

## **Increase of light aromatics space time yield by addition of SAPO-34 into multifunctional catalyst**

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Table S1 XRF results of oxides and zeolites

Sample	Molar composition		
	Mn (mol%)	Zr (mol%)	Mn/Zr ratio
6Mn4Zr	59.35	40.65	1.46
	Zn (mol%)	Cr (mol%)	Zn/Cr ratio
Zn1.0Cr	27.19	46.19	0.94
Zn1.1Cr	29.19	42.90	1.08
Zn1.2Cr	31.94	42.38	1.20
Zn1.3Cr	32.86	39.69	1.32
	Si (mol%)	Al (mol%)	
H-ZSM-5(60)	98.32	1.68	
	Si (mol%)	Al (mol%)	P (mol%)
SAPO-34(0.1)	4.44%	43.54%	52.02%

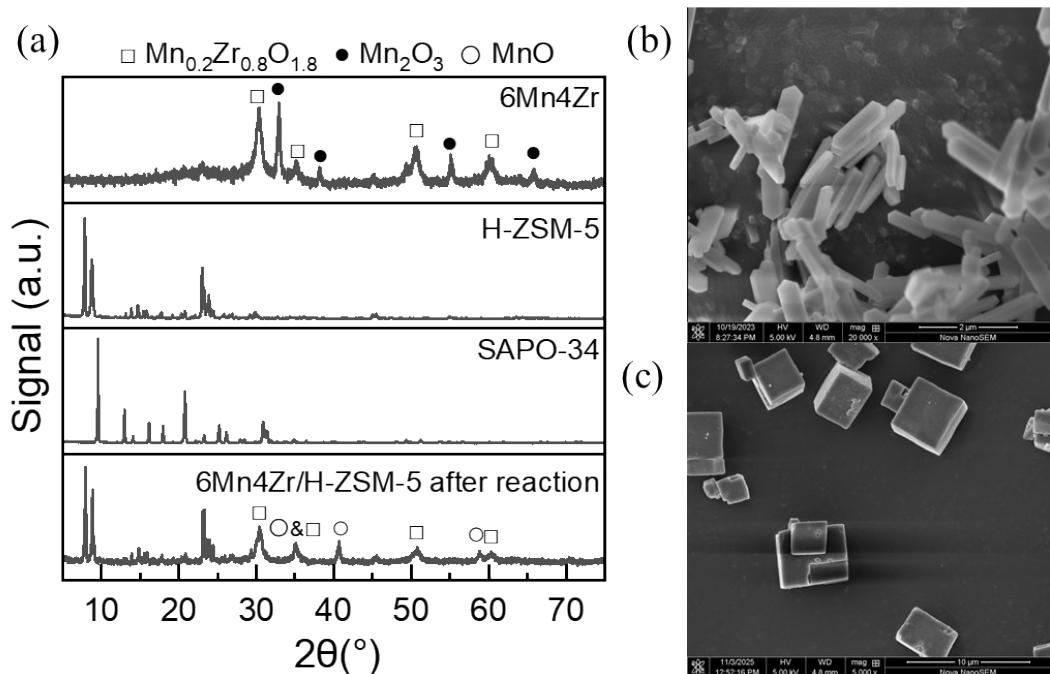


Figure S1. (a) XRD patterns of 6Mn4Zr, H-ZSM-5 and SAPO-34; (b) SEM figure of H-ZSM-5 and (c) SEM figure of SAPO-34.

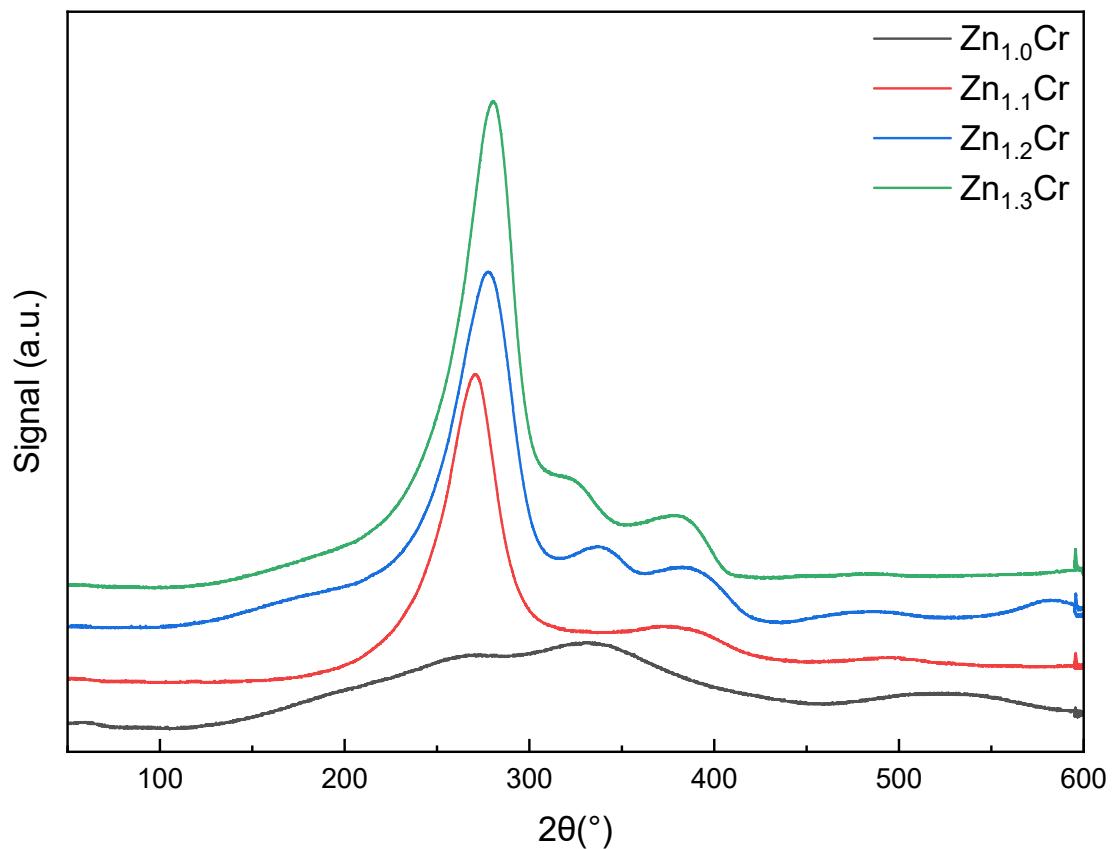


Figure S2.  $\text{H}_2$ -TPR profile of  $\text{Zn}_x\text{Cr}$ .

Table S2. Quantification of XPS profiles of  $\text{Zn}_x\text{Cr}$

Oxides	Fresh oxides		Reduced oxides	
	Zn/Cr ratio (mol%)	Oxygen vacancy (mol%)	Zn/Cr ratio (mol%)	Oxygen vacancy (mol%)
Zn1.0Cr	0.32	15.95	0.34	23.07
Zn1.1Cr	0.45	21.51	0.47	26.97
Zn1.2Cr	0.56	22.26	0.59	28.99
Zn1.3Cr	0.63	25.35	0.68	30.39

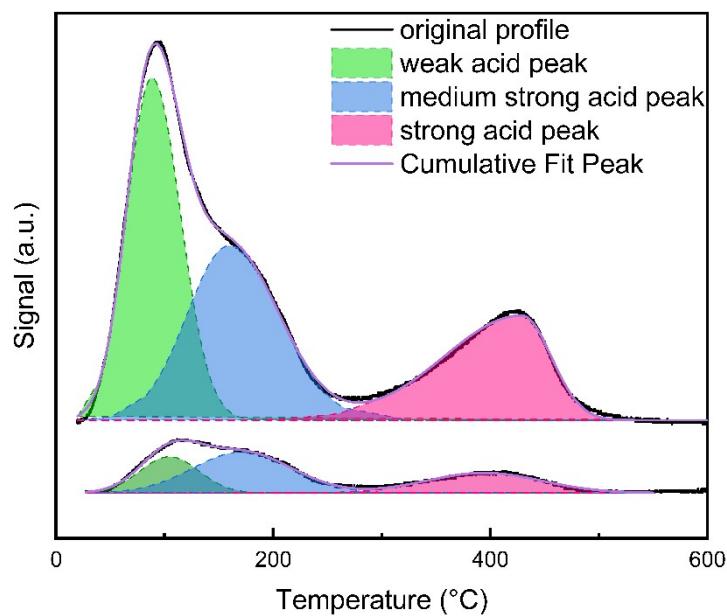


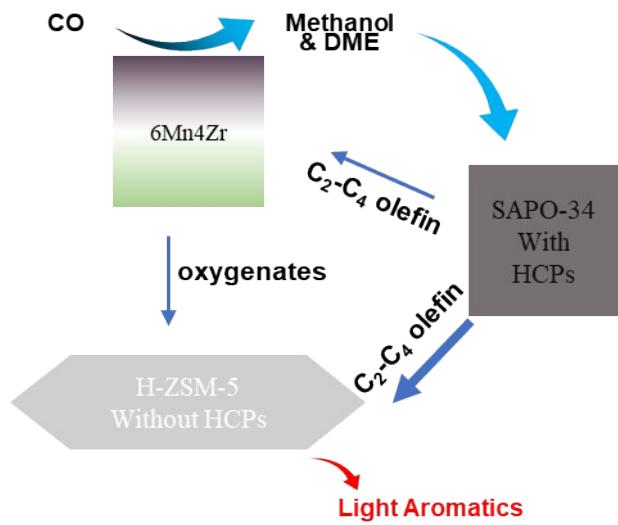
Figure S3. NH<sub>3</sub>-TPD profile of zeolites.

Table S3 Quantification of acid sites in Figure S2

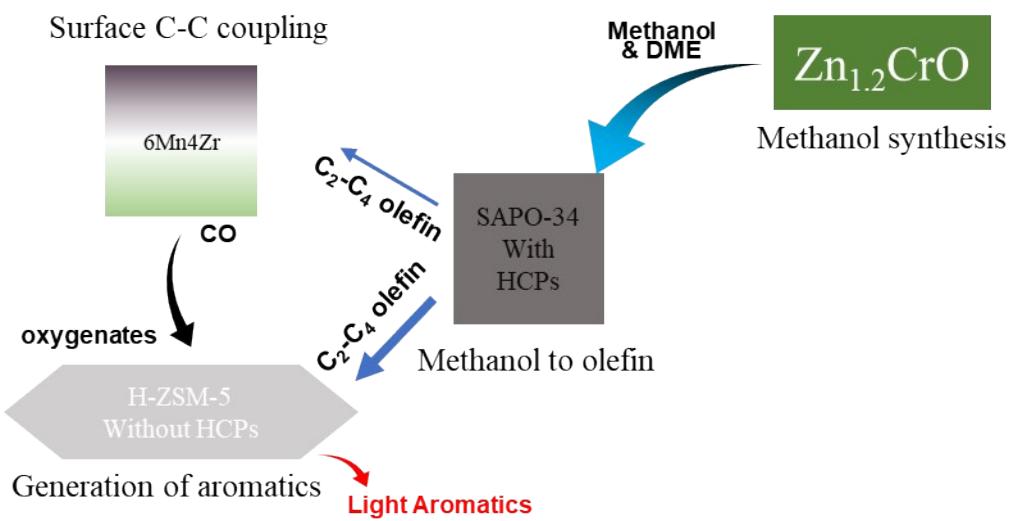
Zeolites	Acid sites distribution			Total acid sites μmol/g
	Weak acid sites	Medium strong acid sites	Strong acid sites	
H-ZSM-5	19.07%	52.09%	28.84%	73.45
SAPO-34	43.01%	31.56%	25.43%	720.41

Table S4 Quantification of HCPs in figure 3

Mass ratio of H-ZSM-5 to SAPO-34	Mass ratio at 230°C	Mass ratio at 800°C	Amount of HCPs
1:0	98.23	95.52	2.71
2:1	88.66	85.14	3.52
1:1	88.25	82.53	5.72
1:2	90.84	85.20	5.64
0:1	85.49	80.31	5.18



Scheme S1. Reaction mechanism over 6Mn4Zr/H-ZSM-5/SAPO-34



Scheme S2. Reaction mechanism over  $Zn_{1.2}Cr(I)|6Mn4Zr/H-ZSM-5/SAPO-34(2:1:1)(8)$