

Electronic Supplementary Information

Selective production of *para*-xylene and light olefins from methanol over mesostructured Zn-Mg-P/ZSM-5 catalyst

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List of contents:

Tables

Table S1 The chemical compositions of different zeolite samples

Table S2 The acid amounts of different zeolite samples determined from NH₃-TPD profiles

Table S3 The detailed assignments of the vibrational bands in the *in-situ* DRIFT spectra

Table S4 Summary of the performance of various catalyst samples for direct conversion of methanol to *p*-xylene in both this work and the literatures

Figure

Fig. S1 The catalytic performance of the regenerated Zn-Mg-P/AT-ZSM-5 catalyst sample.

Table S1 The chemical compositions of different zeolite samples

Samples	SiO ₂ /Al ₂ O ₃ ratio (mol mol ⁻¹)	Zn content (wt%)	Mg content (wt%)	P content (wt%)
ZSM-5	37.2	-	-	-
AT-ZSM-5	37.4	-	-	-
Zn/AT-ZSM-5	37.9	0.85	-	-
Zn-Mg-P/AT-ZSM-5	38.0	0.80	1.83	4.77

Table S2 The acid amounts of different zeolite samples determined from NH₃-TPD profiles

Samples	Acidic amounts (mmol g ⁻¹)			
	Total	Weak	Mid-strong	Strong
ZSM-5	1.51	0.77	0.10	0.64
AT-ZSM-5	1.43	0.69	0.06	0.68
Zn/ZSM-5	1.24	0.67	0.17	0.40
Zn/AT-ZSM-5	1.21	0.60	0.13	0.48
Zn-Mg-P/ZSM-5	0.95	0.28	0.36	0.31
Zn-Mg-P/AT-ZSM-5	0.97	0.40	0.21	0.36

Table S3 The detailed assignments of the vibrational bands in the *in-situ* DRIFT spectra

Wavenumber (cm ⁻¹)	Assignments
800	δ (C-H)s of xylenes
1180	ν (C-O)
1460	δ (C-H)as of -CH ₃
1590	ν (C=C)n of alkenes
1669	ν (C=C) of alkenes
2850	ν (C-CH)s of -CH ₂ -
2863	ν (C-CH)s of -CH ₃
2920	ν (C-H)as of -CH ₂ -
3030	ν (C-H) of aromatics

Table S4 Summary of the performance of various catalyst samples for direct conversion of methanol to *p*-xylene in both this work and the literatures

Samples	Reaction conditions	<i>p</i> -Xylene yield (wt%)	<i>para</i> -Selectivity (wt%)	C ₂ ⁻ ~ C ₄ ⁻ yield (wt%)	Lifetime (h)	Ref.
Si/PLaHZSM-5	420 °C, 2 h ⁻¹	5.09	99.46	44.94	~13	S1
Mg-Zn-Si-HZSM-5	460 °C, 1 h ⁻¹	21.24	98.90	11.78	>12	S2
H[Zn,Al]ZSM-5/SiO ₂	450 °C, 2.3 h ⁻¹	18.18	95.63	-	21	S3
Zn/P/Si/ZSM-5	475 °C, 0.79 h ⁻¹	21.33	89.60	-	-	S4
Zn-Mg-P/ZSM-5	400 °C, 2.4 h ⁻¹	16.67	92.19	49.60	36	This work
Zn-Mg-P/AT-ZSM-5	400 °C, 2.4 h ⁻¹	19.20	90.85	45.59	50	This work

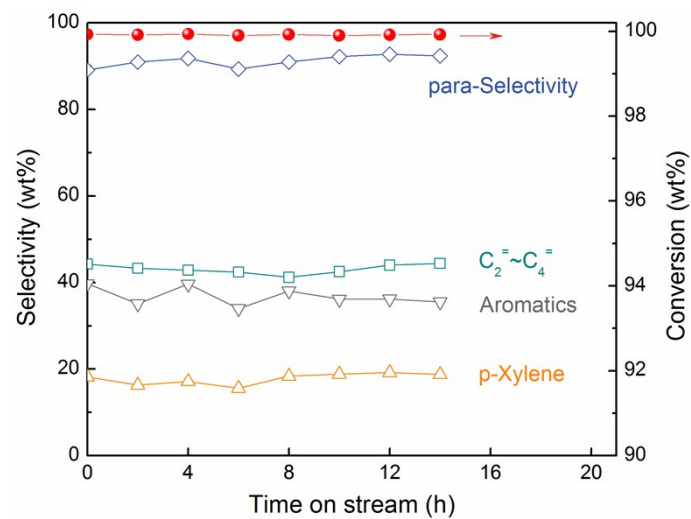


Fig. S1 The catalytic performance of the regenerated Zn-Mg-P/AT-ZSM-5 catalyst sample.

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