Supporting Information

Water Photooxidation by Smooth and Ultra-thin α-Fe₂O₃ Nanotube Arrays

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Figure S1. Cross-sectional view of nanoporous Fe₂O₃ grown on Fe. This is synthesized in 6 min by applying 50VDC. The electrolyte used is ethylene glycol + (3 v%) H₂O + 0.5 wt %NH₄F.
Figure S2. Anodic polarization behavior of: (a) Fe and (b) Ti metal in aqueous ethylene glycol (3 v% H$_2$O + 0.5 wt %NH$_4$F) electrolyte at room temperature. The scan rate is 1 mV/s. The higher current densities for Fe indicated that the passivation (i.e., oxidative corrosion) are rapid for Fe than Ti.

Figure S3. A schematic showing the transformation of nanoporous Fe$_2$O$_3$ into nanotubular Fe$_2$O$_3$ arrays using sonoelectrochemical anodization process. Ultrasonic waves help the chemical dissolution process to create the vertically aligned nanotubes on the Fe foil.
Figure S4. SEM images of Fe$_2$O$_3$ nanotube arrays prepared by electrochemical anodization of Fe under magnetic stirring.

Figure S5. Current transient during anodization of Fe in aqueous ethylene glycol (3 v% water + 0.5 wt% NH$_4$F) solution at 50 V: (a) under ultrasonication and (b) magnetic stirring. The anodization process is faster when ultrasonication waves used for agitation. It also yield better quality nanotubes compared to the magnetic stirring process.
Figure S6. (A) STEM-EDX analysis of hydrogen annealed iron oxide nanotubes prepared by the sonochemical anodization technique. This showed the oxygen deficiency in the structure. A stoichiometry hematite structure should show an atomic ratio of O/Fe as 1.5, however in this case 1.15 is observed. (B) STEM image showing individual iron oxide nanotubes.
Figure S7. (A) Iron oxide nanotubes and (B) nanoparticles coated on Fe foil.