Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A

Supporting information

Coupling Ti-doping and Oxygen Vacancy in Hematite Nanostructures for Solar Water Oxidation with High Efficiency

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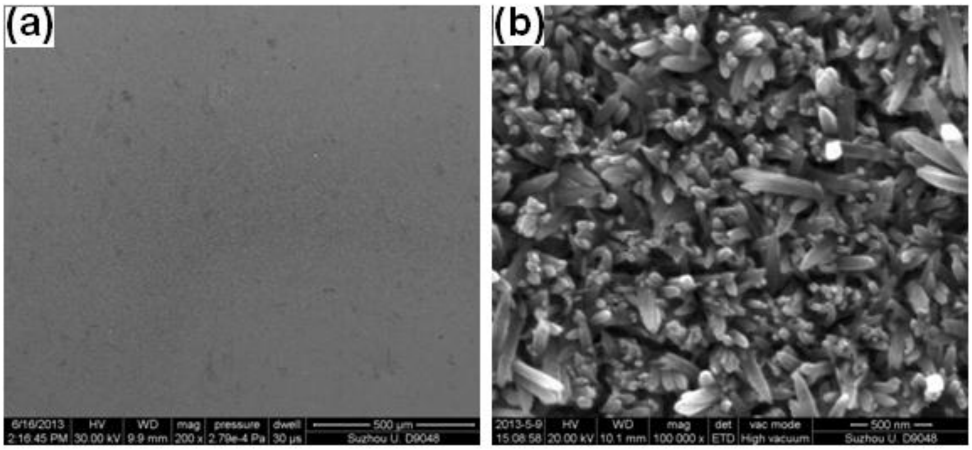
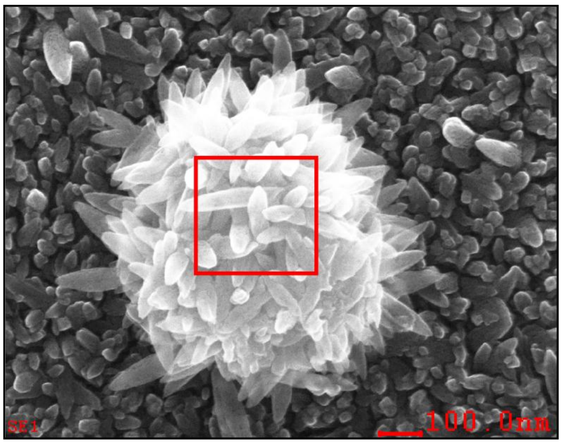


Figure S1: (a) and (b): SEM images of undoped hematite nanostructures sintered in a partial oxygen pressure of 2.1×10^{-2} Torr.



Element	*Wt%*	*At%*
OK	35.54	65.70
TiK	01.83	01.13
FeK	62.62	33.16
Matrix	Correction	ZAF

Figure S2: SEM image (left) and elemental analysis of the coral-like nanostructures (right).

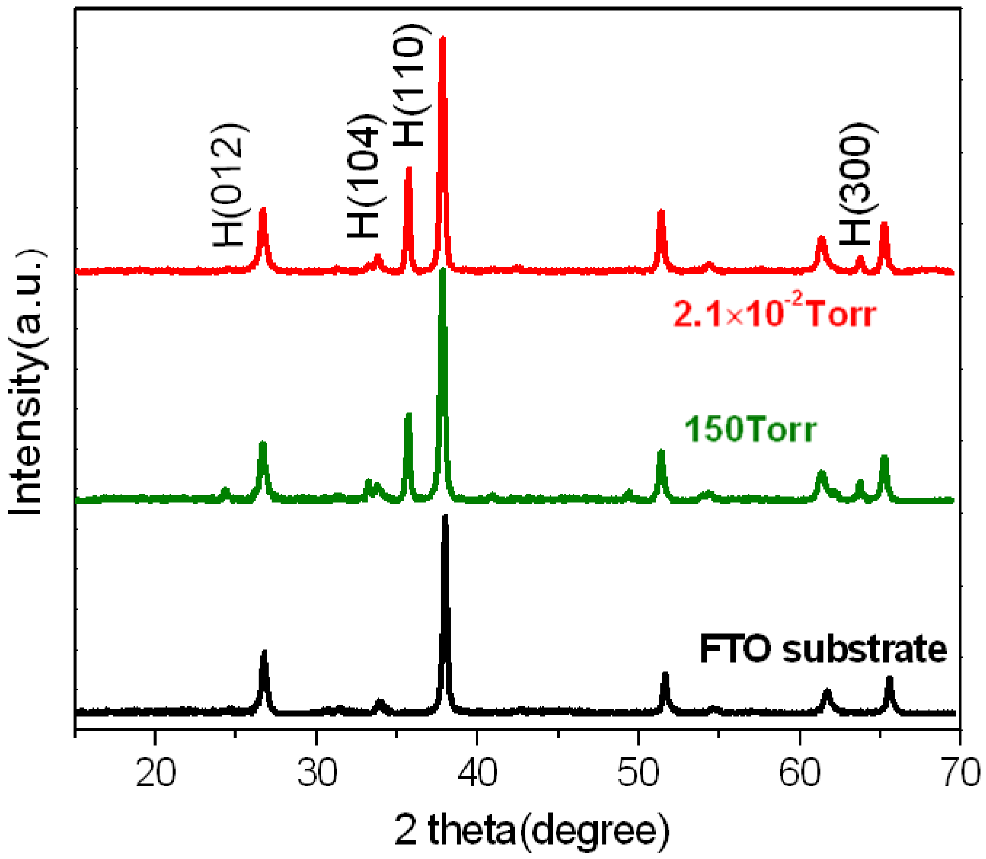


Figure S3: XRD spectra of undoped hematite nanostructures sintered in various partial oxygen pressures.

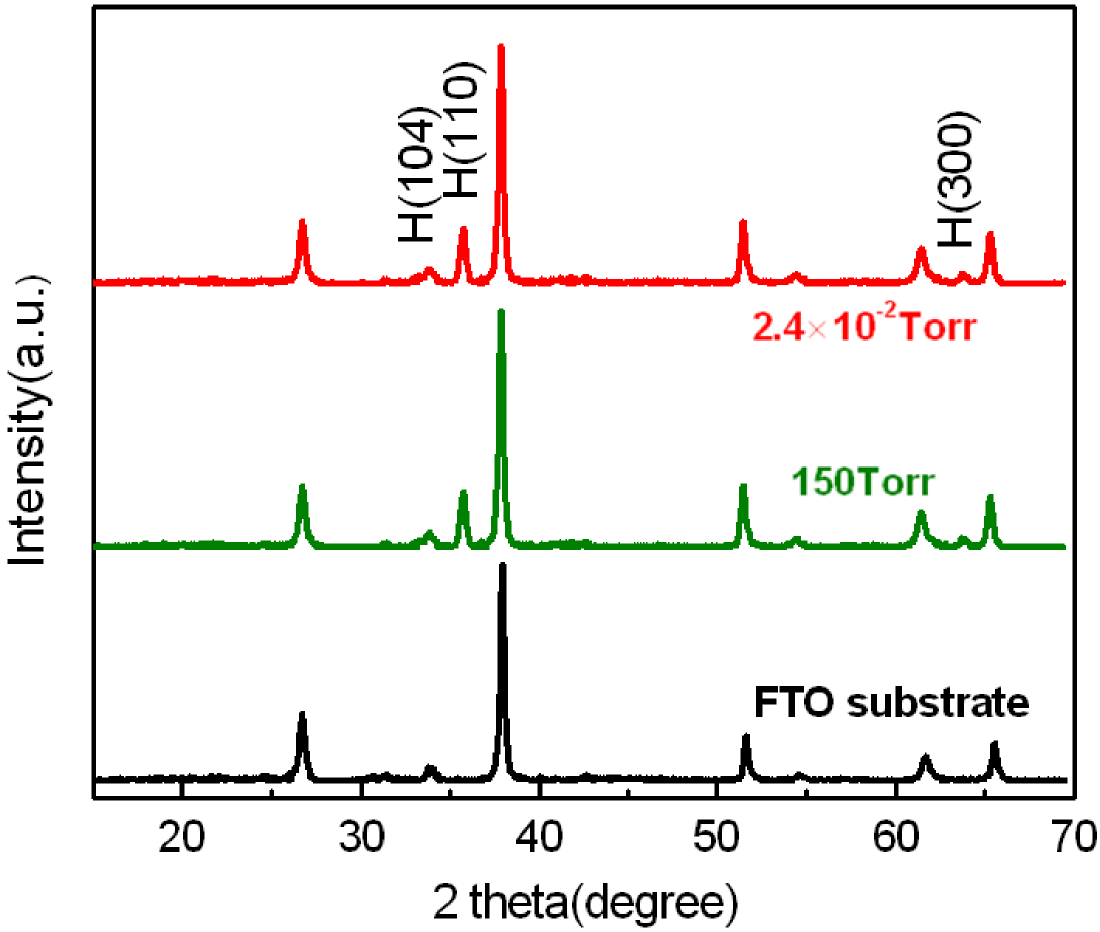


Figure S4: XRD spectra of Ti-doped hematite nanostructures sintered in various partial oxygen pressures.

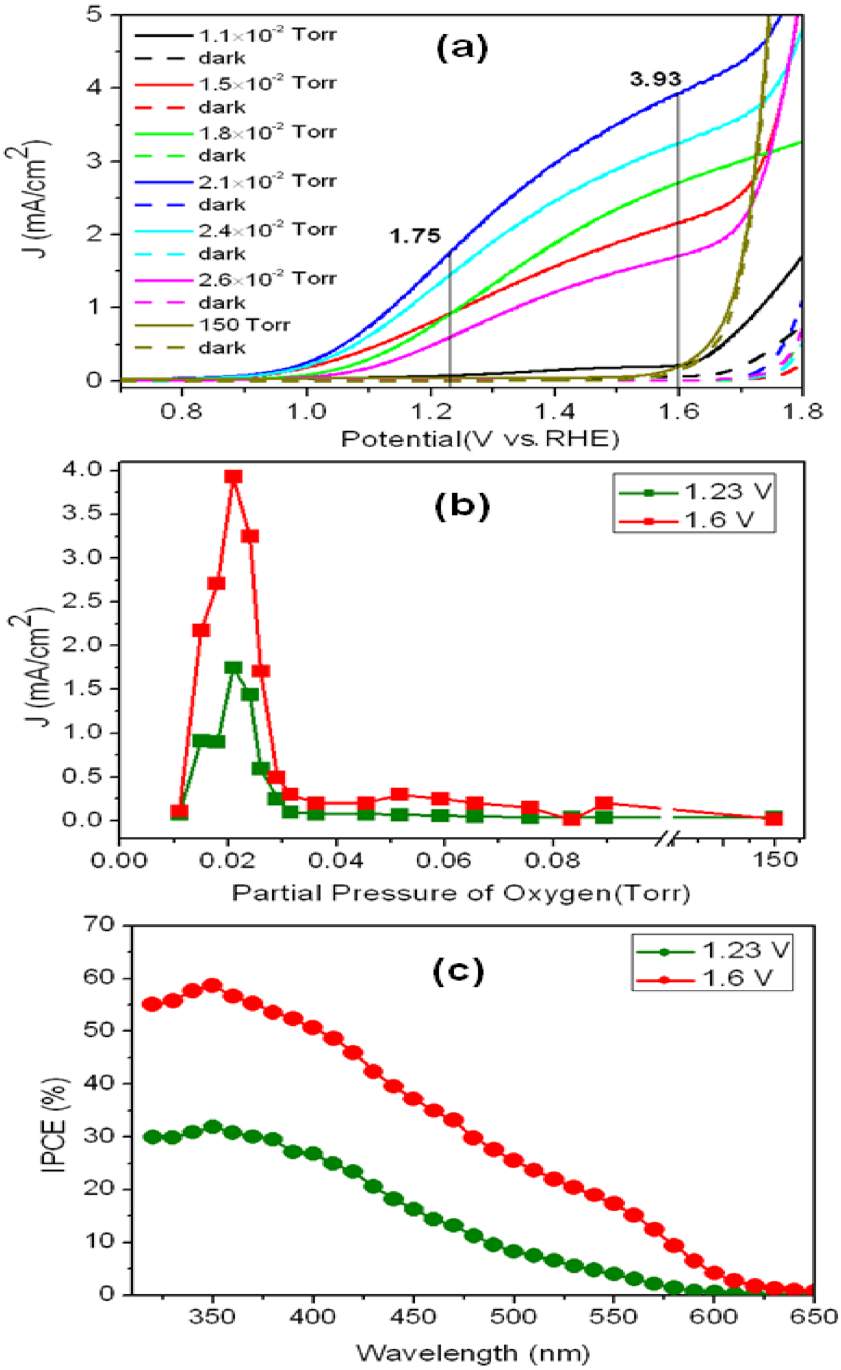


Figure S5: (a) *J-V* scans for undoped hematite sintered in various partial oxygen pressures at 550 °C. (b) Photocurrent density of undoped hematite at 1.23 and 1.6 V vs. RHE as a function of partial oxygen pressure. (c) IPCE spectra for undoped hematite sintered in a partial oxygen pressure of 2.1×10^{-2} Torr at 1.23 (green) and 1.6 (red) V vs. RHE.

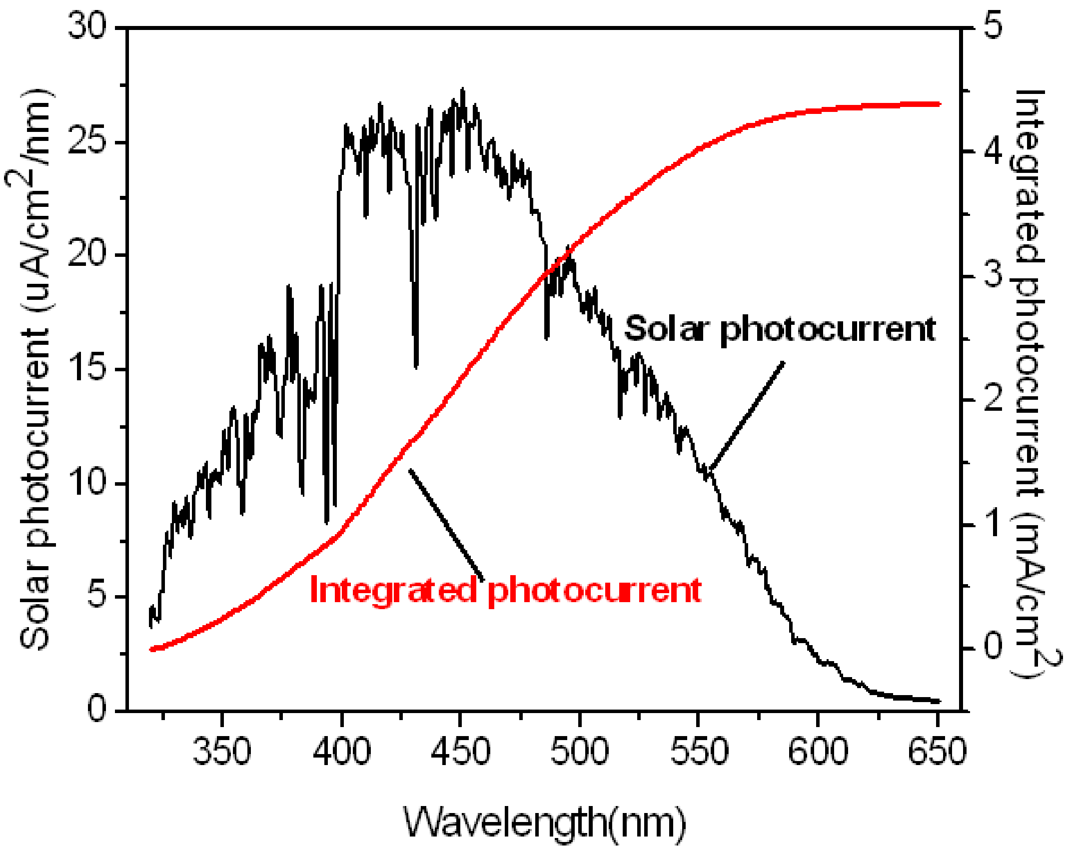


Figure S6: The integrated photocurrent based on the IPCE data (320 nm to 650nm) at 1.6 V vs. RHE. The photocurrent density was calculated by integrating the IPCE spectra with a standard AM 1.5G solar spectrum (ASTMG-173-03), using the following equation:

$$I = \int_{350}^{650} \frac{1}{1240} \lambda IPCE(\lambda) E(\lambda) d\lambda$$

where E(λ) is the solar spectral irradiance at a specific wavelength (λ) and IPCE(λ) is the obtained IPCE profile as a function of wavelengths (λ) at 1.6 V vs. RHE. The integrated photocurrent at 1.23 V vs. RHE was calculated by a similar way. The calculated photocurrents are 2.04 mA cm^{-2} and 4.41 mA cm^{-2} at 1.23 and 1.6 V vs. RHE, respectively.

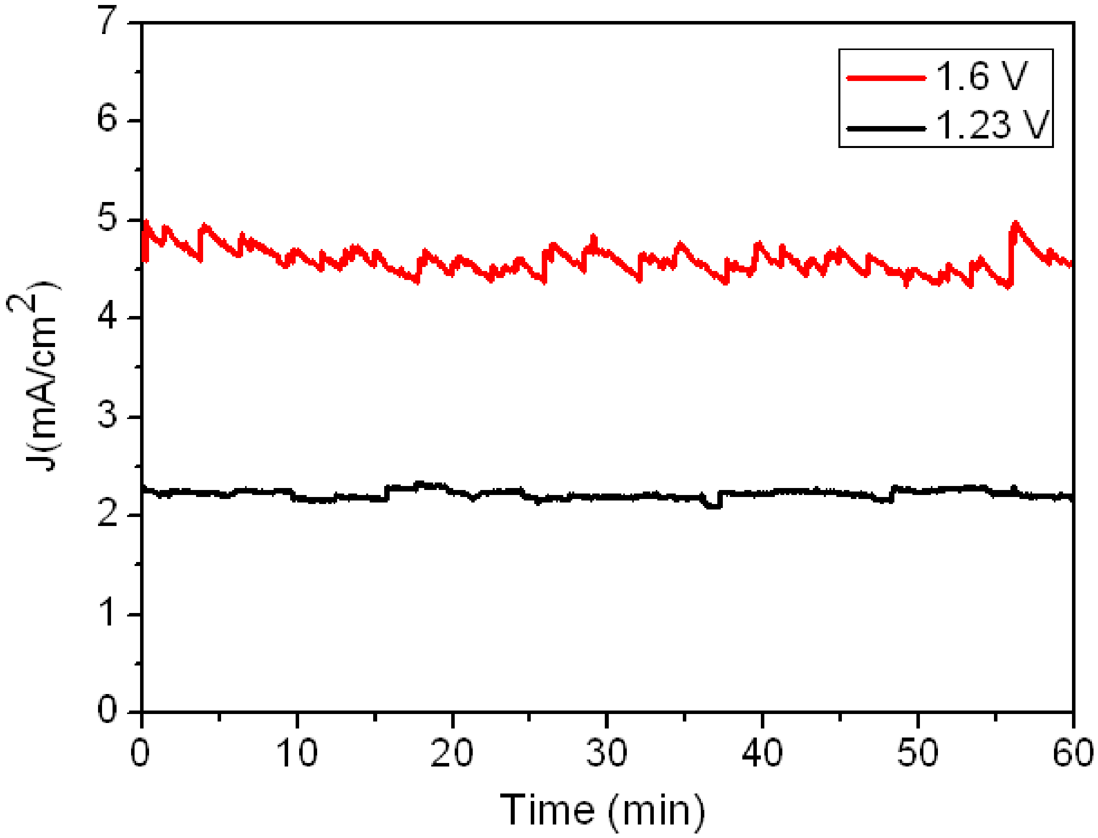


Figure S7: Photochemical stability curves for the Ti-doped sample (2.4×10^{-2} Torr) collected at 1.23 V and 1.6 V vs. RHE.

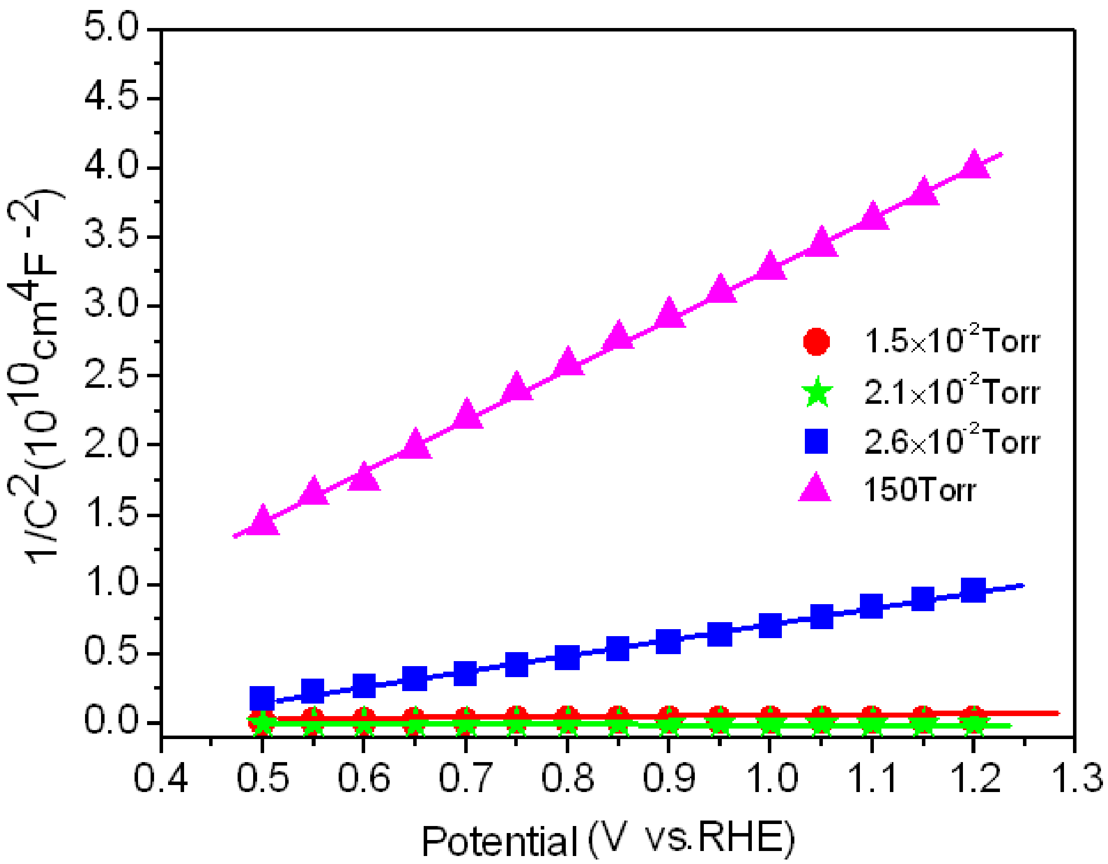


Figure S8: Mott-Schottky plots of undoped hematite samples sintered in various partial oxygen pressures at 550 °C. Results show that the best donor density of undoped hematite sample is 3.73×10^{20} cm^{-3} at 2.1×10^{-2} Torr, while the donor densities of other samples are 6.19×10^{19} cm^{-3} at 1.5×10^{-2} Torr, 1.5×10^{18} cm^{-3} at 2.6×10^{-2} Torr and 4.8×10^{17} cm^{-3} at 150 Torr.