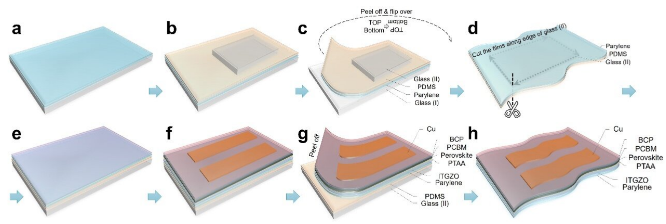
Creating ultralight flexible perovskite solar cells

31 May 2022



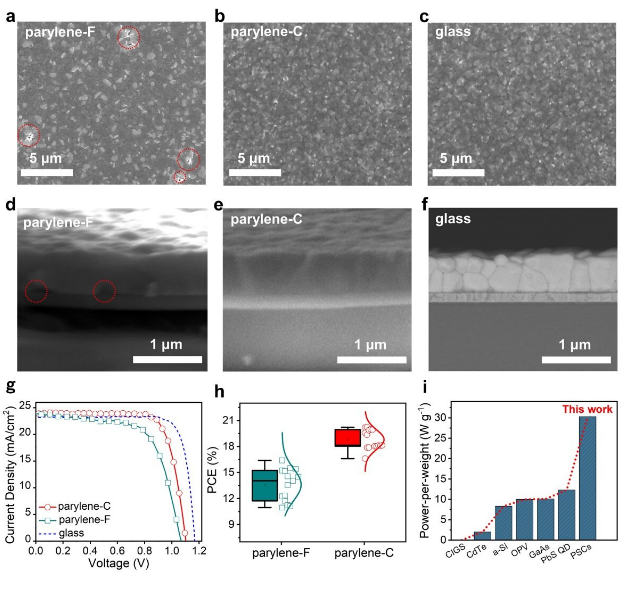
(a) Deposition of parylene film on pre-cleaned glass. (b) Coating PDMS and placing another pre-cleaned glass immediately. (c) Peeling from glass (I) after PDMS solidified, then flipping over. (d) Cutting the films along the edge of glass (II). (e) Sputtering ITGZO. (f) Fabricating the rest layers of PTAA/Perovskite/PC61BM/BCP/Cu, successively. (g) Peeling from PDMS. (h) Fabrication of ultrathin FPSCs completed. Credit: Science China Press

In a recently-published study, 3-µm-thick commercially available parylene-C was deposited on the top of pre-cleaned glass via chemical vapor deposition (CVD) and then the flip-over transferring (FOT) process was employed to ensure a smooth parylene surface. 210-nm-thick Zr, Ti and Ga-doped indium oxide (ITGZO) was sputtered on parylene as transparent conducting oxide (TCO) electrodes, and inverted FPSCs were then accomplished. Devices on glasses and parylene-F (i.e., parylene-VT4) substrates were also constructed to verify the advantages of parylene-C.

This study was published in *Science China Materials* led by Prof. Rui Zhu, Prof. Wei Wang and Prof. Qihuang Gong from Peking University.

Scanning electron microscopy (SEM) with both top and cross-sectional views was performed to study the morphology difference among perovskite films grown on parylene-F, parylene-C and glass-based substrate. The perovskite films on parylene-F exhibited poor film coverage with several pinholes on the film surface and showed interfacial voids at embedded bottom interfaces which would lead to charge accumulation and induce the loss of device performance. For perovskite films prepared on parylene-C, better film uniformity same as glass-based films was obtained as evidenced by the disappearance of surficial pinholes and interfacial voids.

The ultrathin parylene-C based FPSC achieved a remarkable PCE of 20.2%, which was comparable to that based on FPSCs of common thickness. Due to the high PCE and light device weight of 6.67 g/m^2 on parylene-C substrates, an outstanding power-per-weight of 30.3 W/g was realized, indicating the great promise of fabricating efficient, ultrathin and ultralight solar cells with parylene-C films.



Top-view (a-c) and cross-sectional (d-e) scanning electron microscopy images for perovskite films prepared on parylene-F/ITGZO, parylene-C/ITGZO and glass/ITO substrates. Pinholes and interfacial voids are highlighted by red-dash circles. (g) The J-V characteristics of PSCs prepared on parylene-F/ITGZO, parylene-C/ITGZO and glass/ITO substrates. The J-V curves were tested under simulated AM 1.5G sunlight at 100 mW/cm2. (h) The PCE distributions of 15 FPSCs on the parylene-F/ITGZO substrate and 15 FPSCs on the parylene-C/ITGZO substrate, respectively. (i) Comparison of the lightweight solar cells with high power-per-weight. Credit: Science China Press

More information: Jiang Wu et al, Ultralight flexible perovskite solar cells, *Science China Materials* (2022). DOI: 10.1007/s40843-022-2075-7

Provided by Science China Press