Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Microfibrous-structured Al-fiber@ns-Al_2O_3 core-shell composite functionalized by Fe-Mn-K via surface impregnation combustion: as-burnt catalysts for synthesis of light olefins from syngas

Lupeng Han, Chunzheng Wang, Jia Ding, Guofeng Zhao*, Ye Liu, and Yong Lu*

Shanghai Key Laboratory of Green Chemistry and Chemical Processes, School of Chemistry and Molecular Engineering, East China Normal University, Shanghai 200062, China.

Fax: (+86) 21-62233424

Email: *ylu@chem.ecnu.edu.cn* (Y. Lu); *gfzhao@chem.ecnu.edu.cn* (G. Zhao)

* To whom correspondence should be addressed

Calculation equations of CO conversion and products distribution

The CO conversion (%) was calculated by the N_2 internal standard method according to the following equation:[30]

$$X_{CO} = \frac{F_{in}x_{CO,in} - F_{ex}x_{CO,ex}}{F_{in}x_{CO,in}} \times 100 = (1 - \frac{x_{N_2,in}\, x_{CO,ex}}{x_{N_2,ex}\, x_{CO,in}}) \times 100$$

where F_{in} and F_{ex} denote the total flow rate of reactor inlet and outlet, $X_{CO,in}$ and $X_{CO,ex}$ the concentration of the CO in the reactor inlet and outlet, $X_{N_2,in}$ and $X_{N_2,ex}$ the concentration of the N_2 in the reactor inlet and outlet.

The hydrocarbon distribution toward the individual component (i) was calculated according to the amount of carbon atoms in a product with respect to the total carbon atoms as follows:

$$S_i\,(\%C) = \frac{n_i A_i M_i}{\sum n_i A_i M_i} \times 100$$

where n_i denotes the number of carbon atoms in product i, A_i the peak area of product i analyzed by chromatography, and M_i the relative mole correction factor of product i (relative to benzene).

Table S1. Textural properties of Al-fiber@ns-Al_2O_3 composite and as-burnt catalysts.

Sample	S_{BET} (m^2/g)	Pore volume (cm^3/g)	Mean pore size (nm)
Al-fiber@ns-Al_2O_3	13.1	0.02	5.5
Mesoporous ns-Al_2O_3 shell	187.1	0.26	5.5
Al-fiber@ns-Al_2O_3@Fe-Mn-K (air)	9.8	0.018	4.8
Al-fiber@ns-Al_2O_3@Fe-Mn-K (N_2)	3.4	0.012	4.8
Al-fiber@ns-Al_2O_3@Fe-Mn-K (N_2-air)	8.2	0.018	4.4
Al-fiber@ns-Al_2O_3@Fe-Mn-K (im)	7.2	0.015	11.7

Table S2. Catalytic results from the literatures and this study.

Catalyst	Fe	P	T	H_2/CO	GHSV	CO	FTY	HC distribution (%C)[a]		
	(wt%)	MPa	°C	ratio	mL/(g·h)	Conv.(%)	($\mu mol_{CO} g_{Fe}^{-1} s^{-1}$)	CH_4	$C_2^=$-$C_4^=$	C_5^+
Al-fiber@ns-Al_2O_3@Fe-Mn-K (air)	10	4.0	350	2:1	10000	89.6	202.3	14.1	42.1	36.0
Fe/CNF (Ref. 4)	10	2.0	340	1:1	~1000	88.0	29.8	13.0	52.0	18.0
Al-fiber@ns-Al_2O_3@Fe-Mn-K (air)	10	2.0	340	1:1	1000	49.9	19.3	19.1	40.2	31.7
Fe-K/N-CNTs (Ref. 3)	10	0.1	300	1:1	4200	16.5	27.9	17.3	54.6	22.2
Al-fiber@ns-Al_2O_3@Fe-Mn-K (air)	10	0.1	300	1:1	4200	2.0	4.1	13.5	50.7	25.4
Fe/MnK-CNTs (Ref. 10)	7.9	2.0	270	1:1	30000	22.7	311.7	28.8	50.3	13.3
Al-fiber@ns-Al_2O_3@Fe-Mn-K (air)	10	2.0	270	1:1	30000	1.6	23.7	15.1	45.5	33.2
Fe/N-Graphene (Ref. 17)	8	0.5	340	1:1	600	8.8	3.5	21.4	49.6	19.8
Al-fiber@ns-Al_2O_3@Fe-Mn-K (air)	10	0.5	340	1:1	600	26.0	7.5	9.6	23.3	63

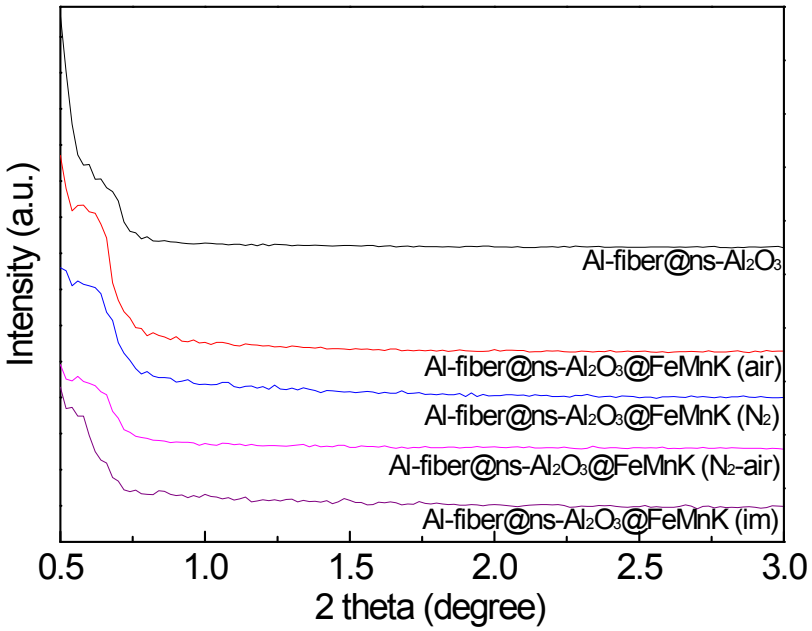

Fig. S1. The SAXD patterns of Al-fiber@ns-Al_2O_3 composite and different Al-fiber@ns-Al_2O_3@Fe-Mn-K catalysts.