Supplemental Information

Electronic Structure, Optical Properties and Photoelectrochemical Activity of Sn Doped Fe$_2$O$_3$ Thin Films

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Figure S1. The XRD $\theta$-2$\theta$ scan of the Fe$_2$O$_3$/Ta-SnO$_2$/Al$_2$O$_3$ thin films, showing the well-defined Kiessing fringes and confirming the high quality of the epitaxial films. Inset: the growth of a 20 nm thick 3%Ta doped SnO$_2$ layer as a conductive layer on Al$_2$O$_3$(0001) substrate, followed by the growth of 30 nm undoped Fe$_2$O$_3$ for XPS measurement.

Figure S2. The large area cross-sectional STEM image of the Fe$_2$O$_3$/Al$_2$O$_3$(0001), showing a smooth and uniform Fe$_2$O$_3$ film over a large lateral length scale.
Figure S3. XPS core level spectra of (a) O 1s and (b) Fe 3p of Sn doped Fe$_2$O$_3$. The shifts of binding energy (BE) for O 1s and Fe 3p as function of Sn doping level were averaged to estimate the shift of the Fermi level displayed in Figure 5a.