Supporting Information

Insight into the impact of Al distributions on catalytic performance of 1-octene aromatization over ZSM-5 zeolite

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Alkylation of benzene with 1-octene was carried out in the same fixed-bed stainless-steel reactor as the 1-octene aromatization. In a typical experiment, the pre-treatment of the ZSM-5-S zeolite catalyst was the same to the 1-octene aromatization. When the reaction temperature decreased to the target temperature (380 ºC), the feedstock with a molar ratio of 1-octene to benzene of 2.0 was fed into the reactor at a certain flow rate. The reaction conditions for this catalytic test were the following: pressure was 1.0 MPa, volume ratio of N_2/feed was 300, and the liquid hourly space velocity (LHSV) was set at 2.0 h^{-1}. The products collection and analysis method were the same to the 1-octene aromatization. In each experiment, the carbon balance was maintained above 95%. The calculations method of conversion and selectivity were shown as follows:

$$Conversion\ of\ 1-octene\ (\%) = \frac{w_0 - w_1}{w_0} \times 100$$

$$Conversion\ of\ benzene\ (\%) = \frac{w_2 - w_3}{w_2} \times 100$$

$$Products\ Selectivity\ (\%) = \frac{w_i}{w_0 - w_1} \times 100$$

w_0 and w_1 represent the weights of 1-octene in the feed and product, respectively; w_2

and w_3 represent the weights of benzene in the feed and product, respectively; w_i denotes the weight of products which reactant converted to.

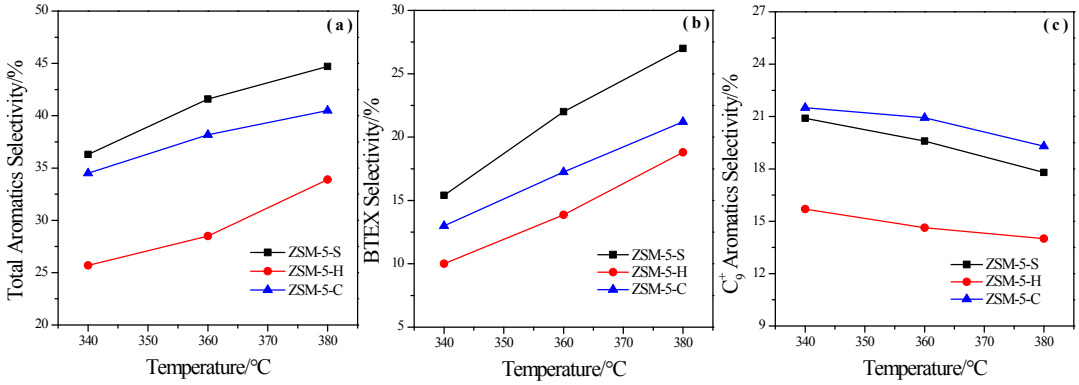

Fig. S1 Total aromatics (a), BTEX (b) and C_9^+ (c) selectivity over ZSM-5-S, ZSM-5-H, and ZSM-5-C catalysts for 1-octene aromatization.

(Reaction conditions: time on steam = 6.0 h, pressure = 1.0 MPa, N_2/1-octene = 300, LHSV = 2.0 h^{-1}.)

Table S1 1-octene conversion and products selectivity over different ZSM-5 catalyst for 1-octene aromatization

Catalysts	1-octene con. (%)[a]	Products Selectivity (%)[a]														
		CH_4	C_2	C_3^0	$C_3^=$	C_4^0	$C_4^=$	C_5^0	$C_5^=$	C_6^0	$C_6^=$	C_7^0	$C_7^=$	C_8^0	$C_8^=$	C_9^+
ZSM-5-S	99.9	0.1	0.7	17.7	0.3	14.6	0.3	6.5	0.2	3.0	0.6	1.3	0.9	2.5	2.5	0.2
ZSM-5-H	99.9	0.1	0.8	15.2	0.6	18.7	0.3	9.5	0.5	4.2	1.0	2.2	1.2	2.3	4.3	1.5
ZSM-5-C	99.4	0.2	0.8	20.1	0.3	12.3	0.7	6.0	0.8	4.7	0.8	1.5	1.1	1.7	4.7	1.8

Products Selectivity (%)[a]									
Cycloalkane	Benzene	Toluene	Ethylbenzene	Xylene	C_9 aromatics	C_{10} aromatics	C_{11}^+ aromatics	BETX	Total Aromatics
1.4	2.2	10.3	1.7	12.8	7.1	2.2	8.5	27.0	44.7
3.5	1.3	7.3	1.6	8.6	6.4	2.4	6.3	18.8	33.9
1.7	1.8	8.2	1.6	9.6	6.3	3.9	9.1	21.2	40.5

[a] the 1-octene conversion and products selectivity are estimated with the time on steam of 6.0 h; $C_i^=$ and C_i^0 mean the alkene and alkane hydrocarbon with i carbon atom, respectively; Reaction conditions: pressure = 1.0 MPa, temperature =380 ºC, N_2/1-octene = 300, LHSV = 2.0 h^{-1}.

Table S2 1-octene and benzene conversion as well as the products selectivity over ZSM-5-S catalyst for alkylation reaction of benzene with 1-octene

Catalysts	Benzene con. (%)[a]	1-octene con. (%)[a]	Products Selectivity (%)[a]												
			CH_4	C_2	C_3^0	$C_3^=$	C_4^0	$C_4^=$	C_5^0	$C_5^=$	C_6^0	$C_6^=$	C_7^0	$C_7^=$	C_8
ZSM-5-S	47.5	99.9	0.1	0.4	12.0	0.2	10.0	0.8	5.3	1.1	2.6	0.9	1.1	0.9	3.1

Products Selectivity (%)[a]									
C_9^+	Cycloalkane	Toluene	Ethylbenzene	Xylene	C_9 aromatics	C_{10} aromatics	C_{11}^+ aromatics	TEX	Total Aromatics
2.7	1.2	11.3	8.7	7.6	7.4	5.0	12.2	35.1	52.2

a, the conversion and products selectivity are estimated with the time on steam of 6.0 h;

$C_i^=$ and C_i^0 mean the alkene and alkane hydrocarbon with i carbon atom, respectively