

Regulating TiO_2 deposition using single-anchored ligand for high-efficiency perovskite solar cells

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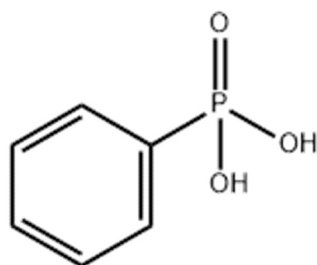


Figure S1. The molecular structure formula of phenylphosphonic acid.

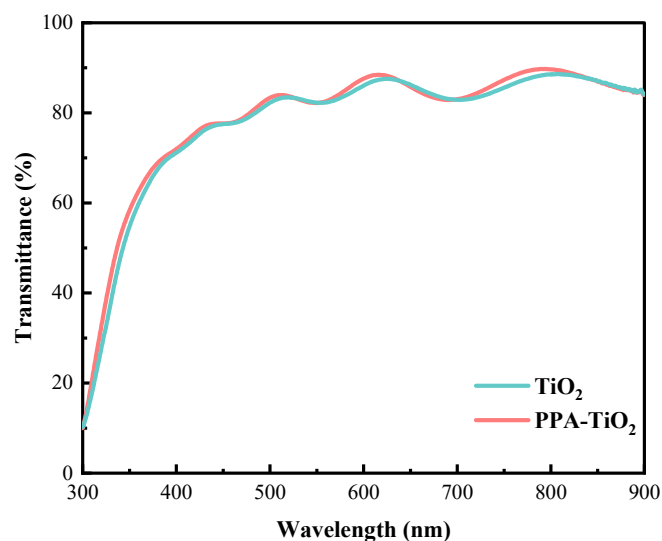


Figure S2. Optical transmittance spectra of ETLs.

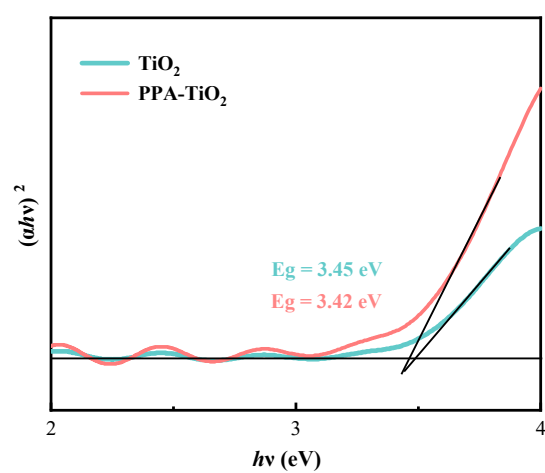


Figure S3. Tauc plots of ETLs.

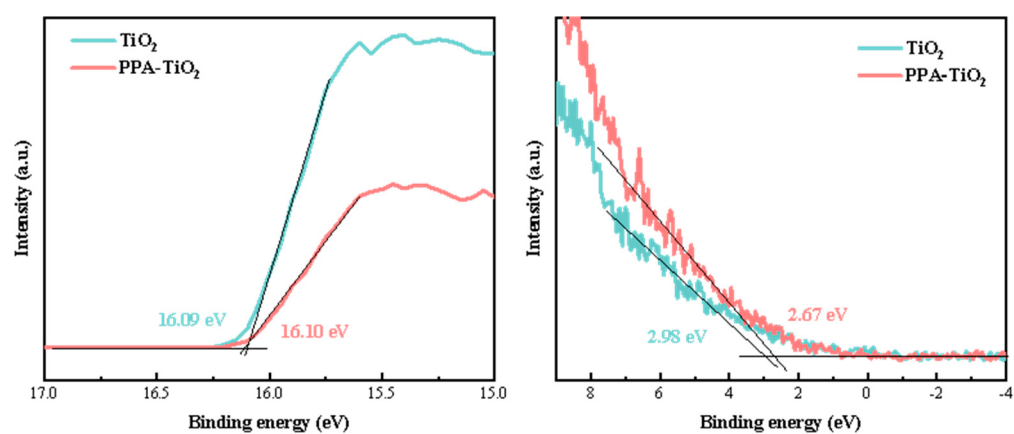
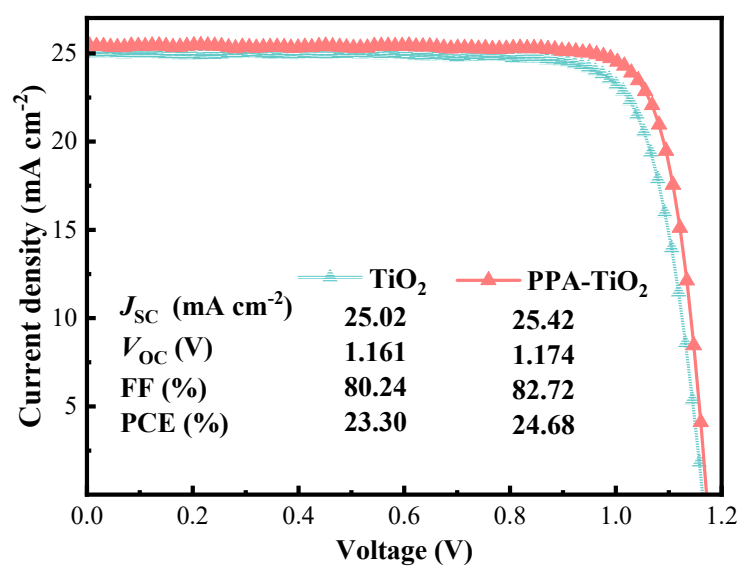


Figure S4. UPS profiles of ETLs.

Figure S5. Forward scan J - V curves of PSCs with different ETLs.

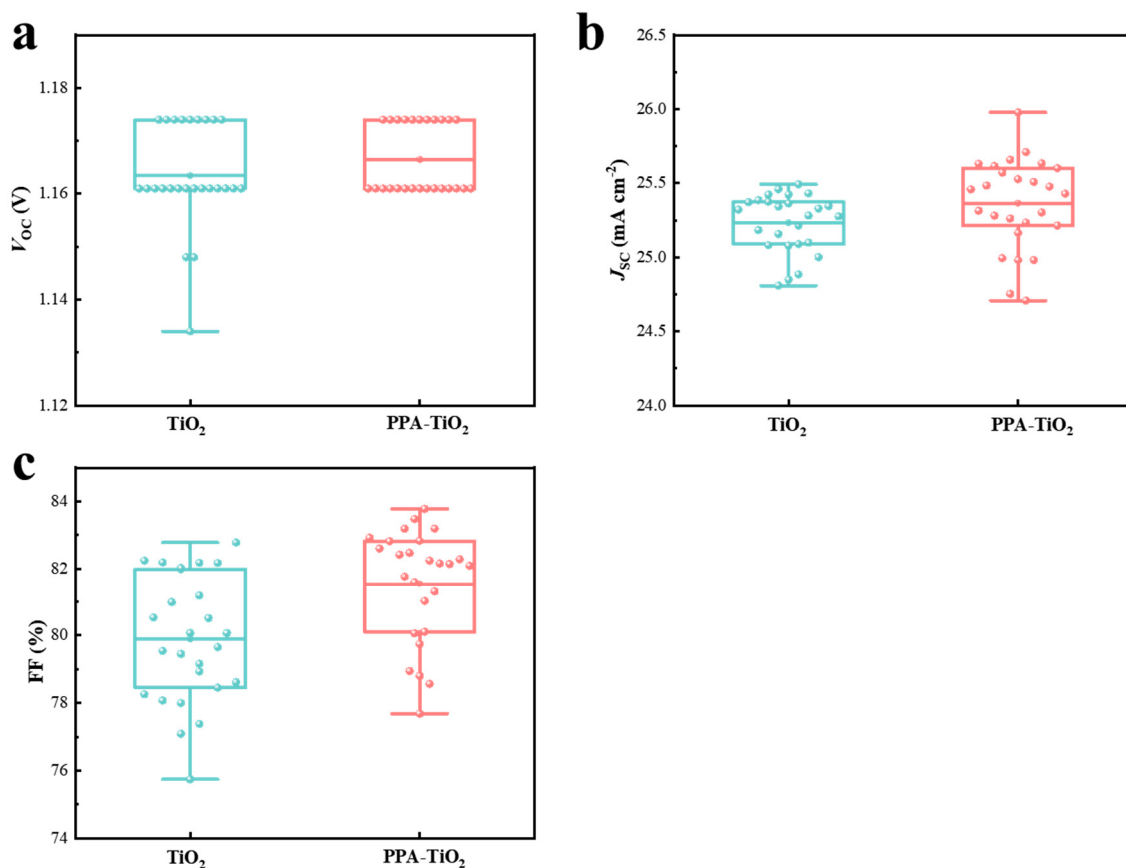


Figure S6. Distribution of the photovoltaic parameters for PSCs based on different ETLs. (a) distribution of V_{oc} ; (b) distribution of J_{sc} ; (c) distribution of FF.

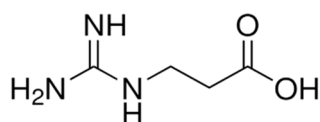


Figure S7. The molecular formula of the β -Guanidinopropionic acid.

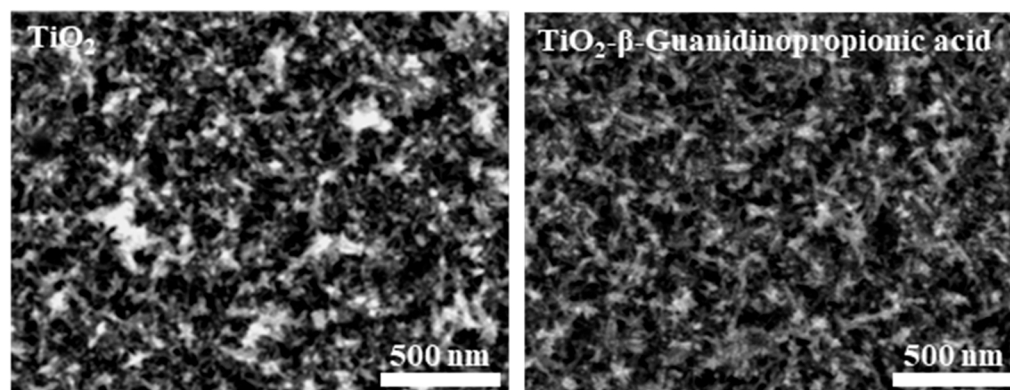


Figure S8. Surface SEM images of ETLs, respectively.

Note S1. To demonstrate the universality of the single-anchored ligand regulation strategy, we used β -Guanidinopropionic acid (Figure S2), which contains a carboxyl

group that can bind to TiO_2 , and the molecular skeleton and the guanidine group that acts as the steric hindrance, to regulate the CBD process of TiO_2 . As predicted, many dendrite-like aggregates appear on the surface of the normal TiO_2 ETL, which makes the surface very rough. However, the surface of the ETL film with β -Guanidinopropionic acid regulation is smoother, and there is no obvious agglomeration (Figure S3).