710	0.59	**5.06**	0.25	N719	I_3^-/I^-	2014	[147]
α-NiS	11.42	680	0.67	**5.2**	–	N719	I^-/I_3^-	2014	[148]
β-NiS	9.80	680	0.63	**4.2**					
NiS	11.42	680	0.67	**5.2**	0.25	N719	I^-/I_3^-	2014	[149]
CdS	10.10	630	0.22	**1.4**					
NiS/CdS	18.43	710	0.51	**6.6**					

Table A.1 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
$W_{18}O_{49}$ NFs	17.14	700	0.66	**7.94**	0.16	N719	I^-/I_3^-	2014	[123]
$W_{18}O_{49}$ NFBs	17.08	710	0.63	**7.66**					
$W_{18}O_{49}$ HSs	16.50	710	0.53	**6.20**					
CoS	9.23	700	0.51	**3.5**	1.00	N3	I^-/I_3^-	2015	[150]
	14.15	703	0.67	**6.6**	0.25	N719			
$FeSe_2$	17.49	718	0.60	**7.53**	0.16	N719	I^-/I_3^-	2015	[151]
Ni-doped CoS_2	12.12	649	0.698	**5.50**	0.27	N719	I^-/I_3^-	2015	[152]
Ni_3S_2	14.13	700	0.63	**6.23**	3.75	N719	I^-/I_3^-	2015	[153]
NiS/Ni_3S_2	15.33	710	0.66	**7.20**					
$Fe_{0.6}Se$	11.59	668	0.544	**4.21**	0.25	N719	I^-/I_3^-	2015	[154]
$Fe_{0.8}Se$	12.89	748	0.595	**5.74**					
FeSe	17.15	738	0.604	**7.64**					
$Fe_{1.2}Se$	14.65	690	0.564	**5.70**					
$Fe_{1.4}Se$	12.08	678	0.597	**4.89**					
FeSe	17.72	717	0.72	**9.16**	0.25	N719	I_3^-/I^-	2015	[155]
$FeSe_2$	14.23	769	0.72	**7.92**	0.16	N719	I_3^-/I^-	2015	[156]
$FeTe_2$	15.34	716	0.66	**7.21**					
$Co_{0.85}Se$	15.43	767	0.676	**8.00**	–	N719	I_3^-/I^-	2015	[157]
$Co_{0.85}Se$	13.44	660	0.68	**6.03**	0.2	N719	I_3^-/I^-	2015	[158]
$CoSe_2$	17.04	743	0.662	**8.38**	–	N719	I^-/I_3^-	2015	[159]
$Ni_{0.85}Se$	16.39	780	0.695	**8.88**	–	N719	I_3^-/I^-	2015	[160]
$Co_{0.85}Se$	16.80	742	0.67	**8.30**	0.25	N719	I_3^-/I^-	2015	[161]
$Mo_{0.6}Se$	15.71	729	0.70	**8.05**	0.25	N719	I_3^-/I^-	2015	[162]
$MoSe_2$	14.11	730	0.65	**6.70**	0.16	N719	I_3^-/I^-	2015	[163]
WSe_2	15.50	730	0.66	**7.48**					
$TaSe_2$	15.81	730	0.64	**7.32**					
CoS	15.4	751	0.642	**7.2**	–	N719	I^-/I_3^-	2015	[164]
CoS/SnO_2	15.6	760	0.63	**7.5**	Liquid state	N719	I^-/I_3^-	2015	[165]
	13.1	860	0.58	**6.6**	Solid state				
CuO	8.13	676	0.62	**3.4**	0.25	N719	I^-/I_3^-	2015	[166]
WO_3	12.8	400	0.18	**0.9**	0.16	N719	I^-/I_3^-	2015	[167]
NH_3-treated WO_3	14.0	680	0.62	**5.9**					
CoS	12.84	805	0.65	**6.72**	0.159	C218	Co^{2+}/Co^{3+}	2015	[168]
CoS_2	10.13	747	0.688	**5.20**	0.237	N719	I^-/I_3^-	2015	[169]
SnO_2	14.11	803	0.55	**6.25**	0.16	N719	I^-/I_3^-	2015	[170]
Ni_5P_4	14.7	720	0.72	**7.6**	0.16	N719	I^-/I_3^-	2015	[171]
NiS	16.79	740	0.59	**7.37**	–	N719	I^-/I_3^-	2015	[172]
NiS	12.68	630	0.72	**5.69**	0.25	N719	I^-/I_3^-	2015	[173]
NiS	13.55	712	0.62	**5.98**	0.25	N719	I^-/I_3^-	2015	[174]

Table A.1 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Ni_3S_4	13.58	700	0.66	**6.56**	0.16	N719	I^-/I_3^-	2015	[175]
MoS_2	13.08	680	0.65	**6.11**					
MoS_2	17.09	670	0.625	**7.35**	–	Ru 535	I^-/I_3^-	2015	[176]
MoS_2	16.90	727	0.517	**6.351**	0.28	N719	I^-/I_3^-	2015	[177]
SnS	16.54	762	0.73	**9.20**	0.25	C101	I^-/I_3^-	2015	[178]
SnSe	16.55	763	0.74	**9.34**					
Ag_2S	16.79	757	0.66	**8.40**	0.16	N719	I^-/I_3^-	2015	[179]
Bi_2S_3	6.67	612	0.55	**2.25**	–	N719	I^-/I_3^-	2015	[180]
Sb_2S_3	14.5	700	0.528	**5.37**	–	N719	I^-/I_3^-	2015	[181]
Al-Si	11.80	748	0.74	**6.13**	0.175	N719	I_3^-/I^-	2015	[182]
SnO_2/SnS_2	15.5	700	0.74	**8.08**	–	N719	I^-/I_3^-	2015	[183]
$Co_{0.85}Se/MoSe_2/MoO_3$	13.80	768	0.671	**7.10**	0.12	N719	I^-/I_3^-	2015	[184]
WO_3	9.52	541	0.19	**0.98**	–	D3	I^-/I_3^-	2015	[185]
NiS_2	17.48	712	0.63	**7.84**	0.25	N719	I^-/I_3^-	2015	[186]
CoS/Au	13.35	640	0.55	**4.73**	–	N719	I^-/I_3^-	2015	[187]
α-Fe_2O_3	14.77	656	0.47	**4.60**	0.25	N719	I^-/I_3^-	2015	[188]
MoS_2/TiO_2	13.76	820	0.45	**5.08**	–	N719	I^-/I_3^-	2015	[189]
ZnS/CoS	15.1	650	0.622	**6.11**	–	Z907	I^-/I_3^-	2016	[190]
TaC	14.56	771	0.63	**7.07**	0.16	N719	I^-/I_3^-	2016	[53]
	12.53	683	0.64	**5.48**			T_2/T^-		
	15.76	845	0.65	**8.67**			Co^{2+}/Co^{3+}		
SnS_2	13.0	710	0.70	**6.47**	–	N719	I^-/I_3^-	2016	[191]
5% Ag-doped SnS_2	16.7	740	0.70	**8.70**					
NiS	14.11	770	0.68	**7.39**	–	N719	I^-/I_3^-	2016	[192]
$Co/Co_{0.85}Se$	14.73	650	0.68	**6.55**	–	N719	I^-/I_3^-	2016	[193]
$Ni/Ni_{0.85}Se$	15.28	680	0.68	**7.07**					
NiS/NiS_2	15.39	788	0.63	**7.66**	–		I^-/I_3^-	2016	[194]
Co_9S_8	13.8	710	0.663	**6.59**	0.25	N719	I^-/I_3^-	2016	[195]
NiS NAs	18.4	738	0.73	**9.8**	0.25	N719	I^-/I_3^-	2016	[196]
NiS NPs	14.9	735	0.71	**7.8**					
PEDOT:PSS	12.79	690	0.33	**2.99**	0.16	N719	I^-/I_3^-	2016	[197]
Si_3N_4	16.11	760	0.67	**8.18**					
SiO_2	15.05	720	0.55	**5.98**					
SiS_2	16.04	700	0.63	**7.02**					
$SiSe_2$	16.98	720	0.67	**8.20**					
CoS	7.72	716	0.52	**5.75**	0.3	N719	I^-/I_3^-	2016	[198]
NiS	2.19	698	0.21	**0.64**					
CoS/NiS	7.96	771	0.54	**6.64**					

Table A.1 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
FeS_2	17.01	780	0.56	**7.43**	0.25	N719	I^-/I_3^-	2016	[199]
FeS_2 without NaOH	10.20	700	0.66	**4.76**	–	N719	I^-/I_3^-	2016	[200]
FeS_2 with NaOH	12.08	740	0.64	**5.78**					
Mo_2C-MS	15.23	853	0.67	**8.70**	0.16	YD2-o-C8	Co^{3+}/Co^{2+}	2016	[201]
Mo_2C-NR	14.04	842	0.59	**6.97**					
As-prepared MoS_2	11.92	656	0.35	**2.74**	–	N719	I^-/I_3^-	2016	[202]
Heat-sintered MoS_2	13.01	705	0.65	**5.96**					
Laser-sintered MoS_2	14.94	718	0.67	**7.19**					
$NiCo_2S_4$/NiS	17.7	744	0.67	**8.8**	–	N719	I^-/I_3^-	2016	[203]
$NiCo_2S_4$	17.4	743	0.66	**8.5**					
Co_9S_8	16.2	741	0.64	**7.7**					
NiS	14.9	735	0.63	**6.9**					
ZIF-67	6.59	760	0.52	**2.85**	–	N719	I^-/I_3^-	2016	[204]
CoS_2-1hr	12.1	760	0.64	**5.87**					
CoS_2-2hr	15.6	740	0.67	**7.77**					
CoS_2-4hr	16.9	730	0.66	**8.20**					
CoS_2-8hr	12.8	750	0.71	**6.78**					
Cu network	0.0085	0.086	0.342	**1.83×10^{-4}**	–	N719	I^-/I_3^-	2016	[205]
CuS NS network	18.10	660	0.534	**6.38**					
ZnO/CoS	10.84	589	0.430	**2.75**	0.25		polysulfide	2016	[206]
ZnO/NiS	11.81	595	0.444	**3.12**					
ZnO/CuS	12.79	605	0.530	**4.10**					
ZnO/PbS	13.28	633	0.566	**4.76**					
SnS_2	13.0	710	0.70	**6.47**	–	N719	I^-/I_3^-	2016	[191]
1% Ag-doped SnS_2	13.9	720	0.69	**6.87**					
3% Ag-doped SnS_2	15.5	720	0.70	**7.78**					
5% Ag-doped SnS_2	16.7	740	0.70	**8.70**					
7% Ag-doped SnS_2	14.3	720	0.70	**7.24**					
Pt Film	16.00	720	0.54	**6.00**	–	N719	I^-/I_3^-	2016	[207]
Pt NRs	17.53	710	0.53	**6.58**					
$Co_{0.85}Se$	16.9	757	0.671	**8.58**	0.16	N719	I^-/I_3^-	2016	[208]
$Ni_{0.85}Se$	14.8	752	0.640	**7.09**					
2H MoS_2	6.78	730	0.35	**1.72**	–	N719	I^-/I_3^-	2016	[209]
1T MoS_2	18.76	730	0.52	**7.08**					
50sccm MoS_2	15.2	707	0.697	**7.50**	0.16	N719	I^-/I_3^-	2016	[210]
150sccm MoS_2	14.9	710	0.698	**7.38**					

Table A.1 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Ni	12.23	760	0.37	**3.39**	0.25	N719	–	2016	[211]
CuS-1	5.51	630	0.49	**1.72**					
CuS-2	5.24	610	0.51	**1.65**					
CuS-3	5.07	620	0.43	**1.37**					
Ni@CuS-1	14.38	550	0.53	**4.16**					
Ni@CuS-2	14.74	590	0.57	**4.89**					
Ni@CuS-3	11.57	680	0.59	**4.62**					
$NiS_{0.5}$	12.6	780	0.654	**6.45**	0.36	N719	I^-/I_3^-	2017	[212]
$NiS_{0.75}$	13.1	790	0.662	**6.86**					
NiS	13.4	780	0.665	**6.95**					
NiS_2 cube	12.16	714	0.64	**5.56**	0.12	N719	I^-/I_3^-	2017	[213]
FeS	14.00	667	0.63	**6.47**	0.12	N719	I^-/I_3^-	2017	[214]
α-Fe_2O_3	10.33	641	0.63	**3.79**					
Ni_3Se_2 array	10.29	670	0.67	**4.62**	1	N719	I^-/I_3^-	2017	[215]
VS_2-140 °C	11.52	671	0.58	**4.48**	0.2	Z907	I^-/I_3^-	2017	[216]
VS_2-160 °C	13.06	681	0.60	**5.34**					
VS_2-180 °C	13.65	726	0.63	**6.24**					
VS_2-200 °C	10.89	672	0.46	**3.37**					
HED-$NiSe_2$	17.30	720	0.67	**8.24**	0.25	N719	I^-/I_3^-	2017	[217]
ED-$NiSe_2$	16.67	720	0.67	**7.97**					
o-$CoSe_2$	17.35	771	0.70	**9.34**	0.16	N719	I^-/I_3^-	2017	[218]
c-$CoSe_2$	16.60	775	0.69	**8.91**					
Co_3Se_4NTs	16.10	772	0.68	**8.44**					
Co_3Se_4 NPs	15.52	762	0.69	**8.15**					
$MoSe_2$/Mo	20.1	711	0.67	**9.57**	–	N719	I^-/I_3^-	2017	[219]
WSe_2/W	20.42	640	0.65	**8.22**	–	N719	I^-/I_3^-	2017	[220]
NbO_2	13.40	720	0.58	**5.62**	0.16	N719	I^-/I_3^-	2017	[221]
$Nb_{3.49}N_{4.56}O_{0.44}$	16.04	700	0.57	**6.36**					
NbN	13.21	710	0.55	**5.19**					
$W_{18}O_{49}$	15.78	670	0.64	**6.69**	0.16	N719	I^-/I_3^-	2017	[222]
W_2N	15.65	690	0.55	**5.97**					
WC	12.96	650	0.62	**5.20**					
WO_3	10.16	670	0.69	**4.69**					
Conductive polymers									
PEDOT-TsO	11.2	670	0.61	**4.60**	0.35	Ru535	I^-/I_3^-	2002	[223]
PEDOT-PSS	11.0	680	0.28	**2.10**					
PEDOT-ClO_4	9.6	680	0.66	**4.2**	0.20	Z907	I^-/I_3^-	2007	[224]
PEDOT-PSS	9.1	680	0.67	**4.2**					
PEDOT-TsO	9.2	665	0.66	**4.0**					
PPy	15.01	740	0.69	**7.66**	–	N719	I^-/I_3^-	2008	[225]
Microporous PANI	14.60	714	0.69	**7.15**	0.50	N719	I^-/I_3^-	2008	[226]

Table A.1 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
PANI-SO_4	10.7	810	0.64	**5.6**	0.15	N719	I^-/I_3^-	2009	[227]
Transparent PEDOT	14.1	787.1	0.73	**8.0**	0.16	N719	I^-/I_3^- (flexible)	2009	[228]
PProDOT-Et_2	11.22	740	0.63	**5.20**	0.238	N719	I^-/I_3^- (flexible)	2009	[229]
PEDOT PProDOT PProDOT-Et_2	8.84 16.80 18.00	705 715 720	0.63 0.59 0.61	**3.93** **7.08** **7.88**	0.25	N3	I^-/I_3^-	2009	[230]
PEDOT	15.0 15.2 15.5	693 683 673	0.76 0.75 0.75	**7.93** **7.86** **7.87**	0.159	N719	I^-/I_3^-	2010	[231]
PProDOT1 PProDOT2 PProDOT3	16.4 16.4 17.0	770 770 761	0.72 0.72 0.71	**9.12** **9.12** **9.25**	0.20	N719	I^-/I_3^-	2010	[232]
PEDOT nanotube arrays PEDOT flat	16.24 15.83	720 730	0.70 0.69	**8.3** **7.9**	0.20	N719	I^-/I_3^-	2011	[233]
Transparent PANI	15.24 9.48	710 687	0.604 0.655	**6.54** (front) **4.26** (rear)	0.25	N3	I^-/I_3^-	2011	[234]
PPy	9.2 8.9	684 704	0.54 0.51	**3.4** **3.2**	0.20	Z907	I^-/I_3^-	2011	[235]
Spherical PPy	15.5	778	0.64	**7.73**	0.18	N719	I^-/I_3^-	2011	[236]
PEDOT	15.9	910	0.71	**10.30**	0.20	Y123	Co^{2+}/Co^{3+}	2011	[237]
PEDOT nanofibers	15.7 17.5	717 724	0.734 0.726	**8.3** **9.2**	0.18	N719	I^-/I_3^-	2012	[238]
PEDOT	15.9	687	0.72	**7.9**	0.159	Z907	T_2/T^-	2012	[239]
PEDOT PProDOT1 PProDOT2 PProDOT-Et_2 PProDOT-Me_2	12.15 12.62 11.95 11.51 12.33	1027 999 1003 1006 1006	0.69 0.78 0.73 0.70 0.70	**8.62** **9.9** **8.7** **8.0** **8.74**	0.20	Y123	Co^{2+}/Co^{3+}	2012	[240]
PProDOT	13.06	998	0.774	**10.08**	0.20	Y123	Co^{2+}/Co^{3+}	2012	[241]
PEDOT	10.7	865	0.70	**6.3**	0.25	LEG4	Co^{2+}/Co^{3+}	2013	[242]
PANI nanowire arrays PANI random network	15.09 12.76	780 720	0.70 0.65	**8.24** **5.97**	0.25	FNE29	Co^{2+}/Co^{3+}	2013	[243]
PPy (TCO-, Pt-free)	13.10	716	0.56	**5.27**	0.25	N719	I^-/I_3^-	2013	[244]

Table A.1 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
PEDOT(TCO-, Pt-free) (EFG substrate)	10.2	770	0.72	**5.78**	0.25	N719	Polymer electrolyte	2013	[245]
PEDOT	14.18	731	0.68	**7.42**	0.35	N719	I^-/I_3^-	2015	[246]
PEDOT	10.4	730	0.68	**5.1**	0.25	N719	I^-/I_3^-	2015	[247]
PANI	11.27	730	0.68	**5.75**	0.25	N719	I^-/I_3^-	2015	[248]
PEDOT	14.0	737	0.72	**7.47**	0.15	N719	I^-/I_3^-	2015	[249]
PEDOT:PSS	4.71	698	0.724	**2.38**	–	N719	I^-/I_3^-	2015	[250]
PEDOT	5.1	750	0.58	**2.2**	0.38	Z907	Co^{2+}/Co^{3+}	2015	[251]
	8.4	920	0.67	**5.1**		D35			
PEDOT	14.09	773	0.59	**6.43**	0.16	N719	I^-/I_3^-	2016	[53]
	11.21	683	0.59	**4.52**			T_2/T^-		
	15.38	851	0.62	**8.11**			Co^{2+}/Co^{3+}		
Cu-doped PANI	5.99	600	0.5324	**6.37**	1	N719	I^-/I_3^-	2016	[252]
PANI	2.45	500	0.5990	**2.44**					
N-doped PANI	1.43	500	0.5727	**1.36**					
PPy	4.5	630	0.38	**1.1**	–	N719	I^-/I_3^-	2016	[253]
PEDOT:PSS	14.92	730	0.47	**5.19**	0.20	N719	I^-/I_3^-	2016	[254]
PEDOT:PSS + TiO_2 NP 200 mg	16.39	720	0.72	**8.27**					
Normal PEDOT	10.81	685	0.59	**4.40**	–	N719	I^-/I_3^-	2016	[255]
PEDOT-36	14.78	705	0.62	**6.38**					
PEDOT:PSS	10.88	720	0.436	**3.441**	0.20	N719	I^-/I_3^-	2016	[256]
PEDOT:PSS + Al_2O_3 NP 50 mg	11.91	710	0.591	**5.023**					
PEDOT:PSS + Si_3N_4 NP 100 mg	12.60	710	0.746	**6.648**					
PEDOT:PSS+ZrO_2 NP 50 mg	10.72	710	0.726	**5.519**					
PEDOT:PSS+V_2O_5 NP 100 mg	11.37	700	0.511	**4.066**					
PEDOT:PSS+WO_3 NP 100 mg	12.49	730	0.475	**4.346**					
PEDOT-TsO	14.25	723	0.48	**4.93**	1	N719	I^-/I_3^-	2017	[257]
PEDOT(hydrazine)	13.62	738	0.45	**4.53**					
PEDOT(iodine)	14.49	745	0.46	**6.86**					
PEDOT	17.72	768	0.67	**9.12** (front)	0.10	N719	I^-/I_3^-	2017	[258]
	11.23	731	0.70	**5.75** (rear)					

Table A.2 Photovoltaic parameters of DSSCs using Pt-free nanohybrid CEs (AM 1.5, 100 mW cm^{-2}).

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
TMCs/carbon nanohybrids									
Pt	12.48	730	0.65	**6.40**	0.20	Z907	I^-/I_3^-	2009	[259]
TiO_2/C	12.53	700	0.57	**5.50**	0.24				
Pt	12.83	735	0.60	**5.68**	0.25	N719	I^-/I_3^-	2010	[260]
TiN	9.28	660	0.35	**2.12**					
CNTs	8.55	705	0.52	**3.53**					
TiN/CNTs	12.74	750	0.57	**5.41**					
Pt	13.71	780	0.71	**7.55**	0.16	N719	I^-/I_3^-	2011	[261]
WO_2	12.69	807	0.65	**6.69**					
MC	14.54	799	0.60	**7.01**					
WO_2/MC	13.55	808	0.71	**7.76**					
WC	41.01	650	0.56	**5.10**	0.16	N719	T_2/T^-	2011	[17]
WC/MC	14.45	650	0.57	**5.34**					
Pt	15.23	807	0.64	**7.89**	0.16	N719	I^-/I_3^-	2011	[100]
MoC/MC	15.50	787	0.68	**8.34**					
WC/MC	14.59	804	0.70	**8.18**					
CoS/MWCNTs	15.96	720	0.64	**6.96**	0.283	N719	I^-/I_3^-	2011	[262]
MoC/MC	15.50	787	0.68	**8.34**	0.16	N719	I^-/I_3^-	2011	[100]
WC/MC	14.59	804	0.70	**8.18**					
Mo_2C/P25/CD	15.25	796	0.67	**8.14**					
WC/P25/CD	14.93	787	0.68	**8.34**					
Pt	10.12	765	0.6508	**5.03**	1.00	N719	I^-/I_3^-	2011	[263]
TiN/NG	12.34	728	0.6433	**5.78**					
Pt	14.08	783	0.68	**7.50**	0.16	N719	I^-/I_3^-	2012	[108]
VC/MC	13.11	808	0.72	**7.63**					
Pt	15.00	808	0.66	**8.00**	0.25	N719	I^-/I_3^-	2012	[264]
TiO_2/MC	15.20	800	0.55	**6.69**					
TiN/MC	15.30	820	0.67	**8.41**					
Pt	15.44	652	0.33	**3.32**			T_2/T^-		
TiN/MC	14.36	697	0.67	**6.71**					
MC	14.54	800	0.60	**7.01**	0.16	N719	I^-/I_3^-	2012	[265]
Ni_5P_4/C	13.85	780	0.69	**7.54**					
Ni_5P_4	13.84	770	0.54	**5.71**					
MoP	12.79	760	0.51	**4.92**					
MC	12.88	630	0.54	**4.40**	0.16	N719	T_2/T^-		
Ni_5P_4/C	11.81	630	0.64	**4.75**					
Ni_5P_4	11.40	630	0.54	**3.87**					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Pt	13.33	782	0.63	**6.59**	1.00	N719	I^-/I_3^-	2012	[266]
C_b	12.80	760	0.61	**5.93**					
TiN	10.06	741	0.48	**3.59**					
TiN/C_b	14.29	791	0.70	**7.92**					
Pt	13.12	744	0.62	**6.08**	0.20	N719	I^-/I_3^-	2012	[267]
Graphene	12.88	701	0.52	**4.70**					
$Ni_{12}P_5$	12.24	727	0.44	**3.94**					
Graphene/$Ni_{12}P_5$	12.86	727	0.61	**5.70**					
Pt	15.86	740	0.63	**7.35**	0.20	N719	I^-/I_3^-	2012	[268]
MoN	13.71	670	0.61	**5.57**					
MoO_2	12.52	515	0.43	**2.79**					
MoO_2/CNTs	13.67	725	0.44	**4.34**					
MoN/CNTs	14.40	735	0.64	**6.74**					
Pt	13.24	740	0.66	**6.41**	0.28	N719	I^-/I_3^-	2012	[269]
MoS_2	11.25	720	0.61	**4.99**					
MWCNTs	9.11	650	0.58	**3.53**					
MoS_2/MWCNTs	13.69	730	0.65	**6.45**					
Pt	12.43	750	0.67	**6.23**	0.20	N719	I^-/I_3^-	2012	[270]
MoS_2/graphene	12.41	710	0.68	**5.98**					
Pt	12.47	730	0.71	**6.48**	0.25	N3	I^-/I_3^-	2012	[271]
Carbon/SnO_2/TiO_2	12.98	740	0.64	**6.15**					
Pristine graphene	11.0	670	0.171	**1.27**	–	N719	I^-/I_3^-	2012	[272]
CoS/graphene	12.8	720	0.364	**3.42**					
Pt	13.23	760	0.75	**7.54**	0.20	N719	I^-/I_3^-	2012	[273]
WS_2	11.72	720	0.63	**5.32**					
MWCNT	10.77	660	0.61	**4.34**					
WS_2/MWCNT	13.63	750	0.72	**7.36**					
$Hf_7O_8N_4$/HfO_2/C	14.13	800	0.70	**7.85**	0.16	N719	I^-/I_3^-	2013	[274]
HfO_2/C	12.96	770	0.67	**6.71**					
HfO_2	12.63	730	0.40	**3.73**					
Pt	6.47	580	0.44	**1.87**	0.25	N719	Co^{2+}/Co^{3+}	2013	[275]
Ag nanowire	5.32	540	0.36	**1.09**					
Ag nanowire/GNP	6.45	550	0.52	**1.61**					
Pt	13.73	835	0.69	**7.91**	0.25	FNE29	Co^{2+}/Co^{3+}	2013	[276]
TaON	11.35	773	0.29	**2.54**					
Graphene	12.33	814	0.46	**4.62**					
Graphene/TaON	13.38	829	0.69	**7.65**					
Pt	15.75	739	0.70	**8.15**	0.25	N719	I^-/I_3^-	2013	[277]
NiS_2	14.42	738	0.66	**7.02**					
Graphene	10.98	716	0.40	**3.14**					
RGO/NiS_2	16.55	749	0.69	**8.55**					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Pt	13.38	828	0.685	**7.59**	0.25	FNE29	Co^{2+}/Co^{3+}	2013	[278]
Ta_3N_5	11.69	783	0.316	**2.89**					
Graphene	12.41	819	0.448	**4.55**					
Graphene/Ta_3N_5	13.53	837	0.693	**7.85**					
Pt (FTO)	9.92	730	0.69	**5.00**	–	N719	I^-/I_3^-	2013	[279]
Graphene(SiO_2)	8.68	691	0.3234	**1.94**					
NiS/graphene(SiO_2)	10.31	724	0.7036	**5.25**					
NiS(FTO)	9.42	707	0.6288	**4.19**					
CoS/graphene(SiO_2)	10.03	725	0.6928	**5.04**					
CoS(FTO)	9.01	708	0.6161	**3.93**					
Pt	13.98	730	0.66	**6.74**	0.20	N719	I^-/I_3^-	2013	[280]
MoS_2	11.66	730	0.63	**5.36**					
MoS_2/C	15.07	750	0.68	**7.69**					
Pt	13.98	720	0.64	**6.40**	0.12	N719	I^-/I_3^-	2013	[281]
Graphitic carbon (GC)	12.71	710	0.53	**4.75**					
Fe_3C/GC	13.77	700	0.63	**6.04**					
Pt	12.95	750	0.66	**6.41**	0.20	N719	I^-/I_3^-	2013	[282]
Graphene flake	10.96	690	0.48	**3.63**					
MoS_2	10.56	670	0.58	**4.10**					
MoS_2/graphene	13.27	750	0.61	**6.07**					
Pt	13.12	763	0.62	**6.24**	0.28	N719	I^-/I_3^-	2013	[283]
MoS_2	12.92	701	0.46	**4.15**					
Graphene nanosheets	11.99	754	0.30	**2.68**					
MoS_2/graphene	12.79	773	0.59	**5.81**					
Pt	12.46	751	0.68	**6.36**	0.28	N719 Ti foil	I^-/I_3^-	2013	[284]
MWCNT	7.83	591	0.33	**1.53**					
NiS	13.25	752	0.71	**7.07**					
NiS/MWCNT	14.18	753	0.74	**7.90**					
Pt	12.35	750	0.69	**6.39**	0.28	N719 Ti foil	I^-/I_3^-	2013	[285]
MWCNT	8.25	376	0.41	**1.27**					
CoS	13.88	750	0.71	**7.38**					
CoS/MWCNT	14.69	751	0.73	**8.05**					
Pt	13.23	740	0.67	**6.56**	0.20	N719	I^-/I_3^-	2013	[286]
WS_2	11.28	720	0.59	**4.79**					
MWCNT	10.77	660	0.61	**4.34**					
5 wt% MWCNT/WS_2	13.51	730	0.65	**6.41**					
Pt	13.80	540	0.41	**3.06**	0.16	Quantum QDSSC	Polysulfide electrolyte	2013	[287]
MWCNT	13.40	510	0.35	**2.39**					
CZTSe	16.36	530	0.44	**3.06**					
MWCNT/CZTSe	17.04	530	0.51	**4.60**					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Pt	15.18	710	0.68	**7.32**	0.16	N719	I^-/I_3^-	2013	[288]
MC	14.45	770	0.64	**7.19**					
TaO/MC	14.97	800	0.68	**8.09**					
TaC/MC	14.51	800	0.68	**7.93**					
Pt	13.99	750	0.68	**7.19**	0.16	N719	I^-/I_3^-	2013	[274]
HfO_2	12.63	730	0.40	**3.73**					
HfO_2/C	12.96	770	0.67	**6.71**					
$Hf_7O_8N_4/HfO_2$/C	14.13	800	0.70	**7.85**					
Rosin carbon Carbon/Fe_3O_4	14.41 16.01	795 750	0.61 0.68	**7.00** **8.11**	0.16	N719	I^-/I_3^-	2013	[120]
HfO_2/MC	14.36	800	0.67	**7.75**	0.16	N719	I^-/I_3^-	2014	[289]
	10.45	590	0.60	**3.69**			T_2/T^-		
SnS_2/C	17.47	745	0.619	**8.06**	0.16	N719	I^-/I_3^-	2014	[125]
Cu/PACF Cu/PACF/CNF	8.49 11.12	720 750	0.52 0.54	**3.20** **4.36**	0.16	N719	I^-/I_3^-	2014	[290]
WC/C	15.35	760	0.67	**7.77**	0.25	N719	I^-/I_3^-	2014	[291]
	13.96	630	0.66	**5.85**			T_2/T-		
Bi_2S_3/RGO	12.20	750	0.60	**5.5**	0.25	N719	I^-/I_3^-	2014	[292]
CNTs/MoS_2	14.93	650	0.47	**4.51**	0.25	N719	I^-/I_3^-	2014	[293]
CNTs/MoS_2/carbon	16.44	790	0.57	**7.23**					
CoS CoS/FGN	11.78 12.91	670 670	0.61 0.64	**4.79** **5.54**	3.75	N719	I^-/I_3^-	2014	[294]
MWCNT TiO_2/MWCNT	14.83 15.71	700 720	0.56 0.68	**5.81** **7.69**	0.25	N3	I^-/I_3^-	2014	[295]
Pt Mn_3O_4/RGO	16.25 15.20	635 635	0.66 0.61	**6.84** **5.90**	0.2	N3	I^-/I_3^-	2014	[296]
Pt $NiSe_2$/RGO	16.00 15.82	710 730	0.60 0.61	**6.82** **6.94**	0.25	N719	I^-/I_3^-	2014	[297]
TiC/SiC/C	11.13	782	0.654	**5.7**	–	N719	I^-/I_3^-	2014	[298]
Pt $CuInS_2$/RGO	14.77 16.61	751 782	0.62 0.58	**6.92** **6.96**	0.25	N719	I^-/I_3^-	2014	[299]
Bi_2S_3 Bi_2S_3/RGO (9 wt%)	15.34 15.33	690 740	0.438 0.609	**4.78** **6.91**	–	N719	I^-/I_3^-	2014	[300]
ZnO/GN	21.70	765	0.671	**8.12**	–	N719	I^-/I_3^-	2015	[301]
$CoNi_2S_4$/carbon fibers	15.3	680	0.677	**7.03**	–	N719	I^-/I_3^-	2015	[302]
Pt RuO_2/G	17.10 16.13	780 766	0.62 0.67	**8.16** **8.32**	–	N719	I^-/I_3^-	2015	[303]
CoS_2/RGO	12.87	670	0.63	**5.43**	–	Z907	I^-/I_3^-	2015	[304]
CoS/GR	15.07	748	0.56	**6.31**	0.20	N719	I^-/I_3^-	2015	[305]
CdS/RGO	14.81	760	0.656	**7.39**	0.25	N719	I^-/I_3^-	2015	[306]
SnO_2/RGO	14.25	720	0.66	**6.78**	–	N719	I^-/I_3^-	2015	[307]
TiO_2/C	4.0	710	0.622	**1.9**	1	N719	I^-/I_3^-	2015	[308]
Cu-Ni/GR	13.35	660	0.623	**5.46**	0.16	N719	I^-/I_3^-	2015	[309]

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
SnS_2/RGO	14.80	718	0.67	**7.12**	0.25	N719	I^-/I_3^-	2015	[310]
CoTe/RGO	17.41	770	0.685	**9.18**	–	N719	I^-/I_3^-	2015	[311]
MoS_2/MWCNT	16.71	737	0.608	**7.50**	0.15	N719	I^-/I_3^-	2015	[312]
MoS_2/G	15.64	685	0.67	**7.18**	–	N719	I^-/I_3^-	2015	[313]
PtO/MWCNTs	17.93	763	0.633	**8.67**	0.25	N719	I^-/I_3^-	2015	[314]
GNs/ZnO	21.7	765	0.671	**8.12**	0.16	N719	I^-/I_3^-	2015	[301]
AuNP/RGO	7.27	355.2	0.50	**1.30**	0.49	N719	I^-/I_3^-	2015	[315]
CoS/$RGO_{0.2}$	19.42	764	0.633	**9.39**	–	N719	I^-/I_3^-	2015	[316]
NiCo/CNFs	11.12	740	0.54	**4.47**	0.25	N719	I^-/I_3^-	2015	[317]
NiO/MWCNT	18.54	644	0.639	**7.63**	0.15	N719	I^-/I_3^-	2015	[318]
TiO_{2-x}/CNT	12.36	700	0.66	**5.71**	–	N719	I^-/I_3^-	2015	[319]
$NiCo_2O_4$/G	16.12	750	0.67	**8.10**	0.28	N719	I^-/I_3^-	2015	[320]
NiO/acetylene black	16.28	780	0.61	**7.75**	0.15	N719	I^-/I_3^-	2015	[321]
CoS/G	15.07	748	0.56	**6.31**	0.20	N719	I^-/I_3^-	2015	[305]
CoS/G	17.02	770	0.63	**8.34**	0.30	N719	I^-/I_3^-	2015	[322]
Ni_3S_2/C	20.75	750	0.62	**9.64**	–	N719	I^-/I_3^-	2015	[323]
$Ni_{0.75}Cu_{0.25}$/G	10.35	750	0.65	**5.1**	0.25	N719	I^-/I_3^-	2015	[324]
$Ni_{0.6}Cu_{0.4}$/G	10.03	720	0.39	**2.87**					
$Cu_{0.75}Ni_{0.25}$/G	7.44	518	0.32	**1.24**					
Fe_2O_3	13.60	711	0.61	**5.89**	0.16	N719	I^-/I_3^-	2016	[325]
Fe_2O_3/GFs	15.05	728	0.68	**7.45**					
Pt	14.89	719	0.68	**7.29**					
g-C_3N_4	8.8	540	0.41	**1.95**	0.2	N3	I^-/I_3^-	2016	[326]
MWCNT	12.6	640	0.53	**4.27**					
g-C_3N_4/MWCNT	14.2	720	0.62	**6.34**					
Pt	14.6	710	0.66	**6.84**					
CoS	17.028	766	0.651	**8.49**	0.12	N719	I^-/I_3^-	2016	[327]
CoS/$rGO_{0.10}$	18.903	767	0.677	**9.82**					
rGO	15.368	733	0.013	**2.01**					
Co/RGO	14.22	750	49.6	**5.29**	–	N719	I^-/I_3^-	2016	[328]
$Pt_{0.1}Co_{0.9}$/RGO	14.66	745	68.1	**7.44**					
Pt/RGO	14.79	730	65.4	**7.06**					
CoS/G	12.09	630	0.71	**5.41**	0.16	Z907	I^-/I_3^-	2016	[329]
CoS	10.93	610	0.61	**4.07**					
RGO	10.21	620	0.35	**2.22**					
Nb_2O_5	12.27	683	0.59	**4.95**	0.16	N719	T_2/T^-	2016	[190]
	15.18	868	0.63	**8.29**			Co^{2+}/Co^{3+}		
Nb_2O_5/C	13.39	689	0.66	**6.11**			T_2/T^-		
	15.68	861	0.73	**9.86**			Co^{2+}/Co^{3+}		
MoS_2/G	16.1	660	0.67	**7.1**	0.16	N719	I^-/I_3^-	2016	[330]
TiO_2/C_a	15.83	705	0.55	**6.04**	–	N719	I^-/I_3^-	2016	[331]

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Ni/GO	17.8	750	0.62	**8.30**	0.16	N719	I^-/I_3^-	2016	[332]
$La_{0.65}Sr_{0.35}MnO_3$/RGO	12.53	780	0.67	**6.57**	–	N719	I^-/I_3^-	2016	[333]
g-C_3N_4/CCB	13.21	688	0.56	**5.09**	0.2	N3	I^-/I_3^-	2016	[334]
Ni–Co/CNFs	9.78	730	0.64	**4.57**	0.2	N719	I^-/I_3^-	2016	[335]
10 wt% CNFs-TiC	9.71	720	0.64	**4.5**	0.25	N719	I^-/I_3^-	2016	[336]
MnO_2 + 6 wt% RGO	15.97	705	0.509	**5.77**	0.25	N719	I^-/I_3^-	2016	[337]
$NiCo_2O_4$/RGO	14.92	690	0.599	**6.17**	–	N719	I^-/I_3^-	2016	[338]
PbSe/RGO PbSe	15.24 4.62	570 570	0.65 0.45	**6.5** **1.2**	0.25	N719	I^-/I_3^-	2016	[339]
ZnSe ZnSe/RGO	6.14 15	540 780	0.43 0.57	**1.44** **6.61**	–	N719	I^-/I_3^-	2016	[340]
CoS_2 CoS_2/RGO	4.11 15.2	530 770	0.53 0.55	**1.18** **6.49**	0.25	N719	I^-/I_3^-	2016	[341]
Bi_2Se_3	7.02	550	0.46	**1.86**	0.25	N719	I^-/I_3^-	2016	[342]
Bi_2Se_3/RGO	16.36	750	0.57	**7.09**					
Pt	15.65	680	0.59	**6.47**					
rGO	4.35	695	0.2447	**0.74**	–	N719	I^-/I_3^-	2016	[343]
Co_9S_8	14.74	669	0.5821	**5.74**					
Co_9S_8/rGO	15.24	703	0.6627	**7.10**					
Pt	15.68	693	0.6856	**7.45**					
MnO_x CNT CNT/MnO_x CNT/MnO_x/CNT	2.99 6.12 3.93 4.67	700 750 740 780	0.45 0.42 0.48 0.55	**0.77** **2.40** **1.39** **2.01**	–	N719	I^-/I_3^-	2016	[344]
In_2O_3 In_2O_3-MWCNTs	1.82 9.45	250 370	0.30 0.37	**0.14** **1.29**	–	N719	I^-/I_3^-	2016	[345]
ACs	15.01	730	0.60	**6.57**	0.15	N719	I^-/I_3^-	2016	[346]
Nano-Si@ACs	15.50	760	0.67	**8.01**					
Pt	15.20	740	0.64	**7.20**					
MoS_2	8.15	610	0.21	**1.04**	0.2	N3	–	2016	[347]
MoS_2/AB	10.27	640	0.20	**1.31**					
MoS_2/VC	10.81	640	0.43	**2.97**					
MoS_2/CNT	12.43	620	0.4	**3.08**					
MoS_2/CNF	10.33	580	0.53	**3.17**					
MoS_2/RHA	10.95	600	0.32	**2.10**					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
$In_{2.77}S_4$@Cc	17.34	750	0.67	**8.71**	0.16	N719	I^-/I_3^-	2016	[348]
$In_{2.77}S_4$	15.06	680	0.47	**4.81**					
Cc	16.56	740	0.63	**7.72**					
Pt	19.19	760	0.60	**8.75**					
CNT/TiO_2	15.96	770	0.57	**7.00**	0.25	N719	I^-/I_3^-	2016	[349]
TiO_2	15.68	770	0.54	**6.51**					
In_2O_3	4.83	320	0.38	**0.59**	1.5	N719	I^-/I_3^-	2016	[350]
In_2O_3-MWCNTs$_{(0.1\%)}$	4.28	430	0.40	**0.74**					
In_2O_3-MWCNTs$_{(0.2\%)}$	5.23	480	0.41	**1.03**					
In_2O_3-MWCNTs$_{(0.3\%)}$	5.63	510	0.43	**1.23**					
In_2O_3-MWCNTs$_{(0.4\%)}$	4.92	450	0.41	**0.91**					
In_2O_3-MWCNTs$_{(0.5\%)}$	4.62	400	0.40	**0.74**					
Fe_3O_4	11.26	511	0.31	**2.1**	0.25	N719	I^-/I_3^-	2016	[351]
Carbon Black	5.84	655	0.47	**2.2**					
Fe_3O_4–CB (1 : 1)	14.14	660	0.49	**5.8**					
Fe_3O_4–CB (1 : 2)	14.40	665	0.51	**6.1**					
Fe_3O_4–CB (2 : 1)	12.55	650	0.50	**5.0**					
Pt	9.33	675	0.52	**4.1**					
$NiSe_2$ nanoparticles	13.96	750	0.62	**6.49**	–	N719	I^-/I_3^-	2016	[352]
$NiSe_2$ + 3 wt% graphene	14.86	750	0.62	**6.91**					
$NiSe_2$ + 6 wt% graphene	16.32	750	0.61	**7.47**					
$NiSe_2$ + 9 wt% grapheme	14.67	760	0.64	**7.14**					
Pt	15.25	760	0.63	**7.28**					
Pt	13.0	720	0.69	**6.47**	0.25	–	I^-/I_3^-	2016	[353]
Sb_2Se_3	11.3	640	0.43	**3.08**					
CNP	12.4	700	0.57	**4.97**					
Sb_2Se_3-CNP	12.7	730	0.68	**6.26**					
$CoSe_2$/C-NG	17.51	730	0.67	**8.41**	0.24	N719	I^-/I_3^-	2016	[354]
$CoSe_2$/C-NR	15.98	730	0.67	**7.83**					
$CoSe_2$/C-NCW	18.03	730	0.67	**8.92**					
Pt	16.43	740	0.67	**8.25**					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
$Ni_{0.85}Se$	17.86 9.51	743 715	0.675 0.772	**8.96** (front) **5.25** (rear)	0.11	N719	I^-/I_3^-	2016	[355]
$Ni_{0.85}Se/RGO_{0.05}$	18.66 8.06	751 720	0.666 0.696	**9.75** (front) **3.97** (rear)					
$Ni_{0.85}Se/RGO_{0.1}$	19.94 7.87	751 717	0.652 0.702	**9.75** (front) **3.97** (rear)					
$Ni_{0.85}Se/RGO_{0.15}$	18.13 6.90	765 715	0.641 0.713	**8.89** (front) **3.52** (rear)					
Pt	16.51 1.19	746 683	0.662 0.664	**8.15** (front) **0.54** (rear)					
NiS	17.08	680	0.52	**6.04**	0.16	N719	I^-/I_3^-	2016	[356]
NiS/Ca	15.56	720	0.61	**6.83**					
NiS/Cc	18.18	760	0.59	**8.15**					
Pt	16.03	750	0.69	**8.29**					
MoS_2 MoS_2/graphene graphene	6.76 16.64 18.92	640 760 770	0.50 0.58 0.46	**2.18** **7.31** **6.72**	–	–	I^-/I_3^-	2016	[357]
FeN	14.02	690	0.70	**6.79**	0.20	N719	I^-/I_3^-	2016	[358]
N-doped graphene	16.13	730	0.74	**8.71**					
FeN/N-doped graphene	18.83	740	0.78	**10.86**					
Pt	16.98	750	0.78	**9.93**					
MoS_2	15.95	720	0.599	**6.89**	–	N719	I^-/I_3^-	2016	[359]
MoS_2/graphene	16.96	720	0.657	**8.01**					
Pt	16.86	730	0.6672	**8.21**					
RGO	9.32	720	0.4098	**2.75**	–	–	I^-/I_3^-	2016	[360]
Co_3O_4	7.43	660	0.2447	**1.20**					
Co_3O_4@RGO	11.91	790	0.6154	**5.79**					
Pt	11.65	790	0.6693	**6.16**					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Pt	15.289	743	0.683	**7.76**	0.28	Z907	I^-/I_3^-	2016	[361]
Graphene	12.085	706	0.612	**5.22**					
NiS	12.836	717	0.651	**5.99**					
NiS/Gr	14.244	727	0.678	**7.02**					
NiS/Ag	14.909	735	0.654	**7.17**					
NiS/Gr-Ag	16.205	753	0.685	**8.36**					
NiS/AB (acetylene black)	14.01	720	0.67	**6.75**	0.2	N3	I^-/I_3^-	2016	[362]
NiS	12.71	680	0.69	**5.96**					
Pt	17.32	660	0.63	**7.20**					
NiSe-Ni_3Se_2/RGO-HD	16.31	750	0.64	**7.83**	–	N719	I^-/I_3^-	2016	[363]
NiSe/RGO-NP	13.80	750	0.60	**6.21**					
NiSe-Ni_3Se_2/RGO-NP	14.41	750	0.65	**7.02**					
NiSe-Ni_3Se_2/RGO-SD	14.03	750	0.64	**6.73**					
NiSe-Ni_3Se_2/RGO-HD-10h	15.48	760	0.63	**7.41**					
Pt	15.25	760	0.63	**7.28**					
Pt	16.45	780	0.48	**6.08**	–	N719	I^-/I_3^-	2017	[364]
$MoSe_2$/rGO	17.11	770	0. 50	**6.56**					
Pt	14.83	740	0.65	**7.15**	0.28	N719	I^-/I_3^-	2017	[365]
MoS_2	14.44	740	0.64	**6.81**					
CNTs	13.33	750	0.62	**6.15**					
MoS_2/CNTs	16.65	740	0.66	**7.83**					
Pt	18.34	716	0.5514	**7.23**	–	N719	I^-/I_3^-	2017	[366]
MoS_2-graphene aerogel (MG)	17.24	714	0.6383	**7.86**					
MoS_2	13.64	780	0.2045	**2.20**					
Pt	12.79	720	0.675	**6.22**	0.25	$(Bu_4N)_2$[Ru(Hdcbpy)$_2$(NCS)$_2$]	I^-/I_3^-	2017	[367]
MoS_2/GP	13.34	696	0.698	**6.48**					
GP	9.61	667	0.395	**2.53**					
Pt	15.58	784	0.68	**8.27**	–	N719	I^-/I_3^-	2017	[368]
CNFs	12.58	777	0.62	**6.11**					
MnO_2/CNFs-1	14.43	786	0.65	**7.42**					
MnO_2/CNFs-2	15.29	782	0.68	**8.09**					
MnO_2/CNFs-3	16.15	783	0.70	**8.86**					
MnO_2/CNFs-4	15.18	779	0.66	**7.77**					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
NiS	14.007	692	0.721	**6.98**	0.25	N719	I^-/I_3^-	2017	[369]
NiS-G0.2	14.398	698	0.696	**6.99**					
NiS-G0.4	14.586	712	0.727	**7.54**					
NiS-G0.6	15.814	715	0.724	**8.18**					
NiS-G0.8	15.600	704	0.691	**7.59**					
Pt	15.606	711	0.726	**8.05**					
Graphene	12.461	703	0.344	**3.02**					
$CoSe_{0.85}$	14.182	687	0.666	**6.49**	0.25	N719	I^-/I_3^-	2017	[370]
$CoSe_{0.85}$-G25	14.218	691	0.695	**6.83**					
$CoSe_{0.85}$-G50	14.342	711	0.722	**7.36**					
$CoSe_{0.85}$-G75	15.789	715	0.724	**8.17**					
$CoSe_{0.85}$-G90	15.581	703	0.694	**7.60**					
RGO	13.24	686	0.38	**3.47**	–	N719	I^-/I_3^-	2017	[371]
CoS_2	14.13	693	0.56	**5.48**					
CoS_2/RGO	16.35	702	0.67	**7.69**					
Pt	15.51	706	0.67	**7.38**					
RGO	8.86	721	0.16	**1.01**	–	N719	I^-/I_3^-	2017	[372]
$Co_{0.85}Se$	14.51	706	0.52	**5.34**					
$Co_{0.85}Se$/RGO	16.01	706	0.69	**7.81**					
Pt	15.44	707	0.69	**7.55**					
Pt	14.52	740	0.76	**8.12**	0.25	–	I^-/I_3^-	2017	[373]
$Ni_2P_2O_7$-NiO/C5	2.41	650	0.08	**0.13**					
$Ni_2P_2O_7$-Ni_3P-Ni/C5	6.16	650	0.16	**0.64**					
$Ni_2P_2O_7$-$Ni_{12}P_5$-Ni_8P_3/C5	12.34	720	0.61	**5.44**					
Ni_2P/C2.5	13.53	750	0.76	**7.81**					
Ni_2P/C5	14.78	770	0.77	**8.82**					
Ni_2P/C10	14.89	780	0.83	**9.57**					
Ni_2P/C20	13.95	770	0.78	**8.38**					
Ni_2P/C40	13.42	770	0.76	**7.91**					
$Ni_{12}P_5$/C10	13.88	760	0.75	**7.94**					
Pt	15.77	700	0.65	**7.19**	0.16	N719	I^-/I_3^-	2018	[374]
Ta/Co-N-C	18.11	650	0.68	**7.96**					
Co-N-C	13.02	720	0.67	**6.25**					
Carbon/carbon nanohybrids									
MWCNTs/graphene	5.6	760	0.70	**3.00**	0.12	N719	I^-/I_3^-	2011	[375]
Pt	15.01	830	0.67	**8.32**	0.16	N719	I^-/I_3^-	2012	[376]
Ni-CNT/CNF	15.83	800	0.63	**7.96**					
Pt	10.0	740	0.67	**5.00**	–	N719	I^-/I_3^-	2012	[377]
graphene	3.6	770	0.39	**1.00**					
MWCNTs	6.4	810	0.57	**3.00**					
Graphene/MWCNTs	8.8	770	0.58	**4.00**					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Pt	16.1	749	0.687	**8.3**	–	N719	I^-/I_3^-	2012	[378]
Ordered MC	16.0	744	0.559	**6.8**					
CNTs	14.7	719	0.380	**4.0**					
MC/CNTs	16.2	749	0.691	**8.4**					
Pt	13.31	770	0.76	**7.79**	–	N719	I^-/I_3^-	2013	[379]
RGO	12.82	780	0.72	**7.19**					
RGO/SWCNTs (20 wt%)	12.81	860	0.76	**8.37**					
SWCNTs	14.56	750	0.71	**7.75**					
Pt	11.9	678.5	0.4	**3.22**	0.25	N719	T_2/T^-	2013	[380]
MC	13.75	666.2	0.53	**4.82**					
Graphene/MC	14.24	671.6	0.69	**6.55**					
Pt	14.6	866	0.68	**8.61**	0.20	Y123	Co^{2+}/Co^{3+}	2013	[381]
Carbon/graphene (C/GNP)	14.3	865	0.74	**9.11**					
Pt	15.2	901	0.66	**9.0**	0.20	Y123	Co^{2+}/Co^{3+}	2013	[382]
Graphene oxide(GO)	15.2	898	0.65	**8.8**					
RGO	15.6	891	0.61	**8.4**					
GO/GNP	15.1	885	0.67	**9.3**					
g-CN	15.4	749	0.68	**7.8**	0.20	N719	I^-/I_3^-	2015	[383]
N-G/CNT	16.23	766	0.542	**6.74**	–	N719	I^-/I_3^-	2015	[384]
G/CNT	17.93	733	0.587	**7.70**	–	N719	I^-/I_3^-	2015	[385]
MC/G	15.13	735	0.61	**6.82**	0.20	N719	I^-/I_3^-	2015	[386]
AC + MWCNTs MWCNTs + graphene Graphene + AC AC + MWCNTs + graphene	19.42 17.23 19.42 21.55	761 736 745 760	0.7002 0.5423 0.6378 0.6548	**10.41** **6.84** **9.23** **10.73**	0.2	N719	I^-/I_3^-	2016	[387]
g-C_3N_4/MWCNTs	14.2	720	0.62	**6.34**	0.2	N3	I^-/I_3^-	2016	[326]
g-C_3N_4/CCB (1 : 1)	13.21	688	0.56	**5.09**	0.2	N3	I^-/I_3^-	2016	[334]
CNT 25 wt%	14.81	650	0.71	**6.94**	0.16	N719	I^-/I_3^-	2016	[388]
Graphite RGO Carbon mixed	14.36	560	0.4092	**3.26**	–	N719	I^-/I_3^-	2016	[389]
AC-doped MWCNT hybrid	16.074	753	0.83	**10.05**	0.2	D719	I^-/I_3^-	2016	[390]
f-PPy/MWCNT h-PPy/MWCNT	16.05 17.50	770 762	0.50 0.53	**6.18** **6.73**	0.16	N719	I^-/I_3^-	2017	[74]
CNX/CNT(2 : 1)-800	16.30	734.2	0.615	**7.38**	0.25	N719	I^-/I_3^-	2017	[78]
CN x-500	13.88	774	0.42	**4.45**	0.23	N719	I^-/I_3^-	2017	[84]
f-CNT f-AC f-MC2	13.2 12.3 15.9	700 677 714	0.704 0.593 0.742	**6.5** **4.93** **8.42**	–	N719	I^-/I_3^-	2017	[391]

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Cs/polymers nanohybrids									
Pt	13.0	690	0.671	**6.10**	0.25	N719	I^-/I_3^-	2011	[392]
PEDOT-PSS	11.6	660	0.495	**3.80**					
CoS	4.42	590	0.396	**1.00**					
CoS/PEDOT-PSS	13.2	650	0.627	**5.40**					
Pt	14.33	670	0.69	**6.57**	0.14 Flexible	CYC-B1	I^-/I_3^-	2011	[393]
TiN(P)	1.32	700	0.19	**0.17**					
PEDOT-PSS	11.87	580	0.59	**4.02**					
TiN(P)/PEDOT-PSS	14.20	680	0.69	**6.67**					
Pt	13.09	746	0.6731	**6.57**	0.20	N719	I^-/I_3^-	2012	[394]
PEDOT-PSS	10.09	713	0.2841	**2.04**					
TiN(P)/PEDOT-PSS	14.45	727	0.6718	**7.06**					
TiN(R)/PEDOT-PSS	14.53	727	0.6526	**6.89**					
TiN(S)/PEDOT-PSS	14.35	724	0.5948	**6.18**					
Pt	23	765	0.501	**8.7**	–	N719	I^-/I_3^-	2013	[395]
NiO	4.83	799	0.073	**0.28**					
PEDOT-PSS	17.6	718	0.363	**4.6**					
NiO/PEDOT-PSS	22	748	0.46	**7.58**					
PEDOT	13.67	741	0.65	**6.58**	0.28	N719	I^-/I_3^-	2013	[396]
PEDOT/PAA/PSS	13.52	758	0.62	**6.35**					
NiS/Ti	13.33	711	0.58	**5.50**	–	Z907	I^-/I_3^-	2014	[397]
PANI/Ti	13.00	733	0.66	**6.29**					
NiS/PANII/Ti	14.56	743	0.68	**7.35**					
TiN	7.23	846	0.48	**2.94**	0.16	MK-2	Co^{2+}/Co^{3+}	2014	[398]
TiC	11.66	842	0.75	**7.36**					
TiN/PEDOT	12.43	834	0.76	**7.89**					
TiC/PEDOT	12.42	827	0.75	**7.73**					
NiO/PEDOT:PSS (48/1)	22.00	748	0.46	**7.58**	–	N719	I^-/I_3^-	2014	[399]
NiS/PEDOT	18.19	751	0.62	**8.47**	0.28	Z907	I^-/I_3^-	2015	[400]
PPY/Cu	14.6	757	0.670	**7.42**	1	N719	I^-/I_3^-	2015	[401]
PtCo/PEDOT:PSS	19.35	744	0.63	**9.07**	–	N719	I^-/I_3^-	2015	[402]
PtNi/PEDOT:PSS	18.04	736	0.63	**8.36**					
Zn_3N_2/PEDOT:PSS	15.77	810	0.69	**8.73**	0.16	N719	I^-/I_3^-	2015	[403]
ZnO/PEDOT:PSS	15.35	740	0.66	**7.54**					
ZnS/PEDOT:PSS	14.99	760	0.65	**7.40**					
ZnSe/PEDOT:PSS	15.72	770	0.68	**8.13**					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
RuO_2/poly(ethylene oxide)	13.78	740	0.63	**6.42**	0.35	N719	I^-/I_3^-	2015	[404]
Ru/poly(ethylene oxide)	13.32	750	0.68	**6.77**	0.515	N719	I^-/I_3^-	2015	[404]
TiO_2/SnO_2/PEDOT:PSS	13.11	714	0.699	**6.54**	0.36	N719	I^-/I_3^-	2015	[405]
TiO_2/PEDOT:PSS	13.14	721	0.607	**5.75**	0.36	N719	I^-/I_3^-	2015	[405]
TiO_2/SnO_2	12.53	636	0.141	**1.12**	0.36	N719	I^-/I_3^-	2015	[405]
PEDOT/$Ag_{0\,wt\%}$	11.79	820	0.5688	**5.50**	–	N719	I^-/I_3^-	2016	[406]
PEDOT/$Ag_{0.06\,wt\%}$	12.21	800	0.5917	**5.80**	–	N719	I^-/I_3^-	2016	[406]
PEDOT/$Ag_{0.6\,wt\%}$	12.00	810	0.6173	**5.99**	–	N719	I^-/I_3^-	2016	[406]
PEDOT/$Ag_{1.2\,wt\%}$	12.66	800	0.5830	**5.90**	–	N719	I^-/I_3^-	2016	[406]
CoPt/PANi	16.15	730	0.68	**8.08**	–	N719	I^-/I_3^-	2016	[407]
PdPt/PANi	15.41	710	0.66	**7.26**	–	N719	I^-/I_3^-	2016	[407]
MoPt/PANi	15.19	710	0.63	**6.83**	–	N719	I^-/I_3^-	2016	[407]
PEDOT	16.3	740	0.615	**7.40**	–	N719	I^-/I_3^-	2016	[408]
PEDOT/Fe_3O_4	18.6	740	0.630	**8.69**	–	N719	I^-/I_3^-	2016	[408]
Fe_3O_4	13.8	677	0.430	**4.02**	–	N719	I^-/I_3^-	2016	[408]
NiS(NPs)/PEDOT-PSS	16.05	760	0.67	**8.18**	0.25	N719	I^-/I_3^-	2017	[409]
PEDOT-PSS	14.02	750	0.50	**5.27**	0.25	N719	I^-/I_3^-	2017	[409]
NiS(NPs)	14.02	740	0.57	**5.90**	0.25	N719	I^-/I_3^-	2017	[409]
CdS_{NRs}-ZnO	11.67	650	0.32	**2.44**	–	N719	I^-/I_3^-	2017	[410]
CdS_{NRs}	8.26	560	0.39	**1.8**	–	N719	I^-/I_3^-	2017	[410]
CdS_{NPs}-ZnO	7.20	510	0.36	**1.35**	–	N719	I^-/I_3^-	2017	[410]
ZnO_{NPs}-PANI	1.10	340	0.33	**0.125**	–	N719	I^-/I_3^-	2017	[410]
PANi	18.94	651	0.608	**7.50**	–	N719	I^-/I_3^-	2017	[411]
PANi-MoS_2	20.16	724	0.665	**9.71**	–	N719	I^-/I_3^-	2017	[411]
Pt	16.30	726	0.673	**7.96**	–	N719	I^-/I_3^-	2017	[411]
Carbon/polymers nanohybrids									
Pt	14.64	680	0.57	**5.66**	0.25	N3	I^-/I_3^-	2007	[412]
PEDOT-PSS	11.01	730	0.30	**2.41**	0.25	N3	I^-/I_3^-	2007	[412]
PEDOT-PSS/C_b	14.05	780	0.53	**5.81**	0.25	N3	I^-/I_3^-	2007	[412]
Pt	17.9	740	0.64	**8.5**	0.25	N3	I^-/I_3^-	2008	[413]
PSS/MWCNTs	9.7	600	0.62	**3.6**	0.25	N3	I^-/I_3^-	2008	[413]
PEDOT-PSS/MWCNTs	15.5	660	0.63	**6.5**	0.25	N3	I^-/I_3^-	2008	[413]
Pt	13.05	720	0.68	**6.30**	0.072 (mask)	N719	I^-/I_3^-	2008	[414]
PEDOT-PSS	10.99	720	0.28	**2.30**	0.072 (mask)	N719	I^-/I_3^-	2008	[414]
PEDOT-PSS/graphene	12.96	720	0.48	**4.50**	0.072 (mask)	N719	I^-/I_3^-	2008	[414]

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Pt	10.7	740	0.65	**5.12**	0.2827	N719	I^-/I_3^-	2011	[415]
PSS/C_b	10.7	690	0.32	**2.44**					
PEDOT-PSS/C_b	10.8	760	0.57	**4.71**					
Pt	12.61	820	0.623	**6.44**	0.50	N719	I^-/I_3^-	2011	[416]
PANI/graphitized polyimide	12.40	834	0.662	**6.85**					
Pt	17.4	701	0.626	**7.55**	0.16	N719	I^-/I_3^-	2011	[417]
PPy	12.0	680	0.502	**4.10**					
MWCNTs	8.4	710	0.534	**3.18**					
PPy/MWCNTs	16.1	702	0.621	**7.02**					
PPy/MWCNTs/PEN	9.3	708	0.613	**4.04**	flexible				
Pt/PEN	10.9	710	0.615	**4.76**					
CNTs	12.2	623	0.51	**3.88**	0.18	N719	I^-/I_3^-	2011	[418]
PEDOT	9.7	628	0.71	**4.32**					
PEDOT/CNTs	9.0	702	0.73	**4.62**					
Pt	14.20	695	0.70	**6.88**	0.50	N3	I^-/I_3^-	2012	[419]
Graphene	12.08	601	0.39	**2.28**					
PANI	12.86	683	0.54	**4.78**					
PANI/graphene	13.28	685	0.67	**6.09**					
Pt/ITO/PEN	12.4	770	0.70	**6.68**	0.15	N719	I^-/I_3^- (flexible)	2012	[420]
PEDOT/PET	12.6	770	0.58	**5.62**					
Graphene/PEDOT/PET	12.6	770	0.63	**6.26**					
Pt	14.33	810	0.67	**7.78**	0.50	N719	I^-/I_3^-	2012	[421]
PEDOT-PSS/C_b	14.37	800	0.61	**7.01**					
Pt	16.2	707	0.683	**7.80**	0.16	N3	I^-/I_3^-	2012	[422]
PPy	13.3	680	0.555	**5.00**					
C	12.9	650	0.512	**4.30**					
PPy/C	15.2	710	0.668	**7.20**					
Conductive C_b	16.6	650	0.31	**3.4**	0.16	C106	T_2/T^-	2012	[423]
Conductive C_b/Pt	16.6	630	0.67	**7.0**					
Conductive C_b/PPy	16.4	650	0.49	**5.2**					
Conductive C_b/PANI	16.5	680	0.46	**5.2**					
Conductive C_b/PEDOT	16.8	650	0.70	**7.6**					
Pt	16	724	0.72	**8.34**	0.25	N719	I^-/I_3^-	2012	[424]
PPy	14.27	722	0.69	**7.11**					
RGO	12.54	715	0.34	**3.05**					
RGO/PPy	15.81	725	0.71	**8.14**					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Pt	11.94	745	0.68	**6.05**	0.28	N719	I^-/I_3^-	2013	[425]
MWCNT	7.81	543	0.49	**2.08**					
PANI	12.22	718	0.59	**5.18**					
PANI/MWCNT	13.53	721	0.64	**6.24**					
PEDOT/ECP	14.99	760	0.63	**7.17**	0.16	N719	I^-/I_3^-	2015	[426]
PANi/MWCNT	22.25	691	0.601	**9.24**	0.25	N719	I^-/I_3^-	2015	[427]
PEDOT/N-doped GR	15.60	739	0.72	**8.30**	0.24	N719	I^-/I_3^-	2015	[428]
PPy/MWCNT	9.85	700	0.63	**4.89**	0.25	N719	I^-/I_3^-	2015	[429]
Ppy/RGO	1.33	300	0.25	**1.99**	0.50	N719	I^-/I_3^-	2015	[430]
rGO/PEDOT-PSS	9.55	827	0.499	**3.94**	0.12	N719	I^-/I_3^-	2015	[431]
PPy:PCL	12.58	660	0.46	**3.86**	0.16	N719	I^-/I_3^-	2015	[432]
PEDOT:PSS	12.81	670	0.55	**4.74**					
s-PT	13.26	680	0.60	**5.40**					
PPy:PCL/C	14.52	700	0.67	**6.78**					
PEDOT:PSS/C	14.95	700	0.72	**7.60**					
s-PT/C	15.90	710	0.75	**8.45**					
PEDOT:PSS/RGO	10.39	745	0.37	**2.89**	0.16	N719	I^-/I_3^-	2015	[433]
PEDOT/RGO	11.16	715	0.64	**5.14**					
Fabric/MWCNT	11.92	688	0.6939	**5.69**	–	D719	I^-/I_3^-	2015	[434]
Polythiophene/GR	12.65	600	0.632	**4.8**	1	N719	I^-/I_3^-	2015	[435]
PANI/C	13.8	770	0.70	**7.45**	–	N719	I^-/I_3^-	2015	[436]
Pt	15.68	752	0.71	**8.36**	–	N719	I^-/I_3^-	2016	[437]
5.0 wt% CB-NPs/s-PT	17.21	764	0.69	**9.02**					
PPy/RGO	17.07	683	0.534	**6.23**	0.25	N719	I^-/I_3^-	2016	[438]
PANI/RGO	12.62	729	0.623	**5.73**					
PEDOT/RGO	16.91	702	0.641	**4.65**					
PPy/MWCNT	17.56	740	0.55	**7.15**	0.30	N719	I^-/I_3^-	2016	[439]
PEDOT/Ex-Gr	22.8	640	0.55	**8.0**	–	N719	I^-/I_3^-	2016	[440]
86 wt% CL/CCPL/SS	14.9	680	0.606	**6.1**	–	N719	I^-/I_3^-	2016	[441]
0.3 wt% SWCNH/PEDOT:PSS	15.42	640	0.47	**4.70**	0.25	N719	I^-/I_3^-	2016	[442]
80% CB/PEDOT:PSS (unsulfidation)	14.44	730	0.6661	**6.99**	–	N719	I^-/I_3^-	2016	[443]
80% CB/PEDOT:PSS (sulfidation)	14.22	750	0.6704	**7.15**					
PANI/GQD	9.3	440	0.391	**1.603**	–	N719	I^-/I_3^-	2016	[444]
MWCNT-PANI	12.13	631	0.60	**4.58**	0.16	N719	I^-/I_3^-	2016	[445]
GN/PANI, 2.0 V	10.30	650	0.64	**4.31**	–	N719	I^-/I_3^-	2016	[446]
PPy-FMWCNTS	12.25	830	0.665	**6.77**	1	N719	I^-/I_3^-	2016	[447]

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
PPy/MWCNT	4.19	400	0.48	**0.80**	0.16	Z907	I^-/I_3^-	2016	[448]
P3HT/MWCNT	5.61	450	0.49	**1.24**					
PITN/grapheme (1 : 4)	14.51	660	0.55	**5.27**	0.25	N719	I^-/I_3^-	2017	[449]
Carbonized hair/PEDOT:PSS	14.85	760	0.58	**6.54**	0.50	N719	I^-/I_3^-	2017	[450]
Pt	15.64	740	0.63	**7.29**					
EP PANi/CF	12.01	675	0.47	**3.81**	0.25	N719	I^-/I_3^-	2017	[451]
PANI/GNP/MWCNT	18.21	780	0.54	**7.67**	0.25	N3	I^-/I_3^-	2017	[452]
f-PPy/MWCNT	16.05	770	0.50	**6.18** (front)	0.16	N719	I^-/I_3^-	2017	[74]
f-PPy/MWCNT	7.53	746	0.60	**3.37** (rear)					
h-PPy/MWCNT	17.50	762	0.53	**7.07** (front)					
h-PPy/MWCNT	9.30	736	0.60	**4.11** (rear)					
f-PEDOT/MWCNT	15.69	771	0.67	**8.10** (front)	0.16	N719	I^-/I_3^-	2017	[453]
f-PEDOT/MWCNT	8.12	721	0.69	**4.04** (rear)					
h-PEDOT/MWCNT	17.09	792	0.67	**9.07** (front)					
h-PEDOT/MWCNT	10.76	757	0.69	**5.62** (rear)					
POMA-FGO(0.5%)	17.34	740	0.62	**7.95**	–	N719	I^-/I_3^-	2017	[454]
POMA-FGO(1%)	16.31	730	0.61	**7.26**					
POMA-FGO(0.5%)-CSA(16%)	18.55	730	0.65	**8.81**					
POMA-FGO(1%)-CSA(16%)	17.84	730	0.61	**7.94**					
PVP-graphene-5	14.8	860	0.70	**8.95**	0.16	YD2-oC8	Co^{2+}/Co^{3+}	2017	[455]
Polymers/polymers hybrids									
Pt	14.75	760	0.69	**7.73**	0.25	N719	I^-/I_3^-	2013	[281]
PPy	11.15	720	0.65	**5.23**					
PEDOT-PSS	12.53	730	0.69	**6.31**					
PPy/PEDOT-PSS	14.27	750	0.71	**7.60**					
PEDOT:PSS	11.93	680	0.58	**4.74**	–	N719	I^-/I_3^-	2015	[456]
Polypyrrole/cotton	7.85	740	0.66	**3.83**	0.36	N719	I^-/I_3^-	2016	[457]

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Carbon/TMCs/polymers nanohybrids									
Bare carbon	14.14	727	0.61	**6.26**	–	N719	I^-/I_3^-	2013	[458]
PPy/C	14.15	726	0.69	**7.09**					
Fe/PPy/C	12.67	693	0.57	**5.07**					
Ni/PPy/C	14.16	720	0.73	**7.44**					
Co/PPy/C	14.21	717	0.75	**7.64**					
Pt	10.9	839	0.77	**6.8**	0.16	N719	I^-/I_3^-	2013	[459]
TiC/graphene/PEDOT-PSS	12.32	762	0.697	**6.55**					
TiC/graphene	9.86	846	0.736	**6.14**					
TiC/PEDOT-PSS	8.9	724	0.65	**4.16**					
TiC/C_b/PEDOT-PSS	10.32	749	0.76	**5.84**					
TiC/graphene/C_b/PEDOT-PSS	10.9	726	0.745	**5.9**					
PEDOT-PSS	6.26	718	0.512	**2.3**					
RGO/PPy/PEDOT	17.0	760	0.55	**7.1**	0.09	N719	I^-/I_3^-	2015	[460]
PEDOT/PSS/TiO_2 200 mg	16.39	720	0.72	**8.27**	0.20	N719	I^-/I_3^-	2015	[254]
Ag-PPy-FMWCNTS	13.10	798	0.669	**7.007**	1	N719	I^-/I_3^-	2016	[447]
MWCNT-PANI-Ni^{2+}	14.25	700	0.60	**6.00**	0.16	N719	I^-/I_3^-	2016	[445]
MWCNT-PANI-Co^{2+}	13.75	698	0.60	**5.75**					
MWCNT-PANI-Mn^{2+}	11.88	652	0.62	**4.77**					
MWCNT-PANI-Cu^{2+}	8.00	553	0.58	**2.57**					
NiS/GNS(0.25%)/PANI	9.93	670	0.66	**4.39**	0.25	N719	I^-/I_3^-	2017	[461]
NiS/GNS(0.50%)/PANI	10.39	680	0.66	**4.66**					
NiS/GNS(0.75%)/PANI	10.82	680	0.65	**4.78**					
NiS/GNS(1%)/PANI	12.13	670	0.66	**5.36**					
NiS/GNS(1.25%)/PANI	11.44	680	0.66	**5.13**					
Polycomponent nanohybrids									
Ag	9.6	710	0.39	**2.60**	0.09	Z907	Solid state	2010	[462]
V_2O_5/Al	8.0	730	0.34	**2.00**					
Pt	15.4	810	0.568	**7.04**	0.10	N719	I^-/I_3^-	2011	[463]
Cu_2ZnSnS_4 (CZTS)	10.7	840	0.403	**3.62**					
CZTSSe	17.7	800	0.522	**7.37**					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Pt	12.23	700	0.4727	**4.03**	0.36	N719	I^-/I_3^-	2012	[464]
$Cu_2ZnSnSe_4$ (CZTSe)	10.39	780	0.4731	**3.85**					
Pt	14.60	724	0.575	**6.08**	0.25	N719	I^-/I_3^-	2012	[465]
S doped NiO	13.23	768	0.496	**5.04**					
Pt	14.00	750	0.60	**6.29**	0.28	N719	I^-/I_3^-	2013	[466]
Transparent $NiCo_2S_4$	14.11	720	0.60	**6.14**					
CoTe $NiTe_2$	12.56 14.13	770 790	0.71 0.65	**6.92** **7.21**	0.16	N719	I^-/I_3^-	2013	[467]
$NbSe_2$ nanosheets $NbSe_2$ nanorods $NbSe_2$/C	15.04 13.94 15.58	770 760 770	0.63 0.64 0.65	**7.34** **6.78** **7.80**	0.16	N719	I^-/I_3^-	2013	[468]
Pt	13.8	720	0.717	**7.1**	0.20	N719	I^-/I_3^-	2013	[469]
Flame-like $CuInS_2$	13.0	750	0.660	**7.1**					
Rod-like $CuInS_2$-ZnS	15.3	770	0.640	**7.5**					
Torch-like $CuInS_2$-ZnS	14.1	760	0.672	**7.2**					
$CuInGaSe_2$	14.54	750	0.66	**7.13**	2.6	N719	I_3^-/I^-	2013	[470]
CZTS [Zn^{2+}, 0.02 M, air]	8.96	580	0.18	**0.93**	0.16	N719	I^-/I_3^-	2013	[471]
CZTS [Zn^{2+}, 0.02 M, N_2]	4.72	700	0.70	**2.32**					
CZTS [Zn^{2+}, 0.005 M, S]	12.46	730	0.66	**5.99**					
CZTS [Zn^{2+}, 0.02 M, S]	14.09	720	0.65	**6.36**					
CZTS [Zn^{2+}, 0.02 M, S]	14.26	740	0.66	**6.98**					
$CoMoS_4$ $NiMoS_4$ $CoMoS_4$/C $NiMoS_4$/C	11.28 11.80 15.82 15.69	640 650 690 710	0.69 0.69 0.66 0.64	**4.96** **5.27** **7.31** **7.14**	0.16	N719	I^-/I_3^-	2013	[472]
Cu_2SnSe_3	11.71	573	0.458	**3.14**	0.25	N719	I^-/I_3^-	2014	[473]
Pt/ITO/PEN	13.36	733	0.63	**6.17**	–	N719	I^-/I_3^-	2014	[474]
Ni_2O_3/Ni-P/PI(TCO-free)	5.37	708	0.23	**0.86**					
Ni_3S_2/Ni-P/PI(TCO-free)	13.62	729	0.63	**6.28**					
$Cu_2ZnSnS_xSe_{4-x}$	15.33	717.73	0.6754	**7.43**	0.25	N719	I^-/I_3^-	2014	[475]
$CuInS_2$	10.16	682	0.478	**3.31**	0.25	N719	I^-/I_3^-	2014	[476]
Cu_2ZnSnS_4	8.42	574	0.65	**3.90**	0.25	N719	I^-/I_3^-	2014	[477]
Cu_2ZnSnS_4	13.35	595	0.63	**4.84**	0.25	N719	I^-/I_3^-	2014	[478]
Cu_2ZnSnS_4	18.63	650	0.53	**6.4**	0.25	N719	I^-/I_3^-	2014	[479]

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
$Cu_{1.88}Fe_{0.73}Sn_{0.63}S_4$	14.57	750	0.73	**8.03**	0.16	N719	I^-/I_3^-	2014	[480]
$CuSbS_2$	6.765	709	0.544	**2.61**	0.25	N719	I^-/I_3^-	2014	[481]
Cu_2SnSe_3	9.78	570	0.55	**3.09**	0.25	N719	I^-/I_3^-	2014	[473]
Cu_2ZnSnS_4	17.20	740	0.62	**7.94**	0.16	N719	I^-/I_3^-	2015	[482]
Cu_2ZnSnS_4	8.66	730	0.24	**1.52**	0.36	N719	I^-/I_3^-	2015	[483]
Ag/Ag_8SnS_6	17.38	694	0.61	**7.36**	–	N719	I^-/I_3^-	2015	[484]
Ag_8SnS_6	14.94	691	0.53	**5.47**					
Ag_8GeS_6	16.59	746	0.65	**8.10**	0.16	N719	I^-/I_3^-	2015	[485]
$NiCo_2S_4$	13.6	758	0.681	**7.03**	0.16	N719	I^-/I_3^-	2015	[486]
$CoNi_2S_4$	15.3	680	0.677	**7.03**	–	N719	I^-/I_3^-	2015	[302]
$NiCo_2S_4$	18.37	670	0.587	**7.22**	–	N719	I^-/I_3^-	2015	[487]
$CoNi_2S_4$	8.862	756	0.687	**4.61**	0.25	N719	I^-/I_3^-	2015	[488]
$CuInS_2$	12.81	743	0.718	**6.83**	0.126	N719	I^-/I_3^-	2015	[489]
Cu_2SnS_3	6.54	730	0.70	**3.35**	–	N719	I^-/I_3^-	2015	[490]
Cu_2ZnSnS_4	12.45	720	0.63	**5.65**	0.25	N719	I^-/I_3^-	2015	[491]
Cu_2ZnSnS_4	21.78	780	0. 51	**8.67**	0.20	N719	I^-/I_3^-	2015	[492]
Cu_2ZnSnS_4	6.713	724	0.646	**3.14**	–	N719	I^-/I_3^-	2015	[493]
$PtCo/Cu_2ZnGeS_4$	16.13	744	0.68	**8.12**	0.16	N719	I^-/I_3^-	2015	[494]
$La_{0.67}Sr_{0.33}MnO_3$	15.2	772	0.5728	**6.62**	–	N719	I^-/I_3^-	2015	[495]
CoSe Co_3SnSe_4 $Co_2Sn_2Se_4$ $CoSn_3Se_4$	14.08 14.48 14.19 14.44	763 775 779 778	0.681 0.687 0.689 0.662	**7.32** **7.71** **7.62** **7.44**	–	N719	I^-/I_3^-	2015	[496]
$CoMoO_4/Co_9S_8$	17.27	743	0.670	**8.60**	0.12	N719	I^-/I_3^-	2015	[497]
$NiCo_2S_4$	18.43	690	0.64	**8.10**	–	N719	I^-/I_3^-	2016	[498]
$La_{0.5}Sr_{0.5}CoO_3$	16.27	705	0.6243	**7.17**	–	N719	I^-/I_3^-	2016	[499]
Cu_2CoSnS_4	17.4	706	0.60	**7.4**	0.25	N719	I^-/I_3^-	2016	[500]
Cu_2FeSnS_4	16.5	699	0.58	**7.1**					
$Cu_2ZnSnS4$	14.31	800	0.62	**7.12**	–	N719	I^-/I_3^-	2016	[501]
$NiCo_2S_4/NiS$	17.7	744	0.67	**8.8**	0.12	N719	I^-/I_3^-	2016	[203]
$NiCo_2S_4$	17.4	743	0.66	**8.5**					
Co_9S_8	16.2	741	0.64	**7.7**					
NiS	14.9	735	0.63	**6.9**					
Pt	16.5	736	0.67	**8.1**					
s-$CoFe_2O_4$	5.41	764	0.052	**0.22**	–	N719	I^-/I_3^-	2016	[502]
h-$CoFe_2O_4$	8.19	732	0.107	**0.64**					
s-$CoFe_2O_4$@CNTs	11.80	700	0.620	**5.12**					
h-$CoFe_2O_4$@CNTs	12.48	693	0.702	**6.07**					
h-$CoFe_2O_4$@CNTs/PPy	12.63	691	0.709	**6.19**					
CNTs	11.63	679	0.593	**4.68**					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
$Bi_4Ti_3O_{12}$/graphene (0%)	11.96	520	0.130	**0.81**	0.25	N719	I^-/I_3^-	2016	[503]
$Bi_4Ti_3O_{12}$/graphene (0.5%)	18.52	623	0.185	**2.14**					
$Bi_4Ti_3O_{12}$/graphene (1.5%)	19.01	711	0.431	**5.83**					
$Bi_4Ti_3O_{12}$/graphene (2.5%)	20.89	724	0.641	**9.70**					
Graphene	22.78	744	0.664	**11.25**					
Pt	23.97	744	0.683	**12.18**					
LSMO@RGO-6%	11.24	800	0.6684	**6.01**	–	–	I^-/I_3^-	2016	[333]
LSMO@RGO-8%	12.53	780	0.6722	**6.57**					
LSMO@RGO-10%	11.94	790	0.6223	**5.87**					
$La_{0.65}Sr_{0.35}MnO_3$ (LSMO)	11.53	760	0.6105	**5.35**					
RGO	11.25	780	0.5618	**4.93**					
Pt	13.84	780	0.6605	**7.13**					
Pt	14.13	790	0.59	**6.53**	–	N719	I^-/I_3^-	2016	[504]
$CuInS_2$-CESM	12.48	780	0.60	**5.79**					
Chicken eggshell membrane (CESM)	8.74	730	0.61	**3.74**					
Pt	12.82	800	0.69	**7.0**	–	N719	I^-/I_3^-	2016	[505]
Exfoliated-$MoS_{2x}Se_{2(1-x)}$	13.40	750	0.65	**6.5**					
Annealed-$MoS_{2x}Se_{2(1-x)}$	13.52	760	0.52	**5.4**					
Pt	15.94	780	0.73	**9.11**	0.36	N719	I^-/I_3^-	2016	[506]
$NiCo_2S_4$(NCS)	16.07	770	0.65	**8.06**					
NCS/RGO-1%	16.01	760	0.71	**8.62**					
NCS/RGO-2%	16.11	770	0.72	**8.96**					
NCS/RGO-3%	15.98	780	0.72	**8.93**					
NCS/RGO-5%	15.96	770	0.71	**8.75**					
NCS/RGO-10%	15.94	770	0.70	**8.69**					
RGO	16.14	740	0.28	**3.31**					
$Bi_5FeTi_3O_{15}$/MoS_2-0%	3.80	364	0.159	**0.22**	–	N719	I^-/I_3^-	2016	[507]
$Bi_5FeTi_3O_{15}$/MoS_2-10%	7.58	554	0.331	**1.39**					
$Bi_5FeTi_3O_{15}$/MoS_2-30%	14.10	590	0.403	**3.35**					
$Bi_5FeTi_3O_{15}$/MoS_2-50%	22.78	540	0.349	**5.20**					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
CuFeSe CuCoSe	14.11 15.09	712 738	0.719 0.701	**7.22** **7.81**	0.25	N719	I^-/I_3^-	2016	[508]
Pt	16.69	662	70.01	**7.74**	–	–	I^-/I_3^-	2016	[509]
$CuFeS_2$	17.32	665	70.34	**8.10**					
Pt-sputtering	16.70	700	0.65	**7.60**	–	N719	I^-/I_3^-	2016	[498]
$NiCo_2S_4$	18.43	690	0.64	**8.10**					
Pt-pyrolysis	16.97	700	0.59	**7.01**					
$NiCo_2S_4$ – after CV1000	18.19	690	0.63	**7.94**					
$NiCo_2O_4$	12.75	690	59.11	**5.20**	0.25	N719	I^-/I_3^-	2016	[338]
RGO	8.54	690	51.42	**3.03**					
$NiCo_2O_4$@RGO	14.92	690	59.93	**6.17**					
Pt	13.82	700	62.75	**6.07**					
$CoSeO_3$ $2H_2O$-0.02	16.34 9.30	754 749	0.652 0.707	**8.04** (front) **4.92** (rear	0.11	N719	I^-/I_3^-	2016	[510]
$CoSeO_3$ $2H_2O$-0.04	16.87 9.87	746 739	0.675 0.726	**8.49** (front) **5.29** (rear)					
$CoSeO_3$ $2H_2O$-0.06	17.64 9.58	745 729	0.677 0.742	**8.90** (front) **5.18** (rear)					
$CoSeO_3$ $2H_2O/rGO_{0.05}$	18.26 11.27	762 731	0.666 0.656	**9.27** (front) **5.41** (rear)					
$CoSeO_3$ $2H_2O/rGO_{0.1}$	19.94 11.44	747 742	0.664 0.684	**9.89** (front) **5.81** (rear)					
$CoSeO_3$ $2H_2O/rGO_{0.15}$	19.59 11.55	763 739	0.646 0.630	**9.65** (front) **5.66** (rear)					
$CoSeO_3$ $2H_2O/rGO_{0.2}$	18.11 11.01	764 737	0.638 0.657	**8.83** (front) **5.33** (rear)					
Pt	16.66 1.22	750 661	0.671 0.677	**8.39** (front) **0.54** (rear)					

Table A.2 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Area (cm^2)	Dye	Electrolyte	Year	References
Pt	15.42	790	0.7179	**8.74**	–	–	I^-/I_3^-	2017	[511]
Cu_2ZnSnS_4	14.33	770	0.7386	**8.15**					
MWCNTS	10.03	610	0.5394	**3.30**					
Cu_2ZnSnS_4/ MWCNTS	16.62	760	0.7157	**9.04**					
Pt	14.80	758	0.645	**7.23**	0.16	N719	I^-/I_3^-	2017	[512]
Graphene oxide (GO)	9.85	748	0.413	**3.04**					
$NiCo_2S_4$	15.20	747	0.649	**7.36**					
GO/$NiCo_2S_4$-1	14.90	750	0.640	**7.06**					
GO/$NiCo_2S_4$-2	16.40	752	0.661	**8.15**					
GO/$NiCo_2S_4$-3	12.50	746	0.636	**6.01**					
Pt	13.31	800	0.674	**7.18**	–	N719	I^-/I_3^-	2017	[513]
$La_{0.5}Sr_{0.5}CoO_{2.91}$ (LSCO)	12.33	810	0.324	**3.24**					
RGO	12.58	750	0.481	**4.54**					
LSCO/graphene oxide	13.13	800	0.602	**6.32**					
$CoFeS_2$	15.23	770	0.71	**8.30**	0.16	N719	I^-/I_3^-	2017	[514]
$CoFeS_2$/GO	15.85	780	0.71	**8.82**					
Pt	14.56	790	0.73	**8.40**					

Table A.3 Photovoltaic parameters of DSSCs using Pt-loaded nanohybrid CEs (AM 1.5, 100 mW cm^{-2}).

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Aare (cm^2)	Dye	Electrolyte	Years	References
Pt electrodes									
Pt	12.50	694	0.6	**5.18**	0.2	N719	I^-/I_3^-	2004	[515]
Pt/NiP-plated glass	14.8	550	0.6	**8.3**	0.2	–	I^-/I_3^-	2005	[516]
Pt	14.11	–	–	**5.03**	0.25	–	I^-/I_3^-	2006	[517]
Pt	15.06	707	0.6	**6.41**	0.25	–	I^-/I_3^-	2008	[518]
Pt	11.8	680	0.7	**5.62**	0.25	N3	I^-/I_3^-	2010	[519]
Pt	15.32	710	0.67	**7.29**	0.283	N719	I^-/I_3^-	2010	[520]
Pt	15.1	742	0.65	**7.3**	0.16	N719	I^-/I_3^-	2010	[521]
Pt-sputtered	14.40	786.3	0.69	**7.89**	–	N719	I^-/I_3^-	2011	[522]
Pt hollow spheres	14.12	815	0.712	**8.20**					
Pt-sputtered + Pt hollow spheres	15.13	805	0.701	**8.53**					
Pt	12.87	660	0.56	**4.75**	0.5	N3	I^-/I_3^-	2011	[523]
Dipping-Pt	14.23	760	0.64	**6.95**	0.16	N719	I^-/I_3^-	2012	[524]
CR-Pt	14.15	750	0.62	**6.64**					

Table A.3 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Aare (cm^2)	Dye	Electrolyte	Years	References
planar Pt	15.9	750	0.66	**7.87**	0.2	N719	I^-/I_3^-	2012	[525]
PtNC-1	16.65	750	0.71	**8.86**					
PtNC-2	17.57	740	0.75	**9.75**					
Pt	17.79	690	0.67	**8.13**	0.16	N719	I^-/I_3^-	2012	[526]
Pt	18.14	762	0.67	**9.3**	–	N719	I^-/I_3^-	2013	[527]
Pt	16.79	636	0.68	**7.21**	0.15	N719	I^-/I_3^-	2013	[528]
Pt	18.48	795	0.67	**9.88**	0.25	N719	I^-/I_3^-	2013	[529]
Pt	16.29	757	0.58	**6.91**	0.36	–	I^-/I_3^-	2013	[530]
	16.41	737	0.53	**6.46**					
	15.59	736	0.49	**5.66**					
Pt/FTO	11.36	650	0.56	**4.13**	0.2	N719	I^-/I_3^-	2015	[531]
Pt-A	9.6	580	0.472	**2.63**					
Pt-B	10.99	660	0.53	**3.82**					
Pt-C	10.95	660	0.48	**3.47**					
Pt	15.38	706	0.7	**7.61**	0.25	N719	I^-/I_3^-	2017	[532]
	16.89	731	0.68	**8.45**					
	13.80	709	0.72	**7.02**					
	13.73	713	0.71	**6.95**					
Pt-loaded nanohybrids									
Pt	13.6	550	0.45	**5.60**	0.20	N3	I^-/I_3^-	2005	[516]
Pt/NiP	14.8	550	0.60	**8.30**					
Pt	0.22	530	0.63	**2.10**	3.00	Ru535	I^-/I_3^-	2006	[533]
Pt/NiO	0.30	530	0.63	**2.80**					
Pt	10.2	700	0.61	**4.45**	0.636	N719	I^-/I_3^-	2007	[534]
Pt/Ti	9.97	690	0.62	**4.31**					
Pt	18.5	742	0.605	**8.30**	0.16	N3	I^-/I_3^-	2008	[535]
Pt/acetylene black	20.7	721	0.604	**9.00**					
$Ni_{0.94}Pt_{0.06}$	16.79	736	0.664	**8.21**	0.16	N719	I^-/I_3^-	2009	[536]
Pt	14.86	723	0.617	**6.63**	0.25	N3	I^-/I_3^-	2009	[537]
Pt/C_b	14.46	753	0.616	**6.72**					
Pt	15.60	745	0.631	**7.33**	0.16	–	I^-/I_3^-	2009	[536]
$Ni_{0.94}Pt_{0.06}$	16.79	736	0.664	**8.21**					
Pt	14.81	750	0.65	**6.99**	0.16	N719	I^-/I_3^-	2010	[538]
PtNP/MWCNTs	18.92	740	0.62	**8.23**					
Pt	17.52	611	0.60	**6.42**	0.25	N3	I^-/I_3^-	2010	[539]
Pt/MC	17.11	635	0.61	**6.62**					
Pt	15.78	769	0.65	**7.93**	0.20	N719	I^-/I_3^-	2010	[540]
Pt/Ni	15.79	770	0.69	**8.41**					
Ni	2.08	674	2.08	**0.09**					
N/Ni	15.74	766	0.47	**5.68**					
N/Ni nanoparticles	15.76	766	0.69	**8.31**					

Table A.3 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Aare (cm^2)	Dye	Electrolyte	Years	References
Pt	14.53	725	0.60	**6.32**	0.40	N719	I^-/I_3^-	2011	[541]
Pt/MWCNTs	16.12	732	0.55	**6.50**					
Pt	13.13	740	0.68	**6.50**	0.16	N719	I^-/I_3^-	2011	[542]
PProDOT-Et_2	11.84	710	0.59	**4.89**					
Pt/PProDOT-Et_2	13.77	740	0.68	**6.69**					
Pt wire	8.65	749	0.73	**4.75**	Fiber-shaped DSSC	N719	I^-/I_3^-	2011	[543]
Carbon fiber (C_f)	6.45	725	0.57	**2.7**					
Pt/C_f	10.55	720	0.67	**5.08**					
Pt/C_f/stainless steel wire	11.66	675	0.74	**5.85**					
Pt	9.42	740	0.68	**4.74**	0.32	N719	I^-/I_3^-	2011	[544]
Pt/SWCNTs	11.20	750	0.71	**5.96**					
Pt	5.05	680	0.58	**2.00**	0.20	N3	I^-/I_3^-	2011	[545]
Pt/graphene	6.67	740	0.59	**2.91**					
Pt	11.29	680	0.62	**4.76**	0.25	N719	I^-/I_3^-	2011	[546]
Graphene	10.64	710	0.25	**1.85**					
Monolayer Pt/graphene	11.42	730	0.73	**6.09**					
Pt	14.9	791	0.69	**8.10**	0.18	N719	I^-/I_3^-	2011	[547]
Pt/PPy	17.4	752	0.66	**8.60**					
Pt	15.14	680	0.73	**7.47**	0.16	N719	I^-/I_3^-	2012	[548]
Pt/MWCNTs	18.60	690	0.70	**9.04**					
Pt	14.57	680	0.68	**6.65**	0.16	N719	I^-/I_3^-	2012	[549]
Pt/graphite	17.57	630	0.64	**7.07**					
Pt	16.03	738	0.73	**8.64**	0.36	N719	I^-/I_3^-	2012	[103]
$Co_{0.85}Se$	16.98	738	0.75	**9.40**					
$Ni_{0.85}Se$	15.63	738	0.72	**8.32**					
Pt/WO_2	12.91	780	0.68	**6.94**	0.16	N719	I^-/I_3^-	2013	[113]
Pt/TiC	13.23	790	0.69	**7.18**					
Pt/VN	13.25	750	0.69	**6.80**					
Pt	13.88	750	0.69	**7.18**	0.16	N719	I^-/I_3^-	2013	[550]
SiC	12.56	710	0.37	**3.29**					
Pt/SiC	12.71	810	0.69	**7.07**					
Pt	15.26	731	0.72	**8.04**	0.36	N719	I^-/I_3^-	2013	[117]
$NiSe_2$	15.94	734	0.73	**8.69**					
Pt	15.69	750	0.67	**7.88**	0.16	N719	I^-/I_3^-	2014	[551]
Pt/SiC-P	16.18	710	0.59	**6.82**					
Pt/SiC-M	16.24	710	0.66	**7.64**					
Pt/SiC-R	15.63	720	0.62	**7.04**					
Pt-mirror	18.50	700	0.58	**7.49**	0.25	N719	I^-/I_3^-	2014	[552]
SnO_2	16.18	506	0.36	**2.96**	0.25	N719	I^-/I_3^-	2014	[553]
Pt/SnO_2	16.24	731	0.74	**8.83**					

Table A.3 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Aare (cm^2)	Dye	Electrolyte	Years	References
PtRu	12.39	728.5	0.585	**5.28**	0.25	N719	I^-/I_3^-	2014	[554]
$PtRu_3$	14.70	718.3	0.644	**6.80**					
$PtRu_4$	13.67	712.6	0.601	**5.85**					
NiO/Pt	17.16	690	0.69	**8.17**	–	N719	I^-/I_3^-	2014	[555]
$MoSi_2$	12.84	729	0.52	**4.78**	0.16	N719	I^-/I_3^-	2014	[556]
$MoSi_2$/Pt	16.10	714	0.68	**7.77**					
$CoPt_{0.02}$	18.53	735	0.75	**10.23**	0.25	N719	I^-/I_3^-	2014	[557]
$CoPt_{0.1}$	17.92	735	0.728	**9.59**	0.25	N719	I^-/I_3^-	2014	[558]
$CoPt_{0.02}$	18.53	735	0.75	**10.23**	0.25	N719	I^-/I_3^-	2014	[557]
Co_2Pt	14.16	741	0.725	**7.61**	0.25	N719	I^-/I_3^-	2014	[485]
$PtRu_3$	14.70	718	0.644	**6.80**	0.25	N719	I^-/I_3^-	2014	[554]
Pt_3Ni	17.05	720	0.715	**8.78**	0.25	N719	I^-/I_3^-	2014	[559]
Pt_3Ni	17.46	730	0.718	**9.15**					
Pt	16.19	738	0.67	**8.03**	0.16	N719	I^-/I_3^-	2014	[134]
Ni_3Se_4@MeOH	16.27	746	0.69	**8.31**					
Ni_3Se_4@EtOH	15.43	738	0.67	**7.65**					
Ni_3Se_4@n-PrOH	13.57	674	0.31	**2.87**					
Pt	15.89	724	0.71	**8.17**	0.36	N719	I^-/I_3^-	2014	[560]
CoSe2	18.55	753	0.73	**10.20**					
CoNi	10.49	530	0.27	**1.51**	–	–	I^-/I_3^-	2014	[124]
$CoNi_{0.50}$	8.72	639	0.48	**2.69**					
$CoNi_{0.33}$	17.25	705	0.57	**6.93**					
$CoNi_{0.25}$	18.02	706	0.66	**8.39**					
$CoNi_{0.20}$	16.30	691	0.48	**5.37**					
Pt	14.17	715	0.69	**6.96**					
Co	9.14	675	0.21	**1.27**					
Ni	6.62	616	0.13	**0.54**					
CoPt	13.99	728	0.67	**6.82**	0.25	N719	I^-/I_3^-	2015	[485]
Co_2Pt	14.16	741	0.73	**7.61**					
Co_3Pt	9.84	723	0.71	**5.06**					
NiS/Pt/Ti-based	14.55	750	0.66	**7.20**	–	Z907	I^-/I_3^-	2015	[561]
Pt_3Ni	17.41	754	0.59	**7.75**	0.30	N719	I^-/I_3^-	2015	[562]
$PtNi_{0.75}$	17.50	716	0.686	**8.59**	0.25	N719	I^-/I_3^-	2015	[563]
Pt/CNFs	13.33	830	0.688	**7.6**	–	N719	I^-/I_3^-	2015	[564]
Pt/G	14.13	800	0.56	**6.35**	0.16	N719	I^-/I_3^-	2015	[565]
Pt/G	10.08	667	0.60	4.01	–	N719	I^-/I_3^-	2015	[566]
Pt	15.33	690	0.61	**6.48**	0.049	N719	I^-/I_3^-	2015	[567]
Pt	10.99	660	0.53	**3.82**	0.20	N719	I^-/I_3^-	2015	[531]
Pt	10.53	600	0.67	**4.26**	0.25	N719	I^-/I_3^-	2015	[568]
Pt	11.25	659	0.62	**4.60**	0.22	N719	I^-/I_3^-	2015	[569]
Pt/CFs	15.52	850	0.68	**8.97**	0.16	N719	Co^{2+}/Co^{3+}	2015	[570]

Table A.3 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Aare (cm^2)	Dye	Electrolyte	Years	References
Pt/NiO	18.38	825	0.625	**9.48**	0.12	N719	I^-/I_3^-	2015	[571]
Pt/Co_3O_4	17.64	811	0.625	**8.93**					
Au/PANI	14.40	771	0.607	**7.71**	–	N719	I^-/I_3^-	2015	[572]
Au/GNP	18.27	1014	0.771	**14.3**	–	ADEKA-1/LEG4	I^-/I_3^-	2015	[573]
Pt/NiO+ Ag mirror	30.10	810	0.462	**11.27**	0.12	N719	I^-/I_3^-	2015	[574]
Pt/PPy	15.50	730	0.65	**7.35**	–	Z907	I^-/I_3^-	2015	[575]
Pt/WO_3	17.9	710	0.697	**8.9**	–	N719	I^-/I_3^-	2015	[576]
PANi-G/Pt	15.22	725	0.675	**7.45**	0.16	N719	I^-/I_3^-	2015	[577]
Pt/C_b	19.69	690	0.68	**9.32**	0.16	N719	I^-/I_3^-	2015	[578]
NiPt	16.15	763	0.737	**9.08**	0.25	N719	I^-/I_3^-	2015	[579]
NiRu	15.79	737	0.665	**7.74**					
NiPd	15.07	714	0.638	**6.86**					
NiPt	17.51	720	0.654	**8.27**	0.25	N719	I^-/I_3^-	2015	[580]
NiPd	15.96	670	0.626	**6.70**					
$Pd_{17}Se_{15}$	16.32	700	0.65	**7.45**	0.25	N719	I^-/I_3^-	2015	[581]
Pd_7Se_4	15.85	703	0.61	**6.88**					
$PtNi_{0.05}$	14.30	741	0.748	**7.93**	0.25	N719	I^-/I_3^-	2015	[582]
$PtCo_{0.05}$	14.74	739	0.711	**7.75**					
$PtFe_{0.05}$	14.46	734	0.710	**7.54**					
$PtPd_{0.05}$	15.37	718	0.679	**7.48**					
$PtMo_{0.05}$	14.01	716	0.726	**7.28**					
$PtCu_{0.05}$	13.89	714	0.723	**7.17**					
$PtCr_{0.05}$	14.25	712	0.703	**7.13**					
$PtAu_{0.05}$	14.28	698	0.682	**6.80**					
NiCo	11.12	740	0.54	**4.47**	0.25	N719	I^-/I_3^-	2015	[317]
Pt	16.12	718	0.51	**5.9**					
$FeSe_2$ NSs	16.14	744	0.70	**8.39**	0.16	N719	I^-/I_3^-	2015	[583]
$FeSe_2$ NRs	15.79	748	0.68	**8.03**					
$FeSe_2$ MPs	15.63	745	0.66	**7.68**					
Pt	15.87	750	0.69	**8.20**					
Cu/Pt	14.44	712	0.689	**7.08**	0.25	N719	I^-/I_3^-	2016	[584]
Cu/Ni/Pt	14.84	720	0.683	**7.30**					
Cu/Co/Pt	15.56	721	0.700	**7.85**					
Cu/Fe/Pt	15.94	726	0.709	**8.21**					
PtNi	17.6	702	0.701	**8.65**	0.25	N719	I^-/I_3^-	2016	[585]
PtFe	15.7	698	0.681	**7.48**					
PtCo	15.68	697	0.652	**7.08**					
$Pt_{0.28}Ni_{99.72}$	12.8	739	0.68	**6.42**	0.25	N719	I^-/I_3^-	2016	[586]
$Pt_{0.14}Co_{99.86}$	11.5	724	0.68	**6.06**					
$Pt_{0.20}Fe_{99.80}$	10.1	721	0.65	**4.66**					

Table A.3 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Aare (cm^2)	Dye	Electrolyte	Years	References
$PtFe_{0.1}$	16.39	712	0.67	**7.84**	0.25	N719	I^-/I_3^-	2016	[587]
$PtCo_{0.1}$	16.68	718	0.70	**8.26**					
$PtNi_{0.1}$	16.90	720	0.72	**8.77**					
RuSe	12.17	729	0.73	**6.51**	0.25	N719	I^-/I_3^-	2016	[588]
NiSe	11.90	726	0.66	**5.73**					
CoSe	10.76	721	0.73	**5.68**					
$PdCo_2$	13.17	671	0.661	**5.84**	0.25	N719	I^-/I_3^-	2016	[589]
PdCo	13.49	710	0.672	**6.44**					
Pd_2Co	13.26	704	0.618	**5.77**					
NiCu/Pt	16.6	737	0.672	**8.22**	0.25	N719	I^-/I_3^-	2016	[590]
NiCu/Pt	18.3	758	0.696	**9.66**					
PtNiCo	17.1	751	0.689	**8.85**	0.25	N719	I^-/I_3^-	2016	[591]
Pt	16.45	771	0.74	**9.39**	–	N719	I^-/I_3^-	2016	[592]
Pt/Co/Ni	17.01	744	0.688	**8.71**	0.25	N719	I^-/I_3^-	2016	[593]
Pt/Pd/Ni	16.34	741	0.684	**8.28**					
Pt/Fe/Ni	16.02	726	0.678	**7.89**					
Pt/Co	15.96	717	0.668	**7.64**					
Pt/Pd	15.88	731	0.642	**7.45**					
Pt/Fe	15.71	716	0.649	**7.30**					
$Co_{3.9}Pt$	16.00	704	0.686	**7.73**	0.25	N719	I^-/I_3^-	2016	[594]
$Ni_{1.1}Pt$	16.77	717	0.689	**8.29**					
PtAg	14.89	709	0.695	**7.34**	–	N719	I^-/I_3^-	2016	[595]
PtPd	15.62	729	0.710	**8.09**					
CNFs	13.40	800	0.63	**6.75**	–	N719	I^-/I_3^-	2016	[58]
Pt/CNFs	13.15	800	0.66	**6.94**					
$Pt_{0.9}Sn_{0.1}$/RGO	17.58	740	0.64	**8.33**	0.49	N719	I^-/I_3^-	2016	[596]
Pt/CNA	16.57	779	0.70	**9.04**	0.09	N719	I^-/I_3^-	2016	[71]
Pt	15.24	710	0.67	**7.24**	0.16	N719	I^-/I_3^-	2016	[597]
Pt_9Fe_1 polyhedrons	17.14	690	0.68	**8.01**					
Pt_9Fe_1 concave cubes	16.53	700	0.66	**7.63**					
Pt_9Fe_1 nanocubes	14.02	690	0.67	**6.47**					
Pt_7Fe_3 polyhedrons	13.47	720	0.67	**6.50**					
Pt_7Fe_3 concave cubes	14.39	690	0.65	**6.45**					
Pt_7Fe_3 nanocubes	13.70	680	0.65	**6.06**					
Pt_0Ru_1/RGO	15.33	725	0.61	**6.81**	0.49	N719	I^-/I_3^-	2016	[598]
$Pt_{0.1}Ru_{0.9}$/RGO	15.82	755	0.63	**7.52**					
$Pt_{0.3}Ru_{0.7}$/RGO	15.77	750	0.66	**7.81**					
$Pt_{0.5}Ru_{0.5}$/RGO	16.33	750	0.66	**8.11**					
$Pt_{0.7}Ru_{0.3}$/RGO	16.25	745	0.69	**8.44**					
$Pt_{0.9}Ru_{0.1}$/RGO	15.79	735	0.66	**7.70**					
Pt_1Ru_0/RGO	16.28	750	0.61	**7.54**					

Table A.3 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Aare (cm^2)	Dye	Electrolyte	Years	References
Pt_1Sn_0/RGO	16.66	747	0.58	**7.26**	0.49	N719	I^-/I_3^-	2016	[596]
$Pt_{0.95}Sn_{0.05}$/RGO	16.57	728	0.58	**7.06**					
$Pt_{0.9}Sn_{0.1}$/RGO	17.58	740	0.64	**8.33**					
$Pt_{0.8}Sn_{0.2}$/RGO	16.01	743	0.65	**7.77**					
$Pt_{0.7}Sn_{0.3}$/RGO	15.60	738	0.62	**7.16**					
$Pt_{0.5}Sn_{0.5}$/RGO	15.48	728	0.63	**7.14**					
$Pt_{0.3}Sn_{0.7}$/RGO	15.81	741	0.58	**6.90**					
$Pt_{0.1}Sn_{0.9}$/RGO	15.31	738	0.61	**6.94**					
Pt_0Sn_1/RGO	15.52	733	0.49	**5.59**					
Pt_1Au_0	13.94	740	0.716	**7.4**	0.49	N719	I^-/I_3^-	2016	[599]
$Pt_{0.9}Au_{0.1}$	14.24	740	0.739	**7.8**					
$Pt_{0.7}Au_{0.3}$	14.31	745	0.739	**7.9**					
$Pt_{0.5}Au_{0.5}$	14.66	745	0.73	**8.0**					
$Pt_{0.3}Au_{0.7}$	13.31	750	0.638	**6.5**					
$Pt_{0.1}Au_{0.9}$	13.40	720	0.247	**2.9**					
Pt_0Au_1	2.82	490	0.057	**0.1**					
Pt	12.26	803.3	0.71	**7.24**	0.49	N719	I^-/I_3^-	2016	[600]
Pt NPs/RGO	12.76	806.7	0.70	**7.26**					
Pt_1Pd_0	14.85	755	0.70	**7.93**	–	–	I^-/I_3^-	2016	[601]
$Pt_{0.9}Pd_{0.1}$	14.97	750	0.70	**7.91**					
$Pt_{0.7}Pd_{0.3}$	15.07	735	0.71	**7.97**					
$Pt_{0.5}Pd_{0.5}$	15.41	735	0.70	**8.03**					
$Pt_{0.3}Pd_{0.7}$	14.64	750	0.72	**7.93**					
$Pt_{0.1}Pd_{0.9}$	14.12	740	0.67	**7.01**					
Pt_0Pd_1	8.96	695	0.11	**0.74**					
Pt_1Fe_0	14.38	805	0.71	**8.24**	–	N719	I^-/I_3^-	2016	[602]
$Pt_{0.9}Fe_{0.1}$	14.25	810	0.73	**8.51**					
$Pt_{0.75}Fe_{0.25}$	15.03	805	0.74	**8.94**					
$Pt_{0.5}Fe_{0.5}$	13.82	810	0.65	**7.42**					
$Pt_{0.3}Fe_{0.7}$	14.03	810	0.56	**5.62**					
$Pt_{0.1}Fe_{0.9}$	12.22	810	0.34	**4.82**					
Cr-Pt_3Ni/CNs	15.80	770	0.72	**8.76**	0.36	N719	I^-/I_3^-	2016	[603]
Pt_3Ni/CNs	15.19	769	0.714	**8.34**					
Pt	13.54	744	0.69	**7.04**					
CNs	11.04	760	0.685	**5.75**					
Co/RGO	14.22	750	0.496	**5.29**	–	N719	I^-/I_3^-	2016	[328]
$Pt_{0.1}Co_{0.9}$/RGO	14.66	745	0.681	**7.44**					
$Pt_{0.3}Co_{0.7}$/RGO	14.59	740	0.683	**7.38**					
$Pt_{0.5}Co_{0.5}$/RGO	14.08	740	0.674	**7.02**					
$Pt_{0.7}Co_{0.3}$/RGO	14.24	740	0.683	**7.12**					
$Pt_{0.9}Co_{0.1}$/RGO	14.43	740	0.699	**7.37**					
Pt/RGO	14.79	730	0.654	**7.06**					

Table A.3 (Continued)

CEs	J_{sc} (mA cm^{-2})	V_{oc} (mV)	FF	PCE (%)	Aare (cm^2)	Dye	Electrolyte	Years	References
Pt-only	15.83	702	0.571	**6.35**	0.25	N719	I^-/I_3^-	2016	[594]
$Co_{3.9}$Pt MT	16.00	704	0.686	**7.73**	0.25	N719	I^-/I_3^-	2016	[594]
$Ni_{1.1}$Pt MT	16.77	717	0.689	**8.29**	0.25	N719	I^-/I_3^-	2016	[594]
NiSe-Ni_3Se_2/RGO-HD	16.31	750	0.64	**7.83**	–	N719	I^-/I_3^-	2016	[363]
NiSe/RGO-NP	13.80	750	0.60	**6.21**	–	N719	I^-/I_3^-	2016	[363]
NiSe-Ni_3Se_2/RGO-NP	14.41	750	0.65	**7.02**	–	N719	I^-/I_3^-	2016	[363]
NiSe-Ni_3Se_2/RGO-SD	14.03	750	0.64	**6.73**	–	N719	I^-/I_3^-	2016	[363]
NiSe-Ni_3Se_2/RGO-HD-10h	15.48	760	0.63	**7.41**	–	N719	I^-/I_3^-	2016	[363]
Pt	15.25	760	0.63	**7.28**	–	N719	I^-/I_3^-	2016	[363]
Co_3Se_4	14.96	793	0.67	**7.95**	0.16	N719	I^-/I_3^-	2016	[604]
$Ni_{0.33}Co_{0.6}$7Se	17.29	789	0.67	**9.01**	0.16	N719	I^-/I_3^-	2016	[604]
$Ni_{0.5}Co_{0.5}Se$	16.42	783	0.69	**8.80**	0.16	N719	I^-/I_3^-	2016	[604]
$Ni_{0.67}Co_{0.33}Se$	15.89	784	0.69	**8.59**	0.16	N719	I^-/I_3^-	2016	[604]
NiSe	14.54	783	0.64	**7.23**	0.16	N719	I^-/I_3^-	2016	[604]
Pt	15.33	791	0.69	**8.30**	0.16	N719	I^-/I_3^-	2016	[604]
PtNi MF	17.48	705	0.66	**8.10**	0.25	N719	I^-/I_3^-	2016	[605]
PtNi hexagon MT	17.79	706	0.66	**8.32**	0.25	N719	I^-/I_3^-	2016	[605]
PtNi MT array	17.85	709	0.67	**8.43**	0.25	N719	I^-/I_3^-	2016	[605]
PtNi NT array	17.60	705	0.66	**8.19**	0.25	N719	I^-/I_3^-	2016	[605]
PtNi NT	17.27	704	0.66	**7.99**	0.25	N719	I^-/I_3^-	2016	[605]
PtNi NF	17.07	702	0.60	**7.28**	0.25	N719	I^-/I_3^-	2016	[605]
Pt	15.83	702	0.57	**6.35**	0.25	N719	I^-/I_3^-	2016	[605]
Pt_1Ni_0	14.18	755	0.662	**7.10**	–	N719	I^-/I_3^-	2017	[606]
$Pt_{0.9}Ni_{0.1}$	14.97	735	0.695	**7.66**	–	N719	I^-/I_3^-	2017	[606]
$Pt_{0.7}Ni_{0.3}$	14.76	735	0.698	**7.58**	–	N719	I^-/I_3^-	2017	[606]
$Pt_{0.5}Ni_{0.5}$	14.61	735	0.704	**7.56**	–	N719	I^-/I_3^-	2017	[606]
$Pt_{0.3}Ni_{0.7}$	14.47	750	0.682	**7.41**	–	N719	I^-/I_3^-	2017	[606]
$Pt_{0.1}Ni_{0.9}$	13.75	765	0.653	**6.88**	–	N719	I^-/I_3^-	2017	[606]
Pt_0Ni_1	0.7	460	0.058	**0.02**	–	N719	I^-/I_3^-	2017	[606]
Pt_1Mo_0	14.13	760	0.732	**7.86**	0.49	N719	I^-/I_3^-	2017	[607]
$Pt_{0.9}Mo_{0.1}$	15.96	720	0.692	**7.95**	0.49	N719	I^-/I_3^-	2017	[607]
$Pt_{0.7}Mo_{0.3}$	15.84	745	0.721	**8.51**	0.49	N719	I^-/I_3^-	2017	[607]
$Pt_{0.5}Mo_{0.5}$	14.60	715	0.698	**7.29**	0.49	N719	I^-/I_3^-	2017	[607]
$Pt_{0.3}Mo_{0.7}$	13.81	735	0.633	**6.44**	0.49	N719	I^-/I_3^-	2017	[607]
$Pt_{0.1}Mo_{0.9}$	11.73	700	0.638	**5.24**	0.49	N719	I^-/I_3^-	2017	[607]
Pt_0Mo_1	1.05	435	0.077	**0.04**	0.49	N719	I^-/I_3^-	2017	[607]
Ni-Co-Se	17.78	774	0.66	**9.04**	0.16	N719	I^-/I_3^-	2017	[608]
Pt	16.10	776	0.65	**8.07**	0.16	N719	I^-/I_3^-	2017	[608]
$CoSe_2$	16.35	758	0.66	**8.16**	0.16	N719	I^-/I_3^-	2017	[608]
$NiSe_2$	15.49	756	0.66	**7.78**	0.16	N719	I^-/I_3^-	2017	[608]

Abbreviations

TCO	transparent conducting oxides
FTO	fluorine-doped tin oxide
ITO	indium tin oxide
TiN(P)	titanium nitride nanoparticles
TiN(R)	titanium nitride nanorods
TiN(S)	titanium nitride mesoporous spheres
TMCs	transition metal compounds
C_a	activated carbon
C_b	carbon black
C_c	conductive carbon
C_f	carbon fiber
CD	carbon dye
C_p	discarded toner of a printer
C60	fullerene
MC	mesoporous carbon
CNTs	carbon nanotubes
CNP	carbon nanoparticle
CNFs	carbon nanofibers
NG	nanograin
NR	nanorock
NP	nanoparticle
AB	acetylene black
VC	vulcan carbon
RHA	rice husk ash
NCW	nanoclimbing wall
GNP	graphene nanoplatelets
GO	graphene oxide
RGO	reduced graphene oxide
SWCNTs	single-wall CNTs
MWCNTs	multiwall CNTs
PET	poly(ethylene terephthalate)
PEN	polyethylene naphthalate
EFG	exfoliated graphite (EFG) sheet
PI	polyimide
PEDOT	poly(3,4-ethylenedioxythiophene)
PANI	polyaniline
PPy	polypyrrole
PProDOT	poly(3,4-propylenedioxythiophene)
PSS	polystyrene sulfonate
PAA	poly(acrylic acid)
TsO	toluene sulfonate
PProDOT-Et_2	poly(3,3-diethyl-3,4-dihydro-2H-thieno-[3,4-b][1,4]dioxepine)
PProDOT-Me_2	poly(3,4-[20,20-dimethylpropylene]-dioxythiophene)
LPAH	large-effective-surface-area polyaromatic hydrocarbon

PACF	activated carbon microfiber powder
GP	graphite paper
POMA-FGO	poly(*o*-methoxyaniline)-graphene oxide
CSA	1S-(+)-camphorsulfonic acid
P3HT	poly(3-hexylthiophene
ZIF-67	zeolitic imidazolate framework 67
HED	hydrothermal electrochemical deposition
ED	electro-deposition
PVP	poly(vinyl pyrrolidone)
AVNF	ammonium vanadate nanofiber
SWCNH	single wall carbon nanohorns
GNP	graphene nanoplatelets
ECNF	selectrospun carbon nanofibers
GOG	graphene organogels
HC-GCF	conductive-graphene-coated cotton fabric
NG	N-doped rGO
HGF	holey rGO framework
NHGF	nitrogen doped holey reduced graphene oxide framework
HCNF	Helical carbon nanofiber
CMS	carbon molecular sieve
APNP	activating polypyrrole nanostructure
CNH	carbon nanohorns
NCSN	nitrogen-doped carbon microspheres
CS	carbon microspheres
GR	grapheme
CNA	aerogel carbon nanotube
GnPs	graphene nanoplatelets
f-PPy	flat polypyrrole
h-PPy	honeycomb-like polypyrrole
HPC	honeycomb-like activated porous carbon
GT	graphene oxide
GCW	graphene/SWCNT cryogel
GCT	graphene oxide /SWCNT
N-CNR	carbon nanorods
N-PCNR	nitrogen-doped porous carbon nanorods (N-PCNRs)
POCNTs	partially oxidized CNTs
AMWCNTs	aligned multiwalled carbon nanotubes
$g\text{-}C_3N_4$	graphitic carbon nitride
NPCN/P	codoped carbon nanosheets
EtOH	Ethanol
MeOH	methanol
n-PrOH	propan-1-ol
$FeSe_2$ NSs	3D hierarchical $FeSe_2$ microspheres
$FeSe_2$ NRs	urchin-like $FeSe_2$ microspheres
$FeSe_2$ MPs	irregular $FeSe_2$ microparticles
HD	hybrid
MF	microflower

MT	microtube
NT	nanotube
H	hexagonal
O	orthorhombic
M	monoclinic
T	tetragonal
NCSs	nitrogen-doped carbon microspheres
CSs	carbon microspheres
CNx	carbon nitride
SCF-MWCNT	soft cationic-functioned multiwall carbon nanotubes
CC-CE	complete carbon-based counter electrode
Graphite-C	graphite CE combined with a circulating electrolyte after subtraction of the energy consumed
f-CNT	functionalized MWCNT
f-AC	functionalized AC
f-MC	functionalized mesoporous carbonaceous

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