Supplementary Material

Design and synthesis of core shells HZSM-5@MCM-41 with variable acidity and mesoporosity for lignin-catalyzed fast pyrolysis to prepare aromatics

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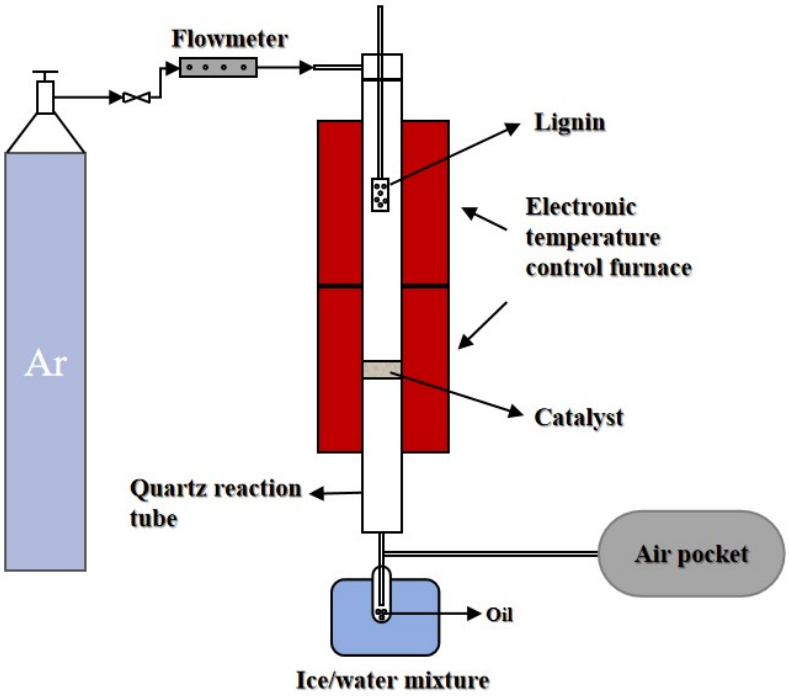

Fig. S1. Pyrolysis experimental setup

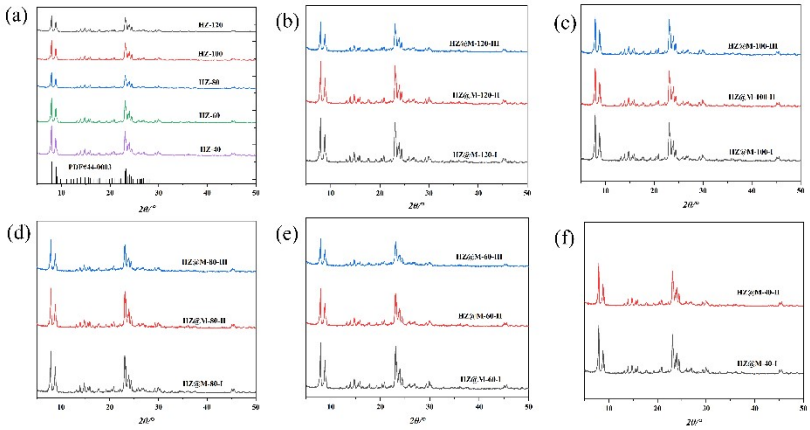

Fig. S2. a: XRD of pristine ZSM-5 with different Si/Al ratios; b-f: XRD of different core-shell catalysts.

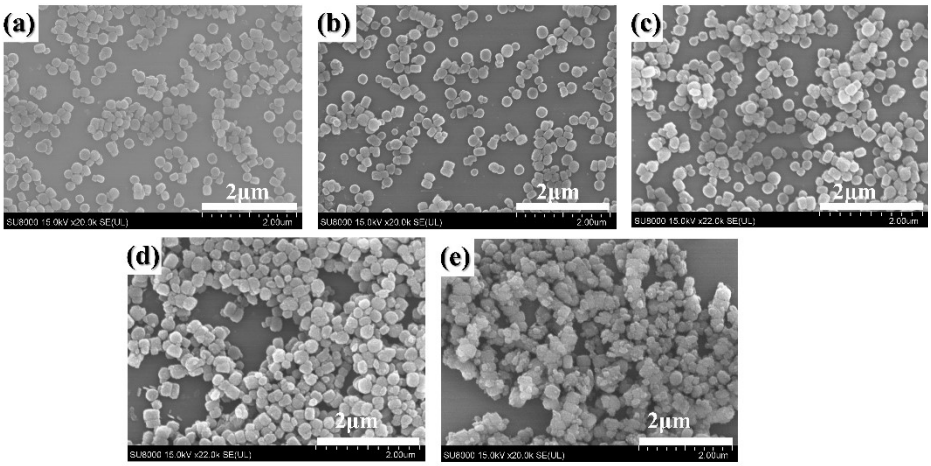

Fig. S3. SEM images of original ZSM-5 with different Si/Al ratios; a: Si/Al=120, b: Si/Al=100, c: Si/Al=80, d: Si/Al=60, e: Si/Al=40.

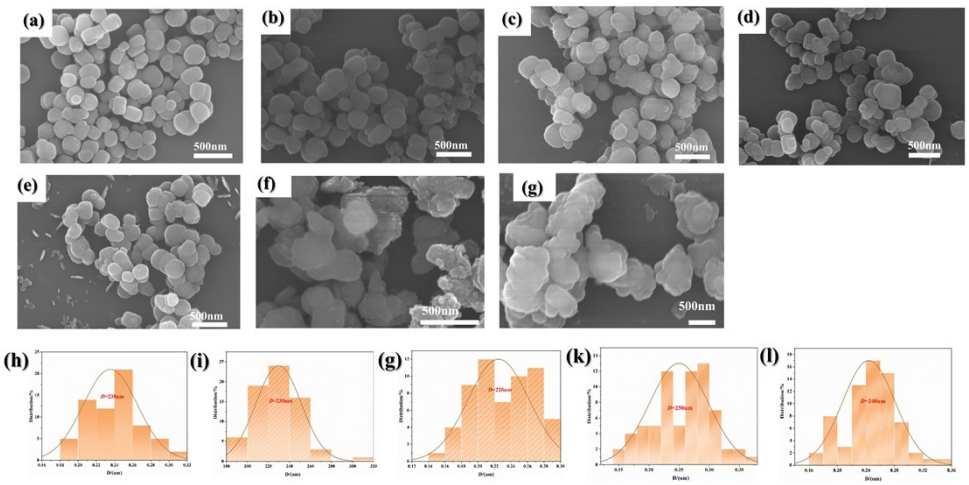

Fig. S4. SEM:(a)-(e): HZ@M-120-II、HZ@M-100-II、 HZ@M-80-II、 HZ@M-60-II、HZ@M-40-II, SEM: (f)Si/Al=60; (g): Si/Al=40. (h)-(l): Particle size distribution corresponding to (a)-(e).

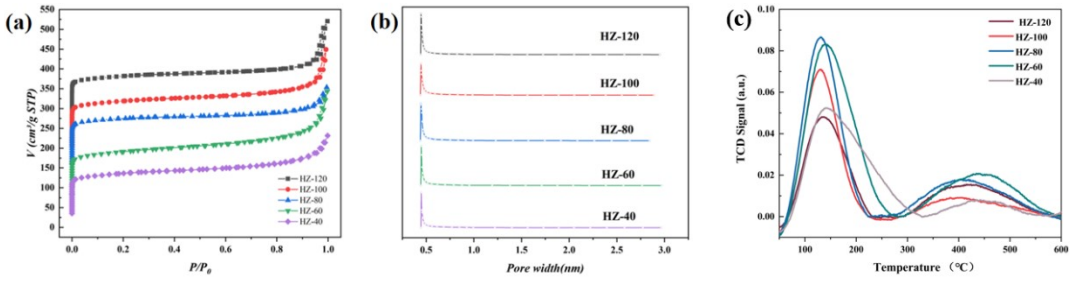

Fig. S5. (a): N_2 adsorption and desorption isotherms of pristine ZSM-5 with different Si/Al ratios, (b): Pore size distribution of pristine ZSM-5 with different Si/Al ratios, (c): NH_3-TPD results for HZ-X catalysts

Table S1

Porosity characteristics of pristine ZSM-5 with different silica-to-aluminum ratios

Sam.	$S_{BET}(m^2g^{-1})$	$S_{micro}(m^2g^{-1})$	$S_{mes}(m^2g^{-1})$	$V_t(cm^3/g^{-1})$
HZ-120	406.6	351.5	55.1	0.37
HZ-100	418.3	349.7	68.6	0.36
HZ-80	406.4	358.1	68.6	0.29
HZ-60	410.4	310.1	100.3	0.39
HZ-40	369.7	294.4	75.3	0.29

Table S2

NH_3-TPD acidity characteristics for different Si/Al ratios and the original ZSM-5

Sam.	Weak acid	Strong acid	Total
HZ-120	0.085	0.022	0.107
HZ-100	0.111	0.033	0.144
HZ-80	0.138	0.059	0.197
HZ-60	0.155	0.062	0.217
HZ-40	0.137	0.016	0.153

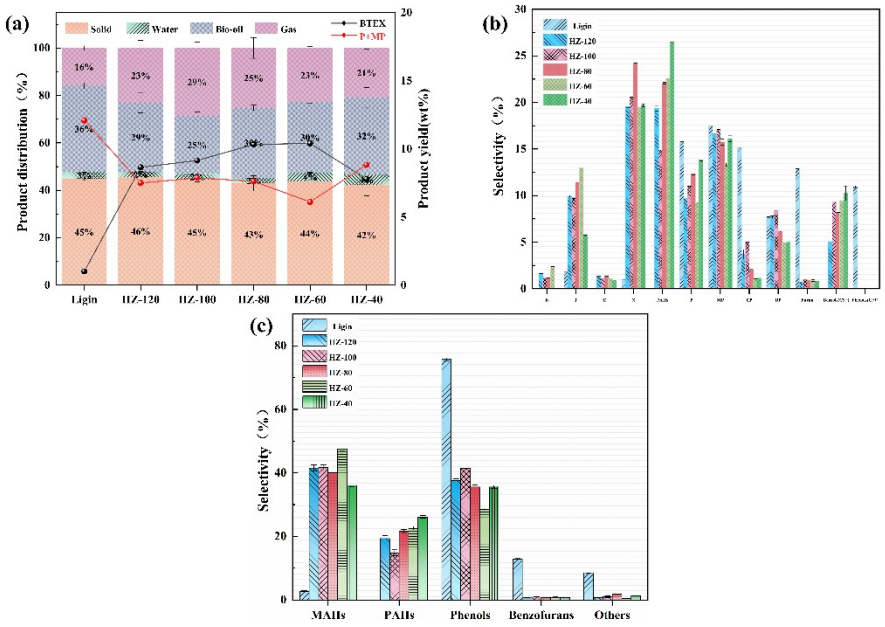

Fig. S6. a: three-phase product distributions of pure lignin, commercial ZSM-5, and pristine ZSM-5 with different Si/Al ratios, b-d: three-phase product distributions with different Si/Al ratios and different thicknesses of HZ@M-X-Y.

B: Benzene; T: Toluene; E: Ethylbenzene; X: Xylene; PAHs: polycyclic aromatic hydrocarbon; P: Phenol; MP: Methyl phenol; EP: Ethyl phenol; DP: Dimethylphenol.