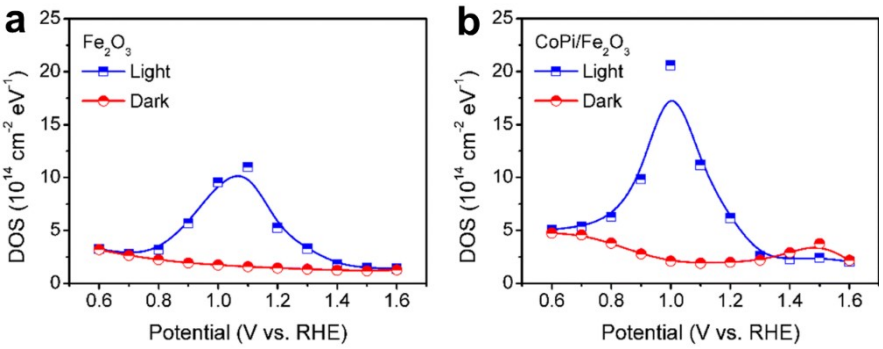
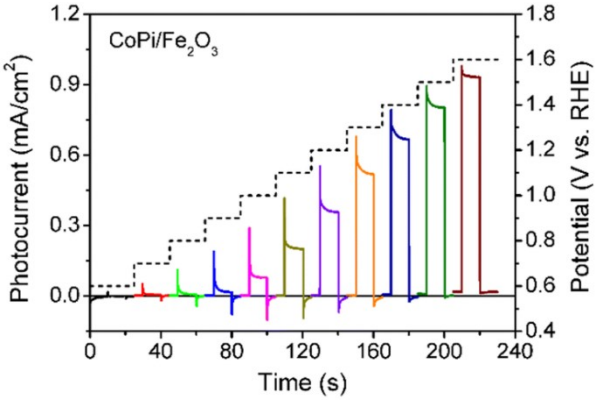
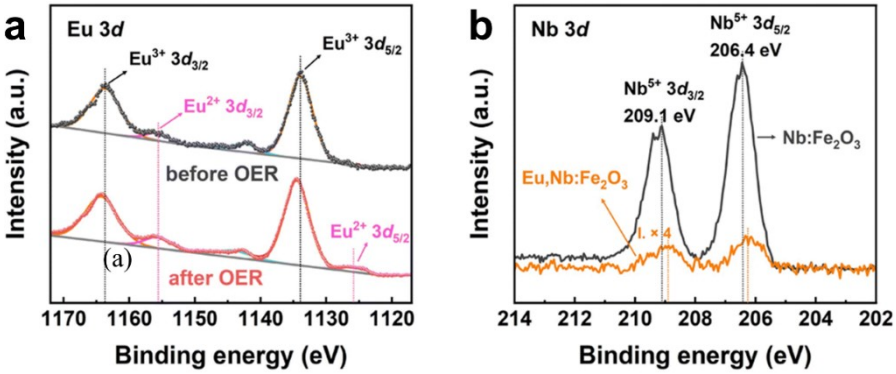
Supplementary Figures



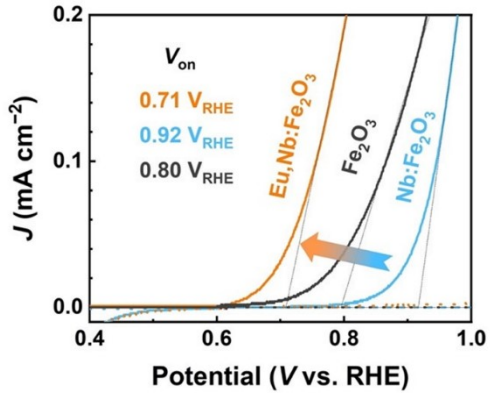
Supplementary Fig. 1 DOS of surface states in (a) bare Fe_2O_3 and (b) $CoPi/Fe_2O_3$ as a function of potential under illumination (456 nm LED: 5 mW cm^{-2}) and in the dark. Reprinted with permission from ref.23. Copyright 2023 Royal Society of Chemistry.



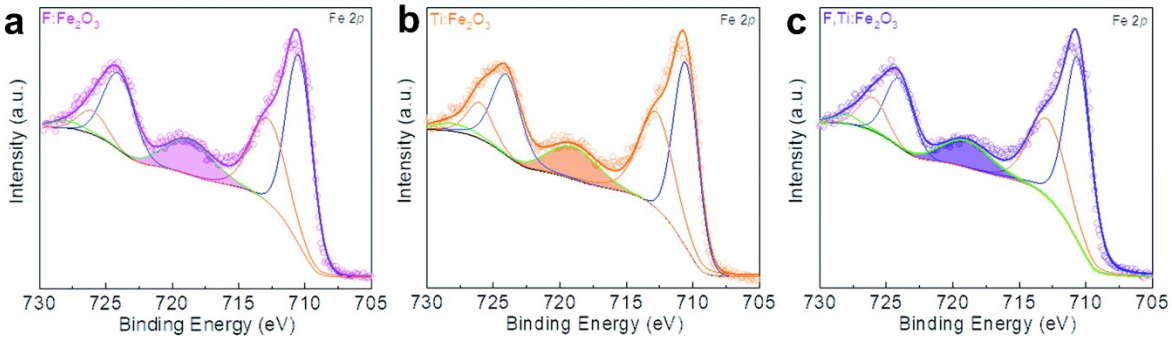
Supplementary Fig. 2 $CoPi/Fe_2O_3$ photoanodes under chopped illumination (AM 1.5 G: 100 mW cm^{-2}). Reprinted with permission from ref.23. Copyright 2023 Royal Society of Chemistry.



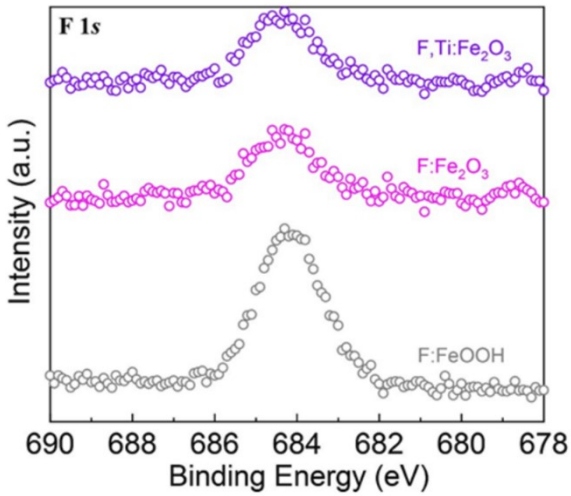
Supplementary Fig. 3 (a) Eu *3d* XPS spectra of Eu,Nb : Fe_2O_3 before and after the OER, (b) Nb *3d* XPS spectra of Nb : Fe_2O_3 and Eu,Nb : Fe_2O_3. Reprinted with permission from ref.25. Copyright 2024 Royal Society of Chemistry.



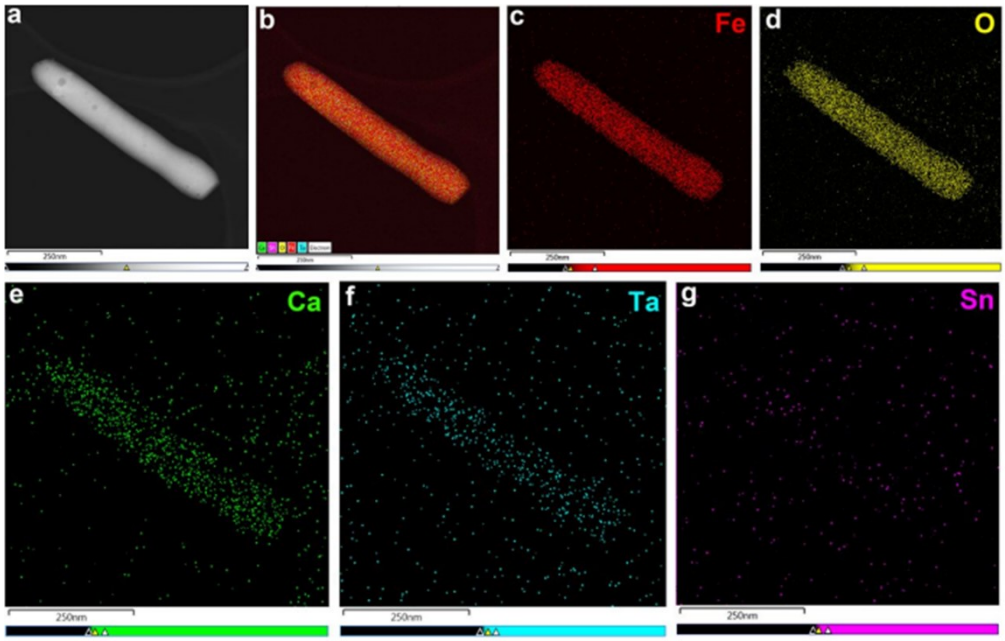
Supplementary Fig. 4 Extracted Von of Fe_2O_3, Nb : Fe_2O_3 and Eu,Nb : Fe_2O_3 Reprinted with permission from ref.25. Copyright 2024 Royal Society of Chemistry.



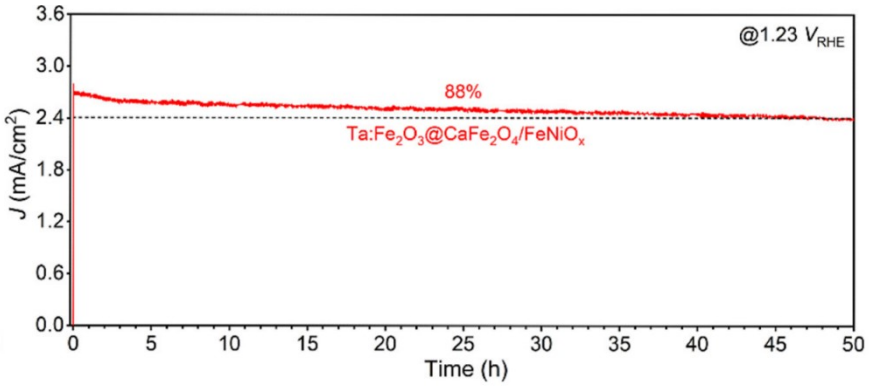
Supplementary Fig. 5 Fe *2p* XPS spectra of (a) F:Fe_2O_3, (b) Ti:Fe_2O_3, and (c) F,Ti:Fe_2O_3. The coloured peaks denote the Fe^{3+} satellite peak. Reprinted with permission from ref.26. Copyright 2022 Royal Society of Chemistry.



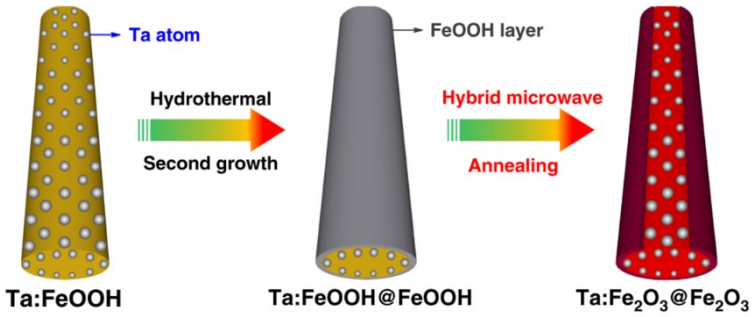
Supplementary Fig. 6 F *1s* XPS spectra of F:FeOOH, F:Fe_2O_3 and F,Ti:Fe_2O_3. Reprinted with permission from ref.26. Copyright 2022 Royal Society of Chemistry.



Supplementary Fig. 7 HAADF (a) and element mapping of Ta:Fe_2O_3@$CaFe_2O_4$ nanorod (b, all elements. c, Fe. d, O. e, Ca. f, Ta. g, Sn). Reprinted with permission from ref.27. Copyright 2023 American Chemical Society.



Supplementary Fig. 8 The long-term stability of Ta:Fe_2O_3@$CaFe_2O_4$/$FeNiO_x$ photoanode for 50 h at 1.23 V_{RHE} in comparison with Ta:Fe_2O_3 photoanode. Reprinted with permission from ref.27. Copyright 2023 American Chemical Society.



Supplementary Fig. 9 Schematic synthesis procedure of Ta:Fe_2O_3@Fe_2O_3 homojunction nanorods. Reprinted with permission from ref.28. Copyright 2020 Springer Nature.

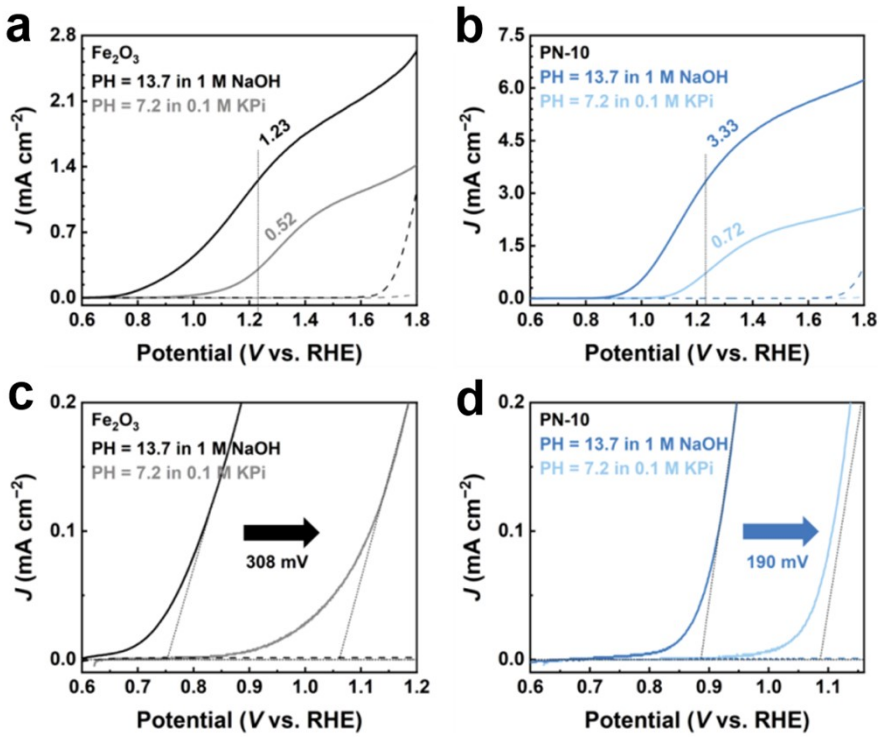


Figure S10. J–V curves of bare Fe_2O_3 (a, c) and PN-10 (b, d) in alkaline (pH 13.7) and near-neutral (pH 7.2) electrolytes. Reprinted with permission from ref.29. Copyright 2024 Springer Nature.