Electronic Supplementary Information

Chromium-substituted hematite powder as a catalytic material for photochemical and electrochemical water oxidation

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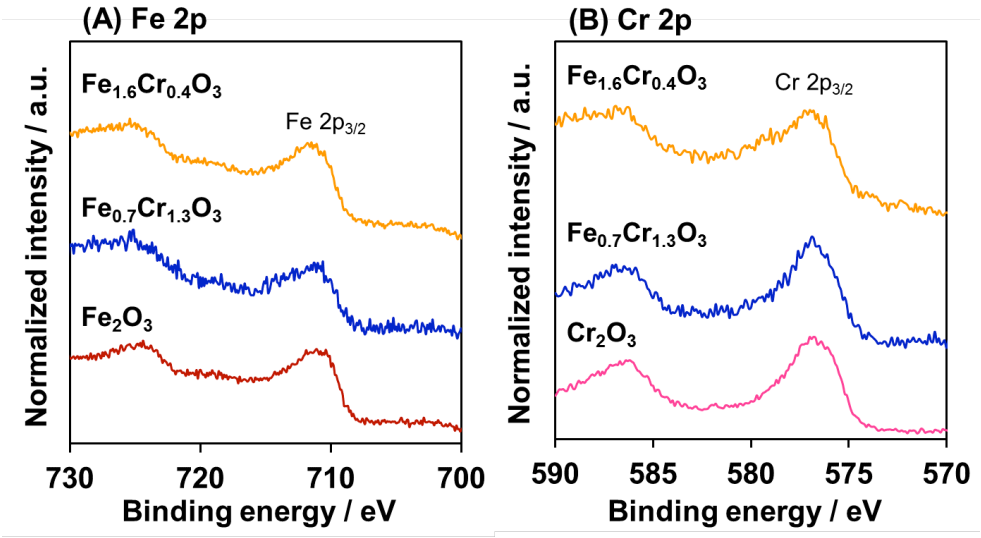

Fig. S1 XPS spectra of (A) Fe 2p and (B) Cr 2p in Fe_2O_3, $Fe_{1.6}Cr_{0.4}O_3$, $Fe_{0.7}Cr_{1.3}O_3$ and Cr_2O_3.

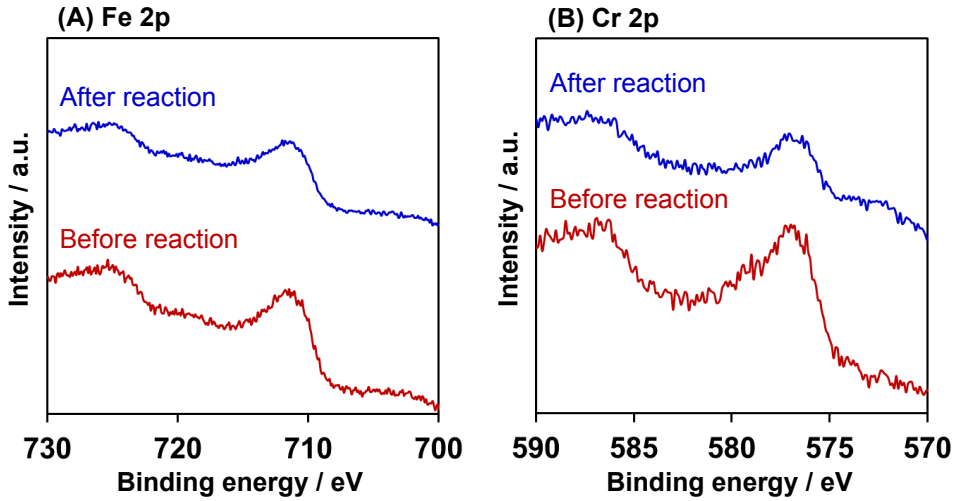

Fig. S2 XPS spectra of (A) Fe 2p and (B) Cr 2p in $Fe_{1.6}Cr_{0.4}O_3$ before and after photochemical water oxidation.

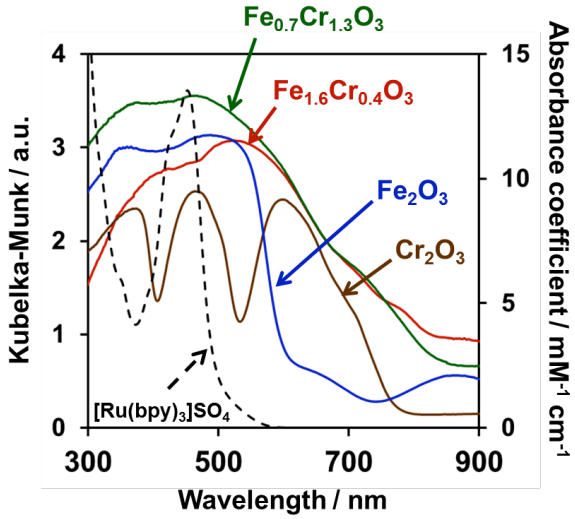

Fig. S3 UV-visible diffuse reflectance spectra and absorbance spectrum of $Fe_{2-x}Cr_xO_3$ and $[Ru(bpy)_3]SO_4$ (in aqueous phosphate solution, 100 mM, pH 7.5).

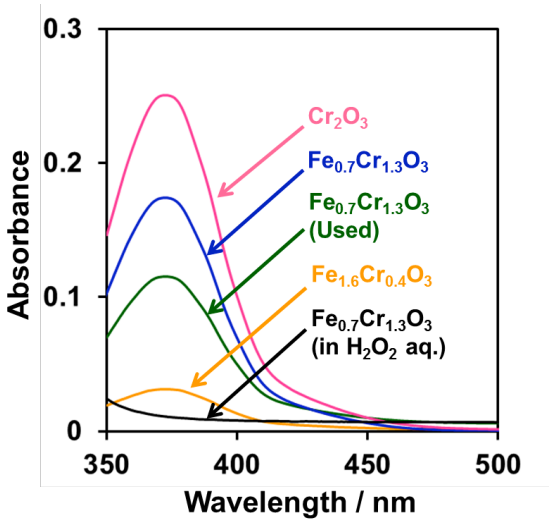

Fig. S4 UV-vis absorbance spectra of the reactant solution after 50 min at +1.80 V (vs. RHE) electrolysis using $Fe_{2-x}Cr_xO_3$/FTO. Reaction condition is the same as Fig. 4. Black line is under similar condition but with 3–3.5 wt% H_2O_2 as a reductant.

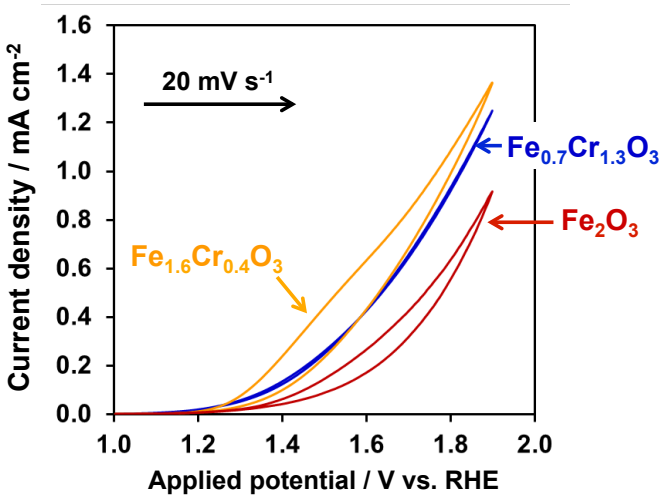

Fig. S5 Current-voltage curves for $Fe_{2-x}Cr_xO_3$ electrodes in a phosphate buffer solution. Scan rate, 20 mV s^{-1}; Solution, phosphate aqueous solution (100 mM pH 7.5) containing 3–3.5 wt% of H_2O_2.

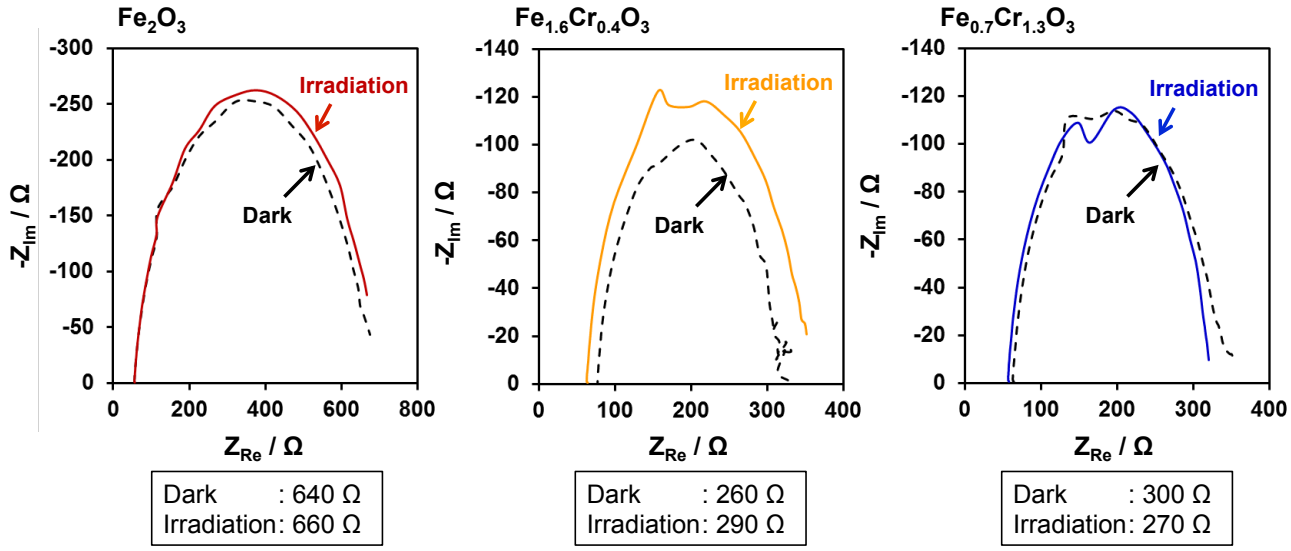

Fig. S6 Impedance spectra of $Fe_{2-x}Cr_xO_3$ electrodes in a phosphate buffer solution recorded at +1.40 V in dark or under visible light irradiation ($480 < \lambda < 500$ nm). Solution, phosphate aqueous solution (100 mM pH 7.5) containing 3–3.5 wt% of H_2O_2. Charge transfer resistance values after curve fitting are also shown.

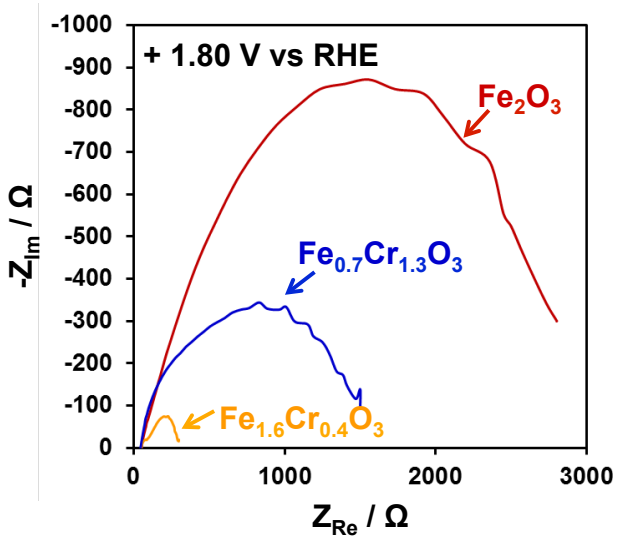

Fig. S7 Impedance spectra of $Fe_{2-x}Cr_xO_3$ electrodes in a phosphate buffer solution recorded at +1.80 V. Solution, phosphate aqueous solution (100 mM pH 7.5) without H_2O_2.