Supporting Information for

Flowing-air Induced Transformation to Promote the Dispersion of CrO_x Catalyst for Propane Dehydrogenation

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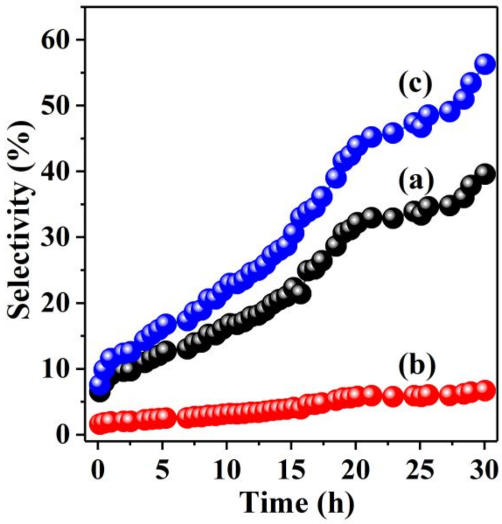


Figure S1. Time on-stream selectivity of methane (a) ethane(b) and ethylene(c) over Cr/MCM-TC catalysts.

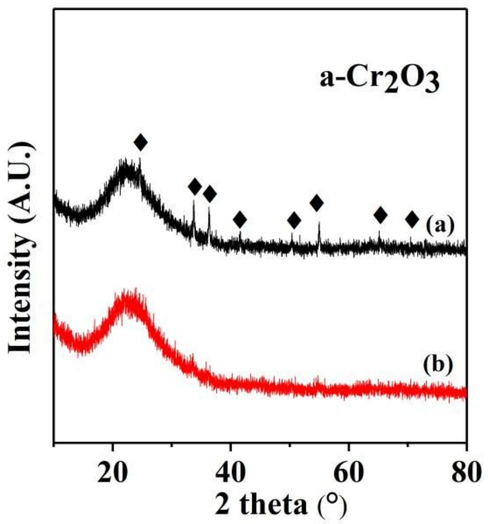


Figure S2. XRD patterns: (a) 5Cr/MCM-TC, (b) 5Cr/MCM-FC

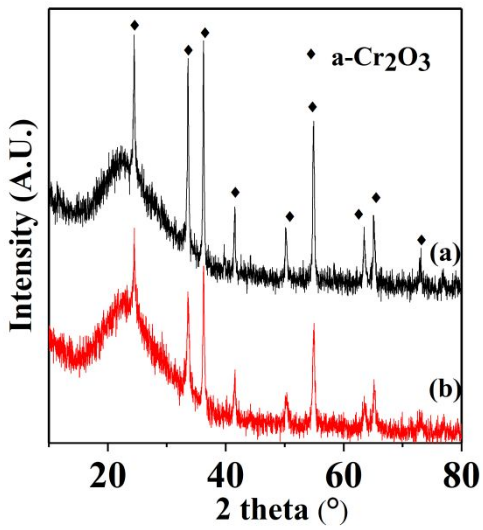


Figure. S3. XRD powder patterns of (a) 20Cr/MCM41-TC and (b) 20Cr/MCM41-FC.

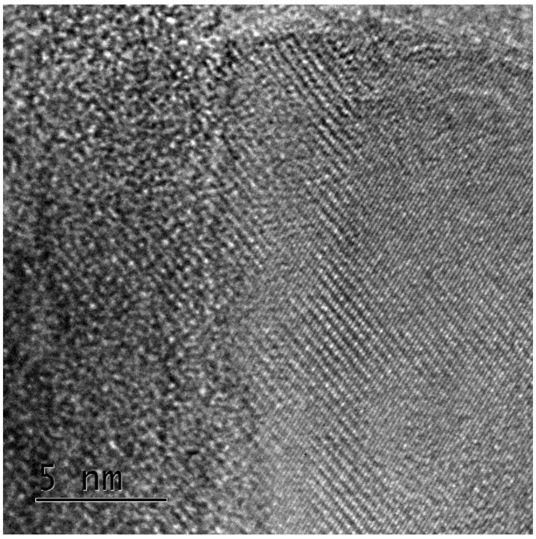


Figure. S4. HRTEM of Cr/MCM-FC.

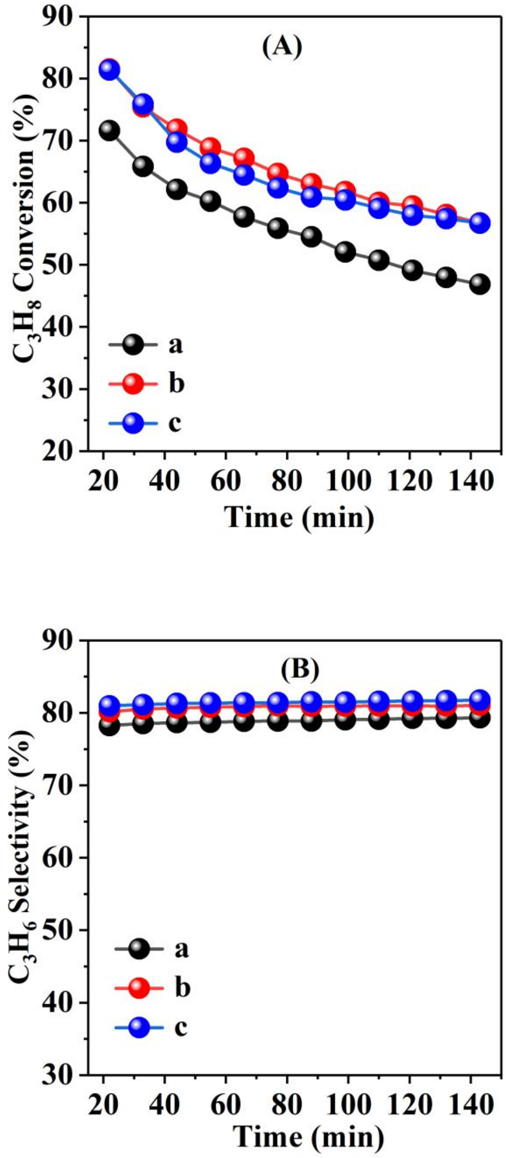


Figure S5. Time on-stream for propane conversion (A) and selectivity (B). (a) 5ml/min, (b) 15ml/min, (c) 30ml/min.

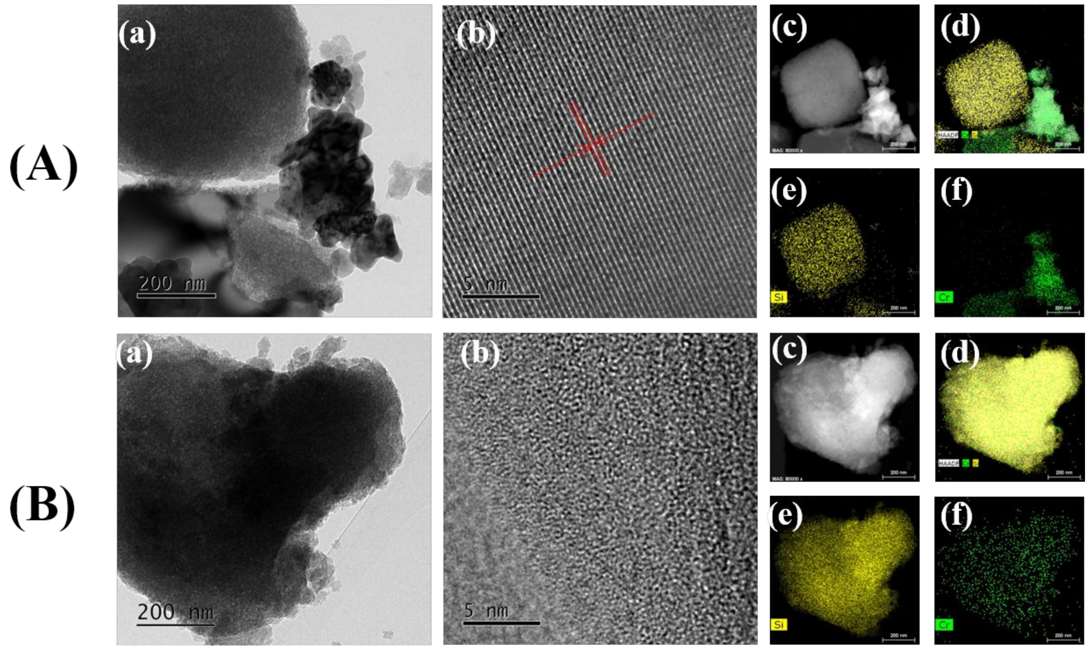


Figure S6. (a) TEM, (b) HRTEM and (c, d, e, f) EDS elemental mapping images of ($H_8CrN_2O_4$) Cr/MCM-TC (A) and ($H_8CrN_2O_4$) Cr/MCM-FC (B).

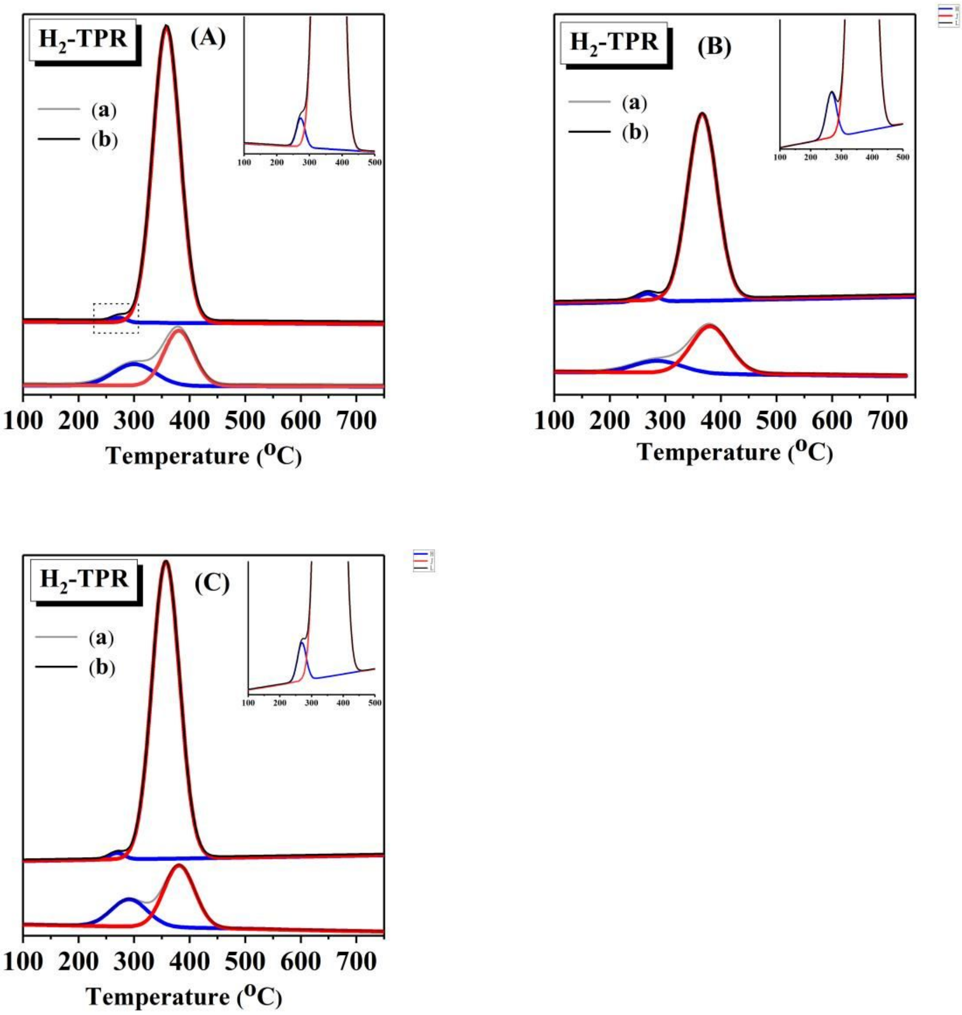
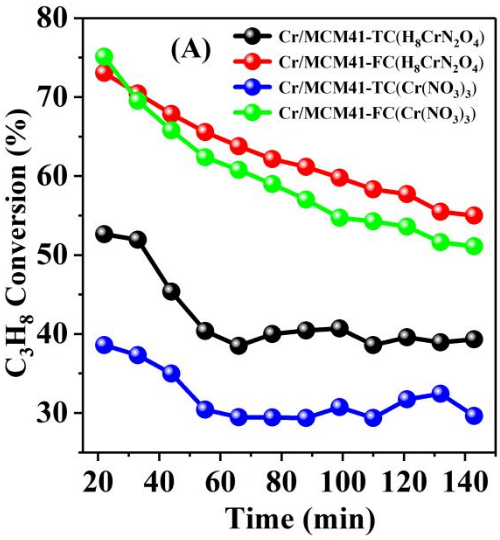


Figure S7. H_2-TPR profiles of ($H_8CrN_2O_4$) Cr/MCM catalysts (A) , ($CrO4^{2-}$) Cr/SBA catalysts (B) and ($H_8CrN_2O_4$) Cr/SBA catalysts (C) with two roasting methods: (a) Cr/X-TC, (b) Cr/X-FC.



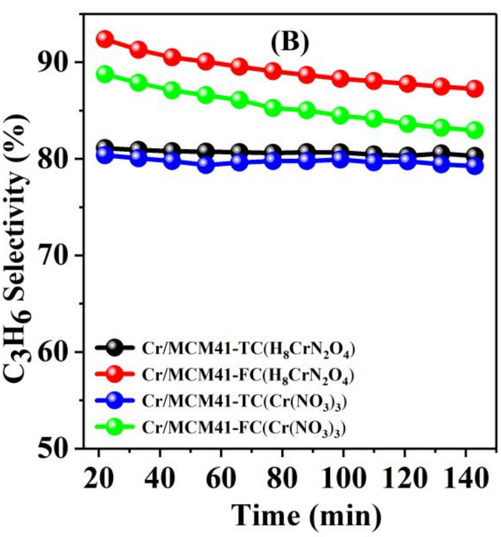


Figure S8. Time on-stream for propane conversion (A) and selectivity (B) over Cr/MCM catalysts with different precursors.

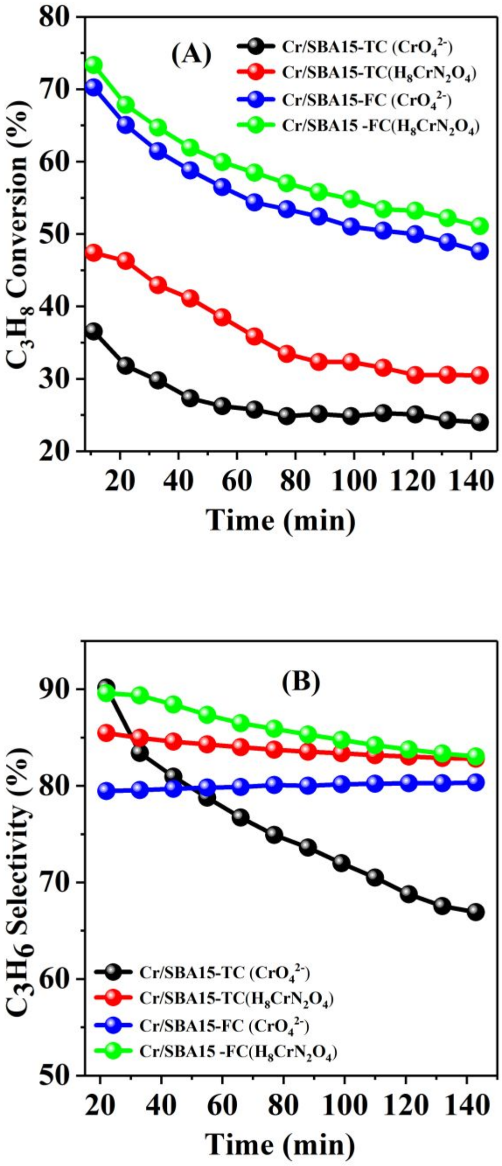


Figure S9. Time on-stream for propane conversion (A) and selectivity (B) over Cr/SBA catalysts with different precursors.

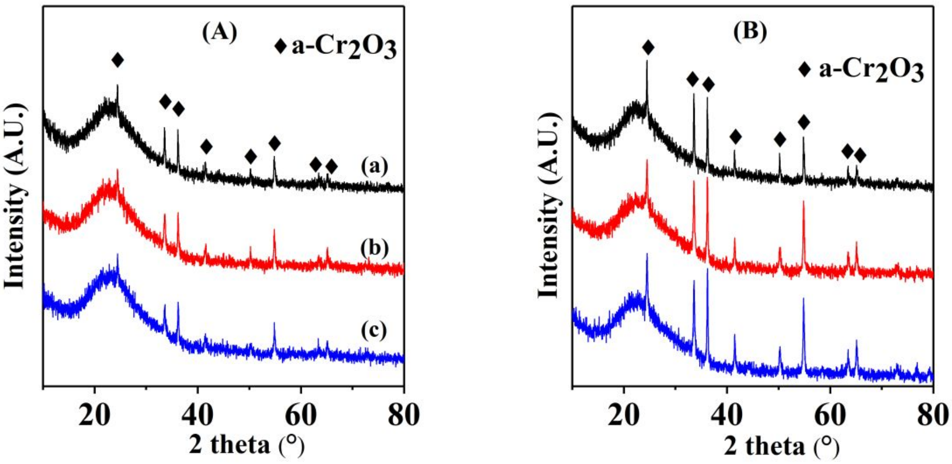


Figure S10 XRD powder patterns of spent Cr/MCM41-FC (A) and Cr/MCM41-TC (B). (a) Fresh samples, (b) reacted for 3h, (c) reacted for 30h.

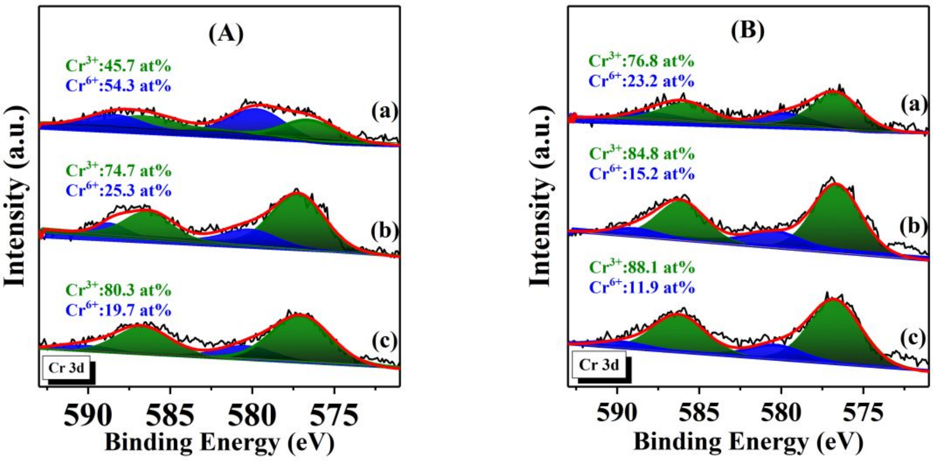


Figure S11 XPS spectra of Cr 2p for spent Cr/MCM41-FC (A) and Cr/MCM41-TC (B). (a) Fresh samples, (b) reacted for 3h, (c) reacted for 30h.

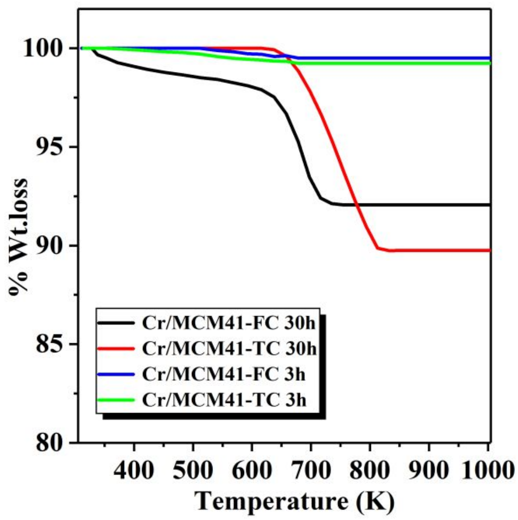


Figure S12 TG of different spent Cr/MCM-41 catalysts. **%Wt. loss** represent the weight-normalized mass loss.

Table S1 Content of Cr elements in Cr/MCM catalysts prepared by two calcination methods

Catalysts	The content of Cr elements (%).
(CrO_4^{2-})Cr/MCM41-FC	7.74
(CrO_4^{2-})Cr/MCM41-TC	8.04

Table S2 Parameters obtained from EXAFS analysis for the Cr/MCM catalysts with two roasting methods.

	shell	CN	R(Å)	σ2	ΔE_0	R factor
Cr/MCM-TC	Cr-O1	4.9±0.3	2.26±0.01	0.0030	6.7	0.0035
	Cr-O2	4.0±0.6	3.18±0.01			
Cr/MCM-FC	Cr-O1	2.7±0.6	1.70±0.01	0.0034	7.8	0.0124
	Cr-O2	4.2±0.6	2.01±0.03			

Table S3 Catalytic performance of all catalysts covered in the paper. (t_0 and $t_{2.5}$ are the initial reaction and reaction 2.5h, respectively, GHSV=4200, C_3H_8=5, N_2=30)

Catalysts	Reaction temp(°C)	Conversion (%)		Selectivity(%)	
		t_0	$t_{2.5}$	t_0	$t_{2.5}$
(CrO_4^{2-})Cr/MCM41-TC	600	30	16	78	73
(CrO_4^{2-})Cr/MCM41-FC	600	87.7	55	81.1	83
($H_8CrN_2O_4$)Cr/MCM41-TC	600	52.6	39	81	80
($H_8CrN_2O_4$)Cr/MCM41-FC	600	73	55	92	87
($Cr(NO_3)_3$)Cr/MCM41-TC	600	38.5	29	80	79
($Cr(NO_3)_3$)Cr/MCM41-FC	600	75	51	88	82
(CrO_4^{2-})Cr/SBA15-TC	600	36	24	83	66
(CrO_4^{2-})Cr/SBA15-FC	600	70	47	79	80
($H_8CrN_2O_4$)Cr/SBA15-TC	600	47	30	85	82

$(H_8CrN_2O_4)Cr/$ SBA15-FC	600	73	51	89	83

Table S4 Quantitative data of H_2 consumption for all samples.

Catalysts	The H_2 Consumption of monomeric Cr(VI) (mmol/g)
(CrO_4^{2-})Cr/MCM41-TC	0.2
(CrO_4^{2-})Cr/MCM41-FC	1.21
($H_8CrN_2O_4$)Cr/MCM41-TC	0.39
($H_8CrN_2O_4$)Cr/MCM41-FC	1.83
(CrO_4^{2-})Cr/SBA15-TC	0.36
(CrO_4^{2-})Cr/SBA15-FC	1.57
($H_8CrN_2O_4$)Cr/ SBA15-TC	0.42
($H_8CrN_2O_4$)Cr/ SBA15-FC	1.91