

Supplementary Materials for Reverse Water-Gas Shift Iron Catalyst
Derived from Magnetite

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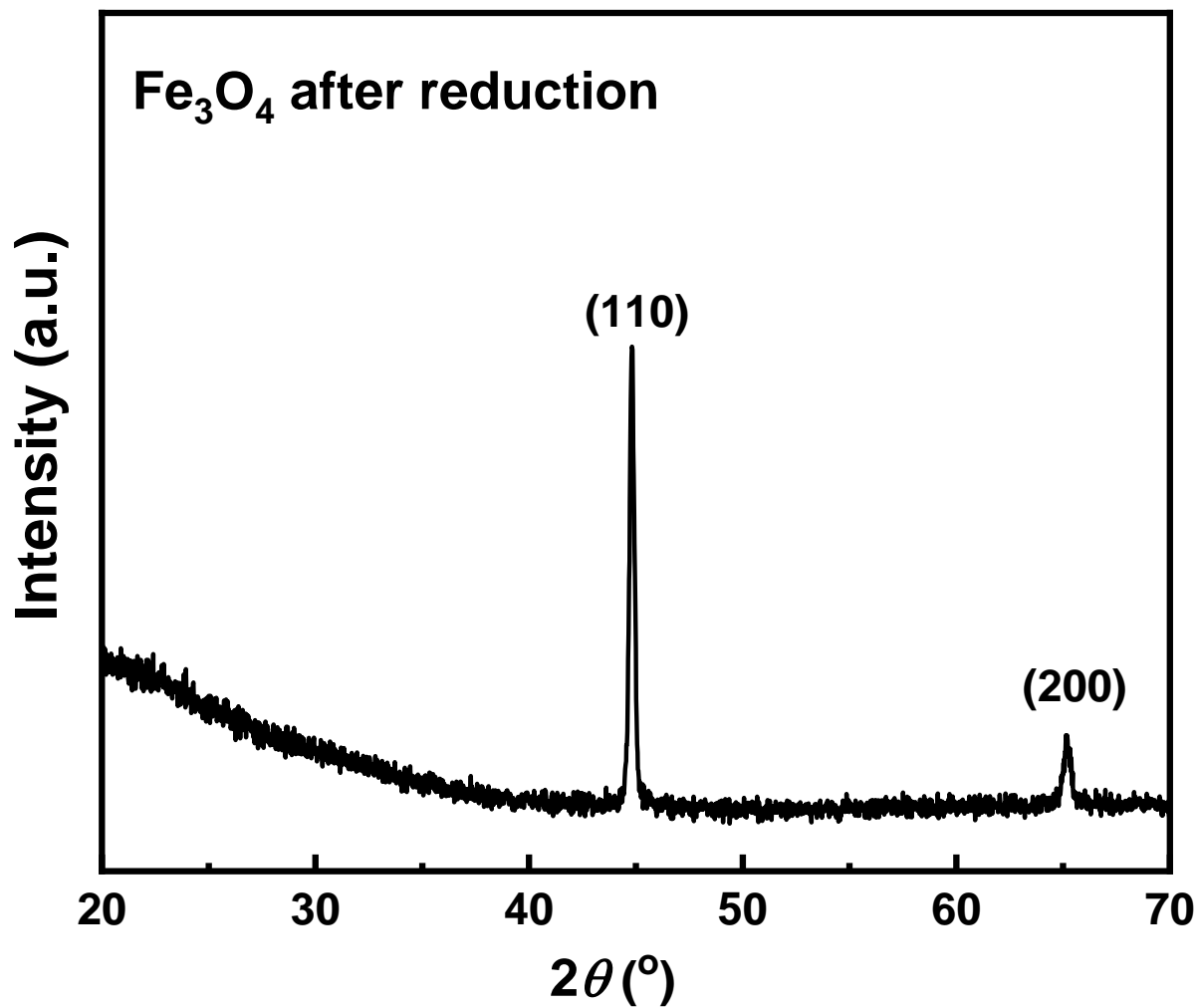


Figure S1. XRD pattern of Fe_3O_4 after the reduction in H_2 .

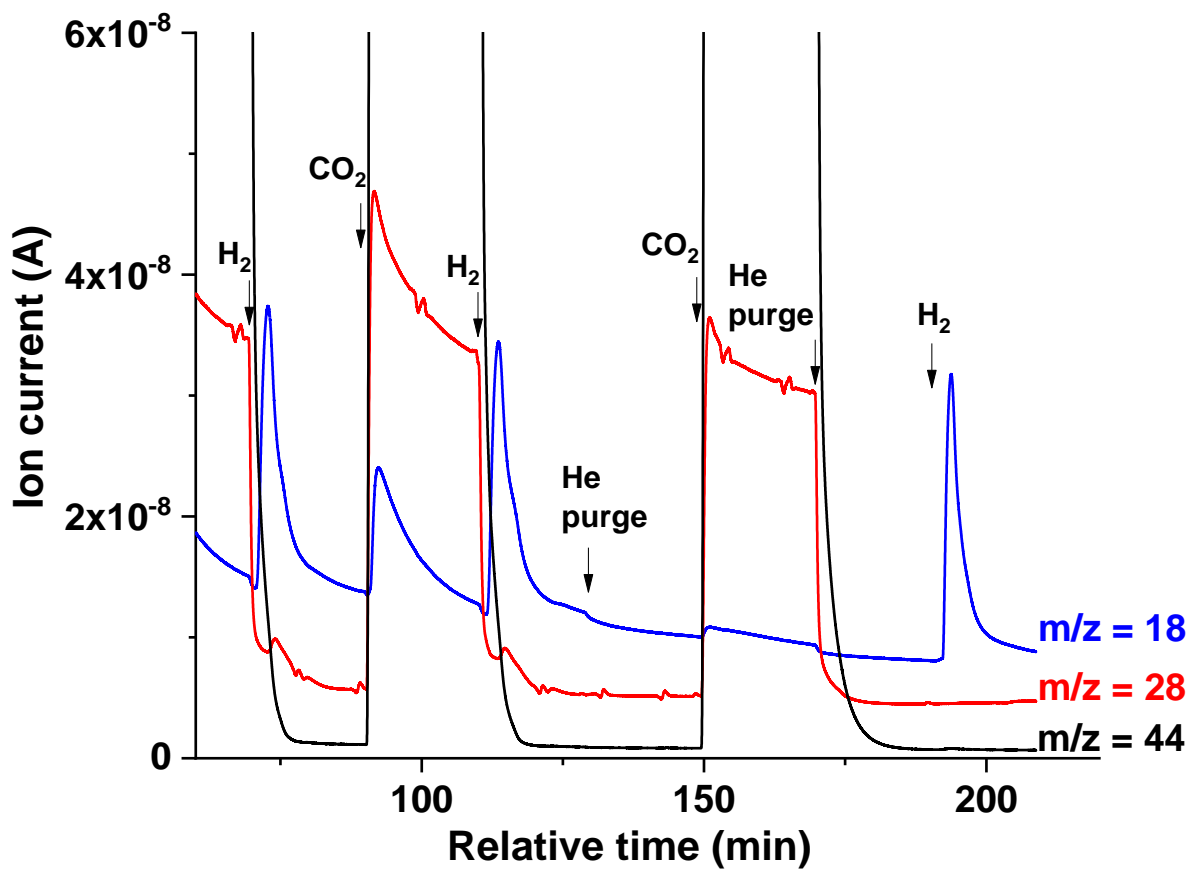


Figure S2. Ion current at $m/z = 18$ (H_2O), 28 (CO), and 44 (CO_2) during H_2/CO_2 switching experiments on Fe_3O_4 . Arrows with a label indicate a change in gas composition to the indicated gas. Reaction conditions: $T = 773$ K, $F_{\text{He}} = 36$ sccm, F_{H_2} or $F_{\text{CO}_2} = 4$ sccm. The figure is a modification of Figure 6.

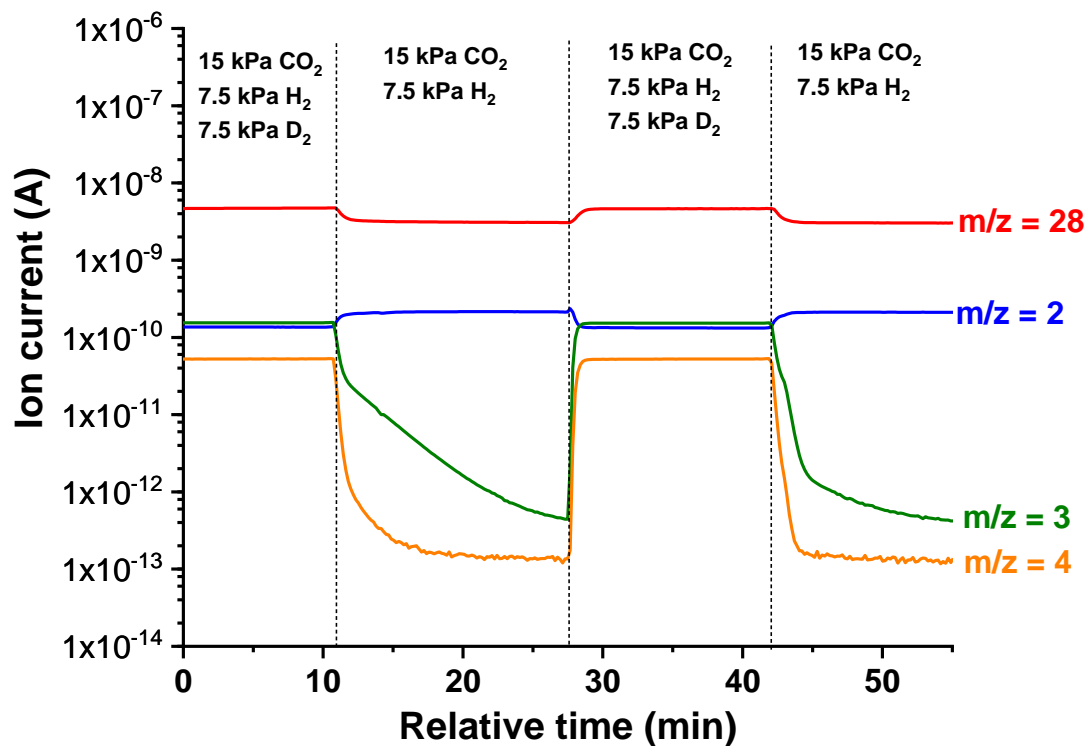


Figure S3. Ion current at $m/z = 2$ (H_2), 3 (HD), 4 (D_2), and 28 (CO) during flow of 7.5 kPa $\text{H}_2 + 7.5$ kPa $\text{D}_2 + 15$ kPa CO_2 and 7.5 kPa $\text{H}_2 + 15$ kPa CO_2 on Fe_3O_4 . Reaction conditions: $T = 753$ K, $F_{\text{tot}} = 75$ sccm.

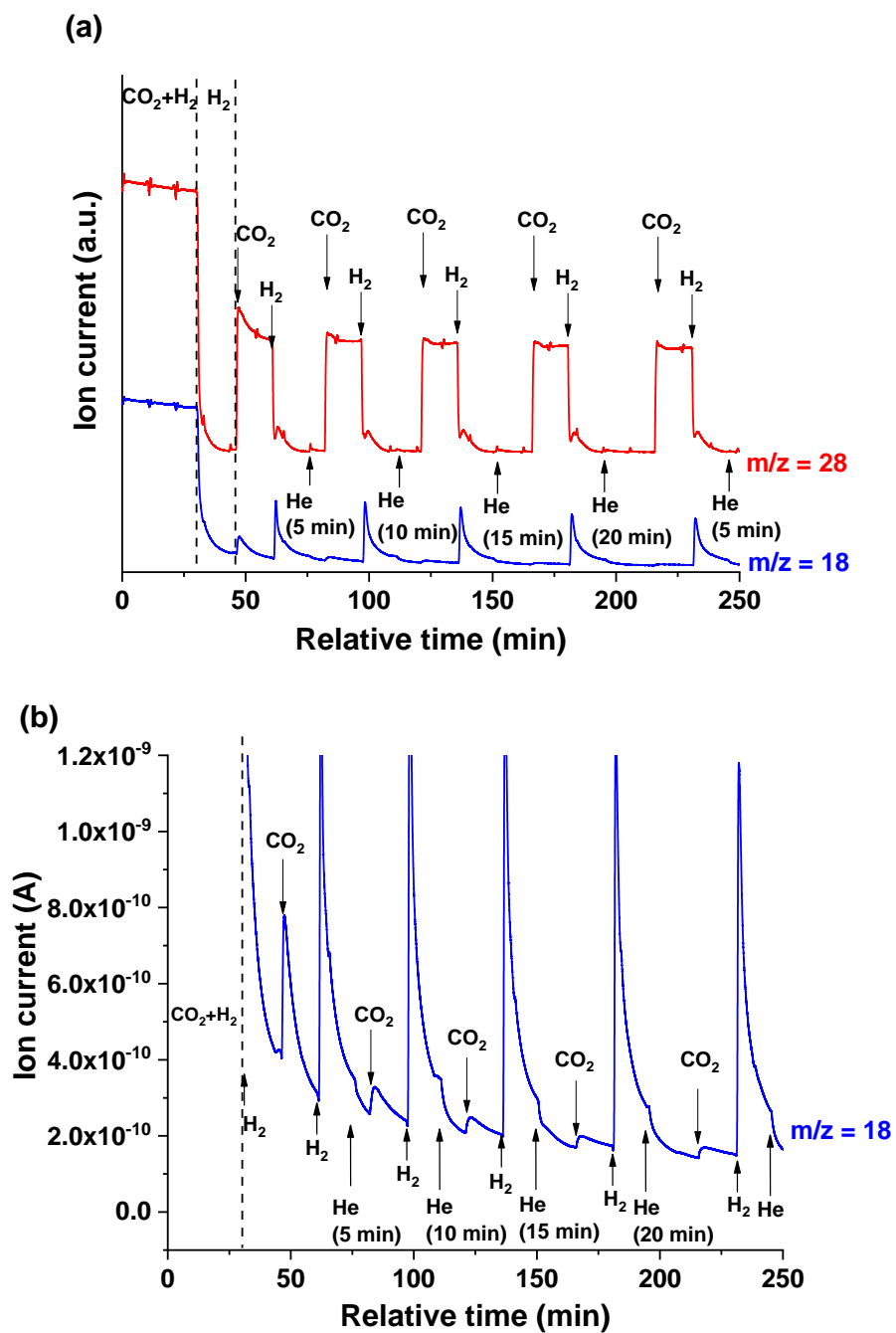


Figure S4. (a) Ion current at $m/z = 28$ (CO) and $m/z = 18$ (H_2O) during H_2/CO_2 switching experiments on Fe_3O_4 . Arrows with a label indicate a change in gas composition to the indicated gas. The catalysts were in flowing H_2 for 2 h followed by the reaction in CO_2+H_2 for 2 h before the first admission of H_2 (relative time: 31 min) and CO_2 (relative time: 46 min). Reaction conditions: $T = 753$ K, $F_{\text{tot}} = 75$ sccm, P_{H_2} or $P_{\text{CO}_2} = 15$ kPa. (b) is the modification of (a).

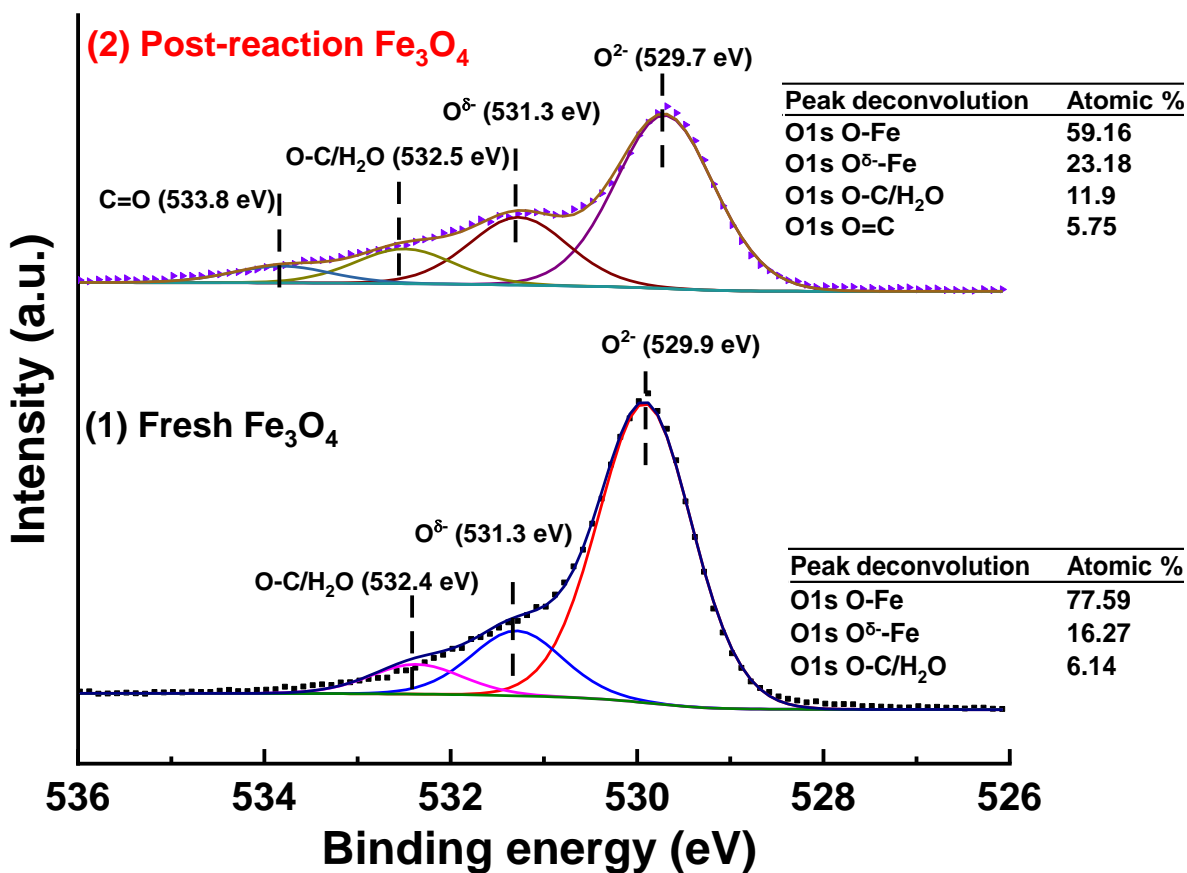


Figure S5. XPS O1s spectra of Fe₃O₄ and post-reaction Fe₃O₄. The curves under the fitted envelope and above the background are contributions of estimated components from peak fitting. The peak deconvolution and their atomic % are listed on the right of the spectra for each sample.

Table S1. Fitted initial slopes and area of H₂O in H₂/CO₂ switching experiment with different He purging time in Figure S4.

Period	Magnitude of H₂O Initial Slope (10⁻¹¹ A min⁻¹)	H₂O Area (10⁻⁹ A min)
1st CO ₂	6.46	1.71
2nd CO ₂ (after 5 min purge)	0.70	0.47
3rd CO ₂ (after 10 min purge)	0.38	0.33
4th CO ₂ (after 15 min purge)	0.19	0.29
5th CO ₂ (after 20 min purge)	0.11	0.22