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Supporting information for

Recent Progress in Flexible-Wearable Solar Cells for Self-Powered Electronic Devices

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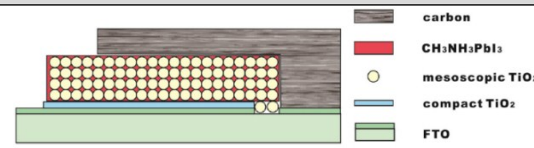
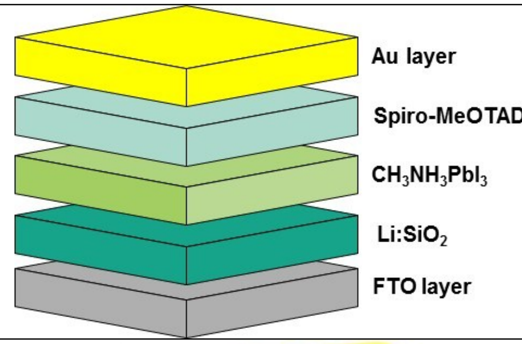
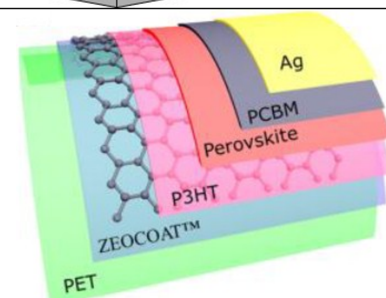
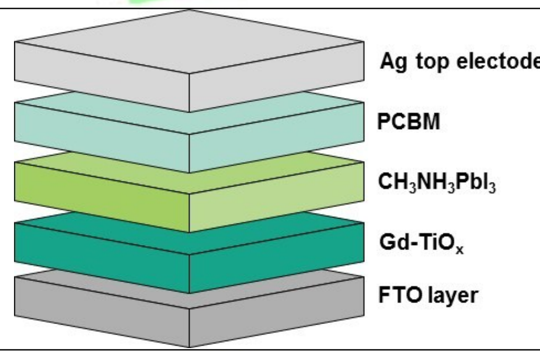
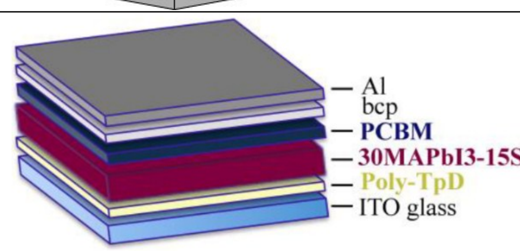
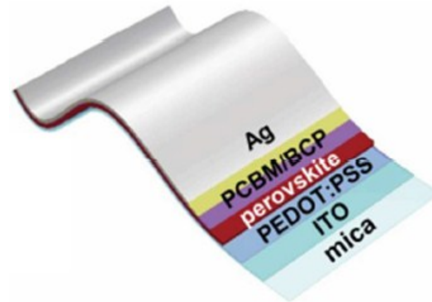
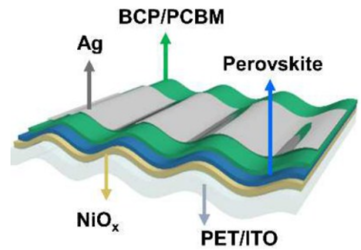
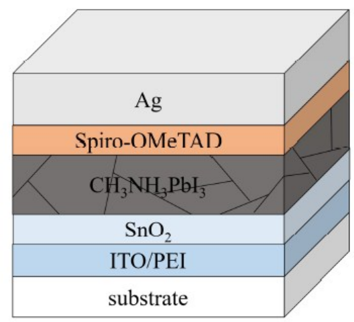
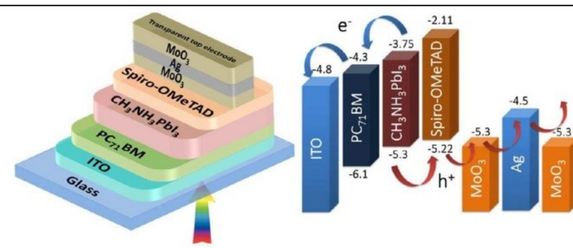
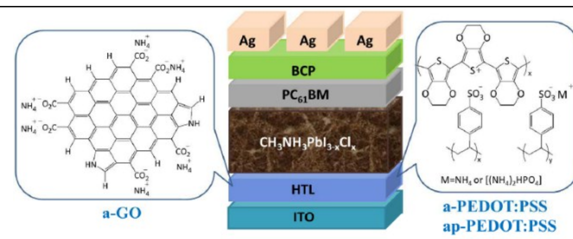
Table S1. Recent approaches in matter of perovskite solar cells.

Device Composition	V_{oc} (V)	J_{sc} (mA/cm^2)	FF (%)	PCE (%)	3D structure	Ref.
1.Carbon 2.$CH_3NH_3PbI_3$ 3.m-TiO_2 4.c-TiO_2 5.FTO	0.74	14.4	0.31	3.3		1
1.Au 2.Spiro-MeOTAD 3.$CH_3NH_3PbI_3$ 4.Li:SnO_2 5.FTO	1.106	23.27	70.71	18.20		2
1.Ag 2.PCBM 3.$CH_3NH_3PbI_3$ 4.P3HT 5.Zeocoat 6.PET	1.04	19.87	76	15.7		3
1.Ag 2.PCBM 3.$CH_3NH_3PbI_3$ 4.Gd-TiOx 5.FTO	1.12	23.61	78	20.53		4
1.Al 2.bcp 3.PCBM 4.30$MAPbI_3$-15s 5.Poly-TpD 6.ITO 7.Glass	1.08 1.08	21.8 22.2	73.6 63.7	17.2 15.2		5

1.Ag 2.PCBM/BCP 3.$CH_3NH_3PbI_3$ 4.PEDOT:PSS 5.ITO 6.Mica	1.06	23.63	77.0	19.34		6
1.Ag 2.BCP/PCBM 3.$CH_3NH_3PbI_3$ 4.NiO_x 5.ITO 6.PET	**0**/1.05 **100**/1.05 **200**/1.05 **300**/1.05 **400**/1.05 **500**/1.05 **bending cycle**	19.21 19.14 19.17 18.83 18.91 18.70	67.94 66.82 65.55 62.8 60.48 57.46	13.64 13.36 13.14 12.36 11.95 10.93		7
1.Ag 2.Spiro-MeOTAD 3.$CH_3NH_3PbI_3$ 4.SnO_2 5.ITO 6.PEI 7.Substrate	**Rigid**/1.05 **Flexible**/10.8	22.57 20.06	75 63	17.73 13.57		8
1.MoO_3 2.Ag 3.MoO_3 4.Spiro-MeOTAD 5.$CH_3NH_3PbI_3$ 6.$PC_{72}BM$ 7.ITO 8.Glass	**336**/0.904 **247**/0.873 **160**/0.978 **138**/0.982 **93**/0.983 **50**/0.933 **45**/0.994 **40**/0.921 **$MAPbI_3$ thickness (mm)**	14.97 14.91 14.11 13.47 12.28 8.81 6.97 7.24	48.96 46.35 56.37 64.39 63.09 50.49 53.48 49.04	6.76 6.31 9.00 9.13 9.23 4.13 3.91 3.50		9
1.Ag 2.BCP 3.PC61BM 4.$CH_3NH_3PbI_{3-x}CI_x$ 5.HTL 6.ITO	**GO**/0.96 **a-GO**/1.00 **PEDOT:PSS**/0.90 **a-PEDOT:PSS**/0.95 **ap-PEDOT:PSS**/0.97 **HTL layer**	16.69 18.40 20.34 20.73 20.06	74.4 76.8 68.8 68.7 69.7	11.97 14.14 12.58 13.51 13.38		10

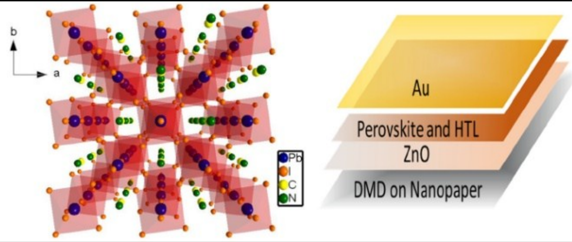
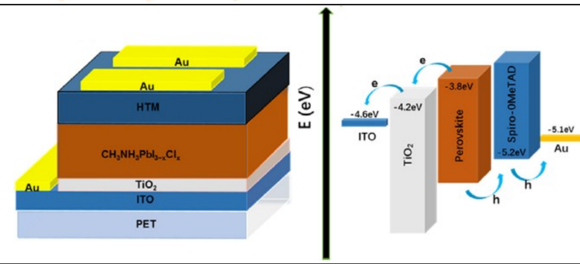
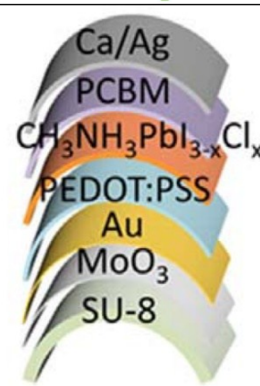
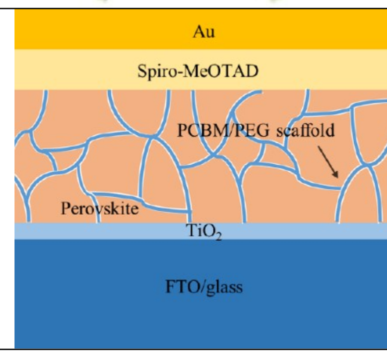
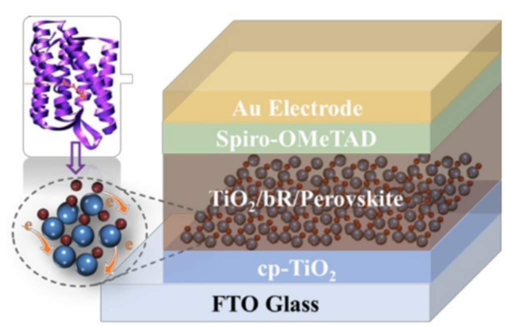
1.Au 2.variated Perovskite layer along with HTL 3.ZnO 4.DMD 5.Nanopaper	**$CH_3NH_3PbI_3$**/0.86 **$CH_3NH_3PbI_2Br$**/0.89 **$CH_3NH_3PBIBr_2$**/0.91 **$CH_3NH_3PbBr_3$**/0.84 **Perovskite layer**	15.37 14.82 10.30 8.22	48.20 41.10 40.80 42.80	6.37 5.42 3.82 2.95		11
1.Au 2.HTM 3.$CH_3NH_3PbI_{3-x}CI_x$ 4.TiO_2 5.ITO + Au 6.PET	**9**/1.02 **12**/1.05 **15**/1.07 **MAI concentration (mg/mL)**	18.2 19.8 19.7	49 60 54	9.06 12.5 11.3		12
1.Ca/Ag 2.PCBM 3.$CH_3NH_3PbI_{3-x}CI_x$ 4.PEDOT:PSS 5.Au 6.MoO_3 7.SU-8	0.93	13.17	73.89	9.05		13
1.Au 2.Spiro-MeOTAD 3.PCBM/PEG 4.TiO_2 5.FTO 6.Glass	**No PCBM/PEG**/0.67 **No PCBM/PEG**/0.96 **With PCBM**/1.04 **With PCBM**/1.07 **With PEG**/0.80 **With PEG**/1.05 **With PCBM/PEG**/1.08 **With PCBM/PEG**/1.10	19.72 22.47 22.82 22.88 22.13 22.92 22.03 23.03	29.7 57.9 56.5 58.0 35.3 65.8 63.7 67.3	3.9 12.5 13.3 14.2 6.3 16.3 15.9 17.1		14
1.Au 2.Spiro-MeOTAD 3.TiO_2 Bacteriorhodopsin (bR) $CH_3NH_3PbI_3$ 4.cp-TiO_2 5.FTO 6.Glass	**TiO_2**/1.027 **TiO_2+bR**/1.058	22.59 22.61	61.8 70.5	14.59 17.02		15

Table S2. Review of recent developed flexible perovskite solar cells.

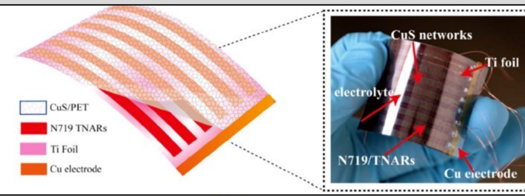
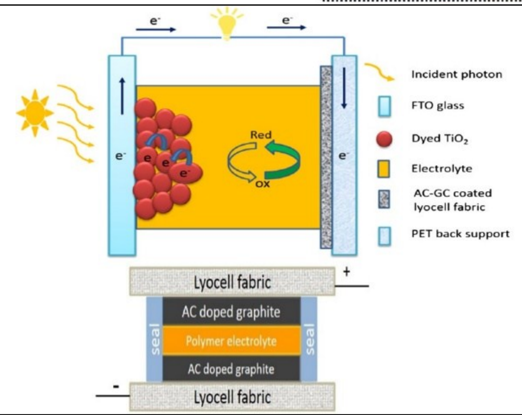
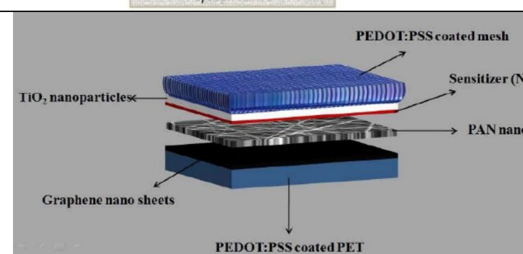
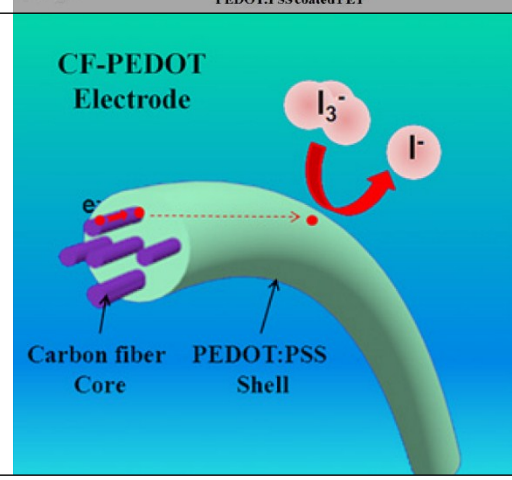
Device Structure (Top to Bottom)	V_{oc} (V)	J_{sc} (mA/cm^2)	FF (%)	PCE (%)	Ref.
Ag/LiF/rhodhamine 101/C60/rhodamine 101/PCBM/$CH_3NH_3PBI_3$/MSA-PEDOT:PSS/PET	0.87	17.2	57.0	8.60	[16]
Al/LiF/C60/CH_3NH_3I/PEDOT:PSS/Graphene-MO/PEN	0.80	15.0	60.0	7.60	[17]
Au/PCBM/$CH_3NH_3PbI_3$/Poly-TDP/PEDOT:PSS/AZO/Ag/AZO/PET	1.04	14.3	47.0	7.00	[18]
Al/TiO_2/PCBM/$CH_3NH_3PbI_3$/PEDOT:PSS/PET	0.75	15.8	41.0	4.90	[19]
Al/PCBM/ $CH_3NH_3PbI_3$/PEDOT:PSS/PH1000/A/PET	0.91	19.5	80.0	14	[20]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/PEI/PEDOT:PSS/PET	0.95	17.2	59.7	9.73	[21]
Al/PCBM/$CH_3NH_3PbI_3$/SWCNT/PET	0.71	11.8	46.0	5.38	[22]
Ag/PCBM/PFN-PI/CH_3NH_3I/PEDOT:PSS/GO/Ag/PET	0.94	12.7	66.2	7.92	[23]
Al/LiF/BCP/C60/$CH_3NH_3I_3$/PEDOT:PSS/Graphene-Mo/PEN	1	21.7	0.8	16.80	[24]
hc-PEDOT:PSS/Spiro-MEOTAD/$CH_3NH_3PbI_{3-x}CI_x$/PEI/Ag/PSSNa/PES	1.07	15.8	70.0	11.80	[25]
Ag/$PC_{71}BM$/$CH_3NH_3PbI_3$/P3HT/Graphene/PET	1.04	18.6	59.4	11.48	[26]
Eutectic Ga-In/PCBM/$CH_3NH_3PbI_3$/PEDOT:PSS/NOA 63	0.92	16.6	70.5	10.75	[27]
Al/In_2O_3 coupled with Ni/MoO_3/Spiro-MeOTAD/$CH_3NH_3PbI_3$/C60/ZnO/AZO/PET	1.08	16.1	68.6	12.20	[28]
Ag/Ca/PCBM/$CH_3NH_3PBI_{3-x}CI_x$/PEDOT:PSS/Au/MoO_3/NOA63	0.83	13.9	60.7	6.96	[29]
Ag/Spiro-MeOTAD/$CH_3NH_3PbI_3$/TiO_2/IZO/PET	1.05	18.2	70.0	13.20	[30]
PET accompanied with Ni mesh/PEDOT:PSS/Spiro-MeOTAD/$CH_3NH_3PbI_{3-x}CI_x$/Al_2O_3/TiO_2/Ti	0.98	17.0	61.0	10.30	[31]
Ag/Spiro-MeOTAD/$CH_3NH_3PbI_3$/TiO_2/IZO/PET	1.05	18.2	70.0	13.20	[32]
ITO/Spiro-MeOTAD/$CH_3NH_3PbI_3$/mp-TiO_2/c-TiO_2/Ti layer	0.10	18.5	61.0	11.01	[33]
Ag/Spiro-MeOTAD/$CH_3NH_3PbI_3$/TiO_2/Ti	0.89	9.5	72.8	6.15	[34]
Ag nanowire/ Spiro-MeOTAD/$CH_3NH_3PbI_3$/TiO_2/Ti	0.92	16.5	49.0	7.45	[35]
CNT/Spiro-MeOTAD/$CH_3NH_3PbI_3$/TiO_2 nanotubes/Ti	0.99	14.4	68.0	8.31	[36]
CNT sheet/Spiro-MeOTAD/$CH_3NH_3PbI_3$/mp-TiO_2/C-TiO_2/Stainless steel	0.66	10.2	48.7	3.30	[37]
PEN-ITO/PEDOT/$CH_3NH_3PbI_3$/TiO_2 nanowire/Ti layer	0.94	21.7	63.0	13.07	[38]
CNT/Spiro-MeOTAD/$CH_3NH_3PbI_3$/ZnO nanorod/ZnO seed/Stainless steel	-	-	-	3.80	[39]
Ag nanotube/ ZnO/$CH_3NH_3PbI_3$/CuI/Cu	0.96	22.5	59.2	12.80	[40]
Ag nanotube/SWCNT/CH3NH3PbI3-xCIx/mp-TiO_2/c-TiO_2/CNT fiber	0.62	8.8	56.4	3.03	[41]
CNT/CH3NH3PbI3/meso-TiO2/c-TiO2/Ti	0.85	14.5	56.0	7.10	[42]
CNT sheet/Spiro-MeOTAD/$CH_3NH_3PbI_{3-x}CI_x$/TiO_2 nanotube/Ti substrate	-	-	-	5.22	[43]
CNT/ $CH_3NH_3PbI_3$/TiO_2/ITO/PEN	0.91	15.9	65.6	9.49	[44]
Ag nanowires/Spiro-MeOTAD/$CH_3NH_3PbI_3$/mp-TiO_2/c-TiO_2/Ti	0.73	12.0	44.0	3.85	[45]
CNT/CH3NH3PbI3/TiO2 nanotubes/Ti substrate	0.92	2.6	48.0	1.16	[46]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_{3-x}CI_x$/meso-TiO_2/c-TiO_2/Ti substrate	0.71	12.3	60.9	5.35	[47]

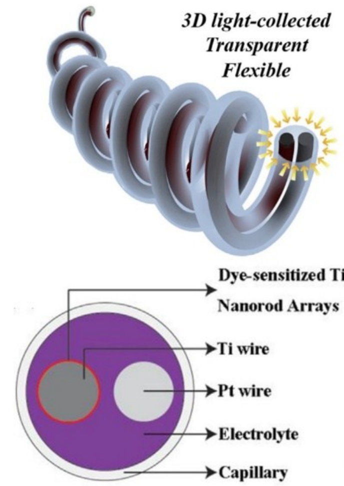
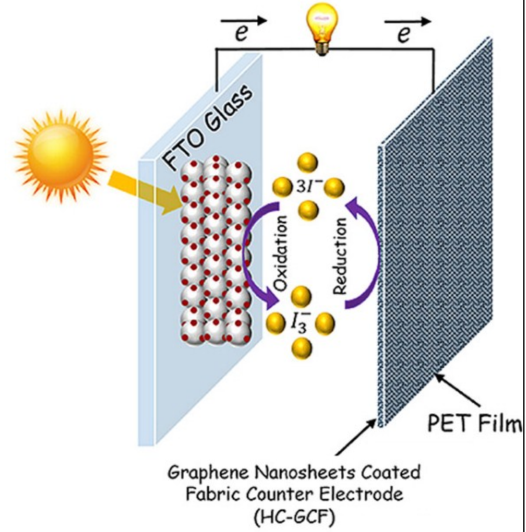
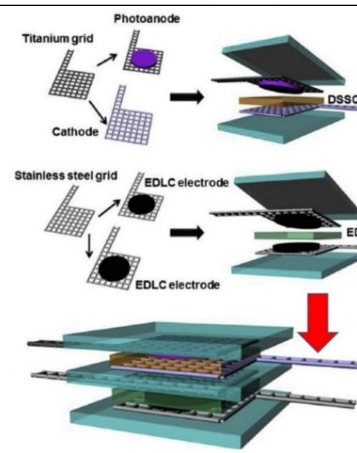
Ag/Spiro-MeOTAD/ $CH_3NH_3PbI_{3-x}CI_x$/TiO2/ITO/PET	1.03	15.3	51.4	8.10	[48]
Ag/Spiro-MeOTAD/ $CH_3NH_3PbI_{3-x}CI_x$/TiOx/ITO/PEN	0.95	21.4	60.0	12.20	[49]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_{3-x}CI_x$/TiO2/ITO/PET	1.03	20.9	70.0	15.07	[50]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_{3-x}CI_x$/mp-TiO_2/c-TiO_2/ITO/PET	0.86	14.1	70.0	8.4	[51]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_{3-x}CI_x$/mp-TiO_2/c-TiO_2/ITO/PET	3.39	5.2	71.0	3.10	[51]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_{3-x}CI_x$/BK-TiO_2/SnO_x/ITO/PET	1.03	19.0	68.0	13.40	[52]
Au/PTAA/$CH_3NH_3PbI_{3-x}CI_x$/TiO_2/ITO/PET	0.91	21.3	69.0	13.50	[53]
Au/PTAA/$CH_3NH_3Pb(I_{1-x}Br_x)_3$/$TiO_2$/ITO/PET	1.11	20.8	69.0	15.88	[54]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/UV-Nb:TiO_2/ITO/PEN	1.04	20.2	76.0	16.01	[55]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/BK-TiO_2/c-TiO_2/ITO/PEN	1.07	19.5	75.0	15.76	[56]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/mp-TiO_2/c-TiO_2/ITO/PET	0.88	14.9	70.0	9.20	[57]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_{3-x}CI_x$/me-TiO_2/c-TiO_2/ITO/PET	0.66	33.7	77.3	12.10	[58]
C/$CH_3NH_3PbI_3$/ZnO/ITO/PET	0.76	13.4	42.0	4.29	[59]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/ZnO nanorod/c-ZnO/ITO/PET	0.80	17.5	43.1	2.62	[60]
Ag/Spiro-MeOTAD/$CH_3NH_3PbI_3$/ZnO quantum dots/Graphite/ITO/PET	0.94	16.8	62.0	9.73	[61]
Ag/Spiro-MeOTAD/$CH_3NH_3PbI_3$/ZnO/ITO/PET	1.03	13.4	73.9	10.20	[62]
Au/PTAA/$CH_3NH_3PbI_3$/ZnO/ITO/PI	1.10	17.6	79.4	15.40	[63]
Au/PTAA/$CH_3NH_3PbI_3$/ZnO/ITO/PEN	1.10	18.7	76.0	15.50	[64]
Au/PTAA/$CH_3NH_3PbI_3$/ZnO/ITO/PI	1.10	17.6	79.4	15.40	[63]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/ZnO/ITO/PET	0.87	19.2	67.6	11.29	[65]
Au/PTAA/$CH_3NH_3PbI_3$/$ZnSnO_4$/ITO/PET	1.05	21.6	67.0	15.30	[66]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/ZnO/ITO/Flexible glass substrate	0.98	19.3	69.0	13.14	[67]
Ag/Spiro-MeOTAD/$CH_3NH_3PbI_3$/PCBM/Zn_2SnO_4/ITO/PET	1.05	17.4	63.8	11.61	[68]
Au/PTAA/$CH_3NH_3Pb(I_{0.9}Br_{0.1})_3$/$ZnSnO_4$/ITO/PEN	1.10	20.4	73.0	16.50	[69]
Au/PTAA/$CH_3NH_3PbI_3$/PCBM/TiO_2/FTO/PEN	0.99	18.7	60.0	11.10	[70]
Au/Spiro-Ome TAD/ss-IL$(HC(NH_2)_2PbI_3)_{0.85}(CH_3NH_3PbBr_3)_{0.15}$/ITO/PET	1.07	22.7	66.2	16.09	[69]
Ag/PEDOT:PSS/P3HTa/$CH_3NH_3PbI_3$/PCBM/ZnO/ITO/PET	0.84	11.4	56.0	5.4	[71]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/Al_2O_3/ITO/PET	1.00	22.8	67.0	14.60	[72]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/PCBM/FPI-PEIE/ITO/PET	1.07	17.8	53.0	10.00	[73]
Ag/Spiro-MeOTAD/$CH_3NH_3PbI_3$/CDIN/PEIE/ITO/PET	1.02	19.7	70.4	14.15	[74]
Ag/Spiro-MeOTAD/$CH_3NH_3PbI_3$/Ti/PET-ITO	0.83	15.2	66.0	8.39	[75]
Ag/Spiro-MeOTAD/$CH_3NH_3PBI_{3-x}CI_x$/W(Nb)O_x/ITO/PEN	0.98	21.4	75.0	15.65	[76]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/Li:SnO_2/ITO/PEN	1.01	19.8	59.3	11.84	[77]
Au/Spiro-OTAD/$CH_3NH_3PbI_3$/PCBM/SnO_2/ITO/PEN	1.08	20.6	63.0	14.00	[78]
Au/Spiro-MeOTAD/Nb_2O_5/$(HC(NH_2)_2PBI_3)_{0.85}(CH_3NH_3PbBr_3)_{0.15}$/$Nb_2O_5$/ITO/PET	1.12	23.5	63.1	15.56	[79]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/Li:SnO_2/ITO/PET	1.02	20.6	76.3	14.78	[2]
Au/LN-P3HT/$CH_3NH_3PbI_3$/PCBM/PEIE/ITO/PEN	0.88	22.0	69.6	13.12	[80]

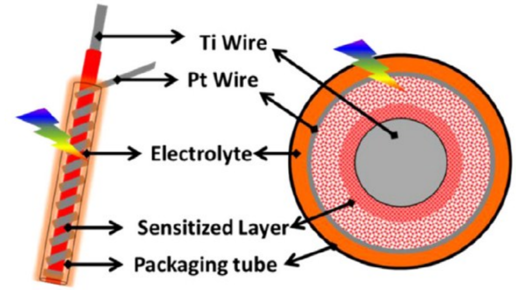
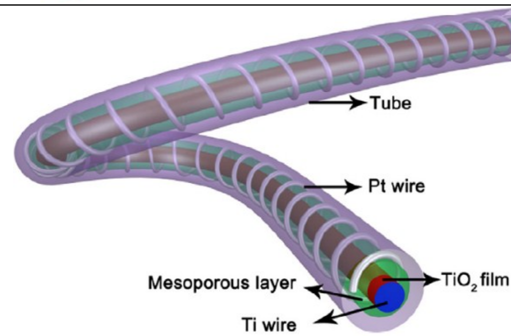
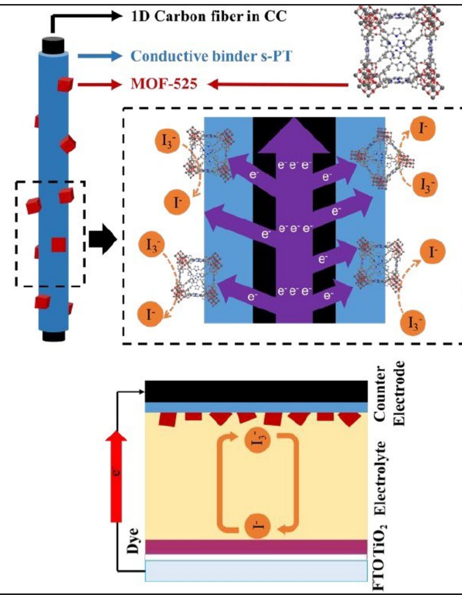
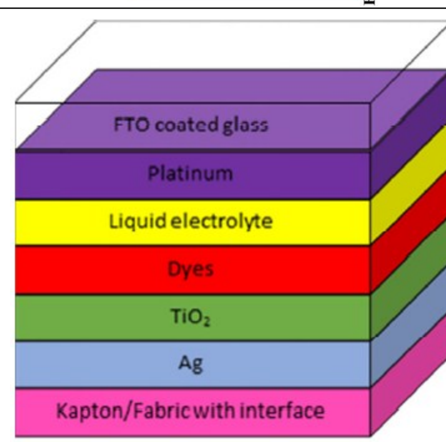
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/C_{60}/ITO/PEN	1.02	23.2	67.3	16	[56]
Au/Co-P3HT/$CH_3NH_3PbI_3$/PCBM/PEIE/ITO/PEN	1.01	19.8	59.3	11.84	[77]
Au/Spiro-MeOTAD/$(HC(NH_2)_2PbI_3)_{0.9}(CH_3NH_3PbI_3)_{0.1}$/ITO/PET	0.96	20.7	64.0	12.70	[81]
Ag/Spiro-MeOTAD/$CH_3NH_3PbI_3$/C_{60}/PEIE/ITO/PEN	1.02	17.9	73.0	13.30	[82]
Ag/MoO_3/Spiro-MeOTAD/$CH_3NH_3PbI_3$/ITO/PEN	0.96	17.4	56.0	11.34	[83]
Al/Bis-C_{60}/PCBM/$CH_3NH_3PbI_{3-x}CI_x$/PEDOT:PSS/ITO/PET	0.86	16.5	64.0	9.20	[84]
Al/TiO_x/PCBM/$CH_3NH_3PbI_{3-x}CI_x$/PEDOT:PSS/ITO/PET	0.88	14.4	51.0	6.40	[85]
Al/BCP/PCBM/$CH_3NH_3PbI_3$/PEDOT:PSS/ITO/PET	0.92	7.9	62.0	4.50	[86]
Ag/Bis-C_{60}/PCBM/$CH_3NH_3PbI_3$/PEDOT:PSS/ITO/PET	0.86	14.6	75.0	9.43	[87]
Ag/Bis-C_{60}/PCBM/$CH_3NH_3PbI_3$/PEDOT:PSS/ITO/PET	0.87	13.9	59.0	7.14	[88]
Al/Ca/PCBM/$CH_3NH_3PbI_3$/PEDOT:PSS/ITO/PET	0.99	17.2	72.0	12.25	[89]
Ag/ZnO/PCBM/$CH_3NH_3PbI_{3-x}CI_x$/PEDOT:PSS/ITO/PET	0.90	10.9	50.0	4.90	[71]
Al/Ca/PCBM/$CH_3NH_3PbI_3$/PEDOT:PSS/ITO/PET	0.92	15.0	49.2	6.80	[90]
Ag/ZnO/$PC_{61}BM$/$CH_3NH_3PbI_{3-x}CI_x$/C_3-SAM/PEDOT:PSS/ITO/PET	0.98	13.7	38.0	5.10	[91]
Ag/Bis-C_{60}/$CH_3NH_3PbI_3$/NiOx/ITO/PET	1.00	20.7	70.5	14.53	[63]
Ag/LiF/PCBM/$MAPbI_3$/$CH_3NH_3PbI_{3-x}CI_x$/PEI-HI/PEDOT:PSS/ITO/PET	19.01	1.1	68.0	13.80	[92]
Ag/Bis-C_{60}/$CH_3NH_3PbI_3$/NiOx/ITO/PET	1.00	20.9	69.6	14.19	[93]
Ag/PCBM/$CH_3NH_3PbI_3$/NiOx/ITO/PEN	1.04	18.7	68.9	13.43	[94]
Al/LiF/C_{60}/$CH_3NH_3PbI_3$/PEDOT:PSS/ITO/PEN	0.97	21.5	83.0	17.30	[24]
Ag/BCP/PCBM/$CH_3NH_3Pb(I_{0.9}Cl_{0.1})_3$/$NiO_x$/ITO/PEN	1.04	17.7	64.2	11.84	[95]
Ag/PCBM/$CH_3NH_3PbI_{3-x}CI_x$/ITO/PET	0.67	12.4	42.4	2.90	[96]
Ag/PCBM/$CH_3NH_3PbI_3$/PEDOT:PSS/ITO/PET	0.89	19.4	68.3	11.29	[97]
Ag/BCP/PCBM/$CH_3NH_3PbI_3$/PEDOT:PSS/c-ITO/Ag nanowires coupled with GFRhybrimer	0.99	21.5	66.0	14.15	[98]
Ag/BCP/C_{60}/$FASnI_3$/PEDOT:PSS/ITO/PEN	0.31	16.1	62.6	3.12	[99]
Al/PCBM/$CH_3NH_3PbI_3$/ITO	0.96	14.8	68.1	9.70	[100]
Ag/PCBM/$CH_3NH_3PbI_3$/PhNa-1T/ITO/PEN	1.03	18.4	77.4	14.70	[101]
Ag/AUH/C60/PCBM/CH3NH3PbI3/PEDOT:PSS/ITO/Glass	0.95	18.3	73	12.6	[102]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/MgO/ITO/Glass	9.09	0.289	28.48	0.746	[103]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/SnO_2/ITO/Glass	21.10	1.10	64.82	15.08	[103]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/SnO_2/SnO_2/ITO/Glass	21.48	1.07	67.46	15.48	[103]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/MgO (3k rpm)/SnO_2/ITO/Glass	21.31	1.13	67.26	16.26	[103]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/MgO (5k rpm)/SnO_2/ITO/Glass	21.26	1.12	74.78	17.92	[103]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/MgO (6k rpm)/SnO_2/ITO/Glass	20.59	1.12	72.27	16.82	[103]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/ SnO_2/ITO/Glass under 200 lx light irradiation	32.87	0.836	59.59	20.23	[103]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/ SnO_2/ITO/Glass under 400 lx light irradiation	62.99	0.871	58.30	21.33	[103]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/MgO (5k rpm)/SnO_2/ITO/Glass under 200 lx light irradiation	32.84	0.867	69.69	24.50	[103]

Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/MgO (5k rpm)/SnO_2/ITO/Glass under 400 lx light irradiation	63.21	0.901	72.04	26.47	[103]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/SnO_2/ITO/PET with flat substrate	18.70	1.03	51.65	9.95	[104]
Au/Spiro-MeOTAD/$CH_3NH_3PbI_3$/SnO_2/ITO/PET with pillar-like substrate	19.18	1.03	52.80	10.43	[104]
Al/PCBM/mp-NiO/cp-NiO/FTO	0.83	4.90	35.0	1.50	[105]
Ag/BCP/PCBM/Psk/mp-Al_2O_3/cp-NiO/FTO	1.04	18.0	72.0	13.5	[106]
Al/BCP/PC_{61}/BM/Psk/mp-NiO/cp-NiO/ITO	1.04	13.24	69.0	9.51	[107]
Carbon electrode/Psk/mp-NiO/mp-TiO_2/cp-TiO_2/FTO	0.89	18.2	71.0	11.4	[108]
Carbon electrode/Psk/mp-NiO/mp-ZrO_2/mp-TiO_2/cp-TiO_2/FTO	0.965	20.4	72.0	14.2	[109]
Al/BCP/PCBM/Psk/mp-NiO/cp-NiO/ITO	0.96	19.8	61.0	11.6	[110]
Al/BCP/C_{60}/Psk/TCO free Au-NiO layer	1.02	13.04	77.0	10.24	[111]
Carbon electrode/Psk/mp-NiO/mp-ZrO_2/mp-TiO_2/FTO	0.917	21.36	76.0	14.9	[112]
Al/PCBM/Psk/cp-NiO/FTO	0.786	14.2	65.0	7.26	[113]
Carbon electrode/Psk/mp-NiO/mp-Al_2O_3/mp-TiO_2/cp-TiO_2/FTO	0.915	21.62	76.0	15.03	[114]
Al/PCBM/Psk/cp-NiO/ITO	1.05	15.4	48.0	7.60	[115]
Al/BCP/PCBM/Psk/cp-NiOx/ITO	0.92	12.43	68.0	7.80	[116]
Au/BCP/PCBM/Psk/cp-NiO/FTO	1.10	15.17	59.0	9.84	[117]
Al/BCP/PCBM/Psk/cp-NiO_x/ITO	0.90	13.16	65.0	7.75	[118]
Ag/bis-C_{60}/C_{60}/Psk/cp-NiO_x/ITO/PET	0.997	20.66	70.5	14.53	[119]
Ag/PCBM/Psk/cp-NiO_x/FTO	1.09	17.93	74.0	14.42	[120]
Ag/bis-C_{60}/C_{60}/Psk/cp-NiO_x/ITO	1.03	21.80	78.4	17.60	[119]
Ag/C_{60}/PC_{61}BM/Psk/sol-gel cp-Cu:NiO layer/ITO	1.11	18.75	72.0	14.98	[121]
Al/ZnO/Psk/cp-NiO_x/ITO	1.01	21.0	76.0	16.1	[122]
Ag/bis-C_{60}/C_{60}/Psk/cp-Cu:NiO through combustion/ITO	1.05	22.23	76.0	17.74	[123]
Ag/PCBM/Psk/cp-NiO_x coupled with PEDOT/ITO	1.02	19.4	70.0	14.11	[124]
Al/LiF/PCBM/Psk/cp-NiO/ITO	1.06	20.2	81.3	17.3	[125]
Ag/Zr Acac/ PCBM/Psk/cp-Cs:NiO_x/FTO	1.120	21.77	79.3	19.35	[126]
Al/ZnO/Psk/cp-NiO_x/ITO	1.01	21.0	76.0	16.1	[122]
Ni/NiO_x/Psk/cp-TiO_2/FTO	0.77	17.88	53.0	7.28	[127]
Ag/Ti(Nb)O_x/PCBM/Psk/cp-NiMgLiO/FTO	1.072	20.21	74.8	16.2	[128]
Al/Zr Acac/PCBM/Psk/cp-Cu:NiO_x/FTO	1.12	23.07	77.5	20.50	[129]
Al/ZnMgO/PCBM/Psk/cp-NiMgO/ITO	1.078	21.3	79.0	18.5	[130]

Table S3. A review of recently developed dye-sensitized solar cells.

Device Composition	**V_{oc} (V)**	**J_{sc} (mA/cm^2)**	**FF (%)**	**PCE (%)**	**3D structure**	**Ref.**
1.CuS/PET 2.N719 TNARs 3.Ti foil 4.Cu electrode	**With CuS-PET**/0.45 **With Pt-PET**/0.44	19.78 17.38	50.79 42.15	4.54 3.24		131
1.Lyocell fabric 2.AC doped graphite 3.Polymer electrolyte 4.AC doped graphite 5.Lyocell fabric Along with side sealings	**0**/0.656 **25**/0.723 **50**/0.730 **75**/0.714 **100**/0.699 **wt% of AC** **Pt-FTO**/0.726 **AC-GC Fabric**/0730	8.6 15.5 15.5 14.6 13.4 14.5 15.5	41.8 43.9 62.8 37.6 37.7 73.5 62.8	2.36 4.92 7.09 3.91 3.54 7.76 7.09		132
1.PEDOT:PSS 2.TiO2 3.N719 dye 4.PAN nanofiber 5.Graphene flakes 6.PEDOT:PSS 7.PET	**Standard**/0.69 **Device**/0.579	17.93 6.77	60.65 39.46	7.39 2.59		133
Highly flexible wire-shaped solar cell with coupled carbon fiber (CF) and PEDOT:PSS which contain the electrolyte and provide a fully dye-sensitized solar cell	**DCF150**/0.481 **DCF150-PEDOT2**/0.730 **DCF150-PEDOT4**/0.685 **DCF150-PEDOT7**/0.678 **DCF50-PEDOT4**/0.723 **DCF100-PEDOT4**/0.737 **With diverse dip-coating application numbers (i.e. 0, 2, 4 and 7)**/V_{oc}	7.49 9.17 11.15 12.01 8.58 9.60	27 71 70 69 64 67	0.98 5.08 4.73 5.34 5.61 3.97		134

1.Capillary 2.Electrolyte 3.Pt wire 4.covered Ti wire with dye sensitized TiO_2 nanorod	**HT_SM**/-0.62 **TT_SM**/-0.72 **TT-N-1_SM**/-0.76 **TT-N-2_SM**/-0.75 **TT-N-3_SM**/-0.75 **TT-N-4_SM**/-0.73 **3.7 cm long dye-sensitized solar cell based on HT, TT and TT-N-x (where x=1, 2, 3, 4) TiO_2 nanorods under standard illumination mode irradiation**	1.0 3.2 4.1 6.0 7.1 6.2	0.71 0.80 0.83 0.83 0.83 0.83	0.5 1.9 2.6 3.7 4.4 3.8		135
1.Decorated cotton fabric with graphene flakes: 1.1.Cotton fabric 1.2.BSA treated layer 1.3.Graphene oxide nanosheets treated 1.4.Decorated cotton with graphene flakes **2.Cathode:** 2.1.PET film 2.2.Decorated cotton fabric with graphene **3.Anode:** 3.1.Holed FTO Glass 3.2.photoanode 3.3.seprator	**FT-PTO base**/0.67 **HC-GFC base**/0.66 **Platinized-Fluorinated Tin oxide (FT-PTO)** **Highly conductive graphene coated cotton fabric (HC-GFC)**	15.88 14.75	78.52 70.92	8.44 6.93		136
1.Photoanode 2.DSSC PEM 3.DSSC cathode 4.EDLC electrode 5.EDLC PEM 6.EDLC electrode DSSC: dye-sensitized solar cell EDLC: electrical double layer capacitors PEM: polymer electrolyte membrane	**1**/0.67 **0.5**/0.64 **0.3**/0.61 **0.2**/0.64 **0.15**/0.63 **Illumination (Sun)**/V_{oc}	3.34 2.30 2.00 1.60 1.26	37 30 30 30 34	1.38 1.46 2.03 2.59 2.96		137

1.Packing tube 2.Electrolyte 3.Pt wire 4.Sensitized dye 5.Ti wire	**FDSC**/0.61 **B-1**/0.64 **B-4**/0.65 **Al-1**/0.69 **Al-4**/0.71 **DM**/0.70	8.93 15.44 15.04 35.83 49.80 60.71	74 73 72 65 58 54	4.03 7.21 7.04 16.07 20.51 22.95		138
1.Tube 2.Pt wire 3.Mesoporous layer 4.TiO_2 5.Ti wire	~0.68 **At atomic layer deposition ALD) thickness of 15 nm**	13.816	~82.5	7.41		139
1.MOF-525 2.Conductive binder s-PT 3.1 D carbon fiber in CC	**MOF-525/s-PT-1**/0.8 **MOF-525/s-PT-2**/0.79 **MOF-525/s-PT-3**/0.80 **MOF-525/s-PT-4**/0.80 **MOF-525/s-PT-5**/0.80 **Bare s-PT**/0.79 **Bare MOF-525**/0.78 **Pt**/0.77 **Base of device**/V_{oc} **sulfonated-poly(thiophene-3-(2-(2-methoxyethoxy) ethoxy)-2,5-diyl) (s-PT)**	12.67 12.86 16.14 12.66 10.95 12.32 12.68 12.82	70 71 70 70 70 71 48 66	6.96 7.21 8.91 6.97 5.97 6.94 4.78 8.21		140
1.Glass 2.FTO 3.Pt 4.Electrolyte 5.Sensitized dye 6.TiO_2 7.Ag 8.Kapton or Fabric	**Kapton**/0.60 **Fabric**/0.30	32.85 36.56	36 25	7.03 2.78		141

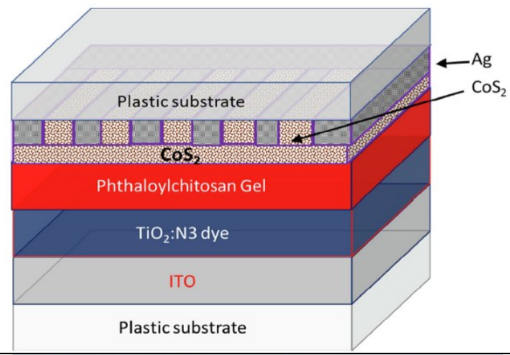
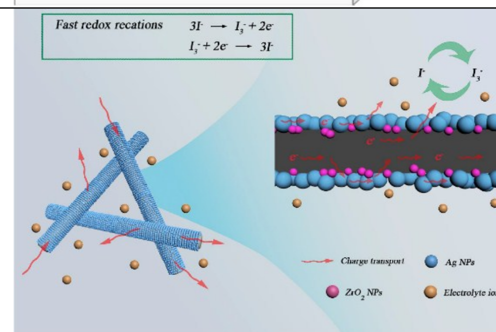
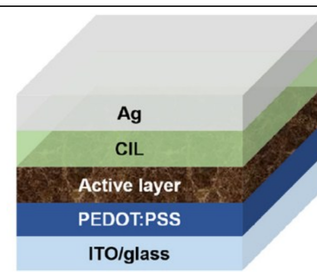
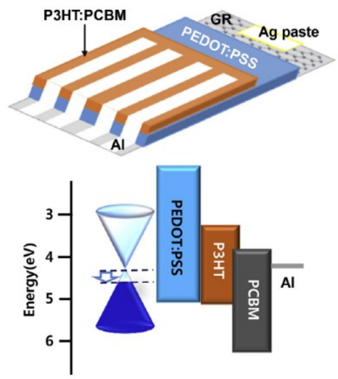
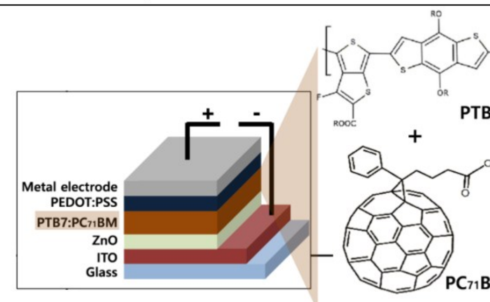
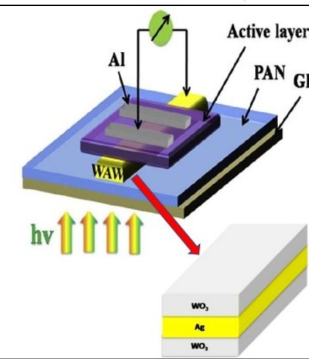
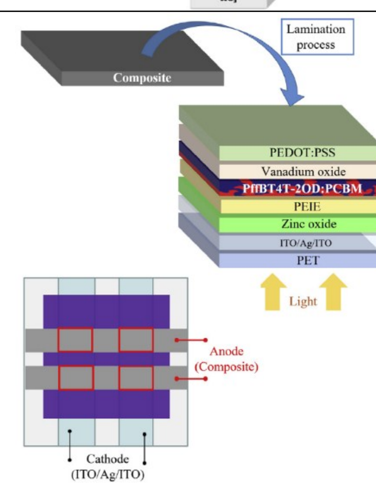
1.Plastic layer 2.coupled Ag with CoS_2 layer 3.CoS_2 4.phthaloylchitosan gel 5.TiO_2:N3 dye 6.ITO 7.Plastic substrate	0.65 **Pt based**/60	17.51 67	64 62	7.09 7.04		142
Ag decorated ZrO_2/C nanofiber as a dye-sensitized solar cell	**Pt**/0.73 **Ag**/0.74 **ZrO_2/C**/0.74 **Ag@ZrO_2/C-1**/0.74 **Ag@ZrO_2/C-2**/0.75 **Ag@ZrO_2/C-3**/0.75 **Ag@ZrO_2/C-4**/0.76 **Ag@ZrO_2/C-5**/0.77	13.28 10.77 9.85 11.16 11.54 11.62 11.79 11.57	54.25 48.81 51.13 51.57 52.04 52.98 53.23 52.86	5.26 3.89 3.73 4.21 4.50 4.62 4.77 4.71		143

Table S4. Review of the recently developed organic solar cells.

Device Composition	**V_{oc} (V)**	**J_{sc} (mA/cm^2)**	**FF (%)**	**PCE (%)**	**3D structure**	**Ref.**
1.Al electrode 2.LiF 3.Ternary blend (ITIC/P(NDI2HD-Se)/PTP8) 4.PEDOT:PSS 5.ITO	**1.5/1.0/0.0** / 0.976 **1.5/0.9/0.1** / 0.976 **1.5/0.85/0.15** / 0.976 **1.5/0.8/0.2** / 0.976 **1.5/0.7/0.3** / 0.976 **1.5/0.5/0.5** / 0.976 **1.5/0.3/0.7** / 0.976 **1.5/0.0/1.0** / 0.976 **PTP8/P(NDI2HD-T)/ITIC** / V_{oc}	10.71 11.83 12.60 11.61 10.47 9.23 9.24 8.76	57 56 57 56 56 57 54 58	6 6.47 7.01 6.35 5.72 5.14 4.87 5.10		144
1.Ag 2.CIL 3.Active layer 4.PEDOT:PSS 5.ITO 6.Glass	**Normal Device**/0.62 **Based on MeOH**/0.63 **Based on PEG**/0.74 **Based on FSO-100**/0.77	15.7 15.9 16.1 16.0	64 65 68 74	6.4 6.5 8.1 9.2		145

1.Al electrode 2.P3HT:PCBM 3.PEDOT:PSS 4.Graphene 5.Ag electrode	**0** / 0.571 **0.01** / 0.580 **0.02** / 0.592 **0.03** / 0.593 **n_G (g/L)** / V_{oc}	9.44 9.87 10.43 10.37	56.58 57.86 59.31 59.16	3.04 3.31 3.66 3.63		146
1.Top metallic electrode 2.PEDOT:PSS 3.PTB7:$PC_{71}BM$ 4.ZnO 5.ITO 6.Glass	**ZnO-S.C.** / 0.62 **ZnO-B.P.** / 0.46 **ZnO (D-1:3)-B.P.** / 0.62 **ZnO (D-1:6)-B.P.** / 0.62 **ZnO (D-1:10)-B.P.** / 0.62 **ZnO-S.C.** / 0.74 **ZnO-B.P.** / 0.73 **S.C.=spin coating, B.P.=brush painted and D=diluted**	9.40 1.23 8.61 9.90 9.45 14.96 45.00	56.55 36.64 56.97 58.39 55.92 67.29 69.26	3.29 0.21 3.03 3.61 3.25 7.43 7.63		147
1.Al electrode 2.Active layer 3.WAW layer (WO_3/Ag/WO_3) 4.PAN 5.Glass	**Based on P3HT:ICBA** **Before transfer** / 0.850 **After transfer** /0.851 **ITO** /0.850 **Based on PTB7:$PC_{71}BM$** **Before transfer** / 0.69 **After transfer** /0.69 **ITO** / 0.71	 7.79 7.61 9.22 14.33 13.38 15.41	 71.6 67.42 67.89 62.21 61.66 64.72	 4.75 4.37 5.36 6.23 5.71 7.14		148
1.PEDOT:PSS 2.Vanadium oxide 3.PffBT4T-2OD:PCBM 4.PEIE 5.ZnO_2 6.ITO 7.Ag 8.ITO 9.PET substrate	**PEDOT/Graphene** / 0.74 **Ag** / 0.72 **Top electrode** / V_{oc}	8.91 10.28	43.4 51.2	2.85 3.78		149

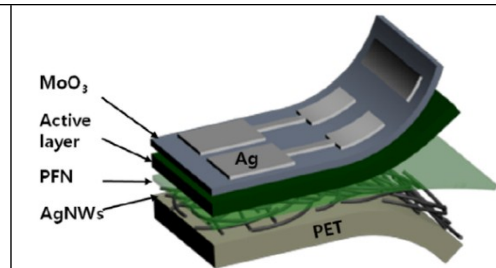
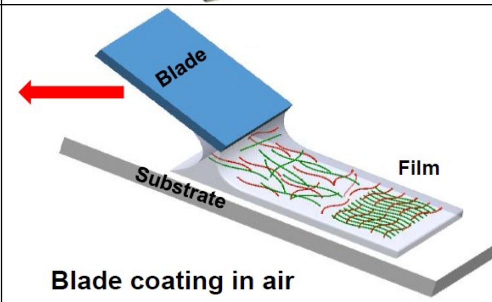
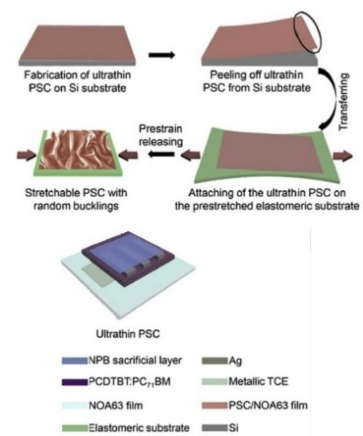
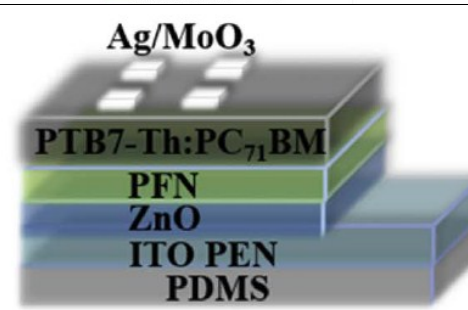
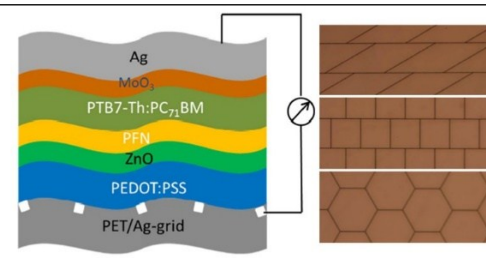
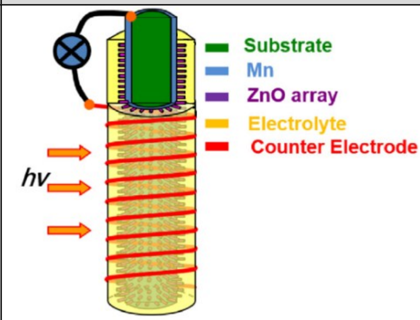
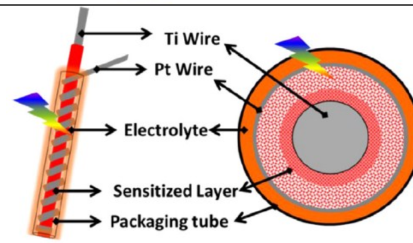
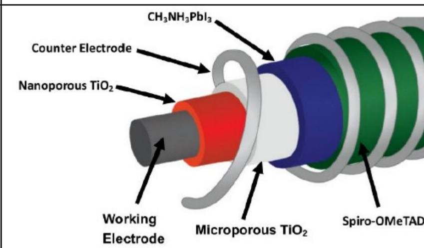
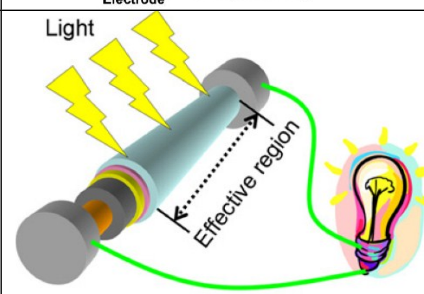
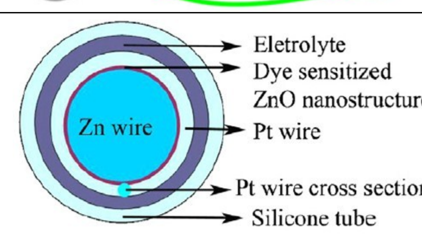
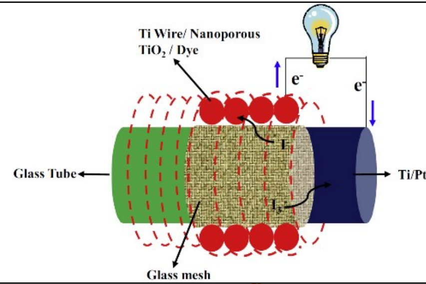
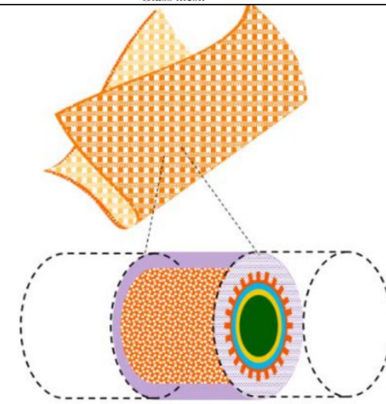
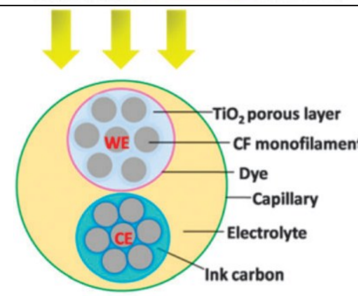
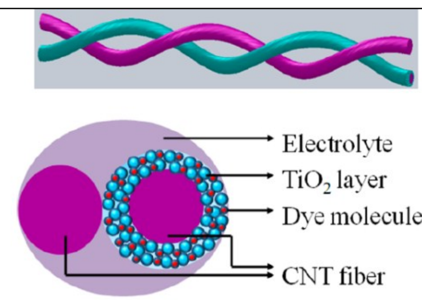
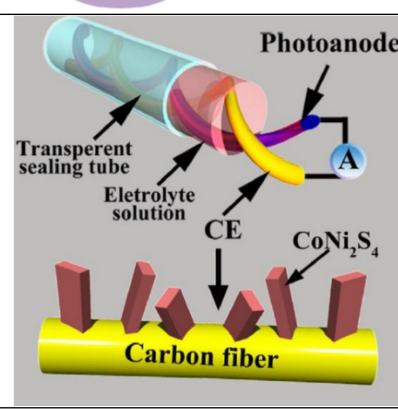
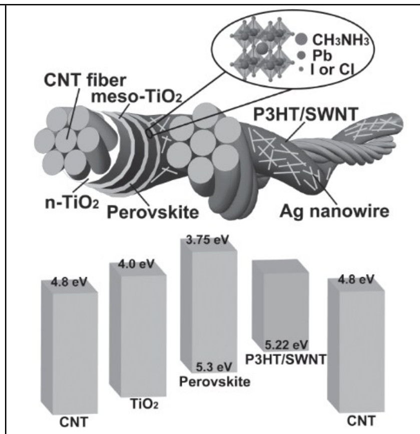
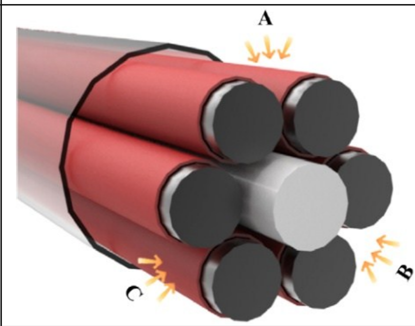
1.Ag electrode 2.MoO_3 3.Active layer 4.PFN 5.Ag nanowires 6.PET substrate	**Glass/ITO/PFN** / 0.753 **PET/Ag nanowire/PFN** /0.740	16.5 12.8	66.6 65.3	8.22 6.13		150
PTZBI:N2200 all polymeric system	**MeTHF** / 0.84 **MeTHF/DIO** /0.83 **CF** / 0.90 **CB** /0.89 **Solvent** / V_{oc} **2-Methyltetrahydrofuran (MeTHF), MeTHF / 1,8-diiodooctane (MeTHF/DIO), chloroform (CF) and chlorobenzene (CB)**	14.86 12.43 9.05 6.23	66.65 65.93 55.43 52.99	8.36 6.78 4.49 2.92		151
1.NPB sacrificial layer 2.Ag 3.PCDTBT:$PC_{71}BM$ 4.Metallic TCE 5.NOA63 film 6.PSC/NOA63 film 6.Elstomeric substrate 7.Si layer	0.9	10.39	62.0	5.8		152
1.Ag MoO3 3.PTB7-th:$PC_{71}BM$ 4.PFN 5.ZnO 6.ITO PEN 7.PDMS	**0** / 0.66 **10** / 0.61 **20** / 0.61 **30** / 0.60 **Compression (%)** / V_{oc} **0** / 0.66 **5** / 0.66 **10** /0.60 **20** /0.61 **30** / 0.68 **40** / 0.68 **50** /0.63 **Compression-stretching cycle** /V_{oc}	17.44 16.66 15.02 14.65 17.44 16.93 16.02 13.80 15.54 14.18 13.74	46 52 51 44 46 46 50 55 44 47 42	5.32 5.29 4.66 3.88 5.32 5.06 4.79 4.58 4.55 4.55 3.66		153
1.Ag 2.MoO3 3.PTB7-Th:$PC_{71}BM$ 4.PFN 5.ZnO 6.PEDOT:PSS 7.Ag-grid 8.PET substrate	**ITO** / 0.774 **Ag-grid (rhombus)** / 0.773 **Ag-grid (square)** / 0.770 **Ag-grid (hexagon)** / 0.761 **Electrode** / V_{oc}	5.16 14.30 14.13 14.38	25.88 58.14 58.81 58.31	1.03 6.43 6.39 6.38		154

Table S5. Summary of recently developed wire-shaped solar cells.

Structure	Mechanism	V_{oc} (V)	J_{sc} (mA/cm^2)	FF (%)	PCE (%)	3D Structure	Ref.
1.Substrate 2.Mn wire 3.ZnO arrays 4.Electrolyte 5.Counter electrode	DS	0.4	4	-	0.818		155
1.Ti wire 2.sensitized layer 3.Pt wire 4.electrolyte 5.Packing tube	DS	**FDSC**/0.61 **B-1**/0.64 **B-4**/0.65 **Al-1**/0.69 **Al-4**/0.71 **DM**/0.70 **Case**/V_{oc}	8.93 15.44 15.04 35.83 49.80 60.71	74 73 72 65 58 54	4.03 7.21 7.04 16.07 20.51 22.95		138
1.working electrode 2.Nanoporous TiO_2 3.Microporous TiO_2 4.$CH_3NH_3PbI_3$ 5.Spiro-MeOTAD 6.Counter electrode	P	0.825	2.165	35.3	0.631		156
1.Mo wire 2.CulnSe$_2$ layer 3.CdS layer 4.ZnO layer 5.ITO layer	All-solid	0.340	13.0	52.2	2.31		157
1.Zn wire 2.Dye-sensitized 3.Pt wire 4.Electrolyte 5.silicon tube	DS	**0.5**/0.430 **1**/0.419 **2**/0.375 **3**/0.363 **12**/0.307 **24**/0.290 **48**/0.263 **Synthesis time (h)**/V_{oc}	4.357 3.343 3.471 2.500 2.543 2.343 2.357	52.0 57.3 47.0 55.9 39.5 39.1 35.8	0.975 0.802 0.628 0.507 0.308 0.266 0.222		158

1.Glass tube 2.Ti wire 3.Nanoporous TiO2 4.Dye 5.Ti/Pt	DS	**Ti_57NT**/0.6 **Ti_57**/0.62 **Ti_100**/0.65 **Ti_150**/0.57 **Ti_57HP**/0.61 **Ti_100HP**/0.65 **Ti_150HP**/0.65 **Device**/V_{oc}	3.82 8.39 9.74 7.13 10.87 12.58 7.23	45 59 64 47 51 58 65	1.03 3.06 4.04 1.93 3.35 4.71 3.05		159
1.Polymeric Core 2.Metallic layer 3.Zn layer 4.ZnO arrays 5.Electrolyte 6.Fabric	DS	**Fe/Zn electrode**/0.58	8	-	1.31		160
Phase I 1.CF monofilament 2.TiO_2 porous layer 3.Dye **Phase II** 1.Counter electrode 2.Ink carbon **Phase III** Electrolyte Capillary	DS	$\mathbf{D_{CF/TiO2}}$/0.271 $\mathbf{D_{CF/Ti/TiO2}}$/0.348 **D-95 µm**/0.329 **D-150 µm**/0.342 **D-250 µm**/0.288 **D-400 µm**/0.256 **Device**/V_{oc}	11.58 13.06 12.19 14.15 9.85 9.05	32.3 30.4 41.1 39.2 37.7 31.5	1.02 1.38 1.65 1.90 1.07 0.73		161
Phase I CNT fiber **Phase II** 1.CNT fiber 2.TiO_2 Layer 3.Dye molecules **Phase III** Electrolyte	DS	**CNT fiber**/0.64 **Solar cell**/0.64	9.03 10.06	45 45	2.60 2.94		162
Phase I 1.CF 2.$CoNi_2S_4$ arrays **Phase II** Photoanode **Phase III** Electrolyte Transparent sealing tube	DS	**$CoNi_2S_4$ NR-CF**/0.68 **$CoNi_2S_4$ ND-CF**/0.65 **Pt wire**/0.68 **CF**/0.65	15.3 8.6 14.2 7.1	67.7 72.7 66.7 22.4	7.03 4.10 6.45 1.03		163

Phase I 1.CNT fiber 2.n-TiO_2 3.meso-TiO_2 4.perovskite layer 5.P3HT/SWNT 6.Ag nanowire **Phase II** CNT fiber	P	0.615	8.75	56.4	3.03		41
Phase I Pt wire **Phase II** 1.Ti wire 2.Electrolyte 3.Dye-sensitized TiO_2 nanotube array **Phase III** Capillary	DS	**SWFF-DSSC**/0.67 **MWFF-DSSC(2)**/0.66 **MWFF-DSSC(3)**/0.65 **MWFF-DSSC(4)**/0.64 **MWFF-DSSC(5)**/0.63 **MWFF-DSSC(6)**/0.61 Without Nb_2O_5 **MWFF-DSSC(6)**/0.66 With Nb_2O_5 **Device**/V_{oc}	6.1 9.4 11.6 13.6 15.2 15.6 18.8	70 59 63 57 57 69 73	2.8 3.6 4.7 4.9 5.4 6.6 9.1		164

Abbreviations: perovskite (P), dye-sensitized (DS), carbon nanotube (CNT), nanoribbon (NR), carbon fiber (CF), nanorod (ND).

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