Supplementary Information

Counter electrode materials combined with redox couples in dye- and quantum dot-sensitized solar cells

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Table S1. Experimental conditions and results about the inorganic iodide-free redox couples based DSCs using different counter electrode catalysts.

CE catalysts	Substrate	Redox couples	Dye	FF	PCE/%	Ref.
Pt	FTO glass	Br^-/Br_3^-	TC-306	0.781	5.22	10
Pt	FTO glass	$SeCN^-/(SeCN)_3^-$	Z907	0.735	7.50	12
Pt	FTO glass	S^{2-}/S_x^{2-}	TH-305	0.705	4.55	13
CoS	FTO glass	S^{2-}/S_x^{2-}	TH-305	0.653	5.24	13

Table S2. Experimental conditions and results about the organic redox couples based DSCs using different counter electrode catalysts.

CE catalysts	Substrate	Redox couples	Dye	FF	PCE/%	Ref.
Pt	FTO glass	TMEPO/$TMEPO^+$	D149	0.70	5.4	14a
Pt	FTO glass	PTZ/Co-complex	Z907	0.44	1.44	14b
Pt	FTO glass	TPD/TPD^+	N3	/	<1%	14c
Pt	FTO glass	HQ/BQ	N719	0.591	4.7	14e,f
PEDOT	FTO glass	HQ/BQ	N719	0.667	5.2	14e,f
MWCNTs	FTO glass	HQ/BQ	N719	0.635	4.9	14 e,f
Pt	FTO glass	HQ/BQ	CM309	0.576	5.2	14e,f
PEDOT	FTO glass	HQ/BQ	CM309	0.678	6.2	14e,f
MWCNTs	FTO glass	HQ/BQ	CM309	0.727	5.8	14e,f

Table S3. Experimental conditions and results about the organic of T^-/T_2 (R=me) redox couples based DSCs using different counter electrode catalysts.

CE catalyst	Substrate	Redox couple	Dye	FF	PCE/%	Ref.
Pt	FTO glass	T^-/T_2	Z907	0.75	6.48	14g
CoS	FTO glass	T^-/T_2	N719	0.49	4.6	14h
PEDOT	FTO glass	T^-/T_2	N719	0.70	6.9	14h
PEDOT	ITO/PEN	T^-/T_2	N719	0.65	5.9	14h
PEDOT	FTO glass	T^-/T_2	Z907	0.72	7.9	14h
Pt	FTO glass	T^-/T_2	N719	0.48	3.66	7a
TiC	FTO glass	T^-/T_2	N719	0.63	4.96	7a
VC	FTO glass	T^-/T_2	N719	0.54	4.06	7a
Cr_3C_2	FTO glass	T^-/T_2	N719	0.65	4.54	7a
WC	FTO glass	T^-/T_2	N719	0.56	5.10	7g
Mo_2C-P	FTO glass	T^-/T_2	N719	0.633	5.50	7b
Mo_2C-NTs	FTO glass	T^-/T_2	N719	0.694	6.22	7b
VN cubes	FTO glass	T^-/T_2	N719	0.64	4.95	7c
VN peas	FTO glass	T^-/T_2	N719	0.68	5.57	7c
WO_2	FTO glass	T^-/T_2	N719	0.57	4.66	7d
$WO_{2.72}$	FTO glass	T^-/T_2	N719	0.71	5.05	7h
WO_3	FTO glass	T^-/T_2	N719	0.64	4.17	7h
MoS_2	FTO glass	T^-/T_2	N719	0.63	4.97	7e
WS_2	FTO glass	T^-/T_2	N719	0.64	5.24	7e
Ni_5P_4	FTO glass	T^-/T_2	N719	0.54	3.87	7f
Ca	FTO glass	T^-/T_2	N719	0.57	4.96	7g
Cb	FTO glass	T^-/T_2	N719	0.58	5.09	7g
Cd	FTO glass	T^-/T_2	N719	0.57	4.75	7g
MC	FTO glass	T^-/T_2	N719	0.53	4.60	7d
SCS[a]	FTO glass	T^-/T_2	N719	0.63	5.4	16a
HCS[b]	FTO glass	T^-/T_2	N719	0.65	5.8	16a
OCS[c]	FTO glass	T^-/T_2	N719	0.70	6.4	16a
VASWCNTs	FTO glass	T^-/T_2	N719	0.68	5.25	16b
CNTs	FTO glass	T^-/T_2	N719	0.69	7.33	16c
Graphite	FTO glass	T^-/T_2	N719	0.59	4.79	16d
VC-MC	FTO glass	T^-/T_2	N719	0.63	5.15	7a
WC-MC	FTO glass	T^-/T_2	N719	0.57	5.34	7g
WO_2-MC	FTO glass	T^-/T_2	N719	0.63	5.22	7d
Ni_5P_4-MC	FTO glass	T^-/T_2	N719	0.64	4.75	7f
Cb/Pt	FTO glass	T^-/T_2	C106	0.67	7.0	17
Cb/PPy	FTO glass	T^-/T_2	C106	0.49	5.2	17
Cb/PANI	FTO glass	T^-/T_2	C106	0.46	5.2	17
Cb/PEDOT	FTO glass	T^-/T_2	C106	0.70	7.6	17

[a]Solid carbon sphere; [b]Hollow carbon sphere; [c]Open ended carbon sphere

Table S4. Experimental conditions and results about the organic of T^{-}/T_2 (R=other units) redox couples based DSCs using different counter electrode catalysts.

CE catalyst	Substrate	R group of the redox couple,	Dye	FF	PCE/%	Ref.
Pt	FTO glass	*p*-phenyl	N719	0.17	0.68	18a
Graphite/Cb/ZrO_2 (CGM)	FTO glass	*p*-phenyl	N719	0.57	4.87	18a
Graphene/CGM(GGCM)	FTO glass	*p*-phenyl	N719	0.66	5.65	18a
Pt	FTO glass	*p*-methylphenyl	N719	0.15	0.66	18a
CGM	FTO glass	*p*-methylphenyl	N719	0.58	5.19	18a
GGCM	FTO glass	*p*-methylphenyl	N719	0.66	5.90	18a
Pt	FTO glass	*p*-methoxyphenyl	N719	0.15	0.65	18a
CGM	FTO glass	*p*-methoxyphenyl	N719	0.57	5.25	18a
GGCM	FTO glass	*p*-methoxyphenyl	N719	0.66	6.14	18a
GGCM[a]	FTO glass	*p*-methoxyphenyl	N719	0.66	6.53	18a
Pt	FTO glass	*p*-chlorophenyl	N719	0.19	0.83	18a
CGM	FTO glass	*p*-chlorophenyl	N719	0.53	4.76	18a
GGCM	FTO glass	*p*-chlorophenyl	N719	0.60	5.45	18a
Pt	FTO glass	*p*-tifluoromethylphenyl	N719	0.15	0.36	18a
CGM	FTO glass	*p*-tifluoromethylphenyl	N719	0.39	3.14	18a
GGCM	FTO glass	*p*-tifluoromethylphenyl	N719	0.50	4.12	18a
Pt	FTO glass	*p*-nitrophenyl	N719	0.10	0.15	18a
CGM	FTO glass	*p*-nitrophenyl	N719	0.55	2.74	18a
GGCM	FTO glass	*p*-nitrophenyl	N719	0.65	3.25	18a
$PEDOT_{BE}$	FTO glass	*p*-phenyl	N719	0.66	6.07	18b
$PEDOT_{UT}$	FTO glass	*p*-phenyl	N719	0.58	4.57	18b
NiS_{SP1}	FTO glass	et	N719	0.68	6.25	18c
Pt	FTO glass	et	N719	0.50	3.98	18c
MC	FTO glass	et	N719	0.53	4.82	18d
GMC	FTO glass	et	N719	0.69	6.55	18d
PEDOT	FTO glass	*n*-bu	N719	0.620	4.25	18e
PEDOT	FTO glass	*n*-hex	N719	0.634	4.32	18e
PEDOT	FTO glass	*n*-oct	N719	0.574	3.61	18e

[a] After optimizing the concentration of the oxide state of the redox coupl

Table S5. Experimental conditions and results about the organic redox couples based DSCs using different counter electrode catalysts.

CE	Substrate	Redox couple	Dye	FF	PCE/%	Ref
Pt	FTO glass	$McMT^{-}$/BMT, X^{+}=TBA^{+}	TH305	0.68	5.1	19a
PEDOT	FTO glass	$McMT^{-}$/BMT, X^{+}=TBA^{+}	TH305	0.65	6.0	19b
PEDOT	FTO glass	$McMT^{-}$/BMT, X^{+}=EMI^{+}	TH305	0.37	0.7	19b
PEDOT	FTO glass	$McMT^{-}$/BMT, X^{+}=$DMHI^{+}$	TH305	0.19	0.1	19b
Pt	FTO glass	A	TH305	0.35	3.3	19b
Pt	FTO glass	B	TH305	0.18	0.6	19b
Pt	FTO glass	C	TH305	0.10	0.2	19b
Pt	FTO glass	D	TH305	0.19	1.6	19b
Pt	FTO glass	T/DT^{2+}	N719	0.57	2.80	20
CoS	FTO glass	T/DT^{2+}	N719	0.65	3.99	20
MWCNTs	FTO glass	T/DT^{2+}	N719	0.66	4.12	20
Pt	FTO glass	$TMTU/TMFDS^{2+}$	N3	0.29	0.60	21a
Cb	FTO glass	$TMTU/TMFDS^{2+}$	N3	0.49	3.1	21a

Cb	SS	TMTU/TMFDS^{2+}	N3	0.32	1.6	21a
Cb	Al	TMTU/TMFDS^{2+}	Z907	0.52	1.9	21a
Pt	FTO glass	TMTU/TMFDS^{2+}	Z907	0.28	0.37	21b
Pt	FTO glass	TMTU/TMFDS^{2+}	D131	0.24	2.08	21b
Cb	FTO glass	TMTU/TMFDS^{2+}	Z907	0.66	1.38	21b
Cb	FTO glass	TMTU/TMFDS^{2+}	D131	0.52	3.88	21b
Pt	FTO glass	M^-/M_2	N719	0.13	0.3	22
Cb	FTO glass	M^-/M_2	N719	0.34	0.9	22
Pt	FTO glass	M^-/T_2	N719	0.30	2.3	22
Cb	FTO glass	M^-/T_2	N719	0.58	4.1	22
Pt	FTO glass	T^-/M_2	N719	0.15	0.8	22
Cb	FTO glass	T^-/M_2	N719	0.52	2.0	22

Table S6. Experimental conditions and results about the metal complex redox couples based DSCs using different counter electrode catalysts.

CE catalysts	Substrate	Redox couple	Dye	FF	PCE/%	Ref
Pt	FTO glass	$FeCp_2^{0/+}$	Carbz–PAHTDTT	0.73	7.50	23b
Pt	FTO glass	$Fe(CN)_6^{4-/3-}$	MK2	0.75	4.10	23c
Pt	FTO glass	$Cu(SP)(mmt)]^{-/0}$,	N719	0.44	1.3	24a
Pt	FTO glass	$[Cu(dmp)_2]^{+/2+}$	N719	0.55	1.4	24a
Pt	FTO glass	$[Cu(phen)_2]^{+/2+}$	N719	0.43	0.12	24a
Pt	FTO glass	$[Cu(dmp)_2]^{+/2+}$	C218	0.66	7.0	24b
Au	FTO glass	$Ni^{3+/4+}$	N719	\	1.50	25a
Pt	FTO glass	oxovanadium(IV/V)	D205/D131	0.59	5.40	26
PEDOT	FTO glass	$[Mn(acac)_3]^{0/+}$	MK2	0.69	4.4	27
PEDOT	FTO glass	$[Mn(acac)_3]^{0/+}$	N719	0.73	4.4	27
PEDOT	FTO glass	$[Mn(acac)_3]^{0/+}$	K4	0.75	3.2	27
Au	FTO glass	$[Mn(acac)_3]^{0/+}$	K4	0.74	2.6	27
Pt	FTO glass	$[Mn(acac)_3]^{0/+}$	K4	0.59	2.8	27
Pt	FTO glass	$[Co(bpy)_3]^{2+/3+}$	YD2–O–C8/Y123	0.74	12.3	28
Ca	FTO glass	$[Co(dtb)_3]^{2+/3+}$	YD2	0.66	4.05	31
OMC	FTO glass	$[Co(dtb)_3]^{2+/3+}$	YD2	0.65	3.43	31
SWCNTs	ITO PET	$[Co(bpy)_3]^{2+/3+}$	D35	0.62	6.6	33
GNP	FTO glass	$[Co(bpy)_3]^{2+/3+}$	Y123	0.70	9.3	35a
GO	FTO glass	$[Co(bpy)_3]^{2+/3+}$	Y123	0.67	9.3	37
RGO–TaON	FTO glass	$[Co(bpy)_3]^{2+/3+}$	FNE29	0.69	7.65	38
RGO	FTO glass	$[Co(bpy)_3]^{2+/3+}$	FNE29	0.46	4.62	38
TaON	FTO glass	$[Co(bpy)_3]^{2+/3+}$	FNE29	0.29	2.54	38
AgNW–GNP	FTO glass	$[Co(bpy)_3]^{2+/3+}$	N719	0.59	2.44	39
NbO_2	FTO glass	$[Co(dtb)_3]^{2+/3+}$	YD2	0.65	3.62	41
TiC	FTO glass	$[Co(dtb)_3]^{2+/3+}$	YD2	0.66	4.13	41
FeS_2	FTO glass	$[Co(bpy)_3]^{2+/3+}$	C128	0.69	6.34	41
$Co_{0.85}Se$	FTO glass	$[Co(Mebpy)_3]^{2+/3+}$	Z907	0.45	1.57	42
$Co_{0.85}Se/Ni_{0.85}Se$	FTO glass	$[Co(Mebpy)_3]^{2+/3+}$	Z907	0.53	2.54	42
PEDOT	FTO glass	$[Co(bpy)_3]^{2+/3+}$	Y123	0.71	10.3	43a
PEDOT	FTO glass	$[Co(phen)_3]^{2+/3+}$	Y123	0.69	9.5	43a
PProDOT	FTO glass	$[Co(bpy–pz)_2]^{2+/3+}$	Y123	0.77	10.08	44
PANI	FTO glass	$[Co(bpy)_3]^{2+/3+}$	FNE29	0.70	8.24	45

Table S7. Experimental conditions and results about the hole transport materials (HTM) based DSCs using different counter electrode catalysts.

CE catalysts	HTM	Dye	FF	PCE/%	Ref.
Au	Sprio-OMeTAD	N719	0.62	0.74	49
Ag	Sprio-OMeTAD	Y123	0.76	7.2	50
Pt	$CsSnI_{2.95}F_{0.05}$	N719	0.73	10.2	53
Au	CuI	Cyanidine	\	0.8	47a
Au	CuI	N3	\	3.75	54
Au	Sprio-OMeTAD	D102	0.61	4.1	55a
Au	Sprio-OMeTAD	Z907	0.58	5.65	55b
Au	PEDOT	D149	0.75	6.1	56
Pt	P3HT	D102	0.46	1.2	57
Pt	PEDOT	N719	0.60	5.4	58
Ag	Sprio-OMeTAD	Z907	0.69	2.7	61
Ag/PEDOT:PSS	Sprio-OMeTAD	D35	0.60	3.7	62
Graphite	CuSCN	N3	0.44	2.1	63
Cb/PEDOT:PSS	CuSCN	N3	0.69	7.4	64
Graphite	P3HT	D102	0.64	1.8	65
Graphite/Cb	P3HT	D102	0.66	3.1	65
Graphite/Cb	Sprio-OMeTAD	D102	0.65	4.03	66
V_2O_5/Al	Sprio-OMeTAD	Z907	0.34	2.0	67
ITO/Au	Sprio-OMeTAD	Z907	0.64	1.96	68
ITO	Sprio-OMeTAD	D102	0.46	1.73[a]	69
ITO	Sprio-OMeTAD	D102	0.56	1.06[b]	69

[a]front illumination, [b]rear illumination

Table S8. Experimental conditions and results about the QDSCs using different counter electrode catalysts.

CE catalyst	Substrate	Redox couple	QDs	FF	PCE/%	Ref.
Au	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.21	0.8	72a
Pt	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.26	2.1	72a
Au/Pt	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.31	2.4	72a
Pt/CuS	FTO glass	S^{2-}/S_x^{2-}	CdS	0.50	2.27	72b
Pt	FTO glass	TMTU/$TMFDS^{2+}$	ZnSe/CdS	0.58	0.86	72c
Pt	FTO glass	$McMT^{-}$/BMT	CdS	0.47	0.6	72d
Pt	FTO glass	$Mn^{2+/3+}$	CdS/CdSe	0.55	0.33	72e
Pt	FTO glass	$Co^{2+/3+}$	CdS/CdSe	0.45	0.22	72e
Cu_2S	Brass	S^{2-}/S_x^{2-}	CdSe	0.576	5.41	74a
Cu_2S	FTO glass	S^{2-}/S_x^{2-}	CdSe	0.555	5.21	74a
CuS nanosheet	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.44	3.65	74b
Cu_2S mesh	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.60	3.65	74d
Cu_2S nanorod	Coper	S^{2-}/S_x^{2-}	$CuInS_2$/CdS	0.417	4.13	74e
$Cu_{1.8}S$	FTO glass	S^{2-}/S_x^{2-}	ZnSe/CdSe	0.423	3.65	75a
$Cu_{1.8}S$/CuS	FTO glass	S^{2-}/S_x^{2-}	CdS	0.564	1.66	75b
c−Cu_xS	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.511	2.77	75c
p−Cu_xS	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.533	3.17	75c

PbS	Pb	S^{2-}/S_x^{2-}	CdSe	0.588	3.01	76a
Mn doped PbS	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.51	3.61	76b
NiS	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.48	3.30	77a
s−Fe_2S	FTO glass	S^{2-}/S_x^{2-}	ZnSe/CdSe	0.361	3.50	78a
m−Fe_2S	FTO glass	S^{2-}/S_x^{2-}	ZnSe/CdSe	0.387	3.90	78a
FeS/Fe_3S_4/Fe_2S	Carbon steel	S^{2-}/S_x^{2-}	CdS/CdSe	0.43	1.76	78b
FeS	Carbon steel	S^{2-}/S_x^{2-}	CdS/CdSe	0.40	3.34	78c
MoS_2	FTO glass	S^{2-}/S_x^{2-}	CdS	0.41	1.21	79a
Bi_2S_3	FTO glass	S^{2-}/S_x^{2-}	CdSe	0.289	2.20	79b
CoS	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.32	1.90	79c
Pt	FTO glass	I^-/I_3^-	SnS	0.65	0.99	80a
TiC	FTO glass	I^-/I_3^-	SnS	0.66	1.05	80a
SnS	FTO glass	I^-/I_3^-	SnS	0.39	0.57	80a
Pt	FTO glass	T^-/T_2	SnS	0.42	0.85	80a
TiC	FTO glass	T^-/T_2	SnS	0.45	1.03	80a
TiC	FTO glass	S^{2-}/S_x^{2-}	SnS	0.51	0.16	80a
TiN	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.20	0.80	80b
Pt	FTO glass	S^{2-}/S_x^{2-}	CdSe	0.33	2.29	81a
OMPC	FTO glass	S^{2-}/S_x^{2-}	CdSe	0.56	4.36	81a
Ca	FTO glass	S^{2-}/S_x^{2-}	CdSe	0.46	3.30	81a
Pt	FTO glass	I^-/I_3^-	CdS	0.202	0.48	81b
Pt	FTO glass	S^{2-}/S_x^{2-}	CdS	0.492	1.05	81b
HCMSC	FTO glass	S^{2-}/S_x^{2-}	CdS	0.467	1.08	81b
CMK	FTO glass	S^{2-}/S_x^{2-}	CdS	0.428	0.67	81b
Carbon foam	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.50	1.75	81c
Carbon foam[a]	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.42	3.60	81d
Au[a]	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.39	3.16	81d
CNF	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.562	2.50	81e
HCNPs	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.38	1.45	81f
N–HCNPs	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.40	2.67	81f
CNTs	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.47	2.09	81f
Pt	ITO glass	S^{2-}/S_x^{2-}	CdS	0.26	0.09	82a
PPy	ITO glass	S^{2-}/S_x^{2-}	CdS	0.27	0.41	82a
PEDOT	ITO glass	S^{2-}/S_x^{2-}	CdS	0.50	1.35	82a
Pt	FTO glass	AT^-/BAT	CdS	0.55	0.52	82b
CoS	FTO glass	AT^-/BAT	CdS	0.59	1.42	82b
PEDOT	FTO glass	AT^-/BAT	CdS	0.72	1.53	82b
PEDOT	FTO glass	T^-/T_2	CdS	0.72	1.22	82b
$CuSnS_3$	FTO glass	S^{2-}/S_x^{2-}	ZnSe/CdSe	0.437	4.06	75a
CZTS	FTO glass	S^{2-}/S_x^{2-}	CdSe	0.40	2.19	83a
CZTSe	FTO glass	S^{2-}/S_x^{2-}	CdSe	0.52	4.35	83a
$Cu_2ZnSn(S_{0.2}Se_{0.8})_4$	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.341	1.89	83c
$Cu_2ZnSn(S_{0.5}Se_{0.5})_4$	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.43	3.01	83c
$Cu_2ZnSn(S_{0.85}Se_{0.15})_4$	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.299	1.31	83c
Amorphous $NiCo_2S_4$	FTO glass	S^{2-}/S_x^{2-}	CdSe	0.283	1.61	83d
Hollow $NiCo_2S_4$	FTO glass	S^{2-}/S_x^{2-}	CdSe	0.489	4.22	83d
Pt/RG	Graphite	S^{2-}/S_x^{2-}	CdS	0.381	1.36	84
Cu_2S/ITO	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.525	4.06	85a
CuS/Cf	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.507	3.86	85b

PbS/Cb	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.58	3.91	86a
PbS/Graphene	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.42	2.63	86b
PbS/ZnO nanorod	FTO glass	S^{2-}/S_x^{2-}	CdSe	0.527	3.06	86c
CoS/graphene	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	\	2.9	87a
CoS/Graphite	Graphite	S^{2-}/S_x^{2-}	CdS/CdSe	0.36	2.70	87b
Co_9S_8/Cf	Cf	S^{2-}/S_x^{2-}	CdS/CdSe	0.57	3.79	87c
FTO/CoS/NiS	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.53	3.40	87d
FTO/NiS/CoS	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.49	2.35	87d
$CuInS_2$	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.52	3.63	88a
$CuInS_2$/Ca/Cb	FTO glass	S^{2-}/S_x^{2-}	CdS/CdSe	0.60	4.32	88a
CZTSe/MWCNTs	FTO glass	S^{2-}/S_x^{2-}	CdSe	0.51	4.60	88b
PEDOT/TiO_2	FTO glass	S^{2-}/S_x^{2-}	CdSe	0.67	1.56	89

[a]The QDSCs using ZnO nanowire photoanode