

## **Supporting Information**

### **Methanol Aromatization over Mg-P Modified [Zn,Al]ZSM-5 Zeolites for Efficient Coproduction of *para*-Xylene and Light olefins**

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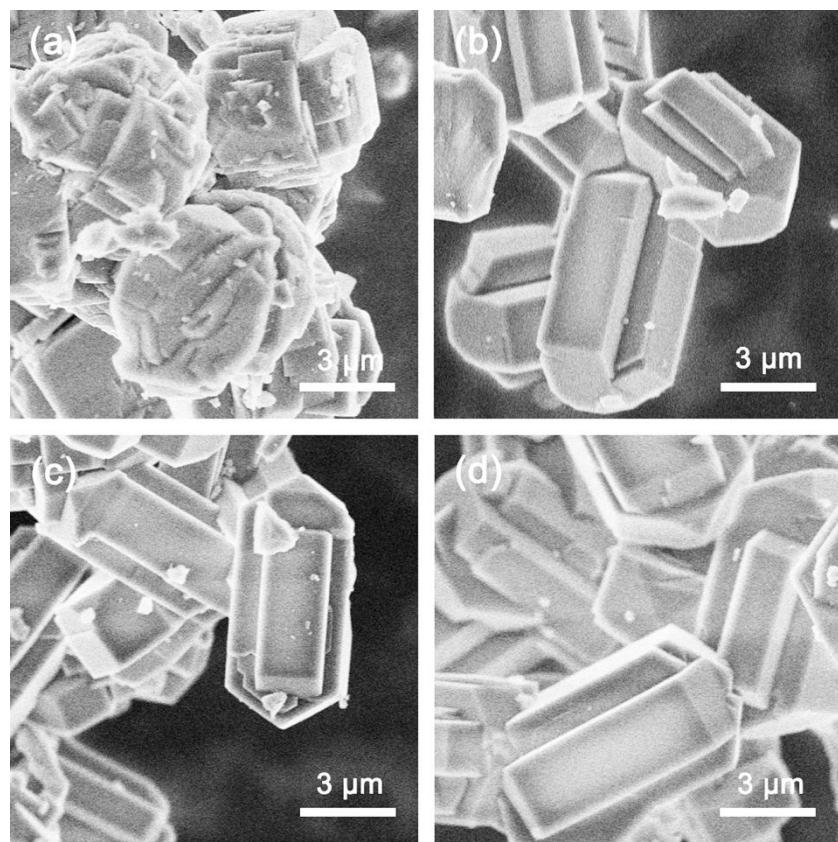
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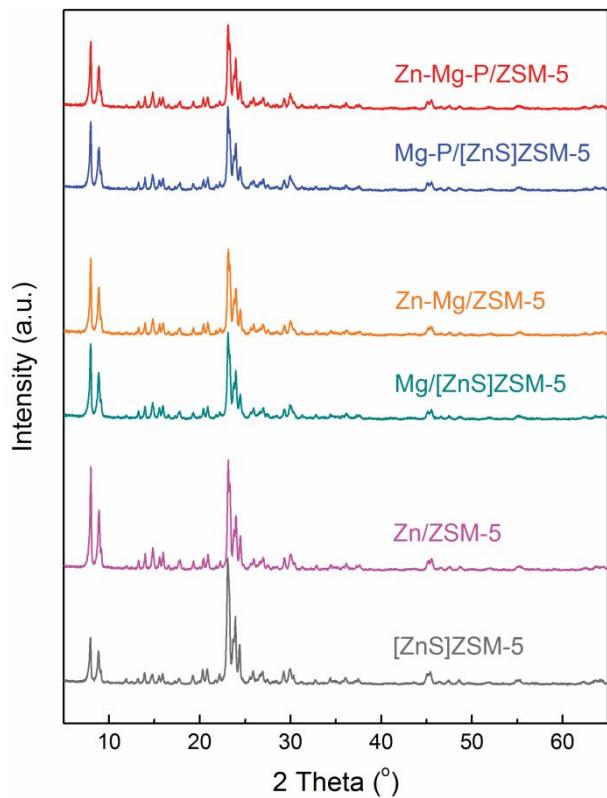
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**Figure S1.** The SEM images of different synthesized zeolite samples: (a) ZSM-5, (b) [ZnS]ZSM-5, (c) [ZnAc]ZSM-5, and (d) [ZnN]ZSM-5.



**Figure S2.** The XRD patterns of Mg and P modified catalyst samples.

**Table S1.** The Elemental Compositions of Different Modified Zeolite Samples

Samples	Compositions, wt%						Si/Al
	Si	Al	Zn	Mg	P	S	
[ZnS]ZSM-5	45.33	1.21	0.58			0.16	35.84
Mg/[ZnS]ZSM-5	43.91	1.18	0.58	1.87		0.10	35.64
Mg-P/[ZnS]ZSM-5	39.06	1.05	0.52	1.70	4.80	0.07	35.77

**Table S2.** The Performance of Different Modified Zeolites for Methanol Conversion to *p*-Xylene and Light Olefins

Samples	[ZnS]ZSM -5	Zn/ZSM -5	Mg/[ZnS]ZS M-5	Zn-Mg/ZS M-5	Mg-P/[ZnS]ZS M-5	Zn-Mg-P/ZS M-5
C <sub>methanol</sub> (wt%)	100.00	100.00	99.97	99.98	99.97	99.98
<i>Product profile (wt%)</i>						
H <sub>2</sub>	1.76	1.88	0.35	0.65	0.15	0.20
CH <sub>4</sub>	1.19	1.22	0.65	0.67	0.49	0.66
C <sub>2</sub> H <sub>6</sub>	0.47	0.99	0.19	0.21	0.23	0.26
C <sub>2</sub> H <sub>4</sub>	5.59	1.63	12.52	11.03	17.19	15.89
C <sub>3</sub> H <sub>8</sub>	9.24	15.21	3.21	3.86	3.62	4.28
C <sub>3</sub> H <sub>6</sub>	7.11	2.20	18.13	14.99	21.75	19.28
C <sub>4</sub> H <sub>10</sub>	8.90	12.09	4.88	5.22	5.67	5.80
C <sub>4</sub> H <sub>8</sub>	2.59	0.83	9.78	9.38	12.93	13.81
C <sub>5</sub> <sup>+</sup>	0.98	1.67	1.17	2.68	2.90	1.36
Benzene	1.53	2.85	1.34	1.66	0.47	0.51
Toluene	16.75	20.15	10.71	13.90	3.82	5.68
Ethylbenzene	1.68	0.96	1.14	0.84	1.09	0.80
<i>p</i> -Xylene	12.33	6.71	24.57	20.82	23.01	22.20
<i>m</i> -Xylene	15.23	15.01	4.60	6.25	2.53	3.81
<i>o</i> -Xylene	5.71	6.68	3.26	2.69	0.95	1.13
C <sub>9</sub> <sup>+</sup>	8.94	9.92	3.50	5.15	3.20	4.33
Light olefins	15.29	4.66	40.43	35.40	51.87	48.98
Total aromatics	62.17	62.28	49.12	51.31	35.07	38.46
<i>para</i> -Selectivity	37.06	23.63	75.76	69.96	86.86	81.80
HTI index (-)	1.87	9.01	0.29	0.37	0.27	0.30

**Table S3.** Summary of the Performance of 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%)	$C_2^= \sim C_4^=$ yield (wt%)	Ref.
Si/PLaHZSM-5	420 °C, 2 h <sup>-1</sup>	5.09	99.46	44.94	S1
Mg-Zn-Si-HZSM-5	460 °C, 1 h <sup>-1</sup>	21.24	98.90	11.78	S2
H[Zn,Al]ZSM-5/SiO <sub>2</sub>	450 °C, 2.3 h <sup>-1</sup>	18.18	95.63	-	S3
Zn/P/Si/ZSM-5	475 °C, 0.79 h <sup>-1</sup>	21.33	89.60	-	S4
Zn-Mg-P/ZSM-5	420 °C, 2.4 h <sup>-1</sup>	22.20	81.80	48.98	This work
Mg-P/[ZnS]ZSM-5	420 °C, 2.4 h <sup>-1</sup>	23.01	86.86	51.87	This work

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