

Electronic Supplementary Information: Enhanced Photoelectrochemical Water Splitting via SILAR-Deposited Ti-Doped Hematite Thin Films with an FeOOH Overlayer

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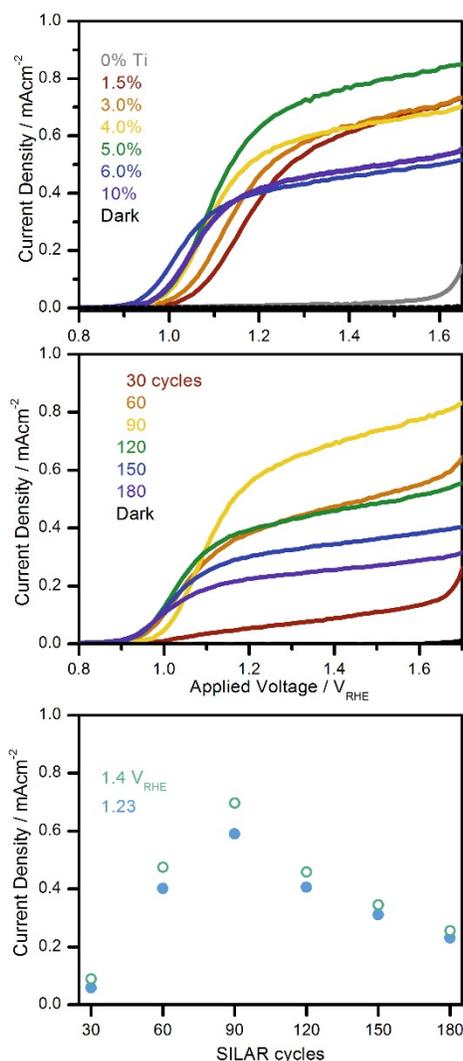


Figure S1: (a) JV curves for 45 nm thick Ti:Fe₂O₃ samples at various Ti/(Ti+Fe) solution ratios. (b) Average current density versus voltage (JV) curves for 5 s% Ti/(Ti+Fe) at various film thicknesses. SILAR cycle number corresponds to approximately twice the film thickness in nm. (c) Current density at two bias voltages as a function of thickness for the sample types in (b).

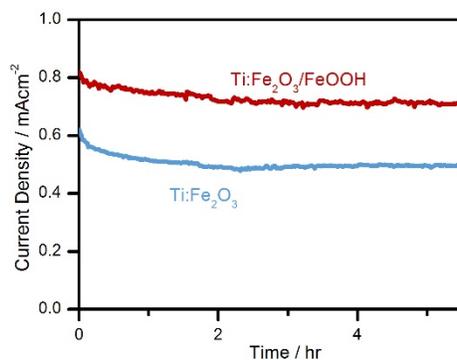


Figure S2: Stability of 5% Ti:Fe₂O₃ with and without an FeOOH overlayer under 1-sun illumination at 1.23 V_{RHE}.

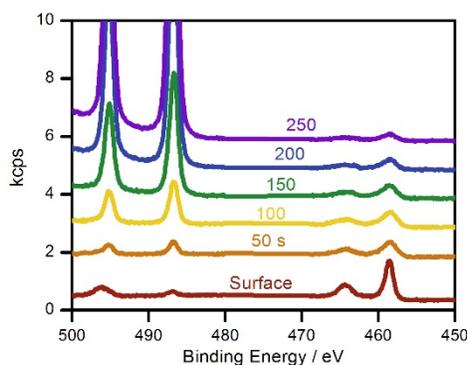


Figure S3: Detail spectra for Sn 3d and Ti 2p peaks. Peaks correspond to Sn⁴⁺ and Ti⁴⁺ oxidation state.

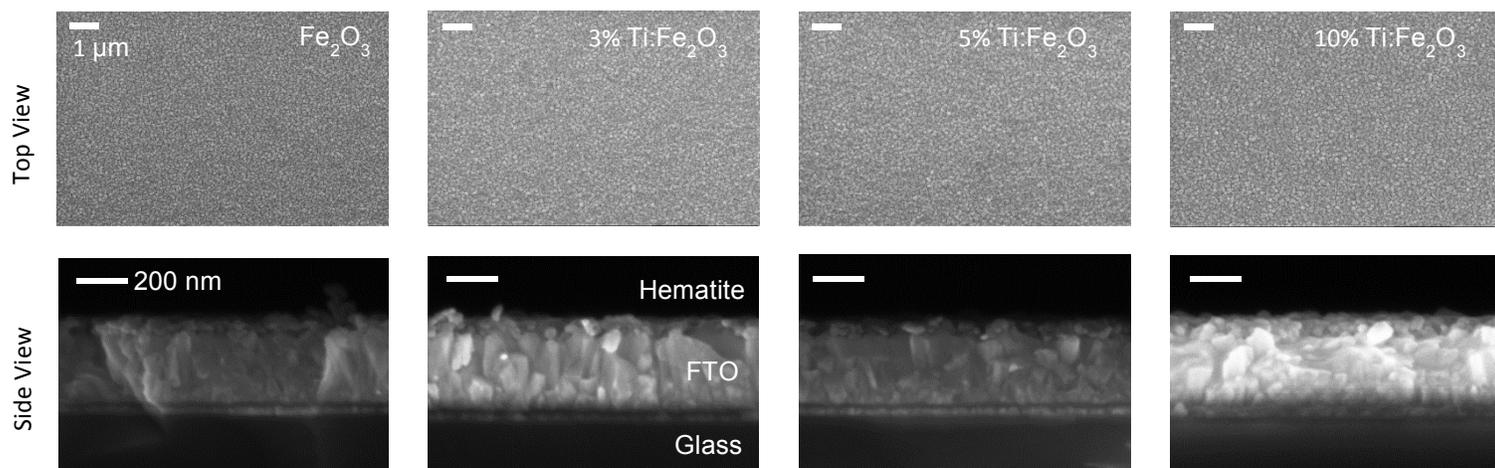


Figure S4: Top and side-view scanning electron microscope images of SILAR-deposited Fe₂O₃ and varying Ti% Ti:Fe₂O₃ after 90 cycles. Images reveal conformal coating (planar on FTO) and growth rate of ~ 5 Å/cycle.

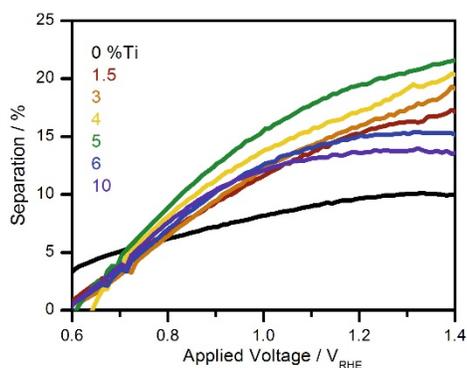


Figure S5: Charge separation (sep %) vs. applied voltage curves for carrying Ti% Ti:Fe₂O₃ generated by $\eta_{sep} = \frac{J_{ph}^{H_2O_2}}{J_{abs}}$ where $J_{ph}^{H_2O_2}$ is the photocurrent density under 1-sun illumination in 1 M NaOH | 0.5 M H₂O₂ (hole scavenging) electrolyte and J_{abs} is the current density assuming perfect charge collection from absorbed photons.

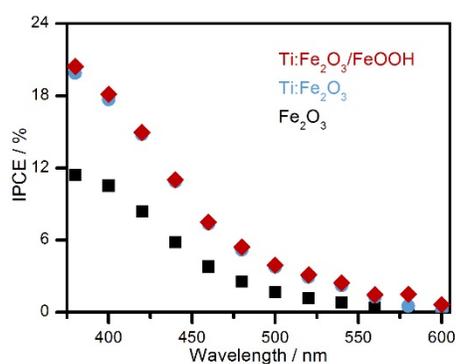


Figure S6: Incident photon-to-current conversion efficiency data for Fe₂O₃, 5 s% Ti:Fe₂O₃ with and without an FeOOH overlayer in hole scavenging electrolyte (0.5 M H₂O₂ and 1 M NaOH in DI water). IPCE divided by absorption is APCE, which is plotted in Fig. 5(a) in the main text.

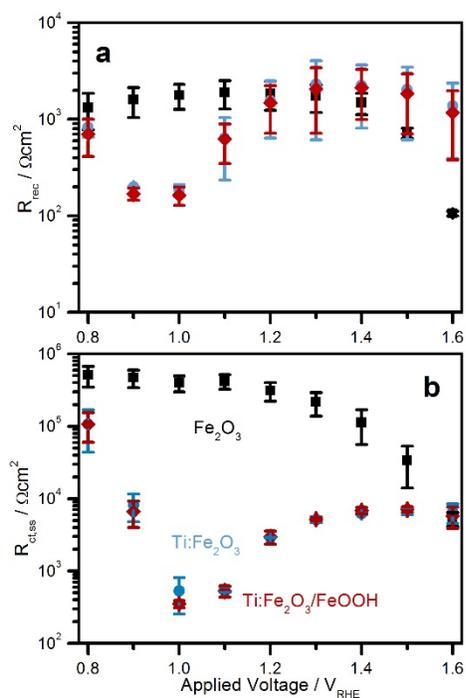


Figure S7: (a) R_{rec} data for Fe_2O_3 , 5 s% $\text{Ti}:\text{Fe}_2\text{O}_3$ with and without an FeOOH overlayer. (b) $R_{ct,ss}$ data for the same sample types; color scheme follows that in (a). The similarity in resistances between the $\text{Ti}:\text{Fe}_2\text{O}_3$ samples indicates that FeOOH has no surface catalytic effect. Color scheme for each panel follows that in (b).

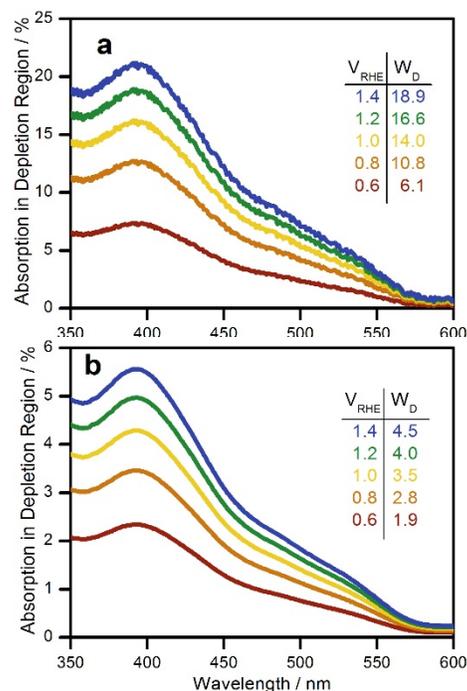


Figure S8: Absorption in the depletion region for (a) Fe_2O_3 and (b) 5 s% $\text{Ti}:\text{Fe}_2\text{O}_3$. Note the $\sim 4x$ difference in scale. Different colors represent different applied voltages that correspond to different depletion widths. Depletion width (W_D) is given in nm.



Figure S9: (a) Photograph of 90 SILAR cycle 5 s% $\text{Ti}:\text{Fe}_2\text{O}_3$ sample.