catalysts

Supporting Information

Insight into the promoting role of Er modification on SO_2 resistance for NH_3-SCR at low temperature over $FeMn/TiO_2$ catalysts

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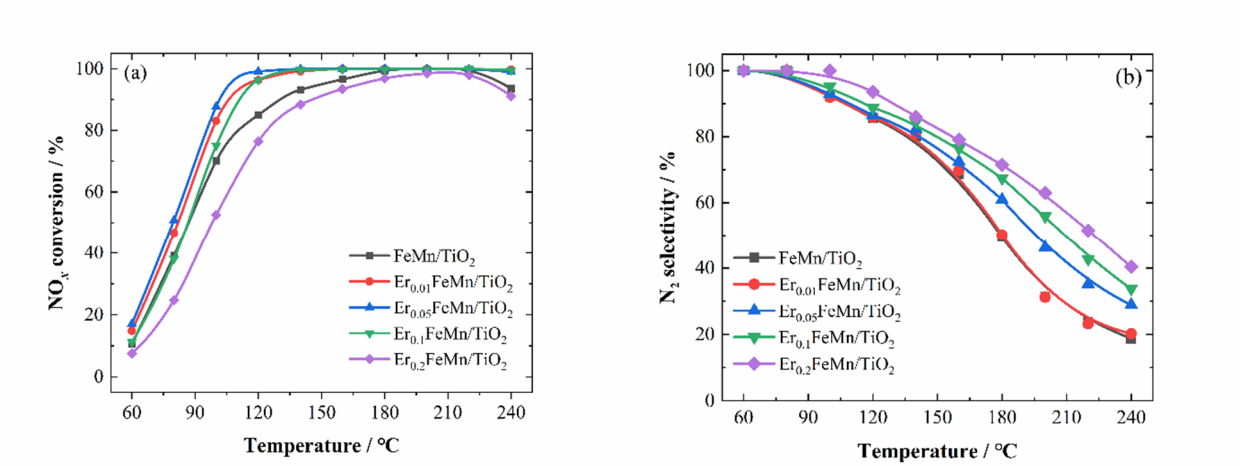

Figure S1. (a) NO_x conversion, (b) N_2 selectivity in the NH_3-SCR reaction (Reaction conditions: 1 mL catalyst, [NO] = [NH_3] = 500 ppm, [O_2] = 5 vol.%, [H_2O] = 5 vol.% (when used), [SO_2] = 100 ppm (when used), balanced with N_2, GSHV = 30,000 h^{-1}).

Table S1. Textural properties of $FeMn/TiO_2$ and $Er_{0.05}FeMn/TiO_2$ catalysts.

Sample	A_{BET} (m^2/g)	V_P (cm^3/g)	D_A /nm
$FeMn/TiO_2$	58.6	0.38	22.0
$FeMnTiO_2$-S	52.2	0.36	24.7
$Er_{0.05}FeMn/TiO_2$	59.5	0.38	21.2
$Er_{0.05}FeMn/TiO_2$-S	57.4	0.43	25.5

Table S2. H_2-TPR results of $FeMn/TiO_2$ and $Er_{0.05}FeMn/TiO_2$ catalysts.

Sample	Peak temperature (ºC) / H_2 consumption(cm^3/g STP)			Total H_2 consumption (cm^3/g STP)
	Peak-1	Peak-2	Peak-3	
$FeMn/TiO_2$	316/14.2	390/16.4	527/1.8	32.4
$Er_{0.05}FeMn/TiO_2$	271/20.1	382/22.4	524/0.4	42.9
FeMnTi-S	360/24.1	460/194.8	542/26.5	244.9
$Er_{0.05}FeMn/TiO_2$-S	379/39.3	457/151.6	576/5.8	196.9

Table S3. Calculation results of surface atomic concentration ratios of Fe, Mn and O in $FeMn/TiO_2$ and $Er_{0.05}FeMn/TiO_2$ catalysts.

Sample	Mn [%]	Fe [%]	O [%]	S [%]	N [%]	Mn^{4+}/Mn^{n+} [%]	SO_4^{2-}/SO_3^{2-}	$O_\alpha/O_\beta + O_\alpha$ [%]
$FeMn/TiO_2$	16.2	4.7	79.1	-	-	31.9	-	20.9
$Er_{0.05}FeMn/TiO_2$	**14.4**	**5.0**	**80.7**	**-**	**-**	**33.9**	**-**	**45.7**
$FeMn/TiO_2$-S	12.8	3.6	76.2	5.3	2.2	26.8	1.1	33.3
$Er_{0.05}FeMn/TiO_2$-S	13.9	3.9	77.8	2.8	1.6	29.7	0.5	41.0

- **EDS result**

The chemical analysis was obtained by energy dispersive X-ray spectrometer (EDS) SUPRA 55 (Zeiss, Germany), and the results were illustrated in Figure. S2 and Table. S4. The atomic percentages of Mn and Er elements over $Er_{0.05}FeMn/TiO_2$ catalyst was 9.42 and 0.35, respectively. The calculated molar ratio of Er/Mn was 0.0375, which was a little lower than the set value of 0.05. It was mainly ascribed to the loss of Er element during the vacuum filtration process. The result implied that Er element had been doped in $FeMn/TiO_2$ catalyst successfully.

Table. S4. Surface element contents of $FeMn/TiO_2$ and $Er_{0.05}FeMn/TiO_2$ catalysts

Catalysts	Element	O	Ti	Mn	Fe	Er	Total
$FeMn/TiO_2$	wt (%)	36.57	36.68	20.64	6.10	0	100
	Atomic percent	64.63	21.65	10.62	3.09	0	100
$Er_{0.05}FeMn/TiO_2$	wt (%)	37.68	35.78	18.41	6.03	2.10	100
	Atomic percent	66.20	20.99	9.42	3.04	0.35	100

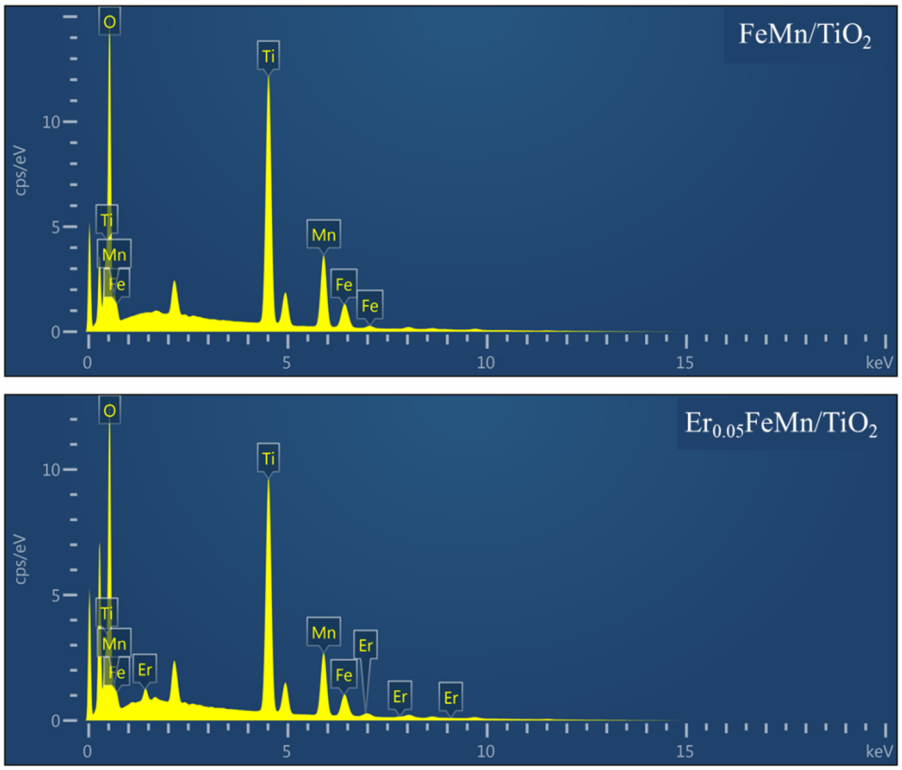

Figure S2. EDS mapping of $FeMn/TiO_2$ and $Er_{0.05}FeMn/TiO_2$ catalysts

- **XPS survey spectrum**

As the doping amount of Er was quite less, the high-resolution scan of Er by XPS was not performed in this work. The XPS survey spectrum was illustrated in Figure S3. The weak peak centered at 168.8 eV which ascribed to Er 4*d* was found in the XPS survey spectrum of $Er_{0.05}FeMn/TiO_2$ catalyst, suggesting that Er element had been doped in $FeMn/TiO_2$ catalyst successfully.

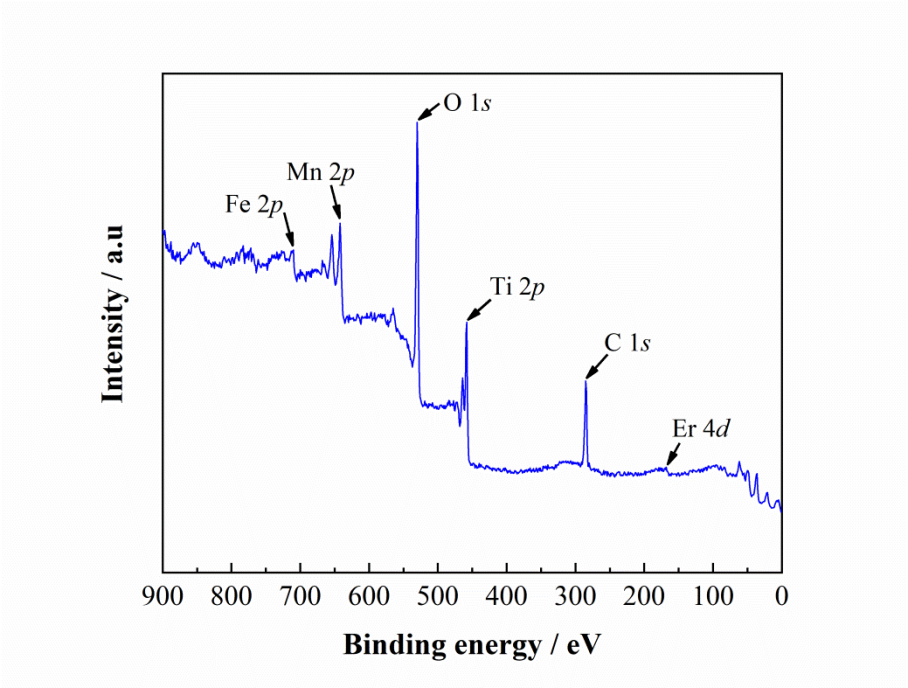

Figure S3. XPS survey spectrum of $Er_{0.05}FeMn/TiO_2$ catalyst