Electronic Supplementary Material (ESI) for RSC Advances.

Microwave treatment: a facile method for the solid state modification of potassium-promoted iron on silica Fischer-Tropsch catalysts

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Supplementary material

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NB: Figure S4 to Figure S7 were added to highlight the differences in the scale bars of the various plots. A summary of these plots is given in Figure S3 (without scale bars).

Table S1. Elemental compositions and textual properties of calcined samples.

Sample	Fe content (wt. %)	K content (wt. %)	BET surface area (m^2/g)[a]		Pore volume (cm^3/g)[a]	
			A	B	A	B
0K/10Fe/SiO_2	10.1	0.01	281	284	0.88	0.85
0.2K/10Fe/SiO_2	10.4	0.24	256	252	0.86	0.87
0.5K/10Fe/SiO_2	10.4	0.54	255	254	0.87	0.86
0.7K/10Fe/SiO_2	10.4	0.79	235	237	0.85	0.85
1.0K/10Fe/SiO_2	10.2	1.09	231	233	0.85	0.84
1.5K/10Fe/SiO_2	10.0	1.59	221	220	0.85	0.84

[a]A : calcined samples without exposure to MW radiation; B : after 10 s of MW treatment (450 W)

Table S2. Peak reduction temperatures observed in H_2-TPR.

Catalyst	Reduction temperatures (°C)			
	Peak 1	Peak 2	Peak 3	Peak 4
0.2K/10Fe/SiO_2	310	425	577	657
0.5 K/10Fe/SiO_2	333	448	583	669
0.7 K/10Fe/SiO_2	335/389	479	586	672
1.0 K/10Fe/SiO_2	341/390	505	578	660
1.5 K/10Fe/SiO_2	341/385	505	581	663

Table S3 TPR reduction temperatures for samples treated for varying periods.

MW irradiation time	Reduction temperatures (°C)			
	Peak 1	**Peak 2**	**Peak 3**	**Peak 4**
0 seconds	335/389	479	586	672
20 seconds	325/382	466	571	660
40 seconds	323/378	472	575	661

Table S4 Peak areas obtained when TPSR is performed *via* the methanator using the 0.7K/10Fe/SiO_2 and 1.0K/10Fe/SiO_2 catalyst.

Catalyst	**Peak 1 (116 °C)**	**Peak 2 (216 °C)**	**Peak 3 (over 500 °C)**	**Total (a.u.)**
0.7K/10Fe/SiO_2	806	1236	385	2427
0.7K/10Fe/SiO_2-MW	704	1186	678	2568
1.0K/10Fe/SiO_2	2142	1303	2746	6191
1.0K/10Fe/SiO_2-MW	789	1716	5794	8299

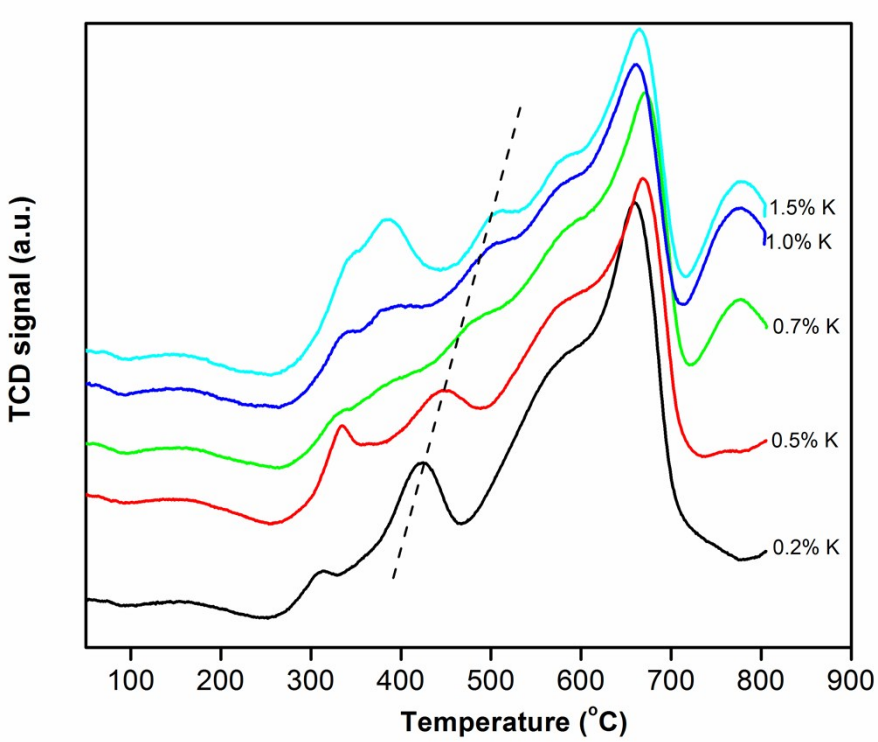

Figure S1 H_2-TPR profiles for the catalysts of the composition *x*K/10Fe/SiO_2, where *x* varies from 0 to 1.5 wt%.

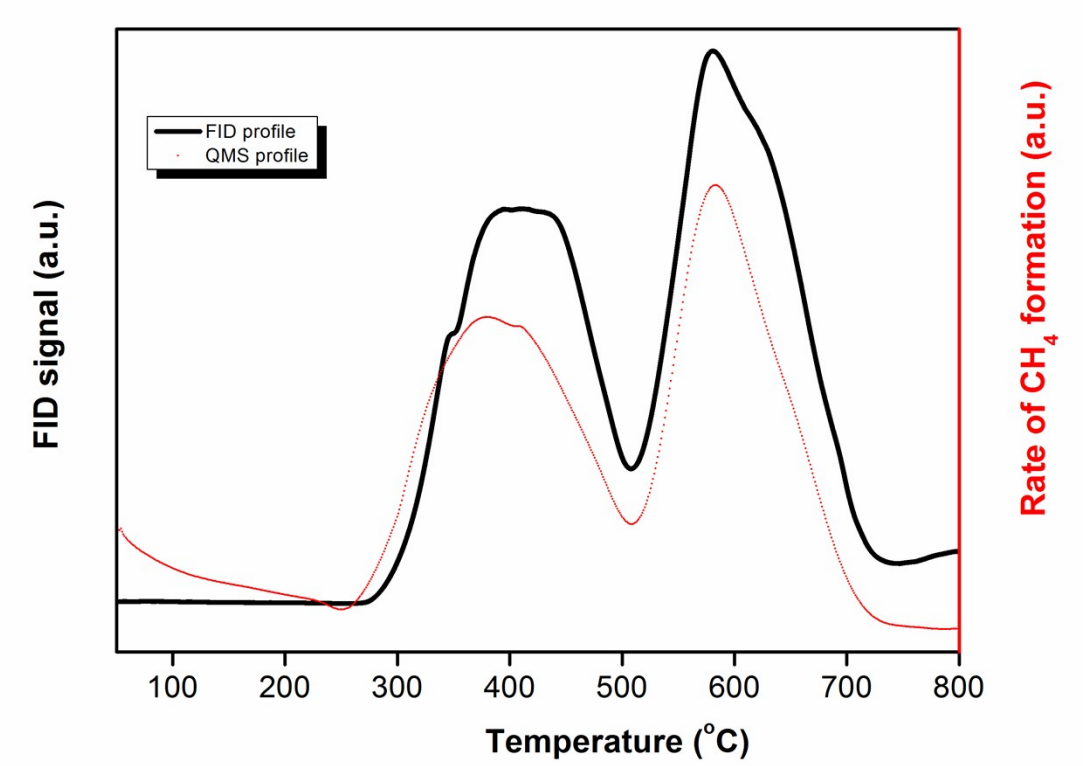

Figure S2 A comparison of typical TPSR profiles obtained from an FID (**–**) and by QMS (**⋯**) performed simultaneously when using the 0.2K/10Fe/SiO_2 catalyst.

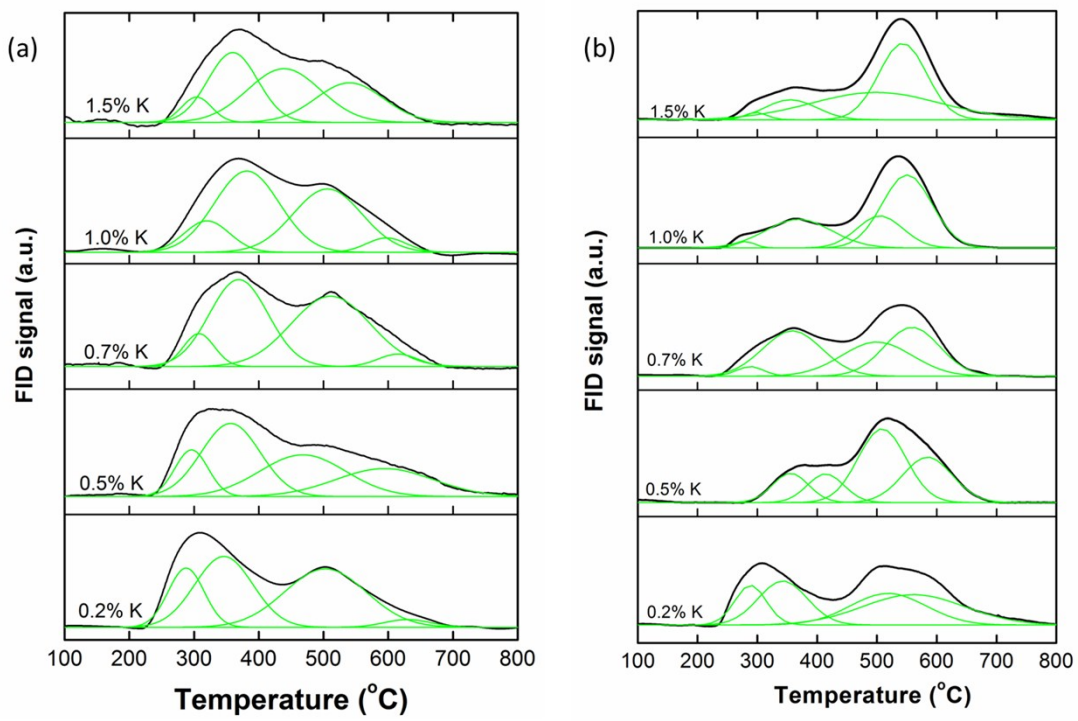

Figure S3 TPSR profiles of (a) *x*K/10Fe/SiO_2-type and (b) *x*K/10Fe/SiO_2-MW catalysts, *x* varies from 0.2 to 1.5 wt%.

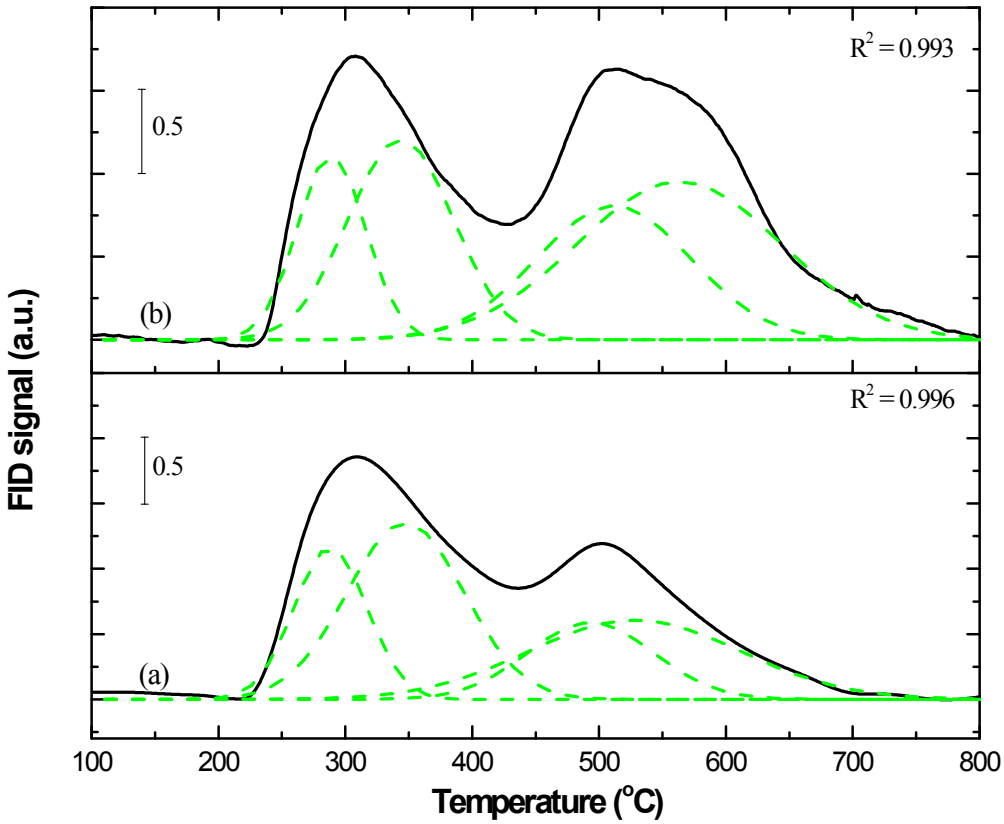

Figure S4 TPSR profiles of (a) 0.2K/10Fe/SiO_2 and (b) 0.2K/10Fe/SiO_2-MW catalysts. Pretreatment conditions: 10 s, 450 W.

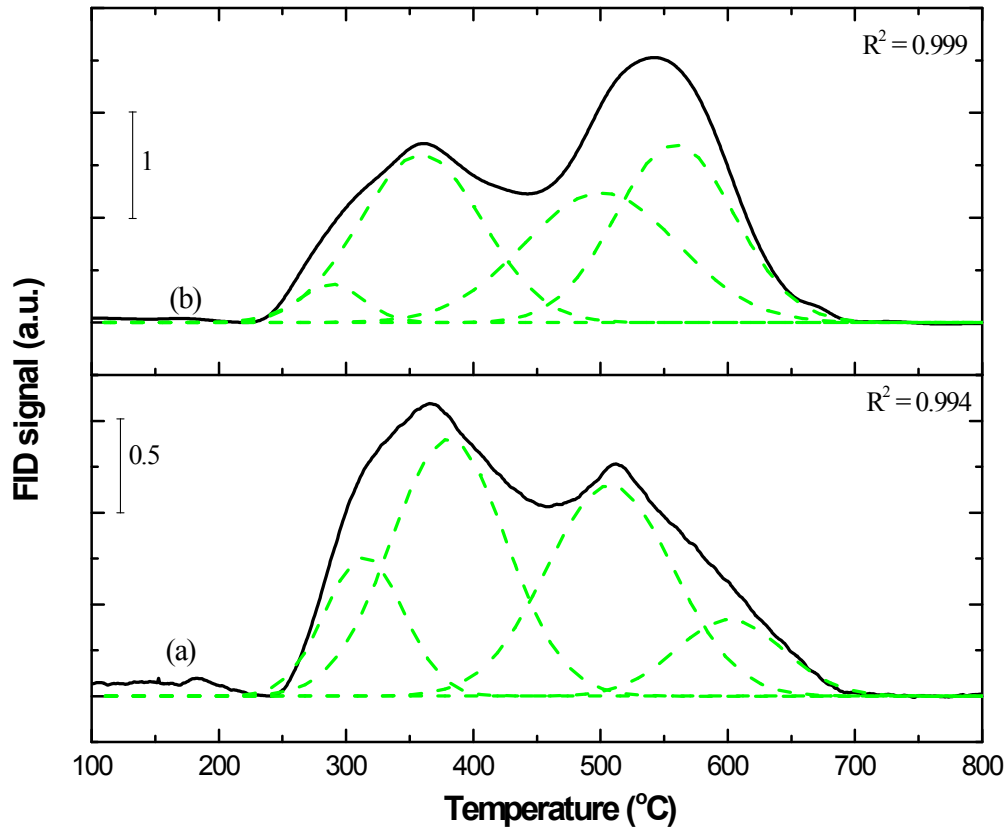

Figure S5 TPSR profiles for 0.7K/10Fe/SiO_2 and 0.7K/10Fe/SiO_2-MW catalysts. Microwave pretreatment conditions: 10 s, 450 W.

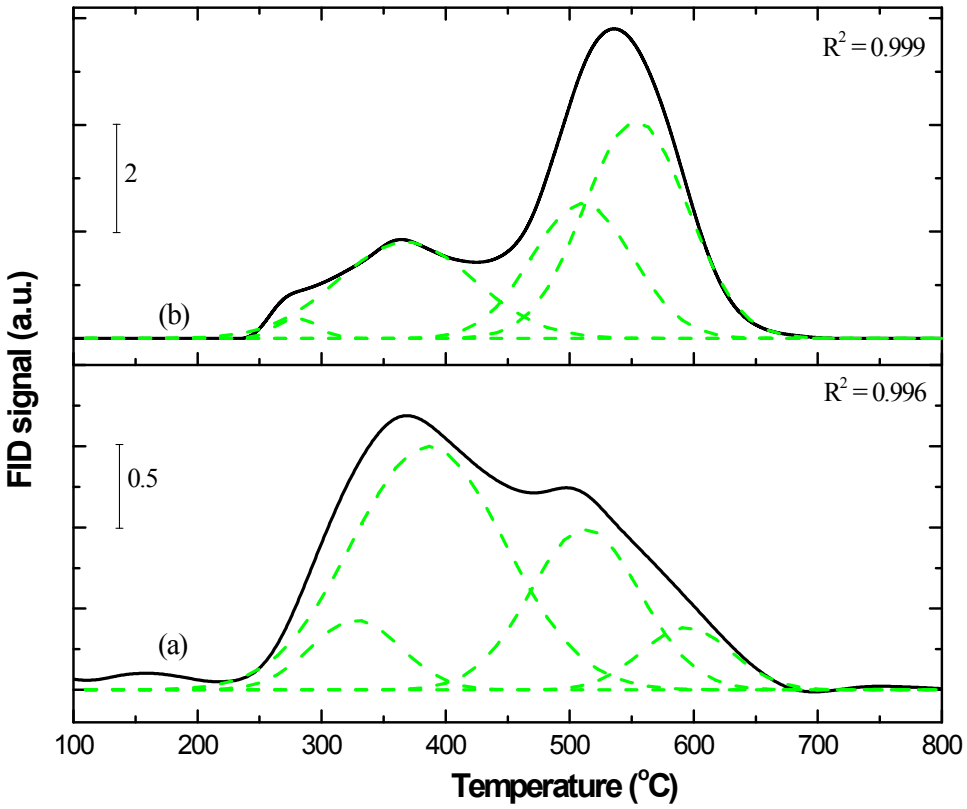

Figure S6 TPSR profiles of 1.0K/10Fe/SiO_2 catalyst (a) before and (b) after microwave (MW) pretreatment. Pretreatment conditions: 10 s, 450 W.

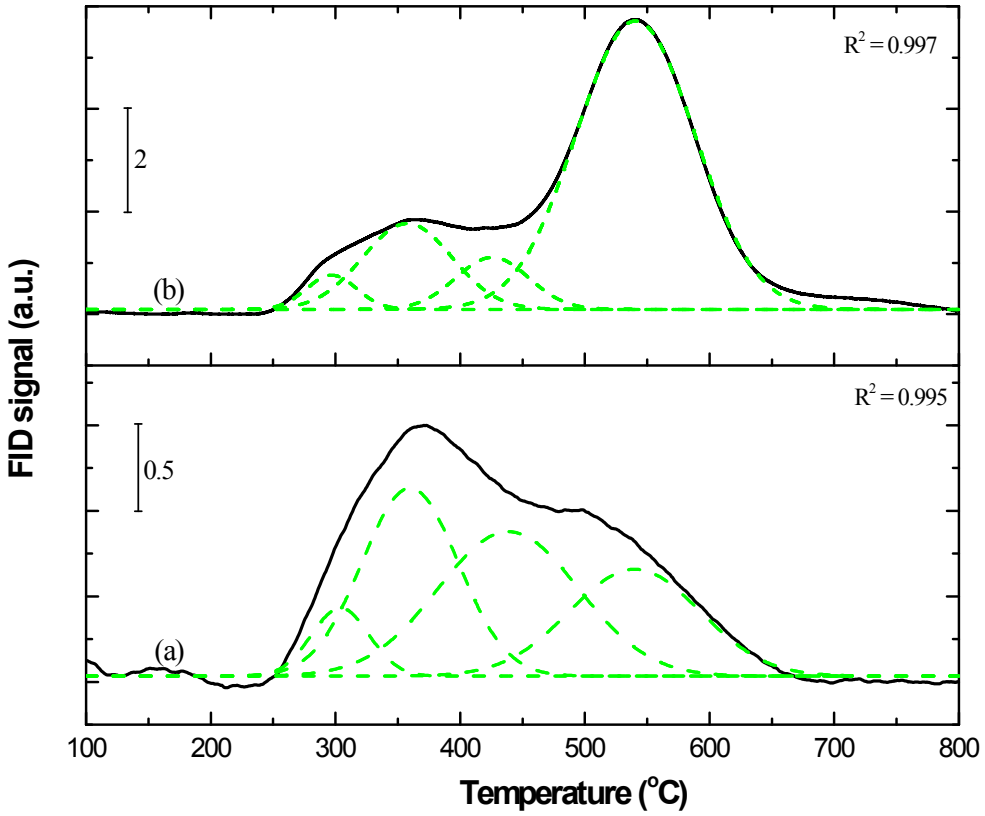

Figure S7 TPSR profiles of the 1.5 K/10 Fe/SiO_2 catalyst (a) before and (b) after microwave treatment.

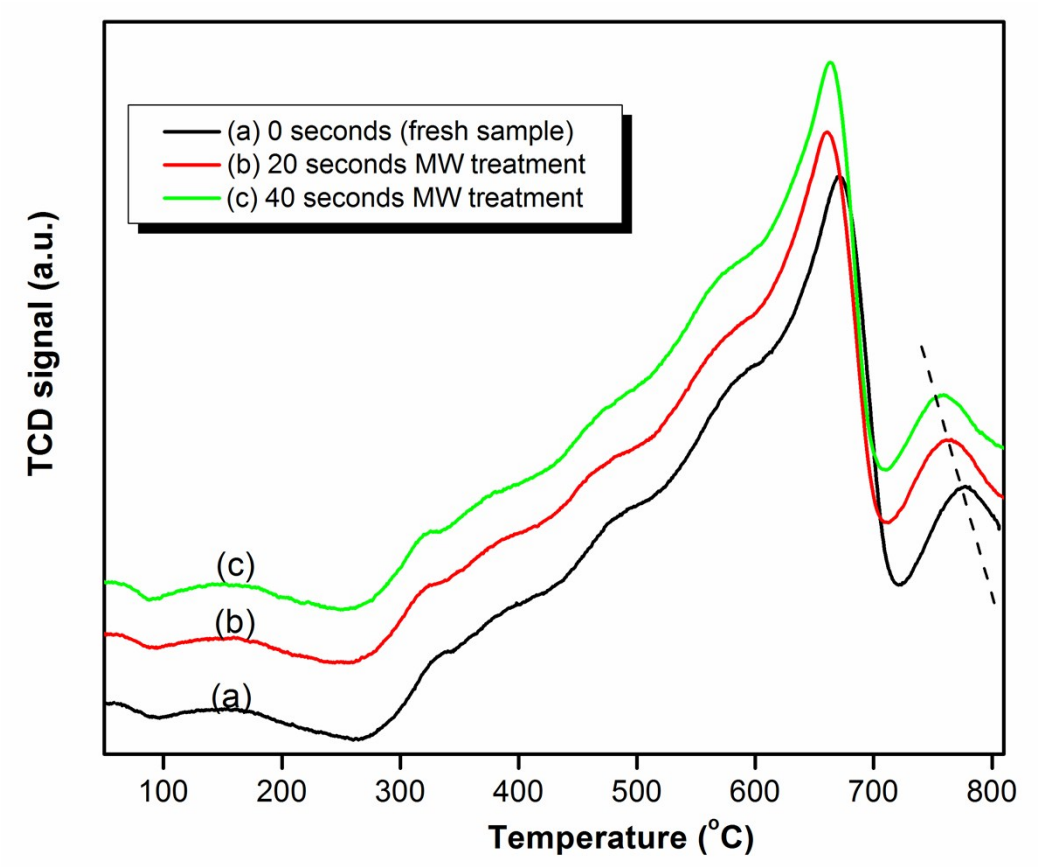

Figure S8 TPR profiles for a 1.0K/10Fe/SiO_2 catalyst that was microwave pretreated for various periods.

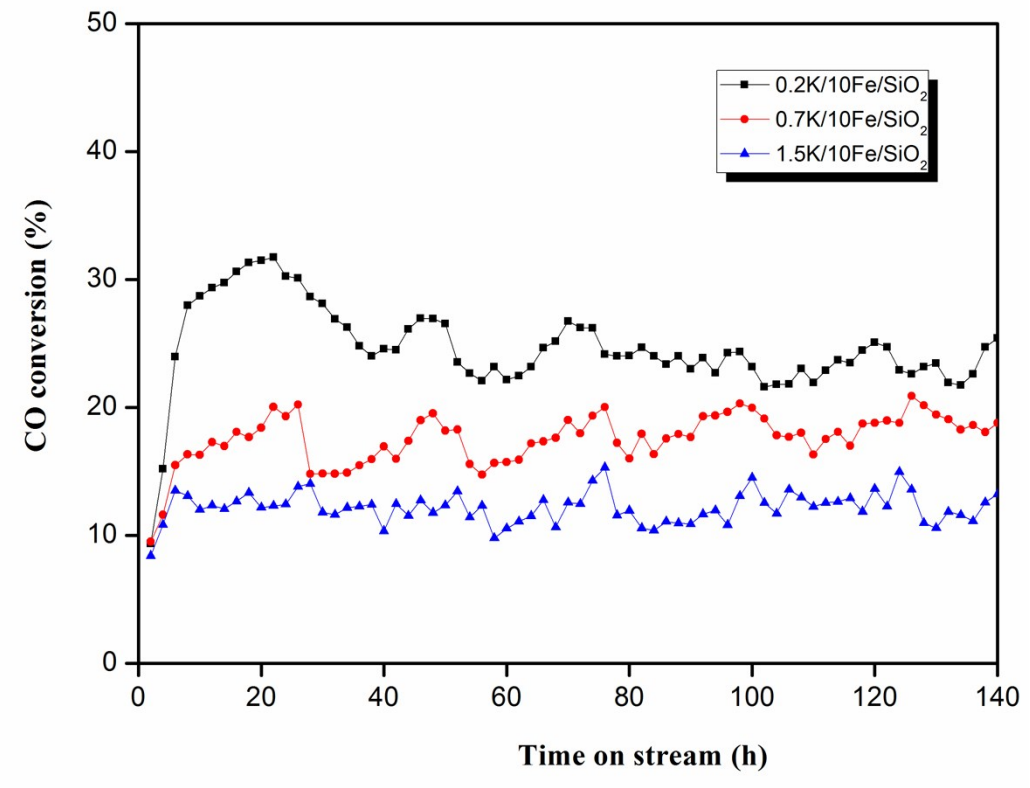

Figure S9 CO conversions for the 0.2K/10Fe/SiO_2, 0.7K/10Fe/SiO_2 and1.5K/10Fe/SiO_2 catalysts that were not microwaved.

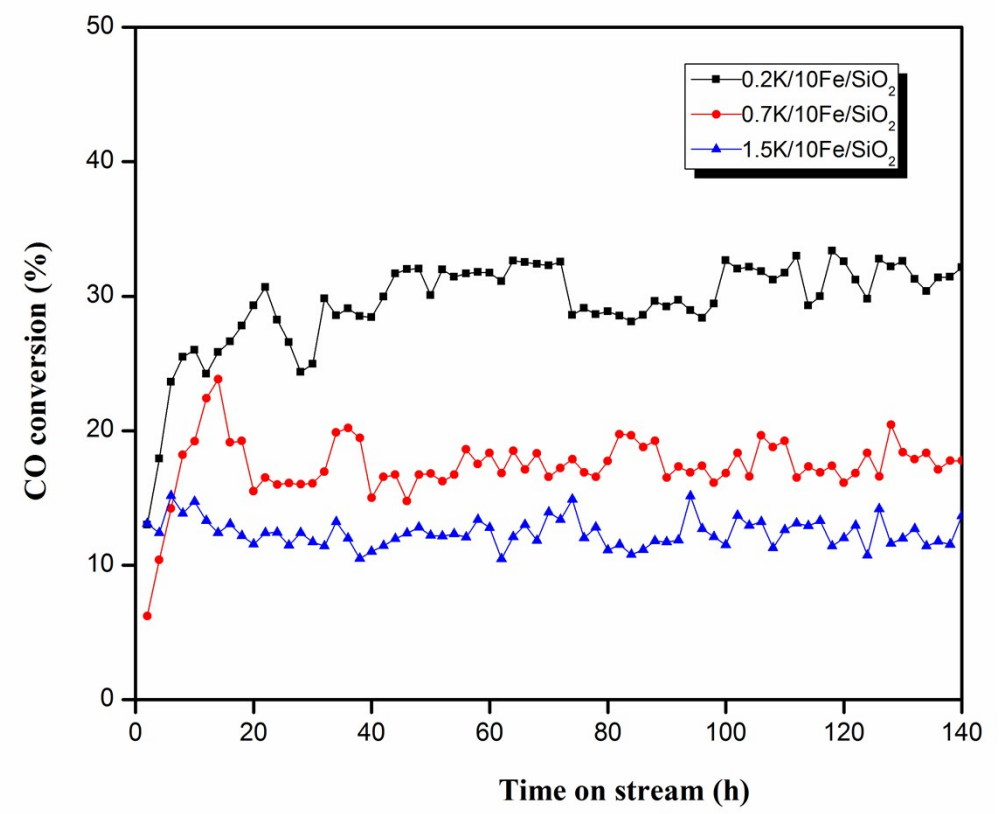

Figure S10 CO conversions for the various microwave pretreated catalysts. Pretreatment conditions: 450 W, 10 s.