

Electronic Supplementary Information (ESI)

Low cost and solution-processable zinc phthalocyanine as alternative hole transport material for perovskite solar cells

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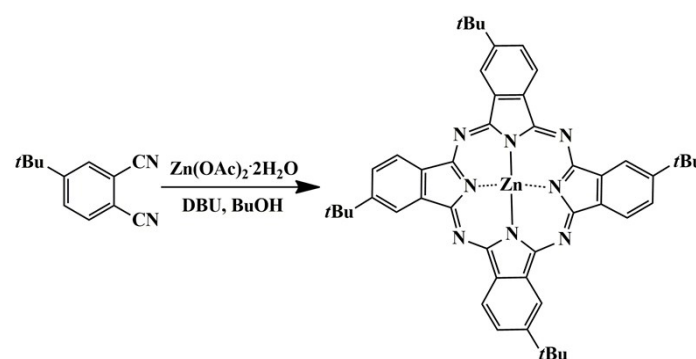


Fig. S1 Synthetic route of ZnPc(tBu)₄.

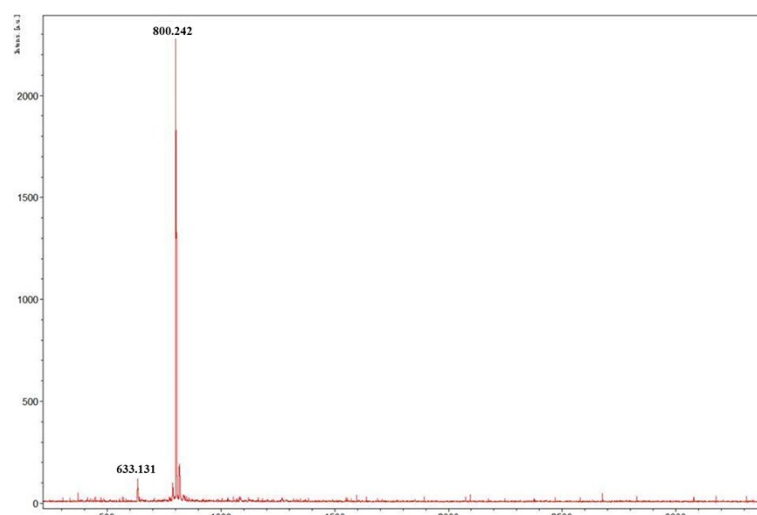


Fig. S2 MALDI-TOF mass spectrum of molecular ion of ZnPc(tBu)₄.

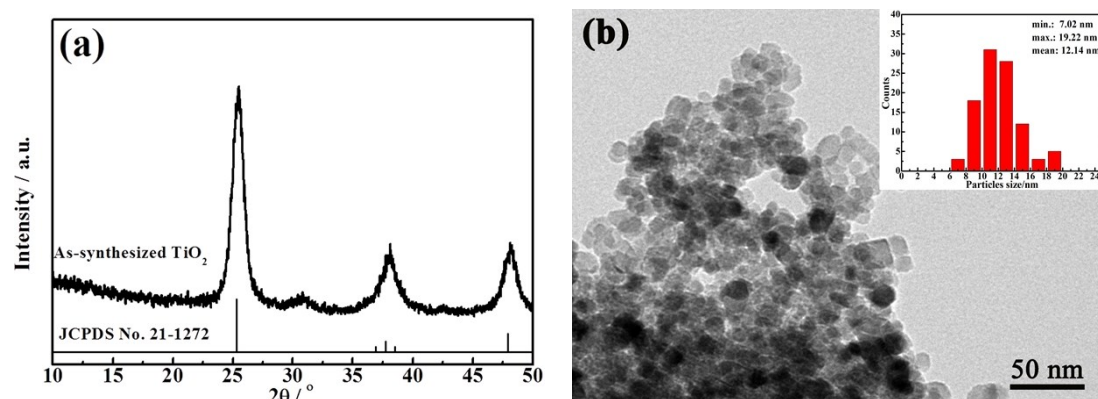


Fig. S3 XRD pattern (a), TEM image (b) and the particle diameter distribution plot (inset) of the synthesized TiO₂ nanoparticles.

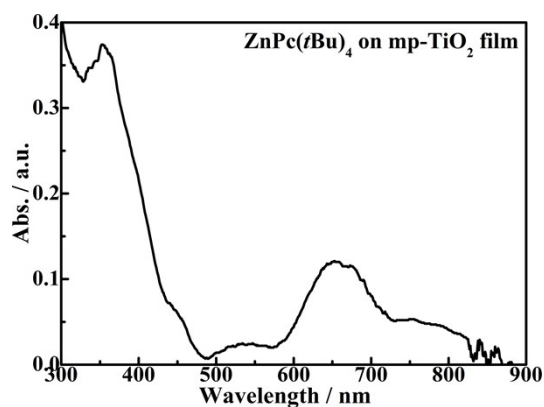


Fig. S4 UV-vis absorption spectra of $\text{ZnPc}(t\text{Bu})_4$ on mp- TiO_2 film.

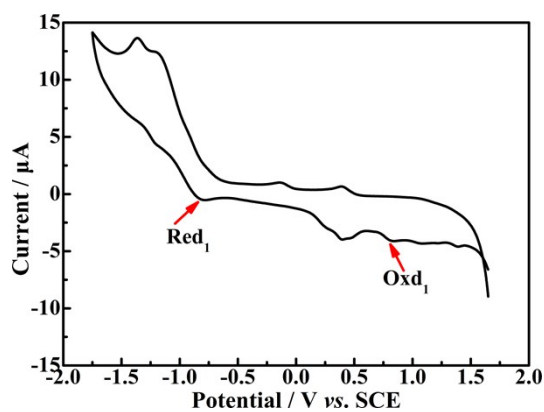


Fig. S5 Cyclic voltammogram (CV) of $\text{ZnPc}(t\text{Bu})_4$.

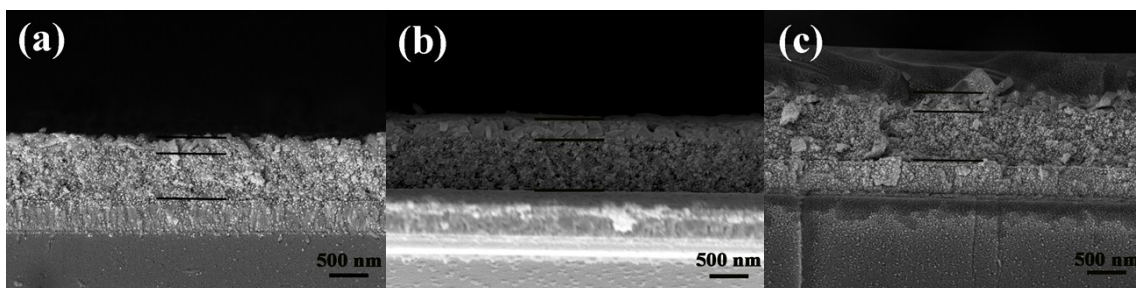


Fig. S6 FESEM images of FTO/mp- TiO_2 /MAPbI₃(a), FTO/mp- TiO_2 /MAPbI₃/ $\text{ZnPc}(t\text{Bu})_4$ (b), and FTO/mp- TiO_2 /MAPbI₃/spiro-OMeTAD(c).

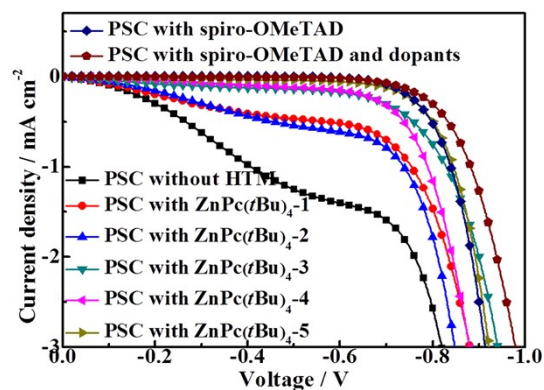


Fig. S7 Dark current curves of PSCs fabricated with different HTM layers listed in Table 2, $\text{ZnPc}(t\text{Bu})_4$ -1 to -5 refer to the HTM layer spin-coated with 2.5×10^{-3} M to 2.5×10^{-2} M $\text{ZnPc}(t\text{Bu})_4$ solution, respectively.

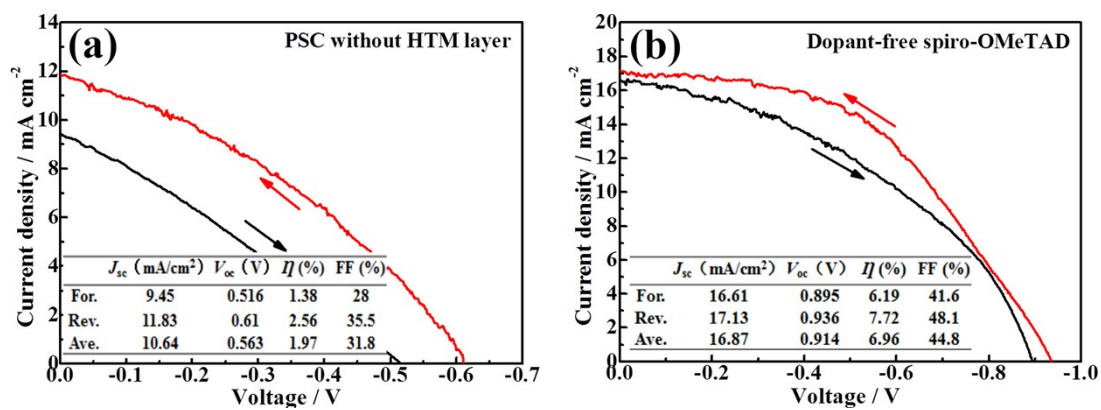


Fig. S8 J - V curves of the best-performing PSCs fabricated without HTM layer (a), and the PSC fabricated by spin-coating 5.9×10^{-2} M spiro-OMeTAD as HTM layer (b) under forward (black) and reverse (red) voltage scanning with an active area of 0.09 cm^2 (100 mW cm^{-2} simulated solar illumination).