Electronic Supporting Information (ESI)

The Performance of α-Fe_2O_3 Photoanode-based Photofuel Cell Enhanced by Transition Metals (Ni, Fe, and Cu) Hydroxides

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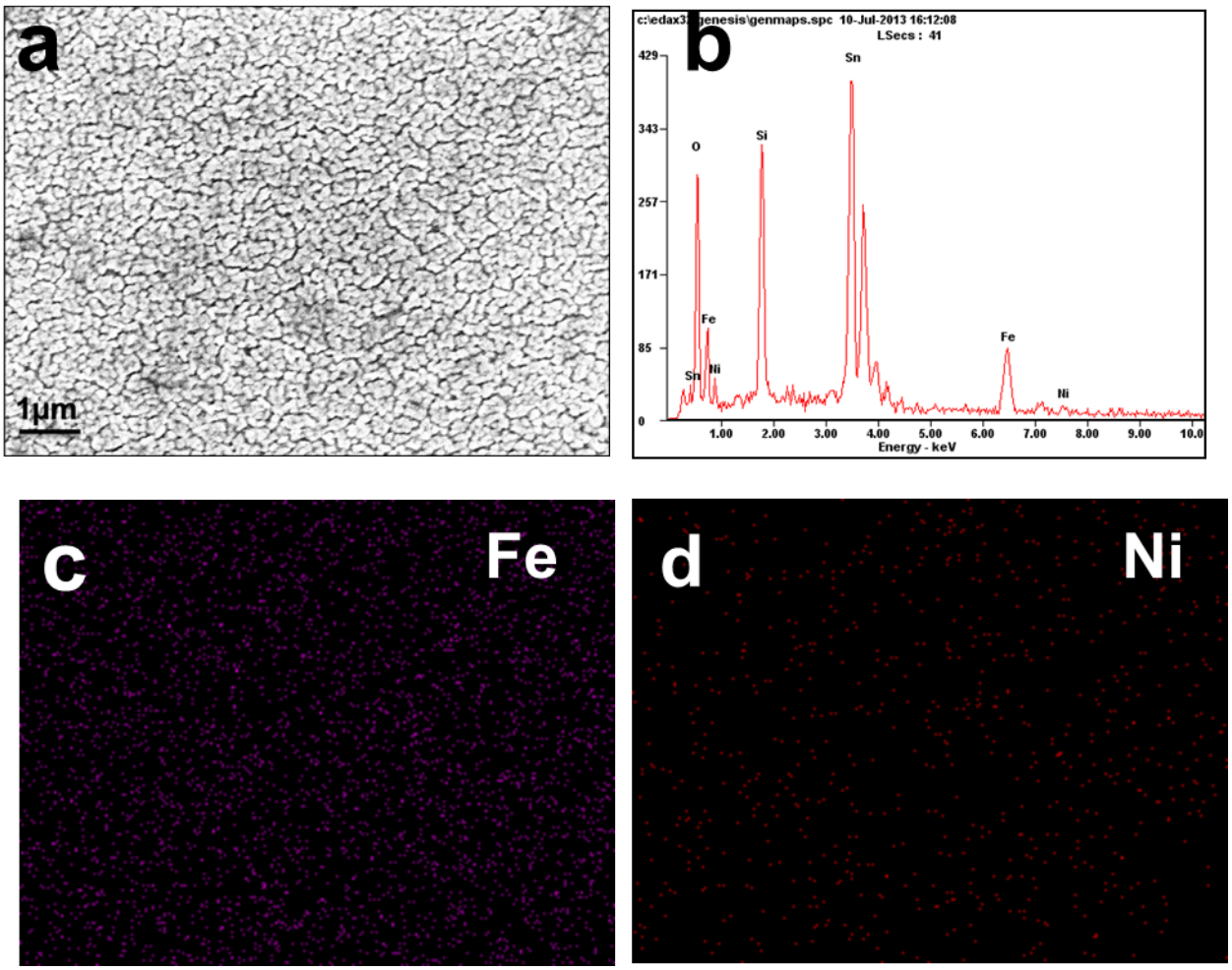

Fig. S1 (a) SEM image of $Ni(OH)_2/Fe_2O_3$ on a FTO glass substrate. (b) EDS spectrum collected for the $Ni(OH)_2$ modified hematite film. Elemental mapping of (c) Fe and (d) Ni.

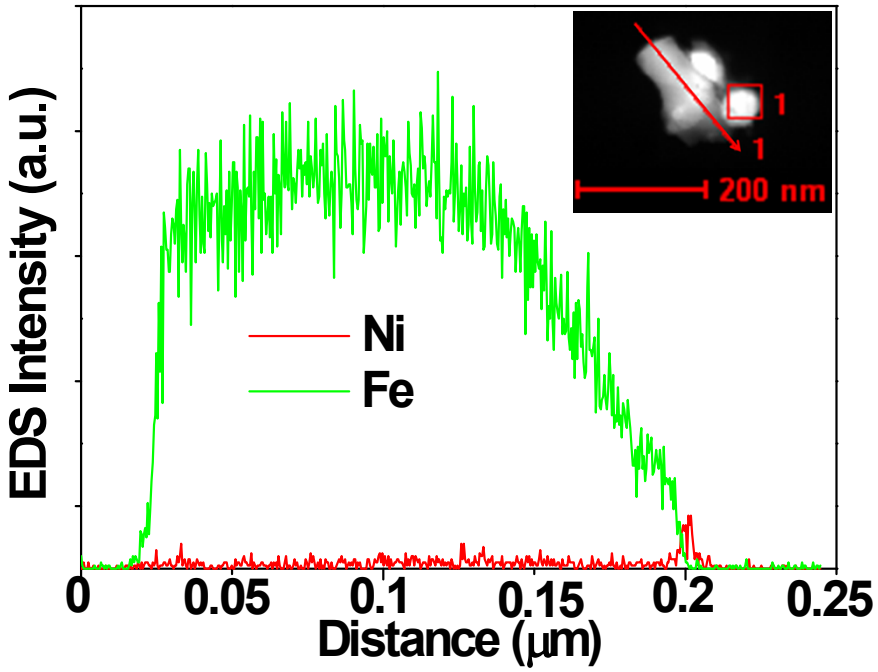

Fig. S2 EDS linescan profile of Fe (green line) and Ni (red line) acquired across the Fe_2O_3 nanorod. Position and the scan direction are depicted by the red arrow in the dark-field STEM image.

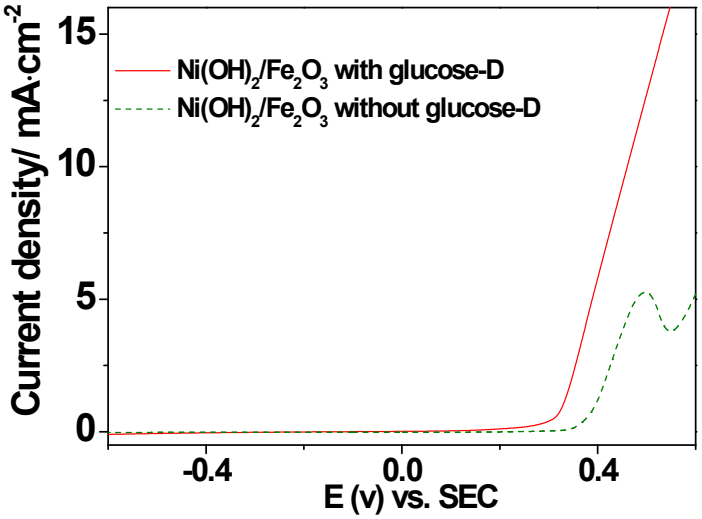

Fig. S3 LSV curves collected for $Ni(OH)_2/Fe_2O_3$ photoanode at a scan rate of 50 mV s^{-1} in a 1 M KOH aqueous solution with glucose (solid line) and without glucose(dashed line).

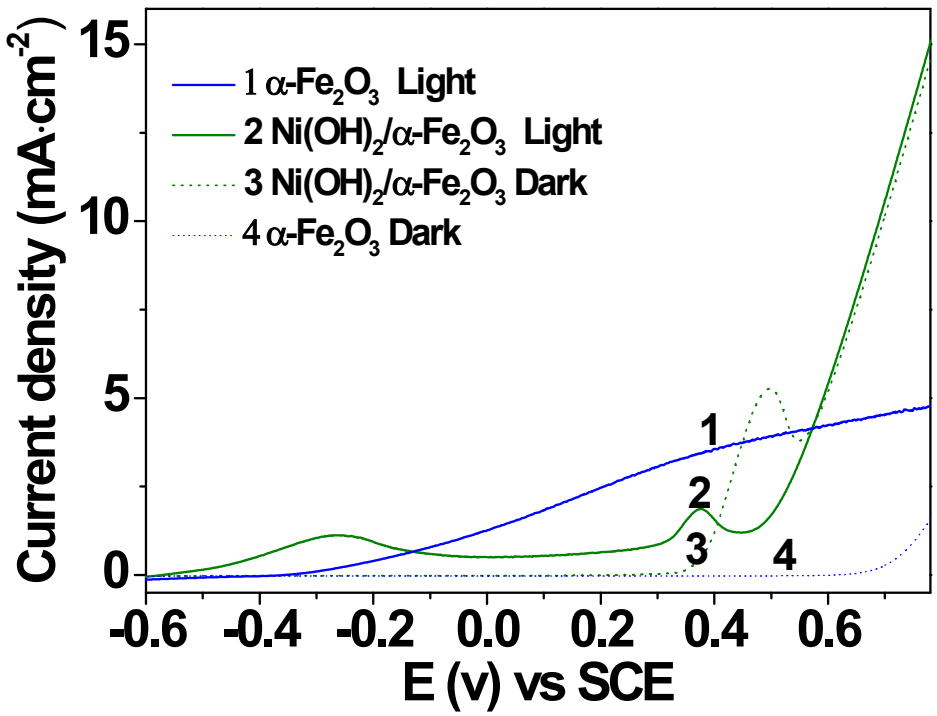

Fig. S4 LSV curves of α-Fe_2O_3 and $Ni(OH)_2/\alpha$-Fe_2O_3 photoanodes in a 1 mol L^{-1} KOH solution; Light source: 300 W Xe lamp; Scanning rate: 20 mV s^{-1}.

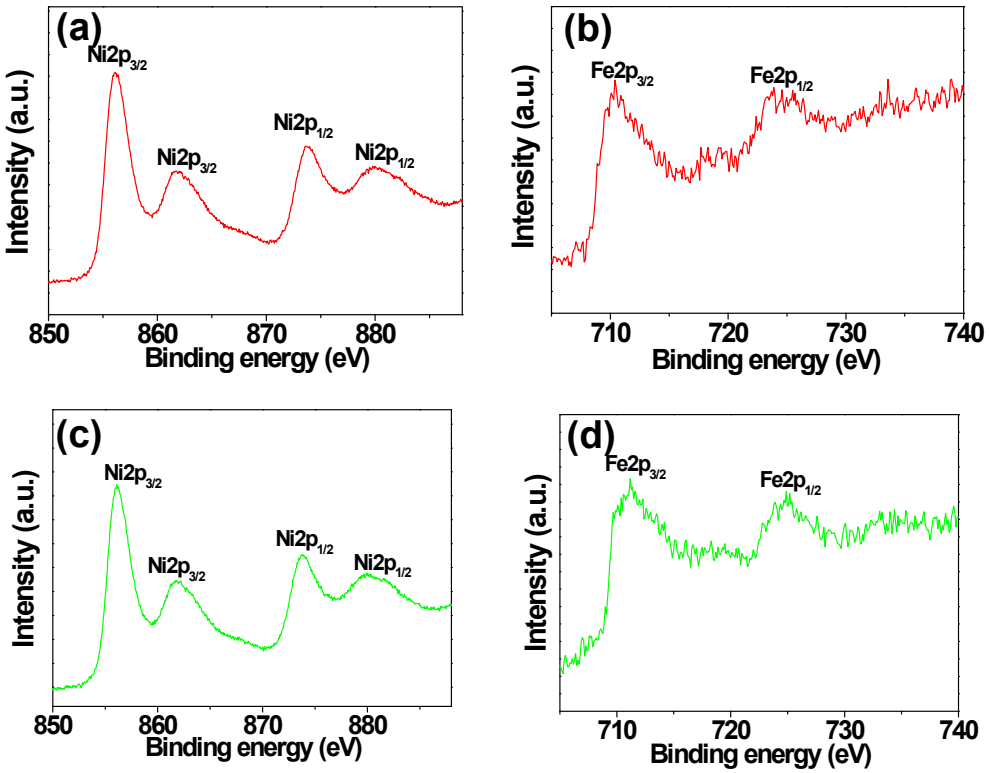

Fig. S5 XPS spectra **(a)** and **(b)** fresh $Ni(OH)_2/\alpha$-Fe_2O_3 photoanode; (c) and (d) $Ni(OH)_2/\alpha$-Fe_2O_3 after 4 h of amperometric I–t test.

The XPS (X-ray Photoelectron Spectroscopy) results of $Ni(OH)_2/\alpha$-Fe_2O_3 electrode show weak peaks of Fe $2p_{3/2}$ (710.8 eV) and $2p_{1/2}$ (724.6 eV) (Fig. S3A, ESI†), which are in good agreement with documented values of Fe^{3+} species. Fig. S3B shows that a binding energy of 856.0 eV and 873.6 eV with intense satellite signals are assigned to Ni $2p_{3/2}$ and $2p_{1/2}$ in $Ni(OH)_2$, respectively.

Table S1 The intermediates from glucose in the I-t test with $Ni(OH)_2/\alpha$-Fe_2O_3 photoanode.

Consumed of Glucose (mmol L^{-1})	The products (mmol L^{-1})						C-balance (%)
	Arabi-nose (C5)	Eryth-rose (C4)	Glycer-aldehyde (C3)	Glycol-aldehyde (C2)	glycollic acid (C2)	Formic acid (C1)	
18.9	6.07	0.61	1.72	1.76	11.9	15.4	71.1

Reaction condition: $Ni(OH)_2/\alpha$-Fe_2O_3 photoanode at 0 V *vs.* SCE in a 1 mol L^{-1} KOH aqueous solution with 0.025 mol L^{-1} glucose. Light source: 300 W Xe lamp. Reaction time, 6 h. The area of Fe_2O_3 film is 1.58 cm^2.

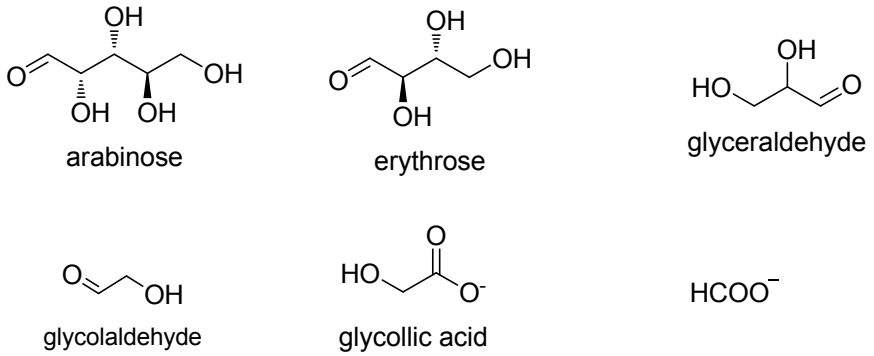

Fig. S6 The molecular structures of the intermediates from glucose.