

*Hosokawa et al.*

Promoter Effect of Pd Species toward Mn Oxide Catalyst on  
Rare-Earth-Iron Mixed Oxide

## Supporting Information

# Promoter Effect of Pd Species toward Mn Oxide Catalyst on Rare-Earth–Iron Mixed Oxide

Saburo Hosokawa,<sup>ab\*</sup> Ryohei Tada,<sup>b</sup> Takuya Shibano,<sup>b</sup> Shogo Matsumoto,<sup>b</sup> Kentaro

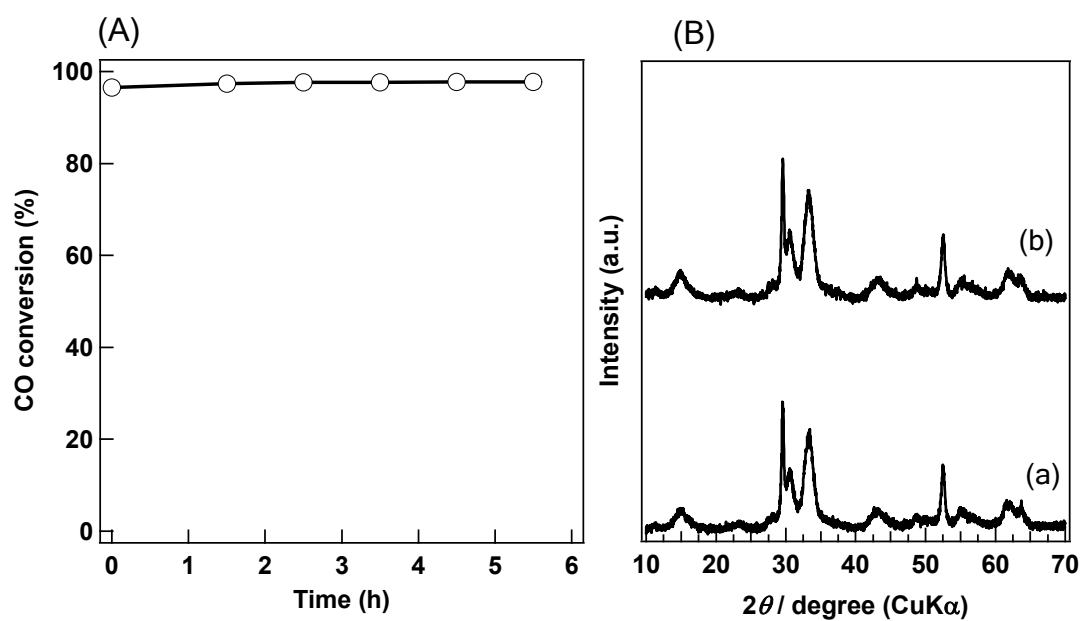
Teramura<sup>ab</sup> and Tsunehiro Tanaka<sup>ab\*</sup>

<sup>a</sup> Elements Strategy Initiative for Catalysts & Batteries (ESICB), Kyoto University, 1-30

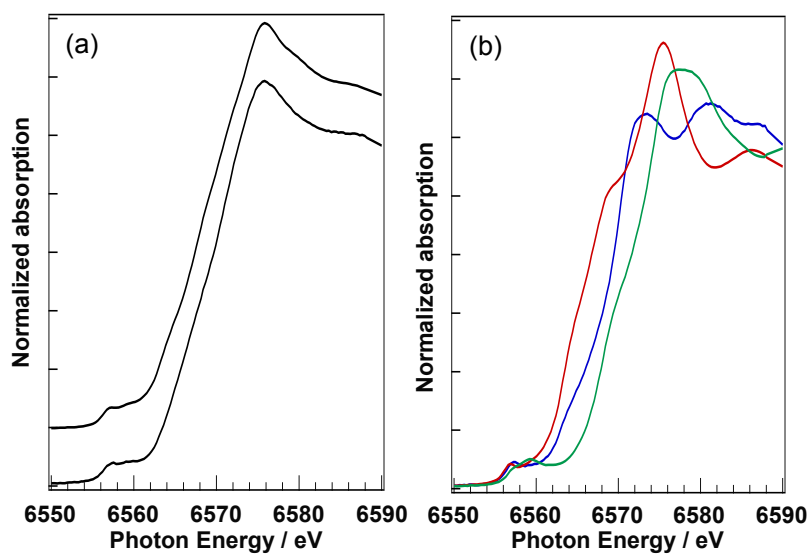
Goryo-Ohara, Nishikyo-ku, Kyoto 615-8245, Japan

<sup>b</sup> Department of Molecular Engineering, Graduate School of Engineering, Kyoto

University, Kyotodaigaku Katsura, Nishikyo-ku, Kyoto 615-8510, Japan

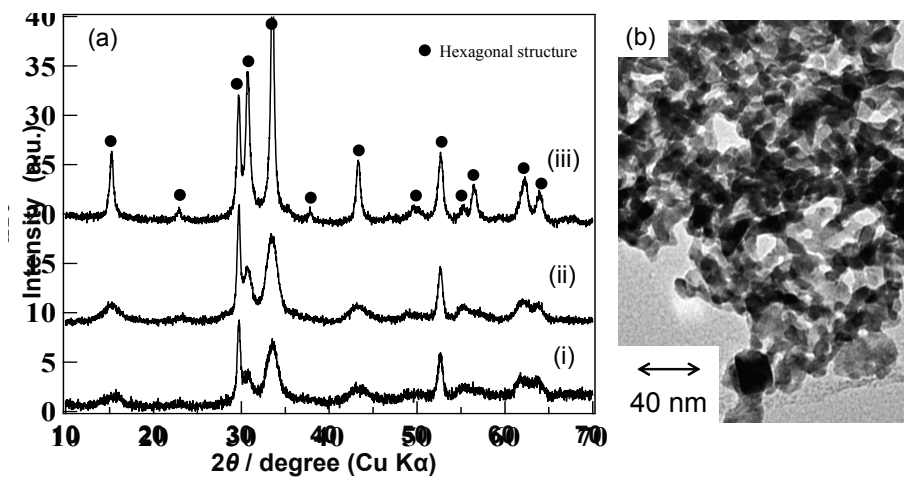
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**Fig. S1** (A) Durability test at 200 °C for CO oxidation over 1.0 wt% Pd/Mn-*h*-YbFeO<sub>3</sub>(ST). (B) XRD patterns of 1.0 wt% Pd/Mn-*h*-YbFeO<sub>3</sub>(ST) before CO oxidation (a) and after durability test (b). No change was observed in the XRD patterns of catalysts before and after CO oxidation.

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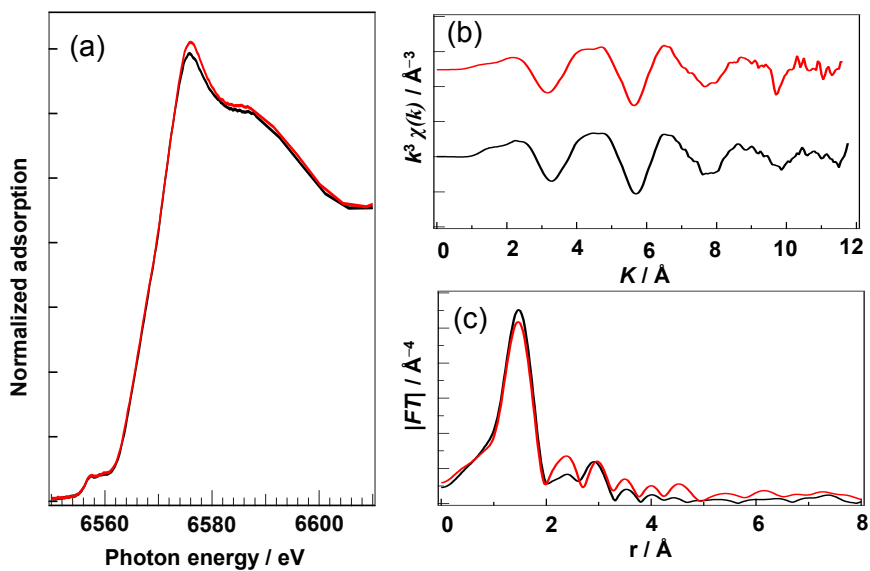
**Fig. S2** Linear curve fitting of Mn K-edge XANES spectra of Mn-*h*-YbFeO<sub>3</sub>(ST).

(a) Solid line shows the experimental data. Broken line represents the fitting data obtained by using XANES spectra of MnO<sub>2</sub>, Mn<sub>3</sub>O<sub>4</sub> and Mn-*h*-YbFeO<sub>3</sub>(PC) in a molar ratio of 32%, 39% and 29%. (b) Mn K-edge XANES spectra of standard samples are shown. Green line, red line and blue line are MnO<sub>2</sub>, Mn<sub>3</sub>O<sub>4</sub> and Mn-*h*-YbFeO<sub>3</sub>(PC), respectively.

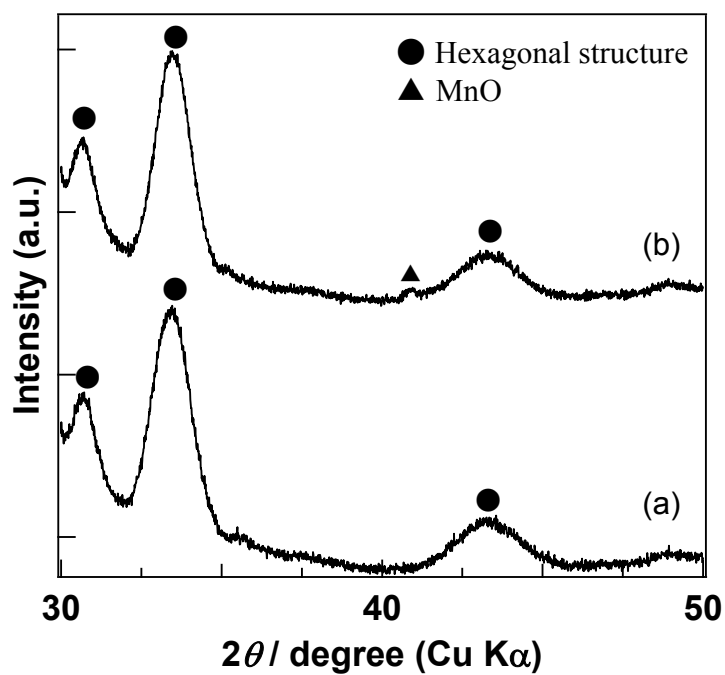
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**Fig. S3** XRD pattern and TEM image of Mn-*h*-YbFeO<sub>3</sub> sample.

(a) XRD patterns of various catalysts. (i) Mn-*h*-YbFeO<sub>3</sub>(ST), (ii) 1.0 wt% Pd/Mn-*h*-YbFeO<sub>3</sub>(ST), (iii) Mn-*h*-YbFeO<sub>3</sub>(PC). (b) TEM image of Mn-*h*-YbFeO<sub>3</sub>(PC).

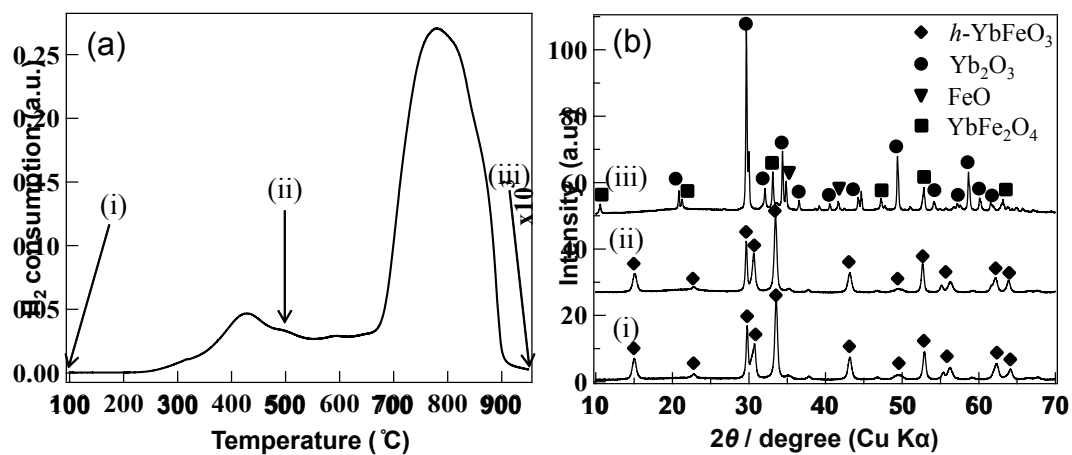
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**Fig. S4** Mn K-edge XAFS spectra of Mn-*h*-YbFeO<sub>3</sub>(ST) and 1.0 wt% Pd/Mn-*h*-YbFeO<sub>3</sub>(ST). (a) XANES spectra, (b) EXAFS oscillations and (c) Fourier transform spectra of EXAFS of Mn-*h*-YbFeO<sub>3</sub>(ST) (black) and 1.0 wt% Pd/Mn-*h*-YbFeO<sub>3</sub>(ST) (red).

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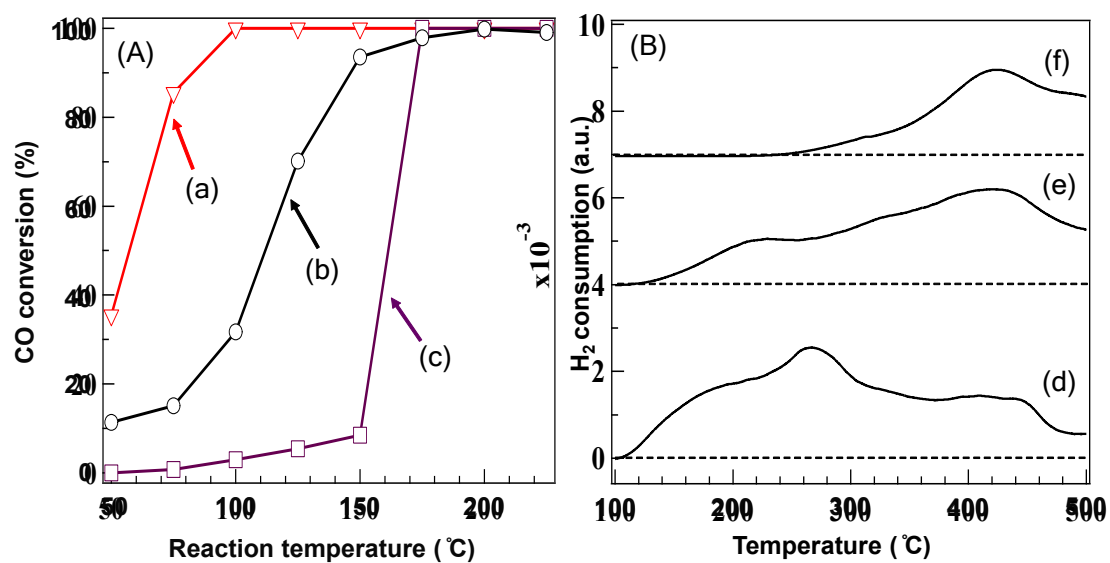
**Fig. S5** XRD patterns of the  $\text{Mn-}h\text{-YbFeO}_3(\text{ST})$ . (a) shows the sample before reduction, and (b) the sample reduced at  $500^\circ\text{C}$ .

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**Fig. S6** H<sub>2</sub>-TPR profile and XRD patterns of the reduced *h*-YbFeO<sub>3</sub>(ST). **(a)** H<sub>2</sub>-TPR profile of *h*-YbFeO<sub>3</sub>(ST) without Mn-modification. **(b)** XRD patterns of *h*-YbFeO<sub>3</sub>(ST). **(i)** shows the sample before reduction, **(ii)** the sample reduced at 500 °C, and **(iii)** the sample reduced at 950 °C.

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**Fig. S7** (A) CO oxidation over 1 wt % Pd/Mn-*h*-YbFeO<sub>3</sub> catalysts. (a) Pd catalyst supported on Mn-*h*-YbFeO<sub>3</sub>(ST) obtained by calcination temperature at 500 °C, (b) Pd catalyst supported on Mn-*h*-YbFeO<sub>3</sub>(ST) obtained by calcination temperature at 800 °C, and (c) 1 wt % Pd/Mn-*h*-YbFeO<sub>3</sub>(PC). (B) H<sub>2</sub>-TPR profiles of Mn-*h*-YbFeO<sub>3</sub> samples. (d) Mn-*h*-YbFeO<sub>3</sub>(ST) obtained by calcination temperature at 500 °C, (e) Mn-*h*-YbFeO<sub>3</sub>(ST) obtained by calcination temperature at 800 °C, and (f) Mn-*h*-YbFeO<sub>3</sub>(PC).