Supporting Information

Unravelling the Metal-Support Interaction in χ-Fe_5C_2/MgO Catalysts for Olefins Synthesis Directly from Syngas

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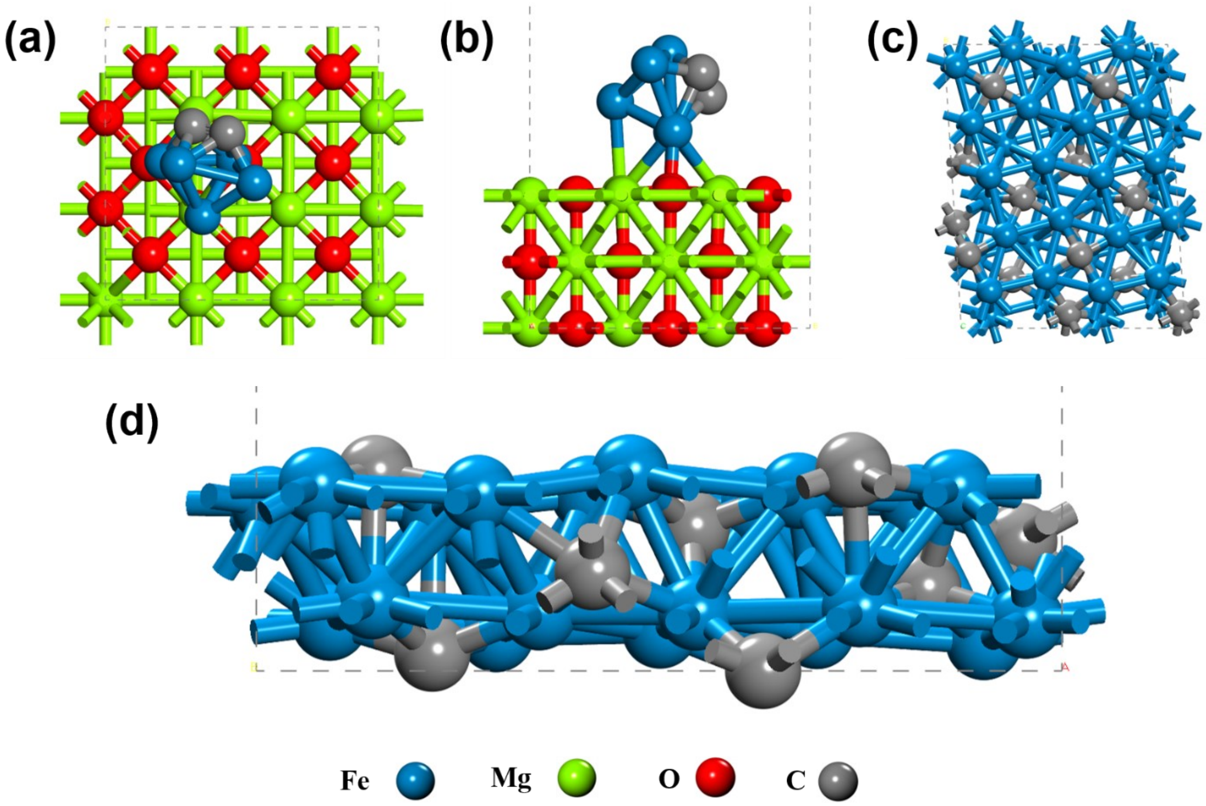

Fig. S1 (a) top and (b) side views of the structure of χ-Fe_5C_2/MgO; (c) top and (d) side views of the structure of χ-Fe_5C_2.

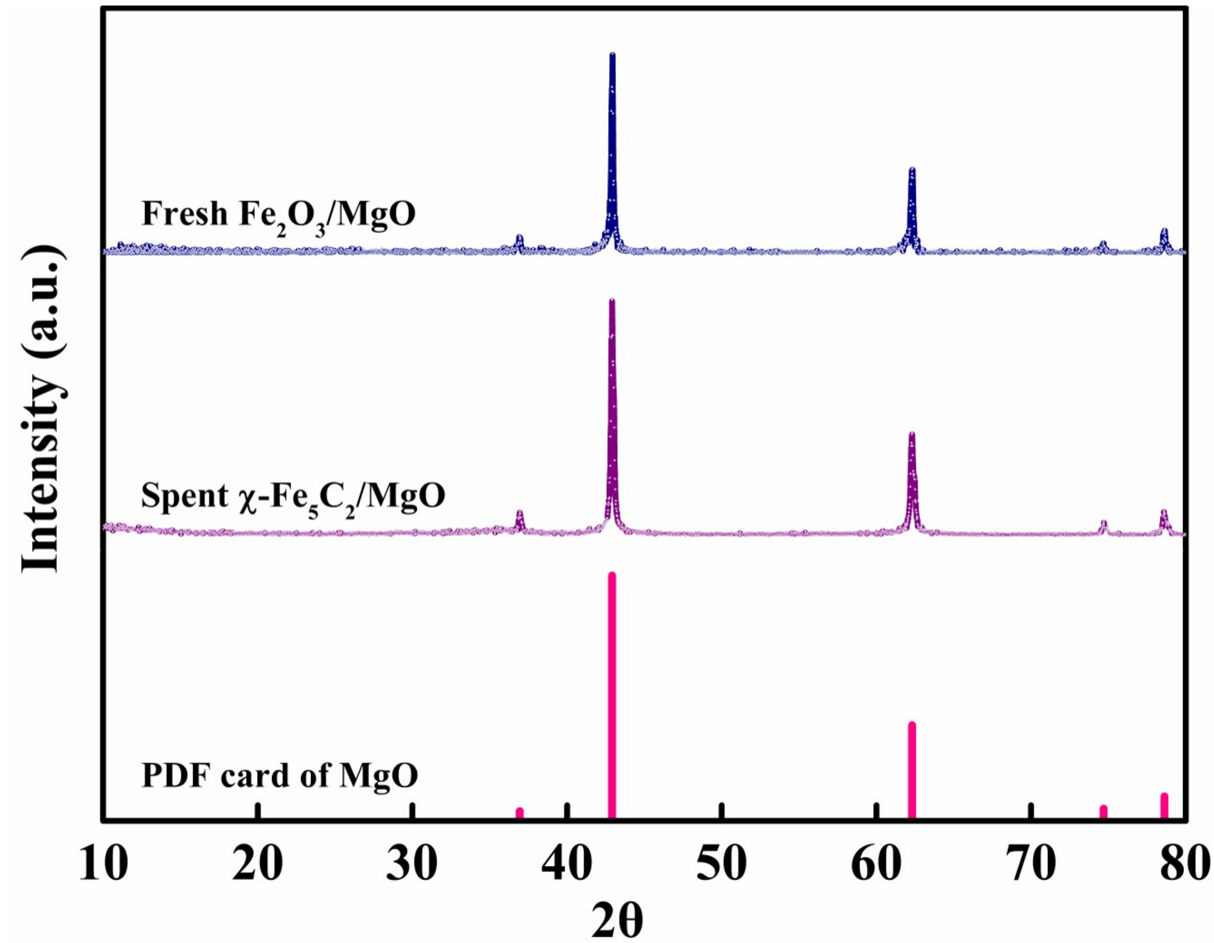

Fig. S2 XRD patterns Fe_2O_3/MgO and χ-Fe_5C_2/MgO.

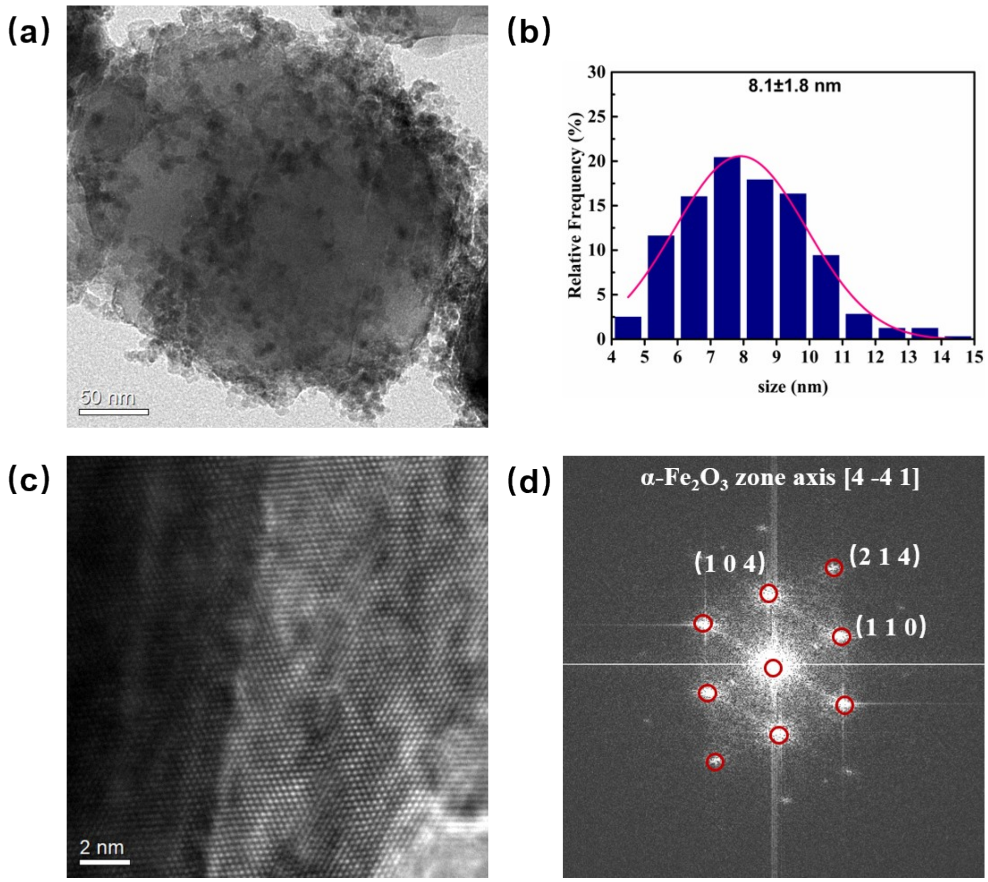

Fig. S3 TEM images of Fe_2O_3/MgO. (a) TEM image, (b) particle size distribution histograms with Gaussian analysis fittings, (c) HR-TEM image, (d) fast Fourier transformation (FFT) of Figure S3c.

Table S1 Phase composition determination of fresh Fe_2O_3/MgO and spent χ-Fe_5C_2/MgO by Mössbauer spectroscopy.

Catalysts	Phases		Mössbauer parameters			Area (%)
			IS (mm/s)	QS (mm/s)	Hhf (kOe)	
Fresh Fe_2O_3/MgO	Fe_2O_3		0.32	0.68		100
χ-Fe_5C_2/MgO	Fe_5C_2	I	0.25	-0.12	215.17	34.1
		II	0.19	-0.01	183.37	42.8
		III	0.23	-0.04	110.86	20.0
	Fe^{2+}/ Fe^{3+}		0.34	1.10		3.1

Table S2 Typical reference data of the performance for CO conversion to lower olefins over supported iron-based catalysts.

Catalyst	Temperature (°C)	Pressure (MPa)	CO Conversion (%)	Selectivity with CO_2 excluded (%)			CO_2 selectivity	Olefin/Paraffin C_2-C_4	Ref.
				CH_4	C_2-$C_4^{=}$	C_{5+}			
Fe/MgO	280	2.0	20.8	23.6	56.9	8.7	38.4	5.3	this work
FeBi/CNT	350	0.1	65.7	30.8	55.4	3.7	40.7	5.5	[1]
35Fe/hNCNC-3	350	0.1	3.5	25.0	54.1	17.6	39.4	16.4	[2]
FePbK/CNT-in	350	2.0	76.2	18.2	52.6	21.0	48.1	6.12	[3]
FeBi/SiO_2	350	0.1	17	29	53.0	10	48	6.6	[4]
Fe/NG	340	0.5	21.1	21.4	49.6	19.8	35.1	5.4	[5]
Fe-K/N-CNTs	300	0.1	16.5	23.6	54.6	17.3	23.6	9.3	[6]

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