Supporting Information

Tunable Surface Modification of Hematite Photoanode by Co(salen)-Based Cocatalyst for Boosting Photoelectrochemical Performance

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Supplementary Figures and Tables

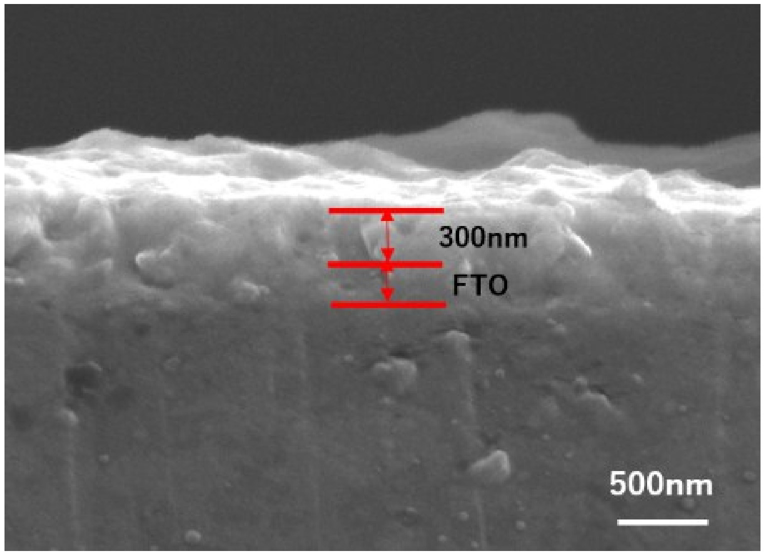

Figure S1. Cross-section FE-SEM image of α-Fe_2O_3/Co(salen)-250.

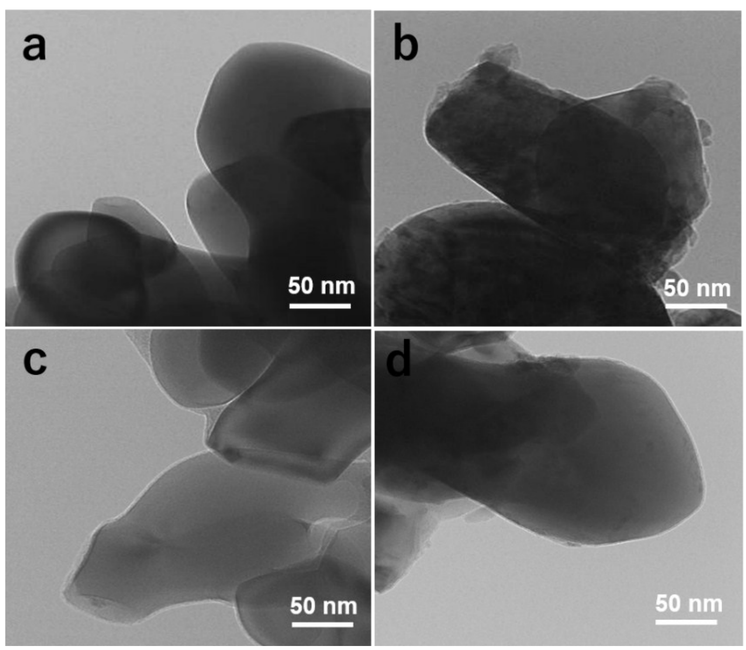

Figure S2. TEM images of (a) α-Fe_2O_3, (b) α-Fe_2O_3/Co(salen)-250, (c) α-Fe_2O_3/Co(salen)-350 and (d) α-Fe_2O_3/Co(salen)-450.

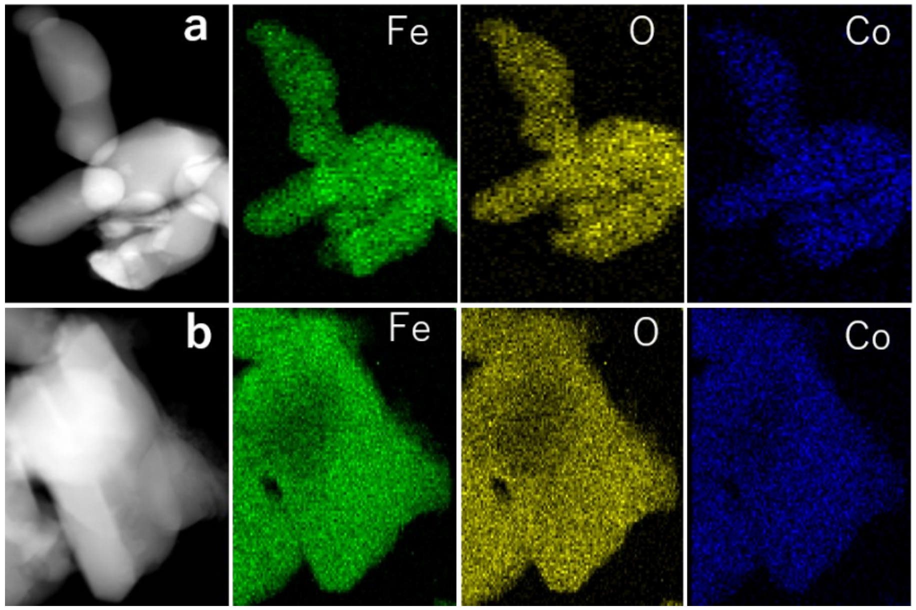

Figure S3. TEM-EDS mapping images of (a) α-Fe_2O_3/Co(salen)-250 and (b) α-Fe_2O_3/Co(salen)-350 refer to the signals of Fe, O and Co, respectively.

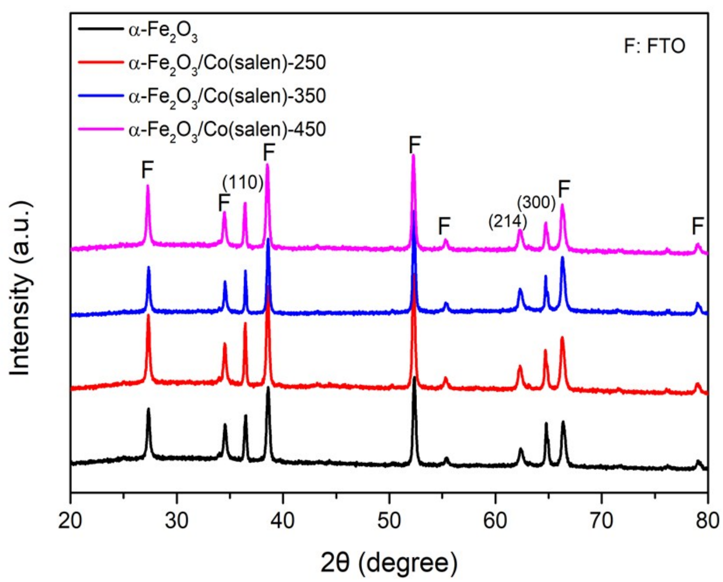

Figure S4. XRD of α-Fe_2O_3, α-Fe_2O_3/Co(salen)-250, α-Fe_2O_3/Co(salen)-350 and α-Fe_2O_3/Co(salen)-450.

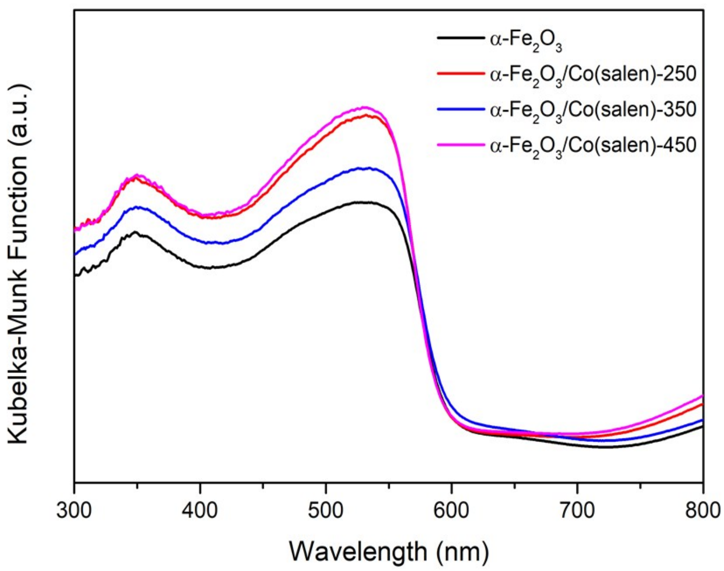

Figure S5. UV-Visible diffuse reflectance spectra of α-Fe_2O_3, α-Fe_2O_3/Co(salen)-250, α-Fe_2O_3/Co(salen)-350 and α-Fe_2O_3/Co(salen)-450.

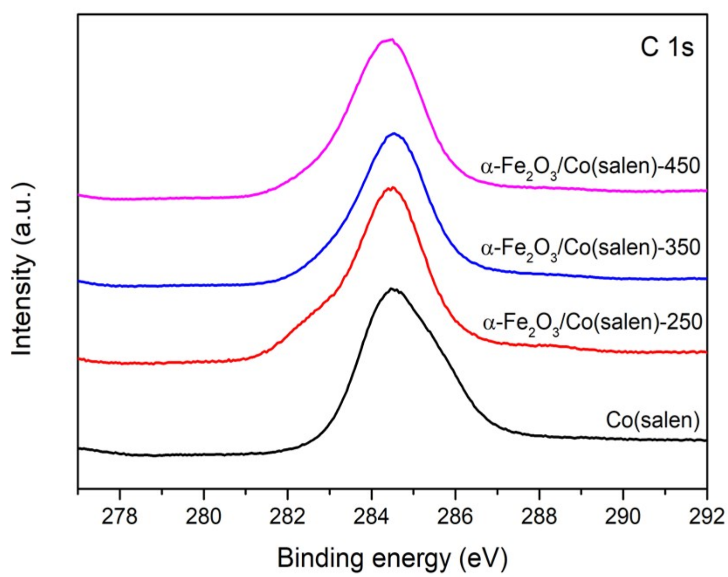

Figure S6. C 1s XPS spectra of Co(salen), α-Fe_2O_3, α-Fe_2O_3/Co(salen)-250, α-Fe_2O_3/Co(salen)-350 and α-Fe_2O_3/Co(salen)-450.

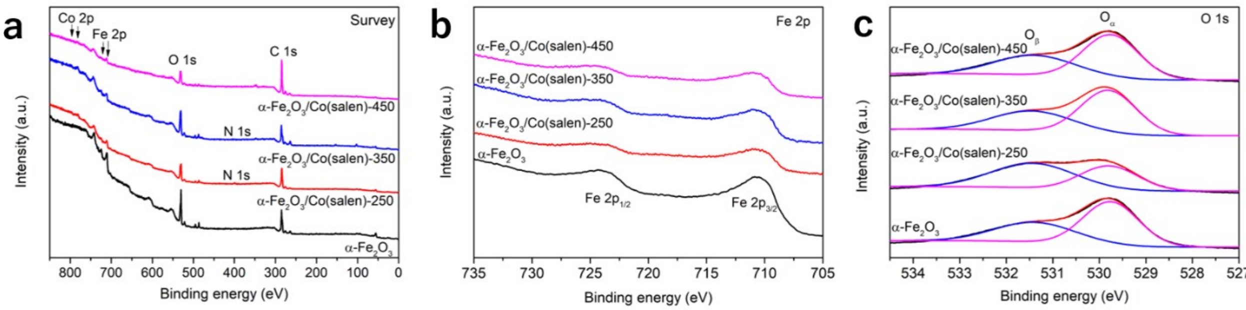

Figure S7. XPS spectra of α-Fe_2O_3, α-Fe_2O_3/Co(salen)-250, α-Fe_2O_3/Co(salen)-350 and α-Fe_2O_3/Co(salen)-450. (a) The total survey spectra, (b) Fe 2p, (c) O 1s.

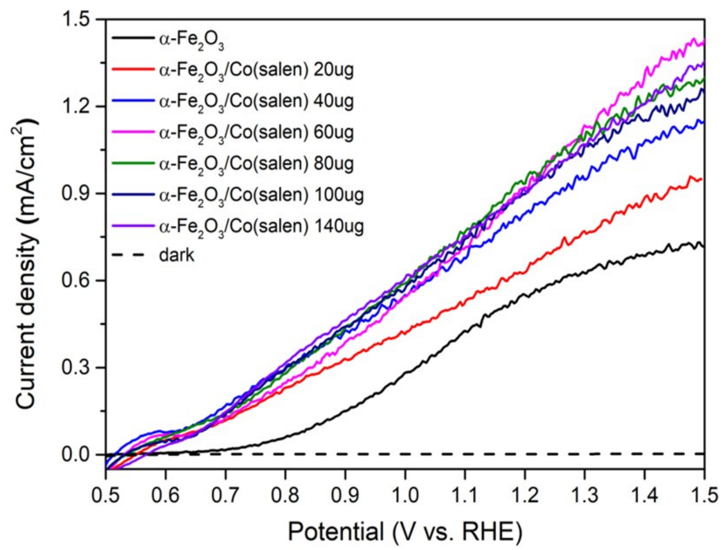

Figure S8. Photo-induced liner sweep voltammetry (LSV) curves of α-Fe_2O_3 and α-Fe_2O_3/Co(salen)-250 photoanodes with different Co(salen) contents in 1 M NaOH solution under the simulated solar light source illumination (100 mW/cm^2).

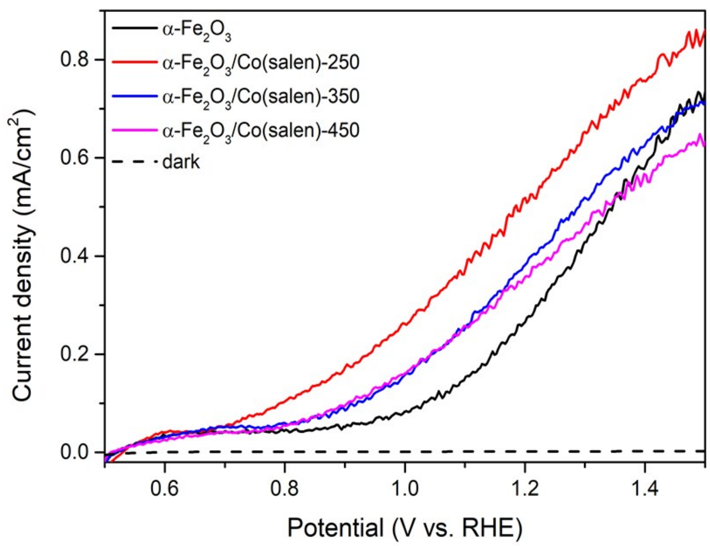

Figure S9. Photo-induced liner sweep voltammetry (LSV) curves of α-Fe_2O_3, α-Fe_2O_3/Co(salen)-250, α-Fe_2O_3/Co(salen)-350 and α-Fe_2O_3/Co(salen)-450 photoanodes in 1 M NaOH solution under the simulated solar light source illumination (100 mW/cm^2).

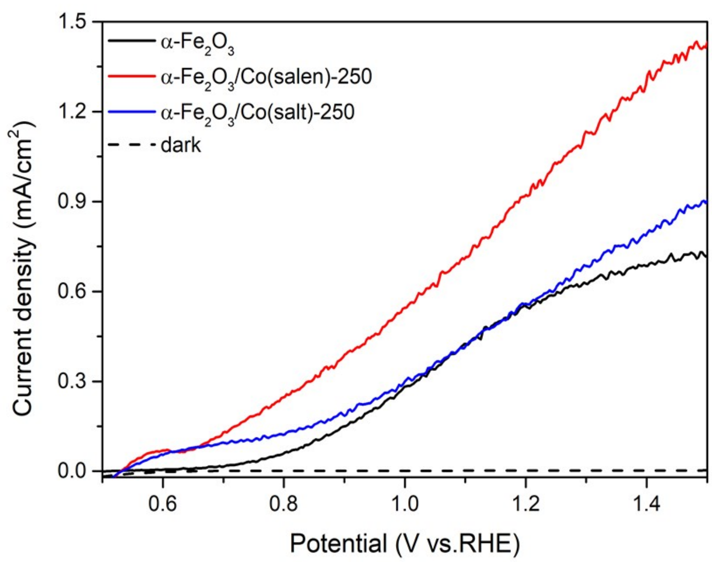

Figure S10. Photo-induced liner sweep voltammetry (LSV) curves of α-Fe_2O_3 and α-Fe_2O_3/Co(salen)-250 and α-Fe_2O_3/Co(salt)-250 photoanodes in 1 M NaOH solution under the simulated solar light source illumination (100 mW/cm^2).

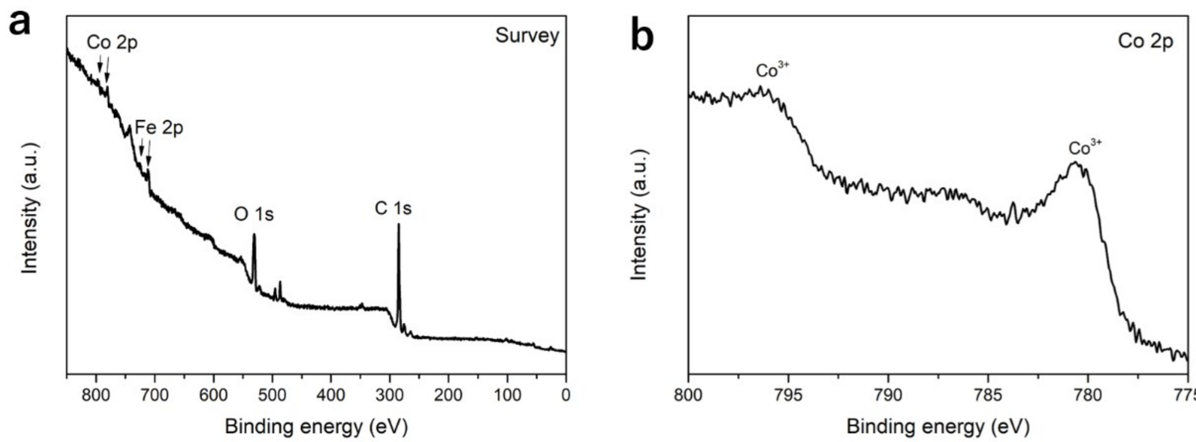

Figure S11. XPS spectra of α-Fe_2O_3/Co(salt)-250. (a) The total survey spectra, (b) Co 2p.

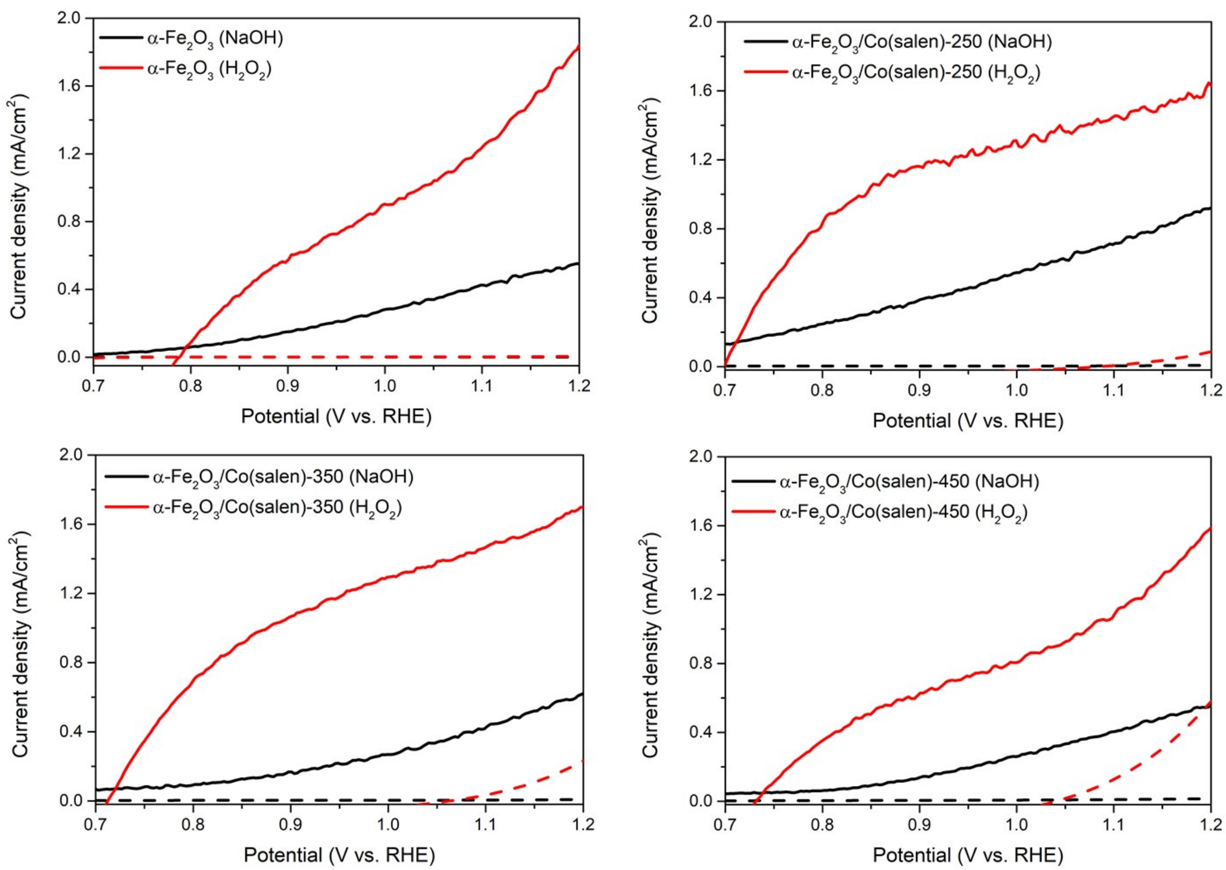

Figure S12. Photo-induced liner sweep voltammetry (LSV) curves of photoanodes in 1 M NaOH solution and 1 M NaOH with 0.5 M H_2O_2 solution under the simulated solar light source illumination (100 mW/cm^2). (a) α-Fe_2O_3, (b) α-Fe_2O_3/Co(salen)-250, (c) α-Fe_2O_3/Co(salen)-350 and (d) α-Fe_2O_3/Co(salen)-450.

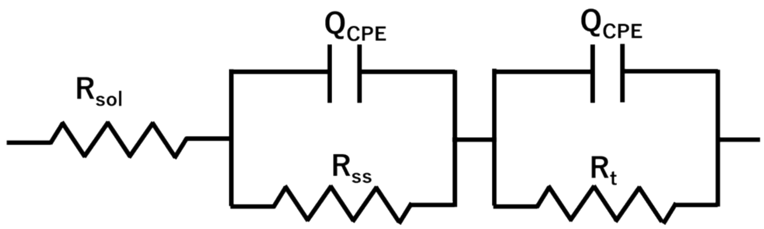

Figure S13. The equivalent circuit of EIS spectra.

Table S1. Comparison of our photoanode to other hematite photoanodes coupled Co-based cocatalysts

Catalyst	Electrolyte	J with cocatalyst a)	J without cocatalyst	Ratio	Onset potential cathodic shift b)	Ref.
Co-N-C-Fe_2O_3	1 M NaOH	0.98	0.57	1.72	180	This work
Co_3O_4-Fe_2O_3	1 M NaOH	1.2	0.72	1.67	40	1
C/Co_3O_4-Fe_2O_3	1 M NaOH	1.48	0.83	1.78	60	2
CoPi-Fe_2O_3	1 M NaOH	1.28	0.856	1.50	100	3
CoPi-Fe_2O_3	1 M NaOH	0.6	0.41	1.46	350	4
CoO_x-Fe_2O_3	1 M KOH	0.65	0.25	2.6	250	5
CoO_x(POM)-Fe_2O_3	1 M NaOH	2.4	1.2	2.0	100	6
$CoFeO_x$-Fe_2O_3	1 M NaOH	1.2	0.88	1.36	200	7

a) J (mA/cm^2) at 1.23 V vs. RHE under AM 1.5G 100 mW/cm^2; b) Onset potential cathodic shift (mV).

Table S2. Fitted parameters of the EIS of α-Fe_2O_3, α-Fe_2O_3/Co(salen)-250, α-Fe_2O_3/Co(salen)-350 and α-Fe_2O_3/Co(salen)-450 photoanodes under dark.

Sample	R_{sol} (Ω cm-^{2})	R_{ss} (Ω cm^{-2})	R_t (Ω cm^{-2})
α-Fe_2O_3	19.5	87.6 k	3.08 k
α-Fe_2O_3/Co(salen)-250	23.4	24.6 k	1.32 k
α-Fe_2O_3/Co(salen)-350	20.3	13.5 k	1.25 k
α-Fe_2O_3/Co(salen)-450	18.2	13.6 k	2.16 k

Table S3. Fitted parameters of the EIS of α-Fe_2O_3, α-Fe_2O_3/Co(salen)-250, α-Fe_2O_3/Co(salen)-350 and α-Fe_2O_3/Co(salen)-450 photoanodes under irradiation.

Sample	R_{sol} (Ω cm^{-2})	R_{ss} (Ω cm^{-2})	R_t (Ω cm^{-2})
α-Fe_2O_3	18.9	16.6 k	57.0
α-Fe_2O_3/Co(salen)-250	20.0	317	95.3
α-Fe_2O_3/Co(salen)-350	22.3	449	67.5
α-Fe_2O_3/Co(salen)-450	19.4	445	70.5

Supplementary References

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