

Er-doped TiO₂ phase junction as electron transport layer for efficient perovskite solar cells fabricated in air

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Table S1 The calculated mass ratio of rutile (X_R) and anatase (X_A) according to XRD spectra and the recombination resistance (R_{rec}) of TiO₂-based PSCs with different Er doping ratio.

Er Doping Ratio	X_A (%)	X_R (%)	R_{rec} (Ω)
undoped TiO ₂	7.93	92.07	349
0.25%	20.37	79.63	395
0.50%	49.18	50.82	771
0.75%	63.73	36.20	982
1.00%	100	0	234

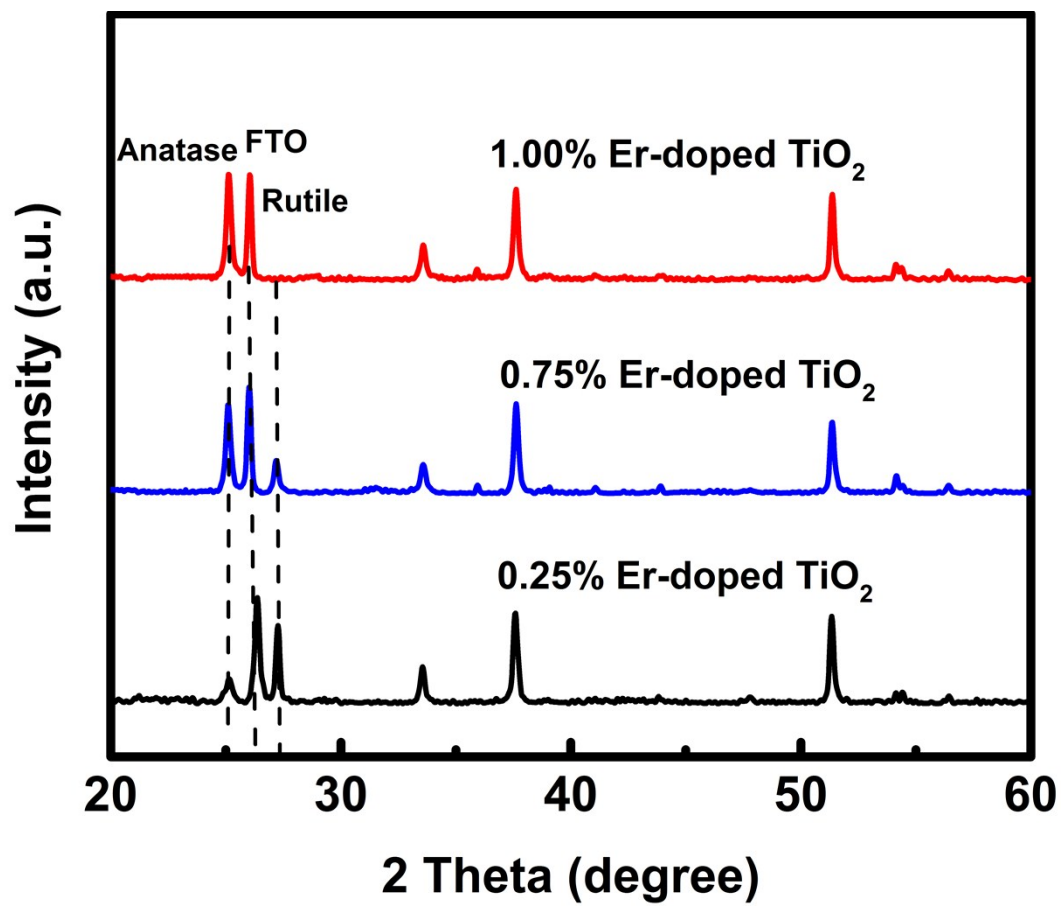


Fig. S1 XRD patterns of TiO₂ films with 0.25%, 0.75%, and 1.00% Er doping ratio on FTO.

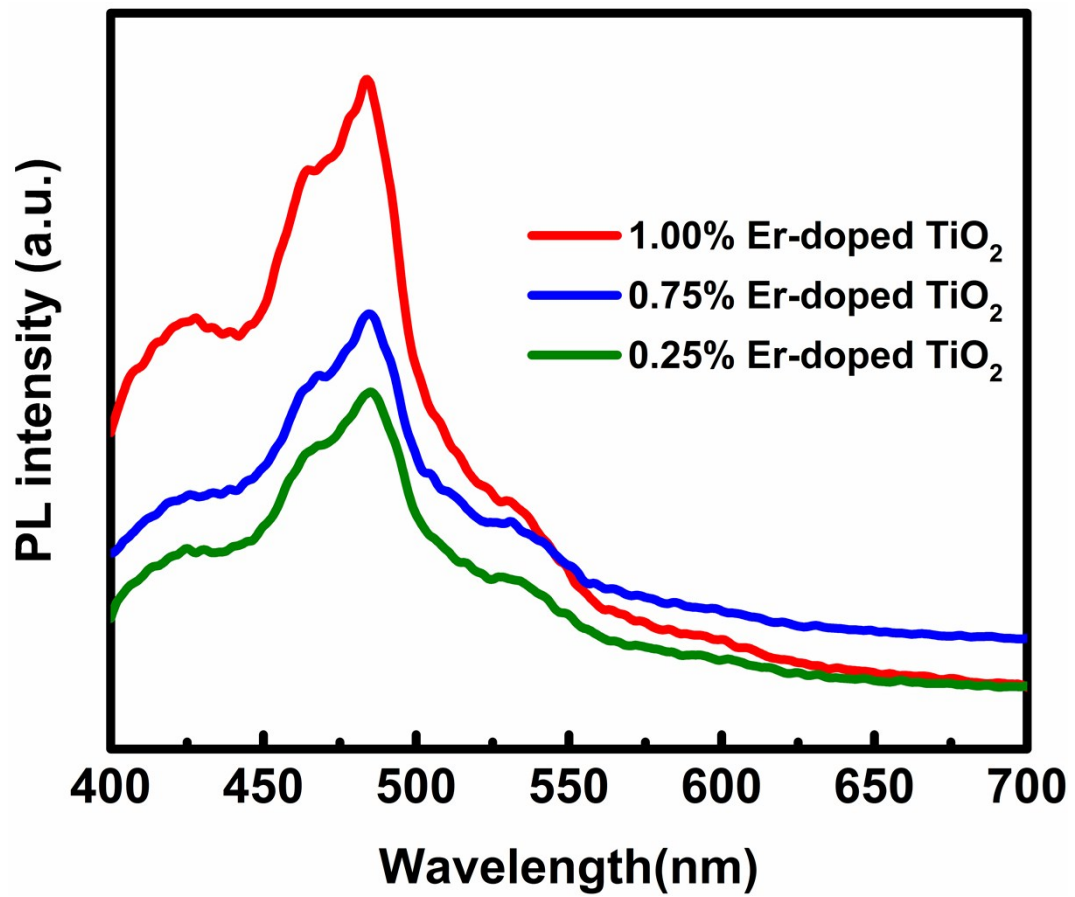


Fig. S2 PL spectra of TiO₂ films with 0.25%, 0.75% and 1.00% Er doping ratio on FTO

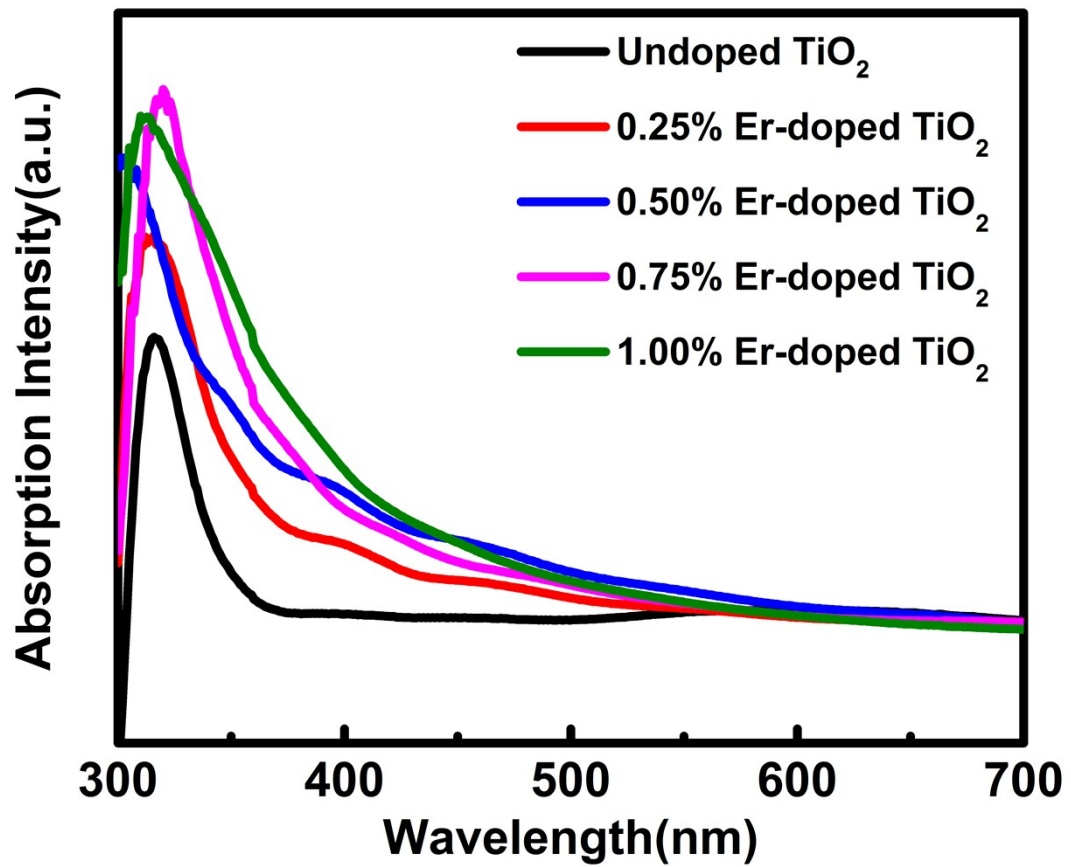


Fig. S3 UV-vis spectra of TiO₂ films without and with 0.25%, 0.50%, 0.75% and 1.00% Er doping ratio on FTO.

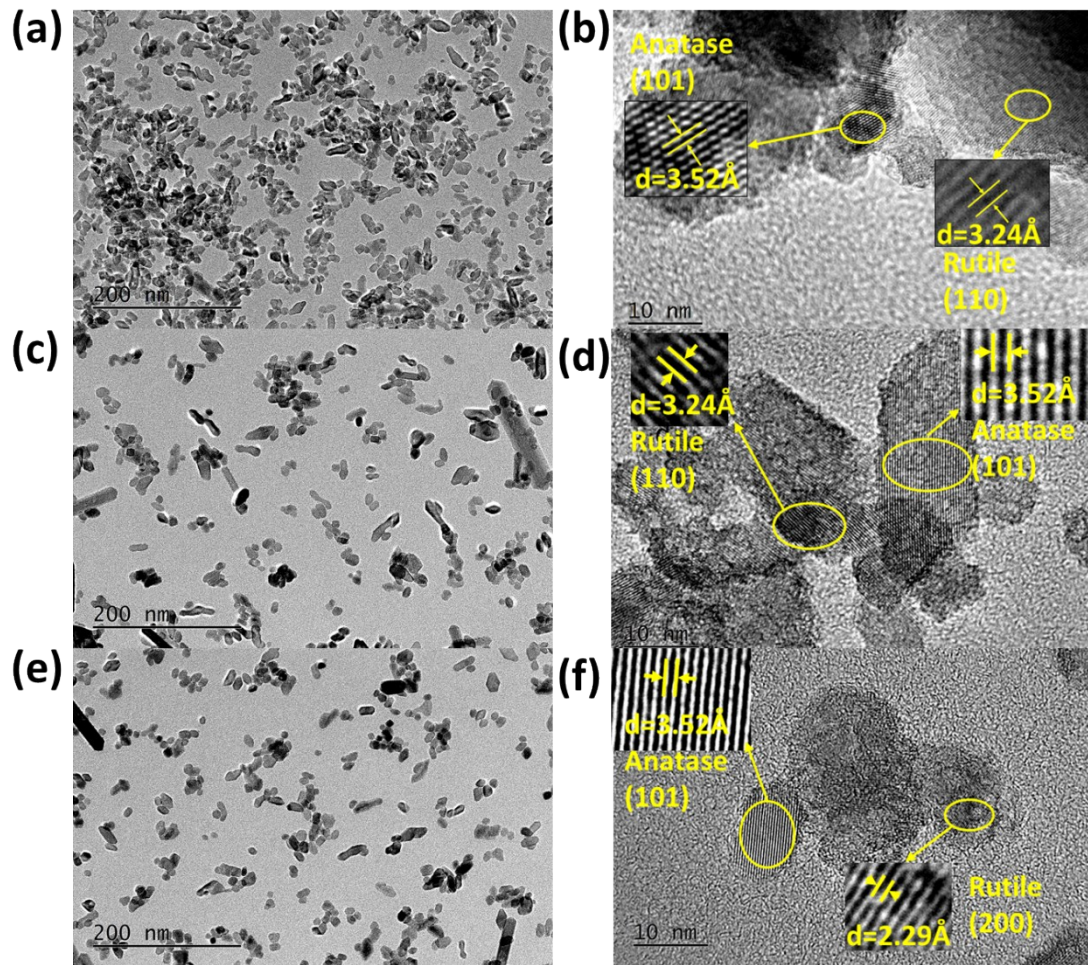


Fig. S4 TEM images (a), (c), (e) and high-resolution TEM images (b), (d), (f) of 0.25%, 0.75% and 1.00% Er-doped TiO₂ respectively.

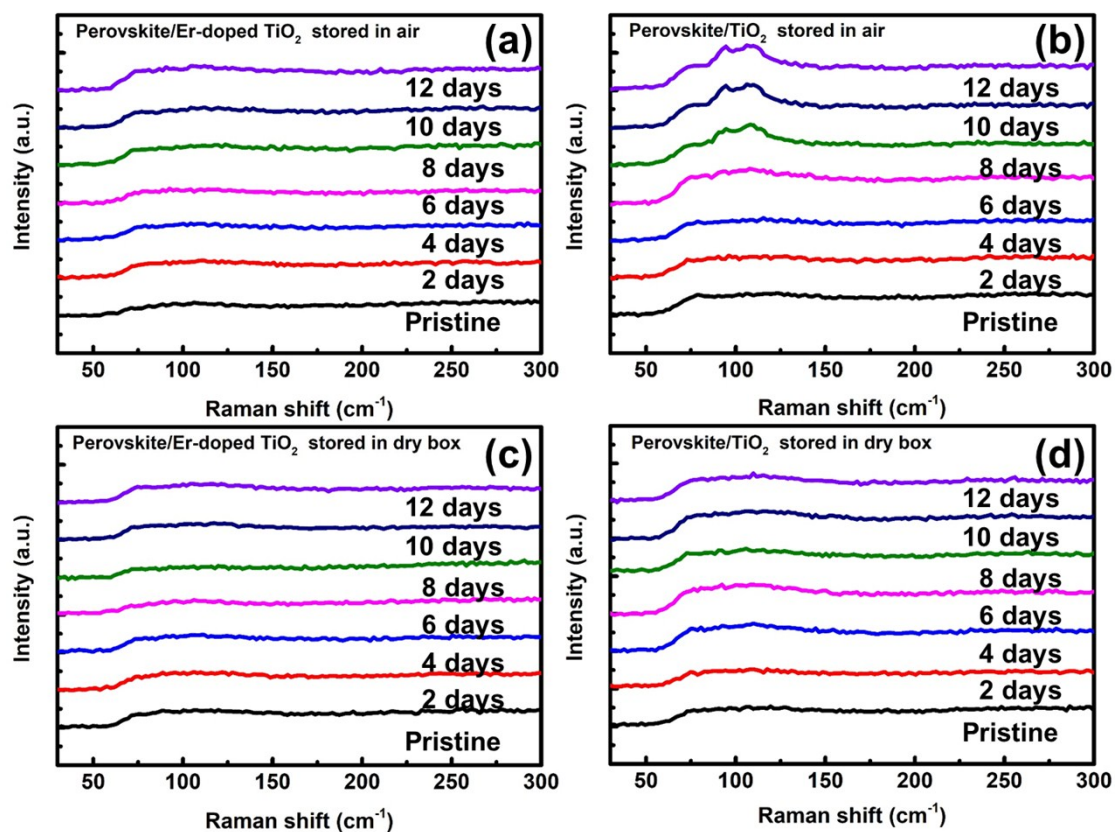


Fig. S5. Raman spectra of perovskite films on Er-doped TiO₂ (a) in air (RH > 50%) and (c) in dry box (RH < 20%), and Raman spectra of perovskite films on undoped TiO₂ (b) in air (RH > 50%) and (d) in dry box (RH < 20%) as a function of stored time (days).

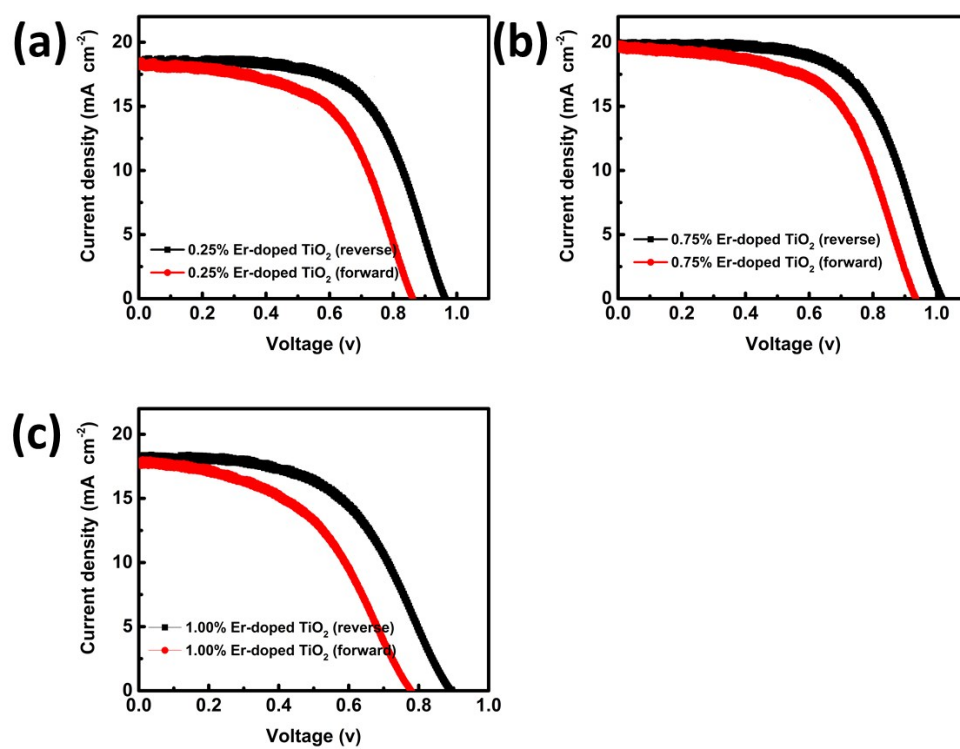


Fig. S6 *J-V* curves of the devices (a), (b), (c) with 0.25%, 0.75% and 1.00% Er-doped TiO₂ respectively.