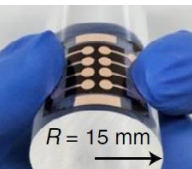


Devices on film substrates

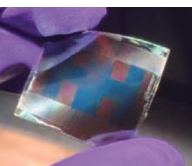


24.7% (中国·南京大) 2022/06/09

PET / ITO / NiO:MeO-2PACz / Cs_{0.2}FA_{0.8}Pb_{1.95}Br_{1.05} / C₆₀ / ALD-SnO₂ / PEDOT:PSS / FA_{0.7}MA_{0.3}Sn_{0.5}Pb_{0.5}I₃ / C₆₀ / 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

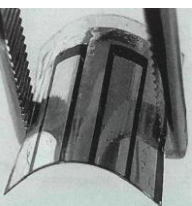


23.8% (スイス·Empa) 2022/09/30

PEN / ITO / 2PACz / Cs_{0.12}FA_{0.8}MA_{0.08}Pb_{1.8}Br_{1.2} / PCBM / ALD-SnO₂ / ITO / PEDOT:PSS / FA_{0.6}MA_{0.4}Sn_{0.6}Pb_{0.4}I₃ / C₆₀ / 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. Wiecezorek, 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.* **2022**, 12, 2202438. DOI:10.1002/aenm.202202438

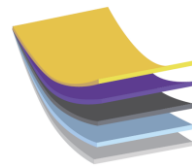


23.68% (香港城市大) 2022/11/09 【1 cm² 21.52%】

PEN / ITO / PTAA:PenAAc / Cs_{0.05}(FA_{0.98}MA_{0.02})_{0.95}Pb(I_{0.98}Br_{0.02})₃ / C₆₀ / BCP / Ag

"Highly efficient flexible perovskite solar cells through pentylammonium acetate modification with certified efficiency of 23.35%"

D. Gao, B. Li, Z. Li, X. Wu, S. Zhang, D. Zhao, X. Jiang, C. Zhang, Y. Wang, Z. Li, N. Li, S. Xiao, W.C.H. Choy, A. K.-Y. Jen, S. Yang, Z. Zhu, *Adv. Mater.*, in press. DOI:10.1002/adma.202206387



23.6% (中国·清華大) 2022/09/06

PEN / ITO / SnO₂ / (Cs/FA/MA)PbI₃ / 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

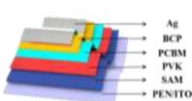


23.4% (中国·蘇州大) 2023/01/17 【1 cm² 21.1%】

PET / ITO / SnO₂ / (FA/MA)PbI₃ / spiro / Au

"In situ crosslinking-assisted perovskite grain growth for mechanically robust flexible perovskite solar cells with 23.4% efficiency"

Y. Wu, G. Xu, J. Xi, Y. Shen, X. Wu, X. Tang, J. Ding, H. Yang, Q. Cheng, Z. Chen, Y. Li, Y. Li, *Joule*, in press. DOI:10.1016/j.joule.2022.12.013

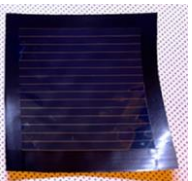


23.01% (中国·中科院寧波材料所) 2022/12/29

PEN / ITO / 4PACz / (Cs/FA)Pb(I/Br)₃:3PyAI / PCBM / BCP / Ag

"Rational design of ferroelectric 2D perovskite for improving the efficiency of flexible perovskite solar cells over 23%"

B. Han, Y. Wang, C. Liu, K. Sun, M. Yang, L. Xie, S. Yang, Y. Meng, S. Lin, P. Xu, J. Li, Q. Qiu, Z. Ge, *Angew. Chem. Int. Ed.*, in press. DOI:10.1002/anie.202217526

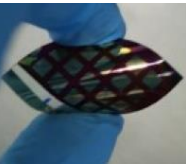


22.54% (韓国·成均館大) 2022/08/08

PEN / ITO / SnO₂:KCl / Cs_{0.05}FA_{0.90}MA_{0.05}Pb_{1.85}Br_{0.15} / 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/acsenerylett.2c01391

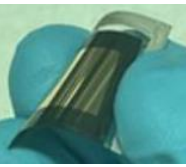


22.44% (中国·陕西師範大[西安]) 2022/04/18

PET / ITO / SnO₂:histamine diiodate / Cs_{0.1}FA_{0.9}PbI₃ / 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

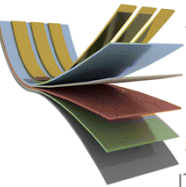


22.37% (中国·電子科技大[成都]) 2022/04/05

PEN / ITO / SnO₂:HCOONH₄ / (FA/MA)PbI₃ / 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



22.1% (中国·大連理工大) 2022/10/12

PET / ITO / SnO₂ / (FA/MA)PbI₃ / spiro / Au

"Polarity and moisture induced trans-grain-boundaries 2D/3D coupling structure for flexible perovskite solar cells with high mechanical reliability and efficiency"

Y. Yan, R. Wang, Q. Dong, Y. Yin, L. Zhang, Z. Su, C. Wang, J. Feng, M. Wang, J. Liu, H. Ma, Y. Feng, W. Shang, Z. Wang, M. Pei, Y. Wang, S. Jin, J. Bian, X. Gao, S. Liu, Yantao Shi, *Energy Environ. Sci.* **2022**, *15*, 5168-5180. DOI:10.1039/d2ee01879a

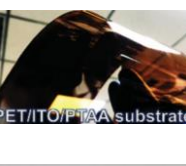


21.76% (中国·西安交通大) 2022/01/26

ITO / SnO₂ / (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

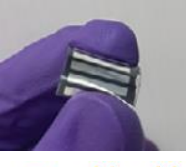


21.76% (中国·吉林大) 2022/07/13

PET / ITO / PTAA / MAPbI₃:ionogel / C₆₀ / BCP / Cu

"Ionogel-perovskite matrix enabling highly efficient and stable flexible solar cells towards fully-R2R fabrication"

Y. Kang, R. Li, A. Wang, J. Kang, Z. Wang, W. Bi, Y. Yang, Y. Song, Q. Dong, *Energy Environ. Sci.* **2022**, *15*, 3439-3448. DOI:10.1039/d2ee01326f

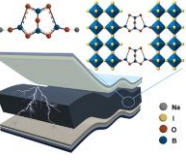


21.73% (中国·香港城市大) 2021/10/03

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 / SnO₂ / FAPbI₃ / spiro / MoO₃ / 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

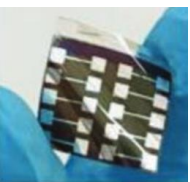


21.50% (中国·廈門大) 2022/10/26

PEN / ITO / SnO₂ / Cs_{0.07}FA_{0.9}MA_{0.03}Pb(I_{0.92}Br_{0.08})₃ / spiro / Ag

"Molecular bridge assisted bifacial defect healing enables low energy loss for efficient and stable perovskite solar cells"

J. Deng, H. Zhang, K. Wei, Y. Xiao, C. Zhang, L. Yang, X. Zhang, D. Wu, Y. Yang, J. Zhang, *Adv. Funct. Mater.* **2022**, *32*, 2209516. DOI:10.1002/adfm.202209516



21.40% (中国·中科院寧波材料所) 2022/11/07

PEN / ITO / SnO₂ / FAPbI₃ / P1 / spiro / Ag

"Energy transfer induced by TADF polymer enables the recycling of excitons in perovskite solar cells"

Y. Meng, J. Zhang, C. Liu, K. Zheng, L. Xie, S. Bu, B. Han, R. Cao, X. Yin, C. Liu, Z. Ge, *Adv. Funct. Mater.* **2023**, 33, 2210600. DOI:10.1002/adfm.202210600



21.33% (中国·鄭州大) 2022/08/23 【1 cm² 19.81%】

PEN / ITO / SnO₂ / (FA/MA)Pb(I/Br)₃ / spiro / Au

"A shape memory scaffold for body temperature self-repairing wearable perovskite solar cells with efficiency exceeding 21%"

T. Xue, Z. Huang, P. Zhang, M. Su, X. Hu, T. Wu, B. Fan, G. Chen, G. Yu, W. Liu, X. Liu, Y. Zhang, Y. Song, *InfoMat* **2022**, 4, e12358. DOI:10.1002/inf2.12358



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/C₆₀/PEIE/ AZO:IZO/PEDOT:PSS / Cs_{0.25}FA_{0.75}Sn_{0.5}Pb_{0.5}I₃ / C₆₀/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

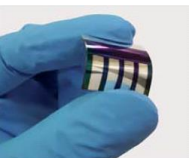


21.3% (中国·中科院大連化物所) 2022/07/21

PET / ITO / NiO_x / (Cs/FA)PbI₃ / PCBM / BCP / Ag

"Surface redox engineering of vacuum-deposited NiO_x 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

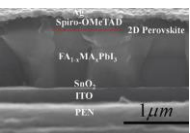


21.10% (中国·廈門大) 2020/12/14

PEN / ITO / HfO_x / SnO₂ / 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

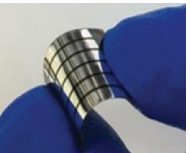


21.1% (中国·中南大[長沙]) 2021/06/26

PEN / ITO / SnO₂ / (FA/MA)PbI₃ / 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

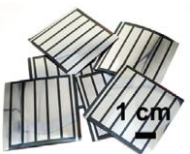


21.09% (中国·南開大[天津]) 2022/03/01

PEN / ITO / SnO₂ / (FA/MA/NpMA)PbI₃ / spiro / MoO₃ / 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

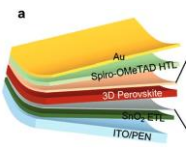


21.08% (中国·南昌大) 2022/05/18

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



21.03% (米国・ブラウン大) 2022/09/23

[PEN / ITO / SnO₂ / \(CsPbI₃\)_{0.04}{\(FAPbI₃\)_{0.9}\(MAPbBr₃\)_{0.1}}_{0.96} / spiro / Au](#)

"Dual-interface-reinforced flexible perovskite solar cells for enhanced performance and mechanical reliability"

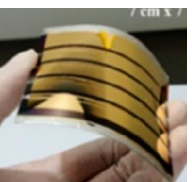
Z. Dai, S. Li, X. Liu, M. Chen, C. E. Athanasiou, B. W. Sheldon, H. Gao, P. Guo, N. P. Padture, *Adv. Mater.* **2022**, 34, 2205301. DOI:10.1002/adma.202205301

21.02% (中国・香港理工大) 2021/09/22

[PET / ITO / PTAA / MAPbI₃ / 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 / TiO₂:SnO₂ / FAPbI₃ / spiro / Au](#)

"SnO₂-TiO₂ 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/acsenenergylett.2c00637

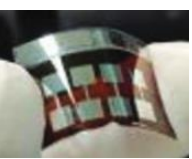


21.0% (中国・大連理工大 & 米国ブラウン大 & スイスEPFL) 2021/05/25

[PET / ITO / SnO₂ / \(CsPbI₃\)_{0.04}{\(FAPbI₃\)_{0.9}\(MAPbBr₃\)_{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

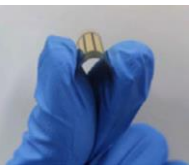


20.9% (中国・華中科技大[武漢]) 2022/07/11

[PEN / ITO / PTAA / Cs_{0.15}FA_{0.85}Pb\(I_{0.95}Br_{0.05}\)₃ / PCBM / BCP / Ag](#)

"Effective passivation with size-matched alkylidiammonium iodide for high-performance inverted perovskite solar cells"

S. Liu, X. Guan, W. Xiao, R. Chen, J. Zhou, F. Ren, J. Wang, W. Chen, S. Li, L. Qiu, Y. Zhao, Z. Liu, W. Chen, *Adv. Funct. Mater.* **2022**, 32, 2205009. DOI:10.1002/adfm.202205009

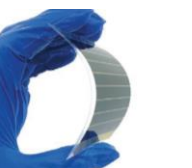


20.87% (中国・南開大[天津]) 2021/02/02

[PET / ITO / SnO₂ / Al\(acac\)₃ / \(FA/MA\)PbI₃ / 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

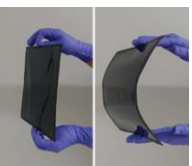


20.86% (中国・西安交通大) 2022/05/13

[PET / ITO / SnO₂ / \(Cs/FA/MA\)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

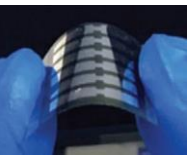


20.75% (韓国・KRICT) 2020/10/22 【19.91% by Newport】

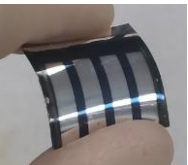
[PEN / ITO / SnO₂ / Zn₂SnO₄ / \(FAPbI₃\)_{0.95}\(MAPbBr₃\)_{0.05} / spiro / Au](#)

"Record-efficiency flexible perovskite solar cell and module enabled by a porous-planar structure as an electron transport layer"

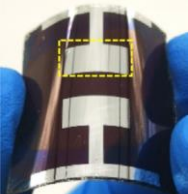
J. Chung, S. S. Shin, K. Hwang, G. Kim, K. W. Kim, D. S. Lee, W. Kim, B. S. Ma, Y.-K. Kim, T.-S. Kim, J. Seo, *Energy Environ. Sci.* **2020**, 13, 4854-4861. DOI:10.1039/d0ee02164d




20.71% (中国·吉林大) 2022/03/08
[CsPbCl₃:Yb³⁺,Ce³⁺,Cr³⁺: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 BHI :Au NTs/C₆₀/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



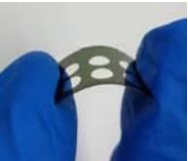
20.60% (中国·清華大) 2022/02/18
[PEN / ITO / SnO₂ / \(FA/MA\)PbI₃ / spiro / MoO₃ / Ag](#)
"Brominated PEAI as multi-functional passivator for high-efficiency perovskite solar cell"
M. Li, J. Zhou, L. Tan, Y. Liu, S. Wang, C. Jiang, H. Li, X. Zhao, X. Gao, W. Tress, L. Ding, C. Yi, *Energy Environ. Mater.*, in press. DOI:10.1002/eem2.12360




20.56% @ 1.01 cm² (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



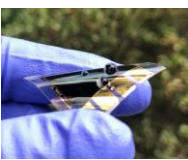
20.50% (中国·吉林大) 2021/12/29
[PEN / ITO / PTAA / \(FA/MA\)PbI₃ / C₆₀ / BCP / Cu](#)
"Thermal dynamic self-healing supramolecular dopant towards efficient and stable flexible perovskite solar cells"
C. Ge, X. Liu, Z. Yang, H. Li, W. Niu, X. Liu, Q. Dong, *Angew. Chem. Int. Ed.* **2022**, 61, e202116602. DOI:10.1002/anie.202116602



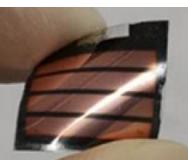
20.46% (中国·華南師範大[廣州]) 2022/10/07
[PEN / ITO / SnO₂ / Cs_{0.05}\(FA_{0.89}MA_{0.11}\)_{0.95}Pb\(I_{0.97}Br_{0.03}\)₃ / spiro / Ag](#)
"Self-healing and efficient flexible perovskite solar cells enabled by host-guest interaction and a 2D/3D heterostructure"
Z. Yang, Y. Jiang, D. Xu, Z. Wang, X. Gao, X. Lu, G. Zhou, J.-M. Liu, J. Gao, *J. Mater. Chem. A* **2022**, 10, 22445-22452. DOI:10.1039/d2ta05968a



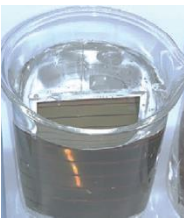
20.40% (中国·廈門大) 2020/04/28
[PEN / ITO / SnO₂ / Cs_{0.05}Rb_{0.05}\(FA_{0.83}MA_{0.17}\)_{0.90}Pb\(I_{0.95}Br_{0.05}\)₃ / spiro / Ag](#)
"Exfoliated fluorographene quantum dots as outstanding passivants for improved flexible perovskite solar cells"
L. Yang, Y. Li, L. Wang, Y. Pei, Z. Wang, Y. Zhang, H. Lin, X. Li, *ACS Appl. Mater. Interfaces* **2020**, 12, 22992-23001. DOI:10.1021/acsami.0c04975



20.4% (韩国·KRICT) 2021/01/04
[PET / ITO / SnO₂ / \(FAPbI₃\)_{0.95}\(MAPbBr₃\)_{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 / C₆₀ / 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%@1.00cm² (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 cm² module (17.20% for 21.82 cm² active area)



20.27% (中国·南開大[天津]) 2022/02/25

PEN / ITO / SnO₂ / FA_{0.84}MA_{0.16}PbI₃:F-PhFACI / 2-DP-O / spiro / MoO₃ / 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/acseenergylett.1c02812



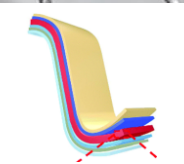
20.25% (中国·蘇州大) 2022/04/15

PEN / ITO / SnO₂: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 SnO₂"

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



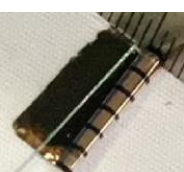
20.22% (中国·南昌大) 2022/05/10

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



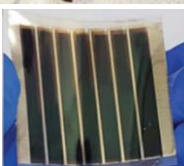
20.2% (中国·北京大) 2022/04/24

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[廣州]) 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



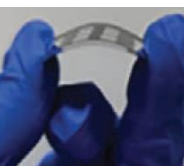
20.1% (中国·大連理工大 & 米国ブラウン大) 2021/02/12

PEN / ITO / SnO₂ / 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 / SnO₂ / Y6 acceptor / Cs_{0.05}(FA_{0.87}/MA_{0.13})_{0.95}Pb(I_{0.87}/Br_{0.13})₃ / spiro / MoO₃ / 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 / SnO₂ / \(FA/MA\)PbI₃ / 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



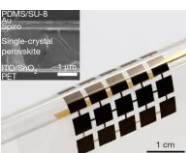
20.05% (韩国·忠南大) 2022/07/19

[PEN / ITO / PTAA / PFN-P2 / MA_{0.6}FA_{0.4}PbI_{2.9}Br_{0.1} / C60 / BCP / Cu](#)

"Optically and mechanically engineered anti-reflective film for highly efficient rigid and flexible perovskite solar cells"

J. S. Choi, Y.-W. Jang, U. Kim, M. Choi, S. M. Kang,

Adv. Energy Mater. **2022**, 12, 2201520. DOI:10.1002/aenm.202201520



20.04% (美国UC San Diego) 2020/07/29

[PET / ITO / SnO₂ / MA\(Sn/Pb\)I₃ / 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



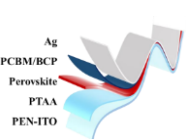
20.01% (中国·上海交通大) 2020/01/30

[PET / ITO / NiO_x-F₂HClNQ / \(Cs/FA/MA\)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



20.01% (中国·蘇州大) 2022/08/25

[PEN / ITO / PTAA / \(Cs/FA\)Pb\(I/Br\)₃ / PCBM / BCP / Ag](#)

"Grain-slip derived network topology to remarkable strength-toughness combination of perovskite film for flexible solar cells"

Z. Lu, Y. Lou, L. Xiao, X. Xu, C. Wang, L. Li, X. Su, G. Zou,

Adv. Energy Mater. **2022**, 12, 2202298. DOI:10.1002/aenm.202202298



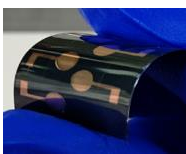
20.00% (中国·中物院四川材料研) 2021/07/17

[PEN / ITO / SnO₂/NbO_x / \(FA/MA\)Pb\(I/Cl\)₃ / spiro / Au](#)

"Boosted charge extraction of NbO_x-enveloped SnO₂ 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 / C₆₀ / 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