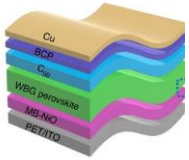
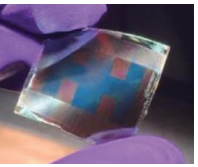
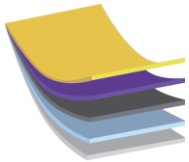
Devices on film substrates



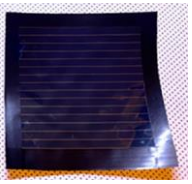
24.7%（中国・南京大）2022/06/09
PET / ITO / NiO:MeO-2PACz / $Cs_{0.2}FA_{0.8}PbI_{1.95}Br_{1.05}$ / C_{60} / ALD-SnO_2 / PEDOT:PSS / $FA_{0.7}MA_{0.3}Sn_{0.5}Pb_{0.5}I_3$ / C_{60} / BCP / Cu
"Flexible all-perovskite tandem solar cells approaching 25% efficiency with molecule-bridged hole-selective contact"
L. Li, Y. Wang, X. Wang, R. Lin, X. Luo, Z. Liu, K. Zhou, S. Xiong, Q. Bao, G. Chen, Y. Tian, Y. Deng, K.Xiao, J.Wu, M.I.Saidaminov, H. Lin, C.-Q. Ma, Z. Zhao, Y. Wu, L. Zhang, H. Tan, *Nature Energy* **2022**, *7*, 708-717. DOI:10.1038/s41560-022-01045-2



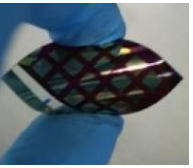
23.8%（スイス・Empa）2022/09/30
PEN / ITO / 2PACz / $Cs_{0.12}FA_{0.8}MA_{0.08}PbI_{1.8}Br_{1.2}$ / PCBM / ALD-SnO_2 / ITO / PEDOT:PSS / $FA_{0.6}MA_{0.4}Sn_{0.6}Pb_{0.4}I_3$ / C_{60} / BCP / Cu
"High-performance flexible all-perovskite tandem solar cells with reduced Voc-deficit in wide-bandgap subcell"
H. Lai, J. Luo, Y. Zwirner, S. Olthof, A. Wieczorek, F. Ye, Q. Jeangros, X. Yin, F. Akhundova, T. Ma, R. He, R. K. Kothandaraman, X. Chin, E. Gilshtein, A. Müller, C. Wang, J. Thiesbrummel, S. Siol, J. Márquez Prieto, T. Unold, M. Stolterfoht, C. Chen, A. N. Tiwari, D. Zhao, F. Fu, *Adv. Energy Mater.*, in press. DOI:10.1002/aenm.202202438



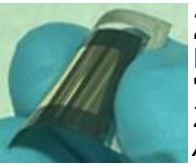
23.6%（中国・清華大）2022/09/06
PEN / ITO / SnO_2 / $(Cs/FA/MA)PbI_3$ / spiro / Au
"Multifunctional succinate additive for flexible perovskite solar cells with more than 23% power-conversion efficiency"
M. Li, J. Zhou, L. Tan, H. Li, Y. Liu, C. Jiang, Y. Ye, L. Ding, W. Tress, C. Yi,
The Innovation **2022**, *3,* 100310. DOI:10.1016/j.xinn.2022.100310



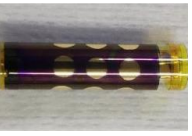
22.54%（韓国・成均館大）2022/08/08
PET / ITO / SnO_2:histamine diiodate / $Cs_{0.1}FA_{0.9}PbI_3$ / spiro / Au
"Van der Waals force-assisted heat-transfer engineering for overcoming limited efficiency of flexible perovskite solar cells"
O. Y. Gong, G. S. Han, S. M. Lee, M. K. Seo, C. H. Sohn, G. W. Yoon, J. Jang, J. M. Lee, J. H. Choi, D.-K. Lee, S. B. Kang, M. Choi, N.-G. Park, D. H. Kim, H. S. Jung, *ACS Energy Lett.* **2022**, *7,* 2893-2903. DOI:10.1021/acsenergylett.2c01391



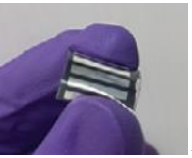
22.44%（中国・陝西師範大[西安]）2022/04/18
PET / ITO / SnO_2:histamine diiodate / $Cs_{0.1}FA_{0.9}PbI_3$ / spiro / Au
"Record-efficiency flexible perovskite solar cells enabled by multifunctional organic ions interface passivation"
L. Yang, J. Feng, Z. Liu, Y. Duan, S. Zhan, S. Yang, K. He, Y. Li, Y. Zhou, N. Yuan, J. Ding, S. F. Liu,
Adv. Mater. **2022**, *34,* 2201681. DOI:10.1002/adma.202201681



22.37%（中国・電子科技大[成都]）2022/04/05
PEN / ITO / SnO_2:$HCOONH_4$ / $(FA/MA)PbI_3$ / spiro / Au
"Pre-buried additive for cross-layer modification in flexible perovskite solar cells with efficiency exceeding 22%"
Z. Zheng, F. Li, J. Gong, Y. Ma, J. Gu, X. Liu, S. Chen, M. Liu,
Adv. Mater. **2022**, *34,* 2109879. DOI:10.1002/adma.202109879



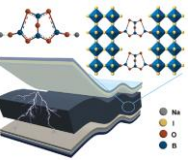
21.76%（中国・西安交通大）2022/01/26
/ ITO / SnO_2 / $(Cs/FA/MA)Pb(I/Br/Cl)_3$ / spiro / Au
"Highly efficient and stable perovskite solar cells enabled by low-dimensional perovskitoids"
J. Chen, Y. Yang, H. Dong, J. Li, X. Zhu, J. Xu, F. Pan, F. Yuan, J. Dai, B. Jiao, X. Hou, A. K.-Y. Jen, Z. Wu,
Science Adv. **2022**, *8*, eabk2722. DOI:10.1126/sciadv.abk2722



21.73%（中国・香港城市大）2021/10/03

PEN / ITO / PTAA / $Cs_{0.05}(FA_{0.98}MA_{0.02})_{0.95}Pb(I_{0.98}Br_{0.02})_3$ / PM6:CH1007:PCBM / $Zr(acac)_4$ / Ag

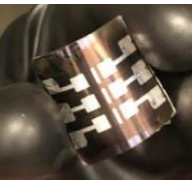
"Low-bandgap organic bulk-heterojunction enabled efficient and flexible perovskite solar cells"
S. Wu, Z. Li, J. Zhang, X. Wu, X. Deng, Y. Liu, J. Zhou, C. Zhi, X. Yu, W. C. H. Choy, Z. Zhu, A. K.-Y. Jen,
Adv. Mater. **2021**, *33*, 2105539. DOI:10.1002/adma.202105539



21.63%（中国・蘇州大）2022/02/24

PEN / ITO / SnO_2 / $FAPbI_3$ / spiro / MoO_3 / Ag

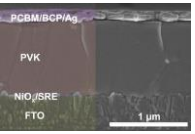
"Full-dimensional grain boundary stress release for flexible perovskite indoor photovoltaics"
C.-H. Chen, Z.-H. Su, Y.-H. Lou, Y.-J. Yu, K.-L. Wang, G.-L. Liu, Y.-R. Shi, J. Chen, J.-J. Cao, L. Zhang, X.-Y. Gao, Z.-K. Wang,
Adv. Mater. **2022**, *34*, 2200320. DOI:10.1002/adma.202200320



21.3%（米国・NREL）2019/05/16

PEN / ITO / PolyTPD:PFN / $Cs_{0.3}FA_{0.6}DMA_{0.1}PbI_{2.4}Br_{0.6}$ /LiF/C_{60}/PEIE/ AZO:IZO/PEDOT:PSS / $Cs_{0.25}FA_{0.75}Sn_{0.5}Pb_{0.5}I_3$ / C_{60}/BCP/Au

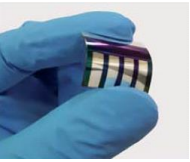
"Enabling flexible all-perovskite tandem solar cells", A. F. Palmstrom, G. E. Eperon, T. Leijtens, R. Prasanna, S. N. Habisreutinger, W. Nemeth, E. A. Gaulding, S. P. Dunfield, M. Reese, S. Nanayakkara, T. Moot, J. Werner, J. Liu, B. To, S. T. Christensen, M. D. McGehee, M. F. A. M. van Hest, J. M. Luther, J. J. Berry, D. T. Moore, *Joule* **2019**, *3*, 2193-2204. DOI:10.1016/j.joule.2019.05.009



21.3%（中国・中科院大連化物所）2022/07/21

PET / ITO / NiO_x / $(Cs/FA)PbI_3$ / PCBM / BCP / Ag

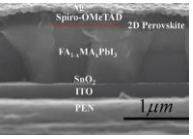
"Surface redox engineering of vacuum-deposited NiOx for top-performance perovskite solar cells and modules"
M. Du, S. Zhao, L. Duan, Y. Cao, H. Wang, Y. Sun, L. Wang, X. Zhu, J. Feng, L. Liu, X.Jiang, Q. Dong, Y. Shi, K. Wang, S. Liu,
Joule **2022**, *6*, 1931-1943. DOI:10.1016/j.joule.2022.06.026



21.10%（中国・廈門大）2020/12/14

PEN / ITO / HfO_x / SnO_2 / $Cs_{0.05}Rb_{0.05}(FA_{0.83}MA_{0.17})_{0.90}Pb(I_{0.95}Br_{0.05})_3$ / spiro / MoO_x / Au

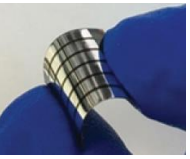
"Artemisinin-passivated mixed-cation perovskite films for durable flexible perovskite solar cells with over 21% efficiency"
L. Yang, Q. Xiong, Y. Li, P. Gao, B. Xu, H. Lin, X. Li, T. Miyasaka,
J. Mater. Chem. A **2021**, *9*, 1574-1582. DOI:10.1039/d0ta10717d



21.1%（中国・中南大[長沙]）2021/06/26

PEN / ITO / SnO_2 / $(FA/MA)PbI_3$ / spiro / Ag

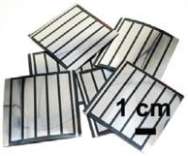
"Creating a dual-functional 2D perovskite layer at the interface to enhance the performance of flexible perovskite solar cells"
C. Long, K. Huang, J. Chang, C. Zuo, Y. Gao, X. Luo, B. Liu, H. Xie, Z. Chen, J. He, H. Huang, Y. Gao, L. Ding, J. Yang,
Small **2021**, *17*, 2102368. DOI:10.1002/smll.202102368



21.09%（中国・南開大[天津]）2022/03/01

PEN / ITO / SnO_2 / $(FA/MA/NpMA)PbI_3$ / spiro / MoO_3 / Ag

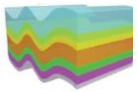
"Crystal growth regulation of 2D/3D perovskite films for solar cells with both high efficiency and stability"
T. Zhou, Z. Xu, R. Wang, X. Dong, Q. Fu, Y. Liu,
Adv. Mater. **2022**, *34,* 2200705. DOI:10.1002/adma.202200705



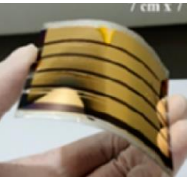
21.08%（中国・南昌大）2022/05/18

PEN / ITO / NiO_x / bio-IL / $(Cs/FA/MA)Pb(I/Br)_3$ / PCBM / BCP / Ag

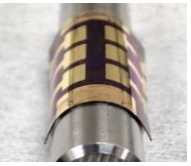
"A bionic interface to suppress the coffee-ring effect for reliable and flexible perovskite modules with a near-90% yield rate"
B. Fan, J. Xiong, Y. Zhang, C. Gong, F. Li, X. Meng, X. Hu, Z. Yuan, F. Wang, Y. Chen,
Adv. Mater. **2022**, *34,* 2201840. DOI:10.1002/adma.202201840



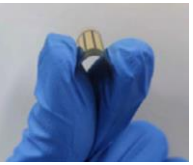
21.02%（中国・香港理工大）2021/09/22
PET / ITO / PTAA / $MAPbI_3$ / PCBM / BCP / Ag
"Highly stable and efficient perovskite solar cells passivated by a functional amorphous layer"
G. Tang, T. Wang, J. Cao, Z. Zhao, J. Song, P. Liu, H. Cheng, F. Zheng, J. Zhao, F. Yan,
J. Mater. Chem. A **2021**, *9*, 21708-21715. DOI:10.1039/d1ta07505e



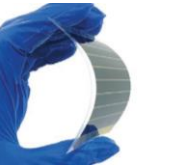
21.02%（韓国・UNIST）2022/05/05
PEN / ITO / TiO_2:SnO_2 / $FAPbI_3$ / spiro / Au
"SnO_2–TiO_2 hybrid electron transport layer for efficient and flexible perovskite solar cells“
M. J. Paik, J. W. Yoo, J. Park, E. Noh, H. Kim, S.-G. Ji, Y. Y. Kim, S. I. Seok,
ACS Energy Lett. **2022**, *7*, 1864-1870. DOI:10.1021/acsenergylett.2c00637



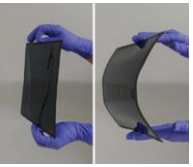
21.0%（中国・大連理工大＆米国ブラウン大＆スイスEPFL）2021/05/25
PET / ITO / SnO_2 / $(CsPbI_3)_{0.04}[(FAPbI_3)_{0.9}(MAPbBr_3)_{0.1}]_{0.96}$ / spiro / Au
"Flexible perovskite solar cells with simultaneously improved efficiency, operational stability, and mechanical reliability"
Q. Dong, M. Chen, Y. Liu, F. T. Eickemeyer, W. Zhao, Z. Dai, Y. Yin, C. Jiang, J. Feng, S. Jin, S. F. Liu, S. M. Zakeeruddin,
M. Grätzel, N. P. Padture, Y. Shi, *Joule* **2021**, *5*, 1587-1601. DOI:10.1016/j.joule.2021.04.014



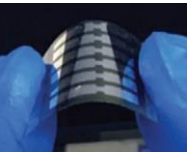
20.87%（中国・南開大[天津]）2021/02/02
PET / ITO / SnO_2 / $Al(acac)_3$ / $(FA/MA)PbI_3$ / spiro / Au
"Humidity-resistant flexible perovskite solar cells with over 20% efficiency"
N. Ren, B. Chen, R. Li, P. Wang, S. Mazumdar, B. Shi, C. Zhu, Y. Zhao, X. Zhang,
Solar RRL **2021**, *5*, 2000795. DOI:10.1002/solr.202000795



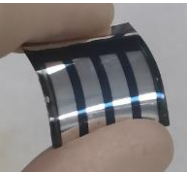
20.86%（中国・西安交通大）2022/05/13
PET / ITO / SnO_2 / $(Cs/FA/MA)Pb(I/Br)_3$ / spiro / Au
"Photoinduced cross linkable polymerization of flexible perovskite solar cells and modules by incorporating benzyl acrylate"
X. Zhu, H. Dong, J. Chen, J. Xu, Z. Li, F. Yuan, J. Dai, B. Jiao, X. Hou, J. Xi, Z. Wu,
Adv. Funct. Mater. **2022**, *32,* 2202408. DOI:10.1002/adfm.202202408



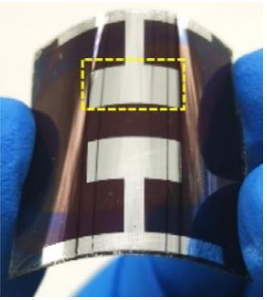
20.75%（韓国・KRICT）2020/10/22 【19.91% by Newport】
PEN / ITO / SnO_2 / Zn_2SnO_4 / $(FAPbI_3)_{0.95}(MAPbBr_3)_{0.05}$ / spiro / Au
"Record-efficiency flexible perovskite solar cell and module enabled by a porous-planar structure as an electron transport layer"
J. Chung, S. S. Shin, K. Hwang, G. Kim, K. W. Kim, D. S. Lee, W. Kim, B. S. Ma, Y.-K. Kim, T.-S. Kim, J. Seo,
Energy Environ. Sci. **2020**, *13*, 4854-4861. DOI:10.1039/d0ee02164d



20.71%（中国・吉林大）2022/03/08
$CsPbCl_3$:Yb^{3+},Ce^{3+},Cr^{3+}:PMMA/PET/ITO/PTAA/$Cs_{0.05}(FA_{0.83}/MA_{0.17})_{0.95}Pb(I_{0.83}Br_{0.17})_3$/ COTIC-4F:PCBM:PTB7-Th BHJ :Au NTs/C_{60}/BCP/Cu
"Toward broad spectral response inverted perovskite solar cells: insulating quantum-cutting perovskite nanophosphors and multifunctional ternary organic bulk-heterojunction", Y. Wu, N. Ding, Y. Zhang, B. Liu, X. Zhuang, S. Liu, Z. Nie, X. Bai, B. Dong, L. Xu, D. Zhou, H. Song,
Adv. Energy Mater. **2022**, *12,* 2200005. DOI:10.1002/aenm.202200005



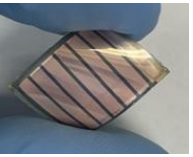
20.60%（中国・清華大）2022/02/18
PEN / ITO / SnO_2 / $(FA/MA)PbI_3$ / spiro / MoO_3 / Ag
"Brominated PEAI as multi-functional passivator for high-efficiency perovskite solar cell"
M. Li, J. Zhou, L. Tan, Y. Liu, S. Wang, C. Jiang, H. Li, X. Zhao, X. Gao, W. Tress, L. Ding, C. Yi,
Energy Environ. Mater., in press. DOI:10.1002/eem2.12360



20.56%@1.01cm^2（中国・南昌大）2020/11/03

PET / hc-PEDOT:PSS / NiO_x / $(FA/MA)Pb(I/Br)_3$:s-GO:PU [meniscus-coat] / PCBM / BCP / Ag

"Cementitious grain-boundary passivation for flexible perovskite solar cells with superior environmental stability and mechanical robustness", X. Hu, X. Meng, X. Yang, Z. Huang, Z. Xing, P. Li, L. Tan, M. Su, F. Li, Y. Chen, Y. Song, *Sci. Bull.* **2021**, *66*, 527-535. DOI:10.1016/j.scib.2020.10.023



20.50%（中国・吉林大）2021/12/29

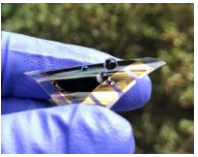
PEN / ITO / PTAA / $(FA/MA)PbI_3$ / C_{60} / BCP / Cu

"Thermal dynamic self-healing supramolecular dopant towards efficient and stable flexible perovskite solar cells"
C. Ge, X. Liu, Z. Yang, H. Li, W. Niu, X. Liu, Q. Dong,
Angew. Chem. Int. Ed. **2022**, *61*, e202116602. DOI:10.1002/anie.202116602

20.40%（中国・廈門大）2020/04/28

PEN / ITO / SnO_2 / $Cs_{0.05}Rb_{0.05}(FA_{0.83}MA_{0.17})_{0.90}Pb(I_{0.95}Br_{0.05})_3$ / spiro / Ag

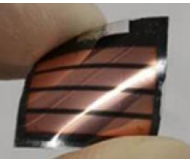
"Exfoliated fluorographene quantum dots as outstanding passivants for improved flexible perovskite solar cells"
L. Yang, Y. Li, L. Wang, Y. Pei, Z. Wang, Y. Zhang, H. Lin, X. Li,
ACS Appl. Mater. Interfaces **2020**, *12*, 22992-23001. DOI:10.1021/acsami.0c04975



20.4%（韓国・KRICT）2021/01/04

PET / ITO / SnO_2 / $(FAPbI_3)_{0.95}(MAPbBr_3)_{0.05}$ / spiro / Au

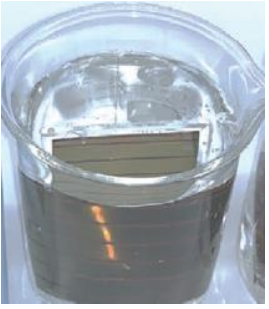
"Highly efficient and stable flexible perovskite solar cells enabled by using plasma-polymerized-fluorocarbon antireflection layer"
E. Cho, Y. Y. Kim, D. S. Ham, J. H. Lee, J.-S. Park, J. Seo, S.-J. Lee,
Nano Energy **2021**, *82*, 105737. DOI:10.1016/j.nanoen.2020.105737



20.32%（中国・吉林大）2022/02/22

PEN / ITO / PTAA / $(Cs/FA/MA)Pb(I/Br)_3$ / C_{60} / BCP / Cu

"Mechanically and operationally stable flexible inverted perovskite solar cells with 20.32% efficiency by a simple oligomer cross-linking method“ N. Jiang, B. Xing, Y. Wang, H. Zhang, D. Yin, Y. Liu, Y. Bi, L. Zhang, J. Feng, H. Sun,
Sci. Bull. **2022**, *67*, 794-802. DOI:10.1016/j.scib.2022.02.010



20.29%@1.00cm^2（中国・南昌大）2021/10/13

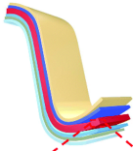
PET / hc-PEDOT:PSS / PEDOT:EVA / $(FA/MA)Pb(I/Br)_3$:Di-g [meniscus-coat] / PCBM / BCP / Ag

"A biomimetic self-shield interface for flexible perovskite solar cells with negligible lead leakage“
X. Meng, X. Hu, Y. Zhang, Z. Huang, Z. Xing, C. Gong, L. Rao, H. Wang, F. Wang, T. Hu, L. Tan, Y. Song, Y. Chen
Adv. Funct. Mater. **2021**, *31*, 2106460. DOI:10.1002/adfm.202106460

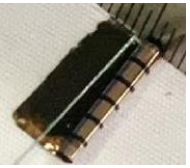
15.01% for 25 cm^2 module (17.20% for 21.82 cm^2 active area)

20.27%（中国・南開大[天津]）2022/02/25
PEN / ITO / SnO_2 / $FA_{0.84}MA_{0.16}PbI_3$:F-PhFACl / 2-DP-O / spiro / MoO_3 / Ag
"Multifunctional two-dimensional polymers for perovskite solar cells with efficiency exceeding 24%“
Q. Fu, H. Liu, X. Tang, R. Wang, M. Chen, Y. Liu,
ACS Energy Lett. **2022**, *7*, 1128-1136. DOI:10.1021/acsenergylett.1c02812

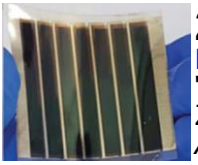
20.25%（中国・蘇州大）2022/04/15
PEN / ITO / SnO_2:Co / $Cs_{0.05}FA_{0.85}MA_{0.10}Pb(I_{0.97}Br_{0.03})_3$ / spiro / Au
"Efficient flexible perovskite solar cells with reduced hysteresis employing cobalt nitrate treated SnO_2“
D. Wu, Z. Ai, S. Li, J. Chen, Y. Zhao, T. Ma, H. Wang, C. Wang, X. Li,
Solar RRL **2022**, *6,* 2200210. DOI:10.1002/solr.202200210



20.22%（中国・南昌大）2022/05/10
PET / AgNW:MXene / NiOx / $Cs_{0.05}FA_{0.85}MA_{0.10}Pb(I_{0.97}Br_{0.03})_3$ / PCBM / Ag
"A 1D:2D structured AgNW:MXene composite transparent electrode with high mechanical robustness for flexible photovoltaics“
W. Chen, R. Zhang, X. Yang, H. Wang, H. Yang, X. Hu, S. Zhang,
J. Mater. Chem. C **2022**, 10, 8625-8633. DOI:10.1039/d2tc01178f

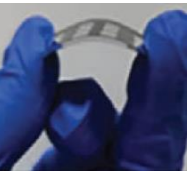


20.2%（中国・北京大）2022/04/24
Parylene-C / ITGZO / PTAA / $(Cs/FA/MA)Pb(I/Br)_3$ / PCBM / BCP / Cu
"Ultralight flexible perovskite solar cells“
J. Wu, P. Chen, H. Xu, M. Yu, L. Li, H. Yan, Y. Huangfu, Y. Xiao, X. Yang, L. Zhao, W. Wang, Q. Gong, R. Zhu,
Sci. China Mater. **2022**, *65*, 2319-2324. DOI:10.1007/s40843-022-2075-7



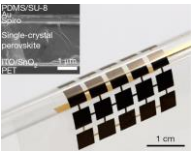
20.16%（中国・暨南大[広州]）2021/10/08
PEN / ITO / PEDOT:PSS / PTAA / $Cs_{0.05}FA_{0.7}MA_{0.25}Pb(I_{0.93}Br_{0.07})_3$ / PCBM / BCP / Ag
"An embedding 2D/3D heterostructure enables high-performance FA-alloyed flexible perovskite solar cells with efficiency over 20%"
Z. Wang, Y. Lu, Z. Xu, J. Hu, Y. Chen, C. Zhang, Y. Wang, F. Guo, Y. Mai,
Adv. Sci. **2021**, *8*, 2101856. DOI:10.1002/advs.202101856

20.1%（中国・大連理工大＆米国ブラウン大）2021/02/12
PEN / ITO / SnO_2 / $Cs_{0.04}(FA_{0.84}MA_{0.16})_{0.96}Pb(I_{0.84}Br_{0.16})_3$ / spiro / Au
"Interpenetrating interfaces for efficient perovskite solar cells with high operational stability and mechanical robustness"
Q. Dong, C. Zhu, M. Chen, C. Jiang, J. Guo, Y. Feng, Z. Dai, S. K. Yadavalli, M. Hu, X. Cao, Y. Li, Y. Huang, Z. Liu, Y. Shi,
L. Wang, N. P. Padture, Y. Zhou, *Nature Commun.* **2021**, *12*, 973. DOI:10.1038/s41467-021-21292-3



20.09%（中国・河南師範大）2022/02/25
PEN / ITO / SnO_2 / Y6 acceptor / $Cs_{0.05}(FA_{0.87}/MA_{0.13})_{0.95}Pb(I_{0.87}/Br_{0.13})_3$ / spiro / MoO_3 / Au
"Semi-planar non-fullerene molecules enhance the durability of flexible perovskite solar cells"
H. Liu, Z. Zhang, Z. Su, W. Zuo, Y. Tang, F. Yang, X. Zhang, C. Qin, J. Yang, Z. Li, M. Li,
Adv. Sci. **2022**, *9*, 2105739. DOI:10.1002/advs.202105739

20.07%（中国・北京大）2022/01/06
PEN / ITO / SnO_2 / $(FA/MA)PbI_3$ / spiro / Au
"Facet orientation tailoring via 2D-seed-induced growth enables highly efficient and stable perovskite solar cells"
C. Luo, G. Zheng, F. Gao, X. Wang, Y. Zhao, X. Gao, Q. Zhao,
Joule **2022**, *6*, 240-257. DOI:10.1016/j.joule.2021.12.006



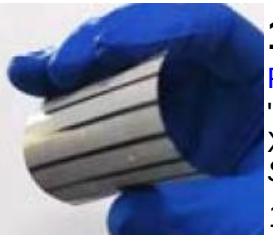
20.04%（米国UC San Diego）2020/07/29
PET / ITO / SnO_2 / MA(Sn/Pb)I_3 / spiro / Au / PDMS/SU-8
"A fabrication process for flexible single-crystal perovskite devices"
Y. Lei, Y. Chen, R. Zhang, Y. Li, Q. Yan, S. Lee, Y. Yu, H. Tsai, W. Choi, K. Wang, Y. Luo, Y. Gu, X. Zheng, C. Wang, C. Wang, H. Hu, Y. Li, B. Qi, M. Lin, Z. Zhang, S. A. Dayeh, M. Pharr, D. P. Fenning, Y.-H. Lo, J. Luo, K. Yang, J. Yoo, W. Nie, S. Xu,
Nature **2020**, *583*, 790-795. DOI:10.1038/s41586-020-2526-z

20.01%（中国・上海交通大）2020/01/30
PET / ITO / NiO_x:F_2HCNQ / (Cs/FA/MA)Pb(I/Br)$_3$ / PCBM / BCP / Ag
"High electron affinity enables fast hole extraction for efficient flexible inverted perovskite solar cells"
P. Ru, E. Bi, Y. Zhang, Y. Wang, W. Kong, Y. Sha, W. Tang, P. Zhang, Y. Wu, W. Chen, X. Yang, H. Chen, L. Han,
Adv. Energy Mater. **2020**, *10*, 1903487. DOI:10.1002/aenm.201903487

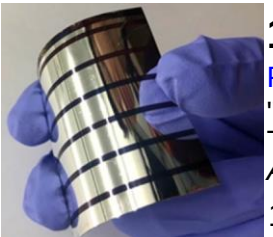
20.00%（中国・中物院四川材料研）2021/07/17
PEN / ITO / SnO_2/NbO_x / (FA/MA)Pb(I/Cl)$_3$ / spiro / Au
“Boosted charge extraction of NbO_x-enveloped SnO_2 nanocrystals enable 24% efficient planar perovskite solar cells"
R. Yuan, B. Cai, Y. Lv, X. Gao, J. Gu, Z. Fan, X. Liu, C. Yang, M. Liu, W.-H. Zhang,
Energy Environ. Sci. **2021**, *14*, 5074-5083. DOI:10.1039/d1ee01519b

20.00%（中国・吉林大）2020/10/12
PEN / ITO / PTAA / PFN-Br / $Cs_{0.05}(FA_{0.87}MA_{0.13})_{0.95}Pb(I_{0.87}Br_{0.13})_3$ / C_{60} / BCP / Cu
“Stable and highly flexible perovskite solar cells with power conversion efficiency approaching 20% by elastic grain boundary encapsulation“, C. Ge, Z. Yang, X. Liu, Y. Song, A. Wang, Q. Dong
CCS Chem. **2020**, *2*, 2035-2044. DOI:10.31635/ccschem.020.202000335

19.87%@1.01cm^2（中国・南昌大）2020/06/15
PET / ITO / PEDOT:EVA / (FA/MA)Pb(I/Br)$_3$ [meniscus-coat] / PCBM / BCP / Ag
"Bio-inspired vertebral design for scalable and flexible perovskite solar cells"
X. Meng, Z. Cai, Y. Zhang, X. Hu, Z. Xing, Z. Huang, Z. Huang, Y. Cui, T. Hu, M. Su, X. Liao, L. Zhang, F. Wang, Y. Song, Y. Chen, *Nature Commun.* **2020**, *11*, 3016. DOI:10.1038/s41467-020-16831-3
17.55% for 31.2 cm^2 module (15.21% for 36 cm^2 aperture area)



19.87%@1.01cm^2（中国科技大＆南昌大）2022/01/15
PEN / hc-PEDOT:PSS / NiO_x / $MAPbI_3$ [meniscus-coat] / PCBM / Ag
"Scalable flexible perovskite solar cells based on a crystalline and printable template with intelligent temperature sensitivity"
X. Yang, H. Yang, M. Su, J. Zhao, X. Meng, X. Hu, T. Xue, Z. Huang, Y. Lu, Y. Li, Z. Yang,
Solar RRL **2022**, *6*, 2100991. DOI:10.1002/solr.202100991
14.74% for 25 cm^2 module



19.7%@1.01cm^2（中国・鄭州大＆南昌大）2021/04/22
PET / ITO / PEDOT:GO gel / $MAPbI_3$ [blade-coat] / PCBM / Ag
"Mechanically robust and flexible perovskite solar cells via a printable and gelatinous interface"
T. Xue, G. Chen, X. Hu, M. Su, Z. Huang, X. Meng, Z. Jin, J. Ma, Y. Zhang, Y. Song,
ACS Appl. Mater. Interfaces **2021**, *13*, 19959-19969. DOI:10.1021/acsami.1c00813
10.26% for 25 cm^2 module