Supporting information

Role of FeO_x support in constructing high performance Pt/FeO_x catalyst for low-temperature CO oxidation

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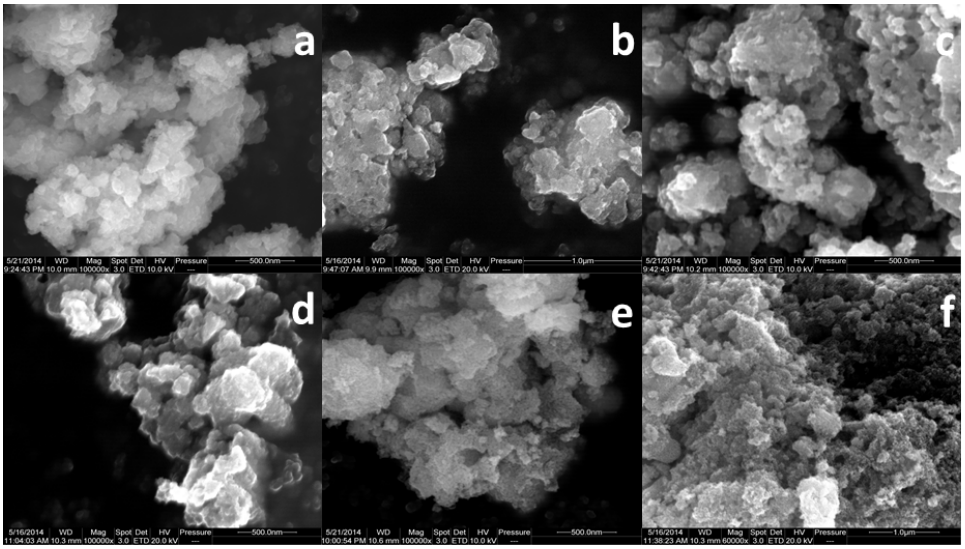

Fig. S1 SEM images of FeO_x supports: (a) FeO_x-100, (b) FeO_x-130, (c) FeO_x-220, (d) FeO_x-300, (e) FeO_x-430 and (f) FeO_x-500.

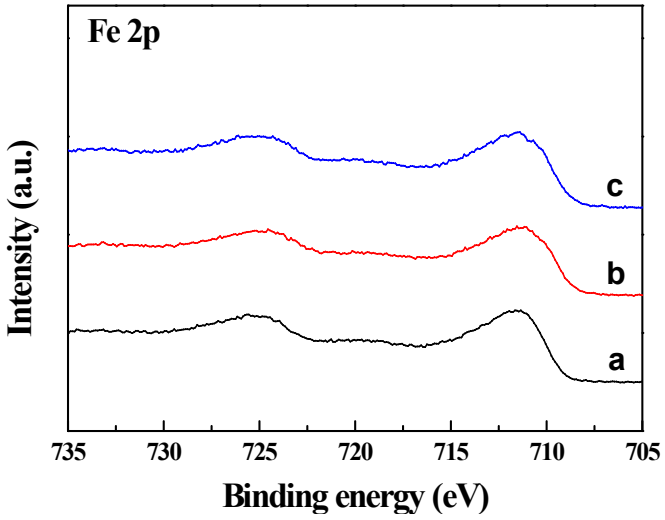

Fig. S2 Fe 2p XPS spectrum of FeO_x supports: (a) FeO_x-100, (b) FeO_x-300, (c) FeO_x-500.

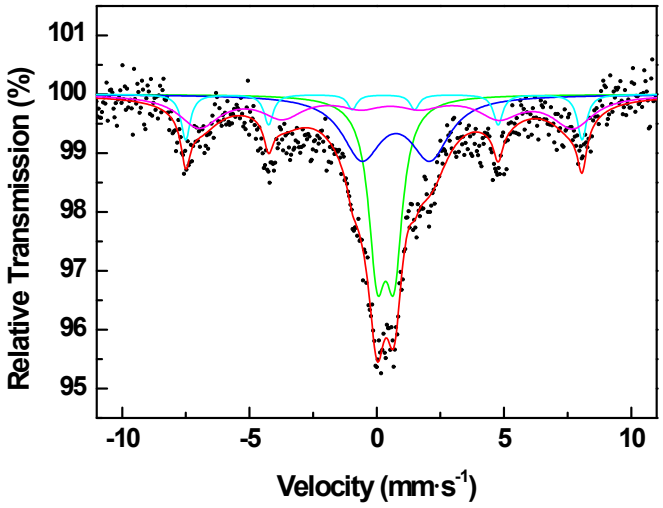

Fig. S3 Mössbauer spectrum of the Pt/FeO_x-100 sample at 298 K.

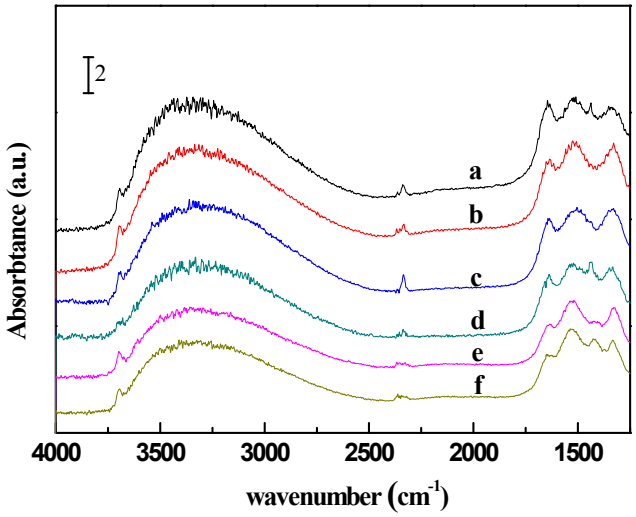

Fig. S4 DRIFT spectra of Pt/FeO_x catalysts: (a) Pt/FeO_x-100, (b) Pt/FeO_x-130, (c) Pt/FeO_x-220, (d) Pt/FeO_x-300, (e) Pt/FeO_x-430 and (f) Pt/FeO_x-500.

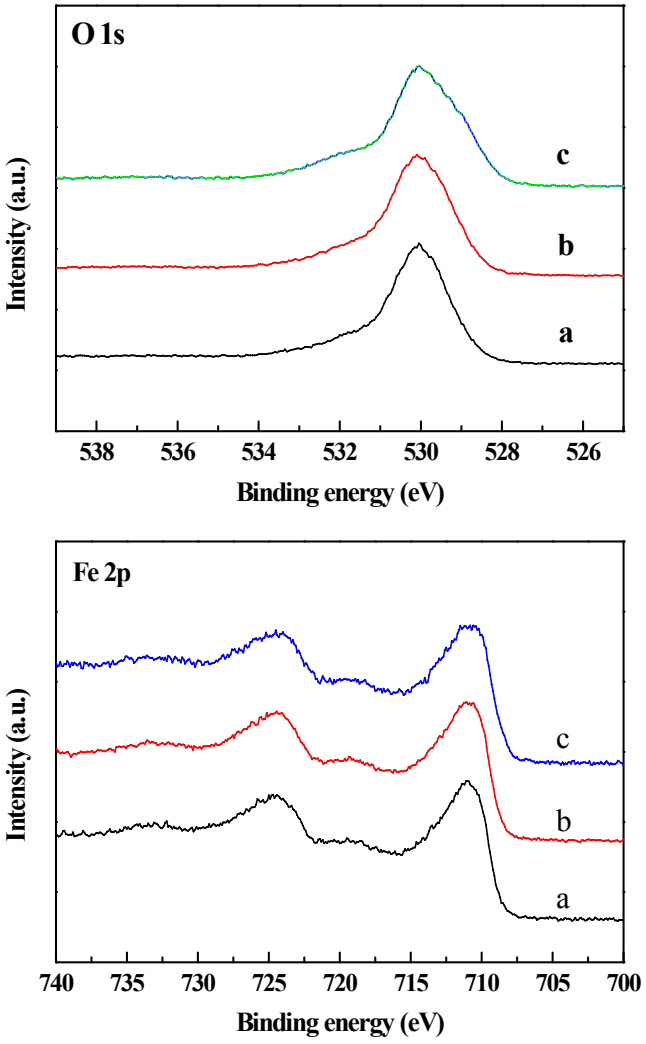

Fig. S5 O 1s and Fe 2p XPS spectra of Pt/FeO_x catalysts: (a) Pt/FeO_x-100, (b) Pt/FeO_x-300, (c) Pt/FeO_x-500.

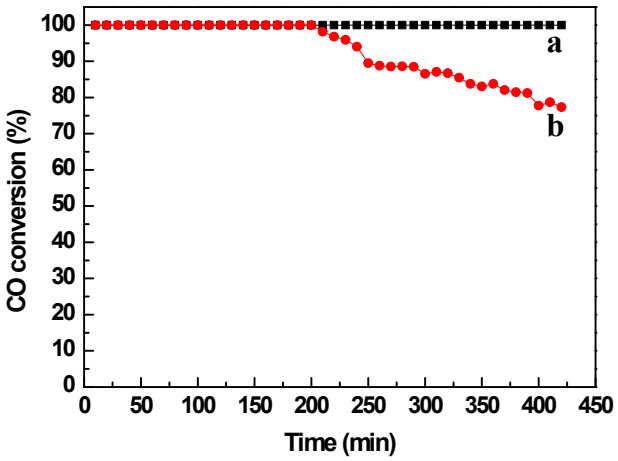

Fig. S6 CO catalytic oxidation activities of (a) Pt/FeO_x-100 in the presence of water vapour and (b) Pt/FeO_x-100 under dry condition. Reaction conditions were as follows: room temperature 0.5% CO, 10% O_2/Ar balance, space velocity: 120000 $mL \cdot g^{-1} \cdot h^{-1}$.

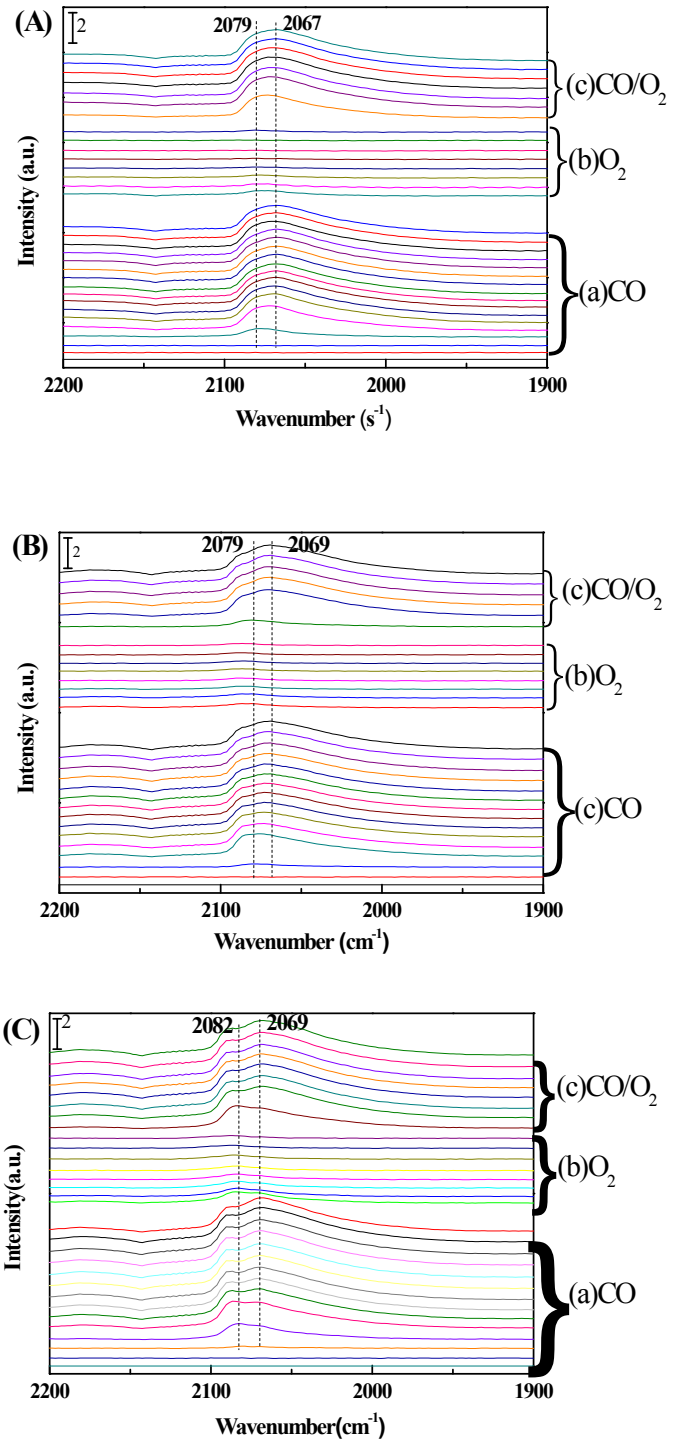

Fig. S7 In situ DRIFT spectra ranging from 2200 to 1900 cm^{-1} of iron oxide supported Pt catalysts: (A) Pt/FeOx-100, (B) Pt/FeOx-300, (C) Pt/FeOx-500 as a function of time after the gas flow was

switched (a) from Ar to 1% CO/Ar, (b) from 1% CO/Ar to 20% O_2/ Ar, and (c) from 20% O_2/Ar to CO/O_2 at room temperature. Each spectrum was recorded with an interval of 40 s.

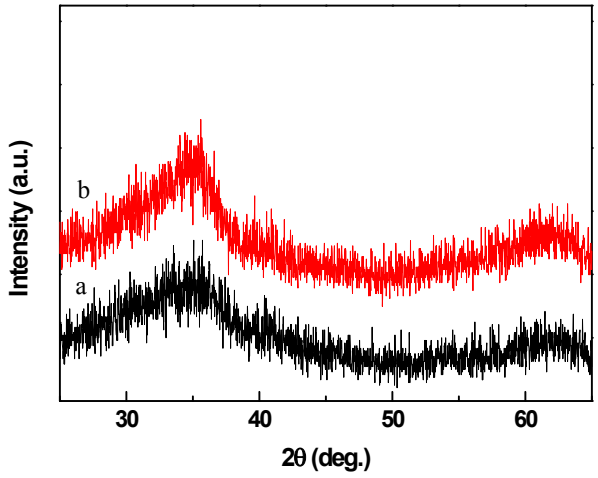

Fig. S8 XRD patterns of FeO_x supports: (a) FeO_x-100, (b) FeO_x-100 treated at 100 °C for 3 h.

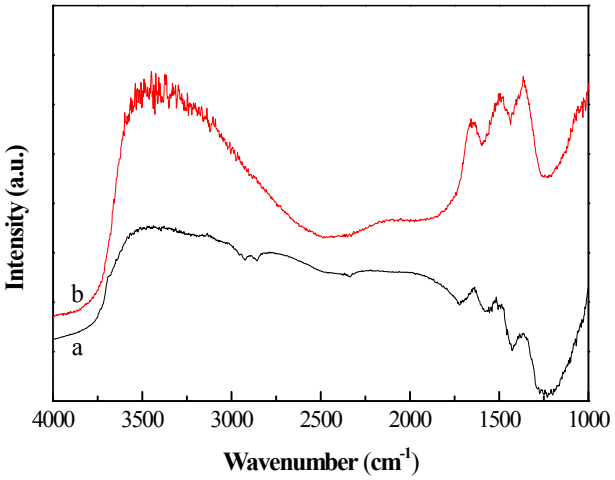

Fig. S9 DRIFT spectra of FeO_x supports: (a) FeO_x-100, (b) FeO_x-100 treated at 100 ^oC for 3 h.

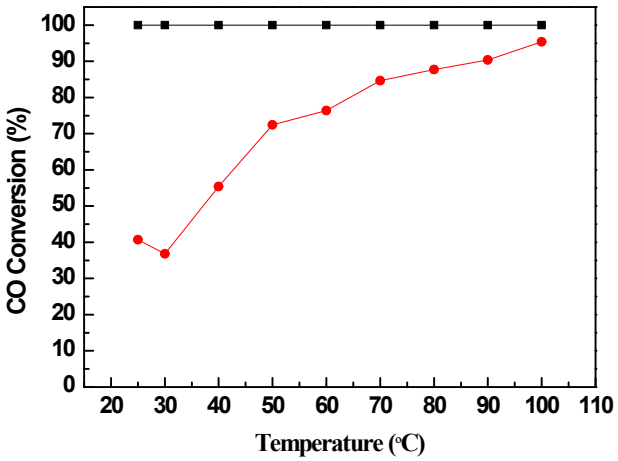

Fig. S10 CO oxidation activities of (a) Pt/FeO_x-100 and (b) Pt/FeO_x-100(treated at 100 °C for 3 h). Reaction conditions: 0.5% CO, 10% O_2/Ar balance, space velocity： 120000 $mL \cdot g^{-1} \cdot h^{-1}$.

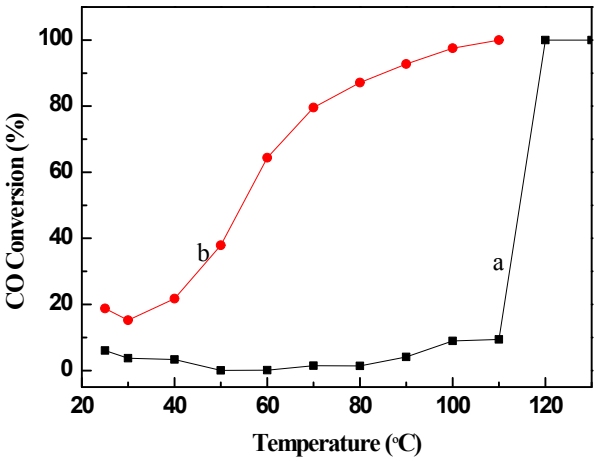

Fig. S11 CO oxidation activities of (a) Pt/FeO_x-500 and (b) Pt/FeO_x-500 in the presence of water vapour. Reaction conditions: 0.5% CO, 10% O_2/Ar balance, space velocity:120000 $mL \cdot g^{-1} \cdot h^{-1}$.

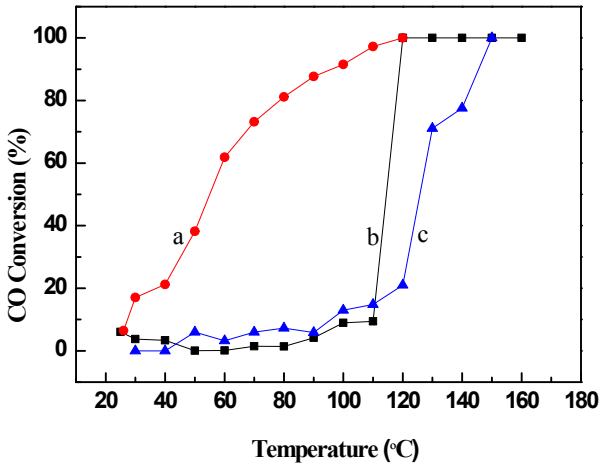

Fig. S12 CO oxidation activities of (a) Pt/FeO_x-500 with reductive treatment, (b) Pt/FeO_x-500, (c) Pt/FeO_x-500 with oxidative treatment. Reaction conditions: 0.5% CO, 10% O_2/Ar balance, space velocity：120000 $mL \cdot g^{-1} \cdot h^{-1}$.

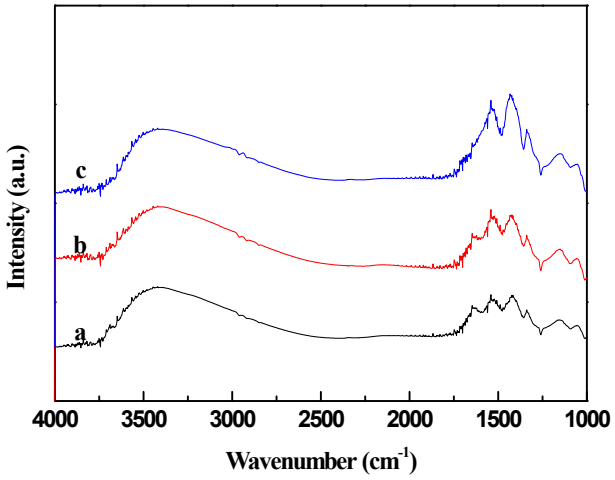

Fig. S13 DRIFT spectra of (a) Pt/FeO_x-500 with reductive treatment, (b) Pt/FeO_x-500, (c) Pt/FeO_x-500 with oxidative treatment.

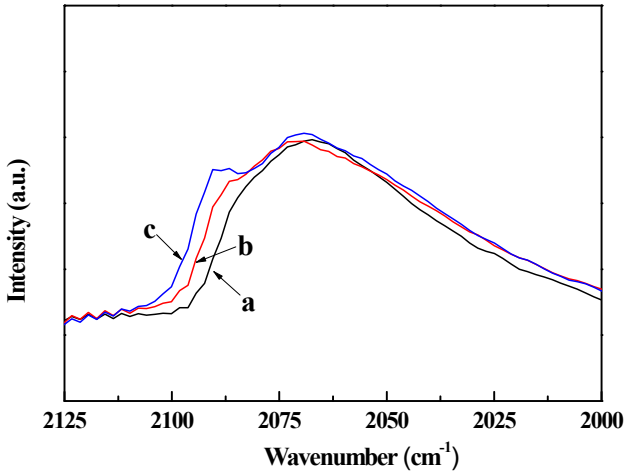

Fig. S14 In situ DRIFT spectra of Pt/FeO_x catalysts as a function of adsorbing saturated CO: (a) Pt/FeO_x-100, (b) Pt/FeO_x-300, and (c) Pt/FeO_x-500.

Table S1 *Texture properties of FeO_x supports.*

Supports	S_{BET} ($m^2 \cdot g^{-1}$)	Pore Volume ($cm^3 \cdot g^{-1}$)	Pore Size [a] (nm)
FeO_x-100	185	0.22	4.5
FeO_x-130	195	0.25	4.7
FeO_x-220	178	0.23	4.9
FeO_x-300	118	0.23	7.5
FeO_x-430	43	0.18	16.8
FeO_x-500	41	0.16	18.5

[a] Average pore diameters calculated from adsorption branches using BJH model.

Table S2 H_2 consumption of FeO_x calculated from H_2-TPR profiles.

Iron oxides	H_2 consumption of the first peak ($mmol \cdot g^{-1}$)	H_2 consumption of the second peak ($mmol \cdot g^{-1}$)	H_2 consumption of the third peak ($mmol \cdot g^{-1}$)	Total H_2 consumption ($mmol \cdot g^{-1}$)
FeO_x-100	0.84	2.25	5.17	8.26
FeO_x-130	1.78	3.53	5.56	10.87
FeO_x-220	2.82	4.46	5.77	13.04
FeO_x-300	4.07	6.43	5.58	16.07
FeO_x-430	2.42	9.39	6.67	18.48
FeO_x-500	2.64	10.00	6.33	18.97

Table S3 Texture properties of Pt/FeO_x catalysts.

Catalysts	S_{BET} ($m^2 \cdot g^{-1}$)	Pore Volume ($cm^3 \cdot g^{-1}$)	Pore Size [a] (nm)
Pt/FeO_x-100	163	0.28	6.5
Pt/FeO_x-130	131	0.26	7.7
Pt/FeO_x-220	147	0.27	7.0
Pt/FeO_x-300	107	0.23	8.4
Pt/FeO_x-430	48	0.18	14.7
Pt/FeO_x-500	41	0.18	17.3

[a] Average pore diameters calculated from adsorption branches using BJH model.

Table S4 High fine parameters of the fitted curves to the Mössbauer spectra.

sample	Multiplet	IS	QS	Hf	Peak area	Assignment
		mm s^{-1}	mm s^{-1}	kOe	(%)	
Pt/FeO_x-100	Doublet Ⅰ	0.39±0.01	0.67±0.02		31.3	amorphous ferrihydrite
	Doublet Ⅱ	0.80±0.08	2.68±0.04		28.0	Fe^{2+}
	Sextet Ⅰ	0.32±0.02	0.02±0.04	482.8±1	9.9	Fe_3O_4
	Sextet Ⅱ	0.50±0.04	0.18±0.01	455.0±4	30.8	Fe_3O_4

IS: the isomer shift relative to α-Fe at room temperature; QS: the quadrupole shift; Hf: the magnetic hyperfine field at ^{57}Fe nuclei.

Table S5 H_2 consumption of Pt/FeO_x catalysts calculated from H_2-TPR profiles.

Catalysts	H_2 consumption of the first peak ($mmol \cdot g^{-1}$)	H_2 consumption of the second peak ($mmol \cdot g^{-1}$)	H_2 consumption of the third peak ($mmol \cdot g^{-1}$)	Total H_2 consumption ($mmol \cdot g^{-1}$)
Pt/FeO_x-100	1.04	1.34	4.31	6.69
Pt/FeO_x-130	0.77	1.78	5.23	7.78
Pt/FeO_x-220	0.40	2.69	4.22	7.31
Pt/FeO_x-300	0.31	5.67	4.15	10.13
Pt/FeO_x-430	0.00	10.55	4.37	14.92
Pt/FeO_x-500	0.00	10.46	4.40	14.86