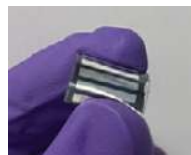


## Devices on film substrates

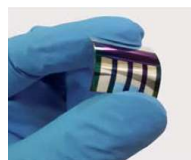


**21.73%** (中国·香港城市大) 2021/10/03

PEN / ITO / PTAA /  $\text{Cs}_{0.05}(\text{FA}_{0.98}\text{MA}_{0.02})_{0.95}\text{Pb}(\text{I}_{0.98}\text{Br}_{0.02})_3$  / PM6:CH1007:PCBM /  $\text{Zr}(\text{acac})_4$  / 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

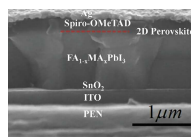


**21.10%** (中国·廈門大) 2020/12/14

PEN / ITO /  $\text{HfO}_x$  /  $\text{SnO}_2$  /  $\text{Cs}_{0.05}\text{Rb}_{0.05}(\text{FA}_{0.83}\text{MA}_{0.17})_{0.90}\text{Pb}(\text{I}_{0.95}\text{Br}_{0.05})_3$  / spiro /  $\text{MoO}_x$  / 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

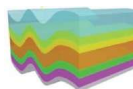


**21.1%** (中国·中南大[長沙]) 2021/06/26

PEN / ITO /  $\text{SnO}_2$  / (FA/MA) $\text{PbI}_3$  / 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



**21.02%** (中国·香港理工大) 2021/09/22

PET / ITO / PTAA /  $\text{MAPbI}_3$  / 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



**21.0%** (中国·大連理工大 & 米国ブラウン大 & スイスEPFL) 2021/05/25

PET / ITO /  $\text{SnO}_2$  /  $(\text{CsPbI}_3)_{0.04}[(\text{FAPbI}_3)_{0.9}(\text{MAPbBr}_3)_{0.1}]_{0.96}$  / 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

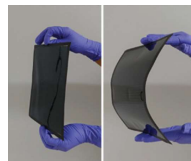


**20.87%** (中国·南開大[天津]) 2021/02/02

PET / ITO /  $\text{SnO}_2$  /  $\text{Al}(\text{acac})_3$  / (FA/MA) $\text{PbI}_3$  / 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



**20.75%** (韓国·KRICT) 2020/10/22 【19.91% by Newport】

PEN / ITO /  $\text{SnO}_2$  /  $\text{Zn}_2\text{SnO}_4$  /  $(\text{FAPbI}_3)_{0.95}(\text{MAPbBr}_3)_{0.05}$  / 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



**20.50%** (中国·吉林大) 2021/12/29

PEN / ITO / PTAA / (FA/MA) $\text{PbI}_3$  /  $\text{C}_{60}$  / 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

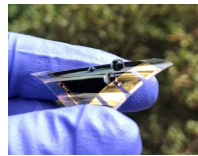


**20.40%** (中国·厦門大) 2020/04/28

PEN / ITO / SnO<sub>2</sub> / Cs<sub>0.05</sub>Rb<sub>0.05</sub>(FA<sub>0.83</sub>MA<sub>0.17</sub>)<sub>0.90</sub>Pb(I<sub>0.95</sub>Br<sub>0.05</sub>)<sub>3</sub> / 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

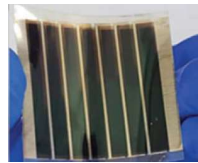


**20.4%** (韩国·KRICT) 2021/01/04

PET / ITO / SnO<sub>2</sub> / (FAPbI<sub>3</sub>)<sub>0.95</sub>(MAPbBr<sub>3</sub>)<sub>0.05</sub> / 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



**20.16%** (中国·暨南大[広州]) 2021/10/08

PEN / ITO / PEDOT:PSS / PTAA / Cs<sub>0.05</sub>FA<sub>0.7</sub>MA<sub>0.25</sub>Pb(I<sub>0.93</sub>Br<sub>0.07</sub>)<sub>3</sub> / 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<sub>2</sub> / Cs<sub>0.04</sub>(FA<sub>0.84</sub>MA<sub>0.16</sub>)<sub>0.96</sub>Pb(I<sub>0.84</sub>Br<sub>0.16</sub>)<sub>3</sub> / 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

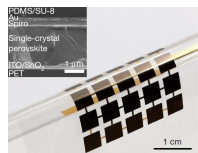


**20.07%** (中国·北京大) 2022/01/06

PEN / ITO / SnO<sub>2</sub> / (FA/MA)PbI<sub>3</sub> / 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

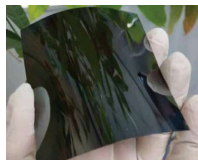


**20.04%** (米国UC San Diego) 2020/07/29

PET / ITO / SnO<sub>2</sub> / MA(Sn/Pb)I<sub>3</sub> / 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

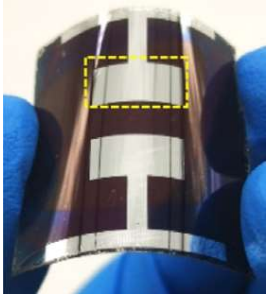


**20.01%** (中国·上海交通大) 2020/01/30

PET / ITO / NiO<sub>x</sub>:F<sub>2</sub>HClNQ / (Cs/FA/MA)Pb(I/Br)<sub>3</sub> / PCBM / BCP / Ag

"High electron affinity enables fast hole extraction for efficient flexible inverted perovskite solar cells"

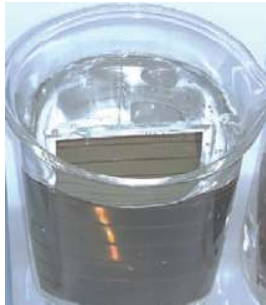
P. Ru, E. Bi, Y. Zhang, Y. Wang, W. Kong, Y. Sha, W. Tang, P. Zhang, Y. Wu, W. Chen, X. Yang, H. Chen, L. Han,  
*Adv. Energy Mater.* **2020**, *10*, 1903487. DOI:10.1002/aenm.201903487



**20.56%@1.01cm<sup>2</sup>** (中国·南昌大) 2020/11/03

PET / hc-PEDOT:PSS / NiO<sub>x</sub> / (FA/MA)Pb(I/Br)<sub>3</sub>: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



**20.29%@1.00cm<sup>2</sup>** (中国·南昌大) 2021/10/13

PET / hc-PEDOT:PSS / PEDOT:EVA / (FA/MA)Pb(I/Br)<sub>3</sub>: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.*, in press. DOI:10.1002/adfm.202106460

15.01% for 25 cm<sup>2</sup> module (17.20% for 21.82 cm<sup>2</sup> active area)



**19.87%@1.01cm<sup>2</sup>** (中国·南昌大) 2020/06/15

PET / ITO / PEDOT:EVA / (FA/MA)Pb(I/Br)<sub>3</sub> [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<sup>2</sup> module (15.21% for 36 cm<sup>2</sup> aperture area)



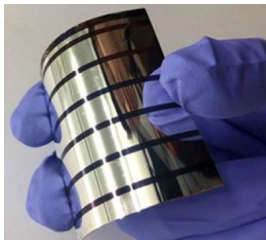
**19.87%@1.01cm<sup>2</sup>** (中国科技大 & 南昌大) 2022/01/15

PEN / hc-PEDOT:PSS / NiO<sub>x</sub> / MAPbI<sub>3</sub> [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*, in press. DOI:10.1002/solr.202100991

14.74% for 25 cm<sup>2</sup> module



**19.7%@1.01cm<sup>2</sup>** (中国·鄭州大 & 南昌大) 2021/04/22

PET / ITO / PEDOT:GO gel / MAPbI<sub>3</sub> [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<sup>2</sup> module