Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Design of novel hierarchical cage active particles and zeolite for direct conversion of syngas to gasoline fuel

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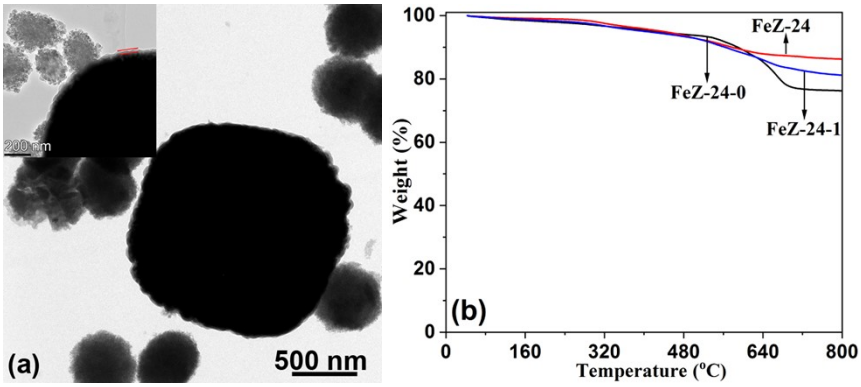

Fig.S1 (a) TEM image of FeZ-24-1, (b) TG of the used catalysts after FTS reaction.

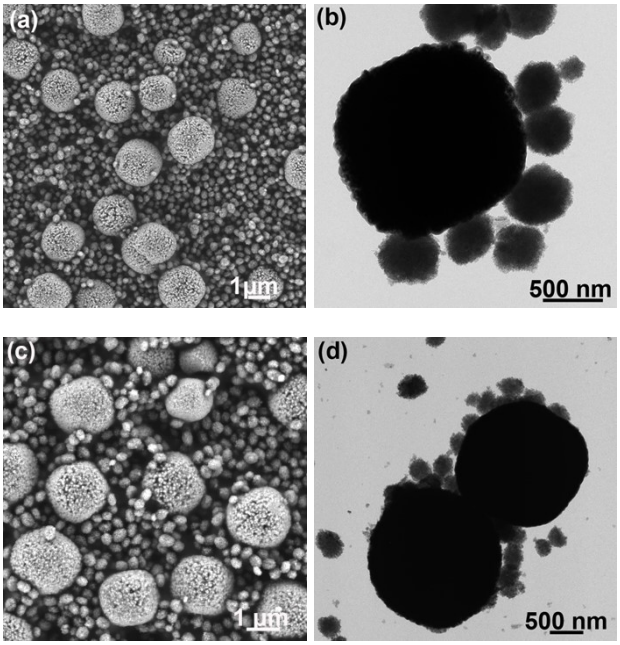

Fig.S2 Morphology of the prepared catalysts: (a) SEM image of FeZ-16, (b) TEM image of FeZ-16, (c) SEM image of FeZ-27, (d) TEM image of FeZ-27.

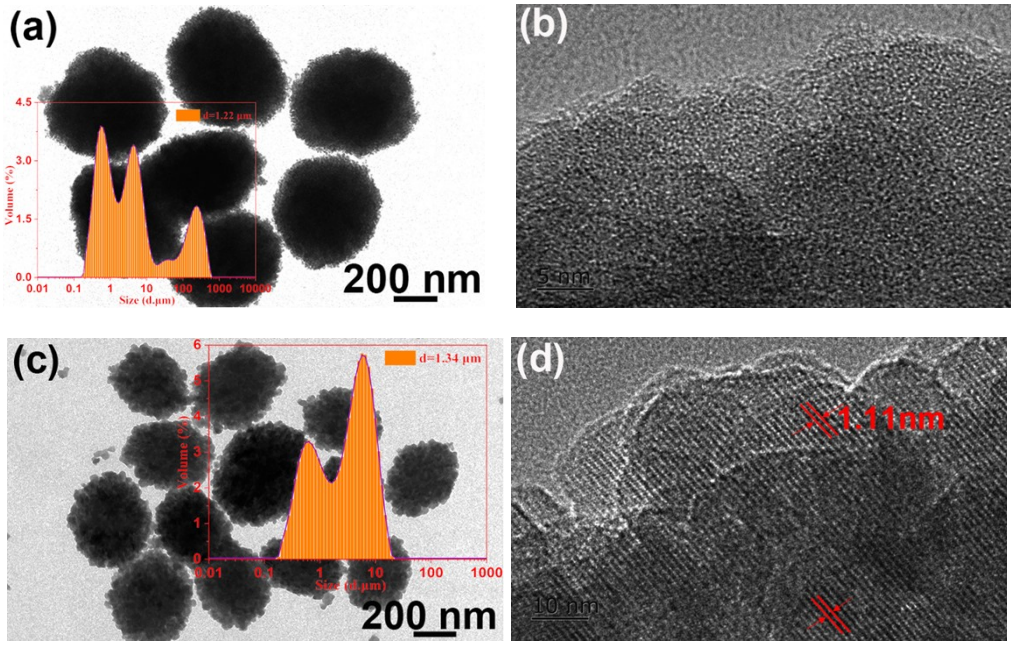

Fig.S3 TEM images and particle size distribution of the prepared zeolites: (a) zeolite-16, (b) HRTEM image of zeolite-16, (c) zeolite-27, (d) HRTEM image of zeolite-27.

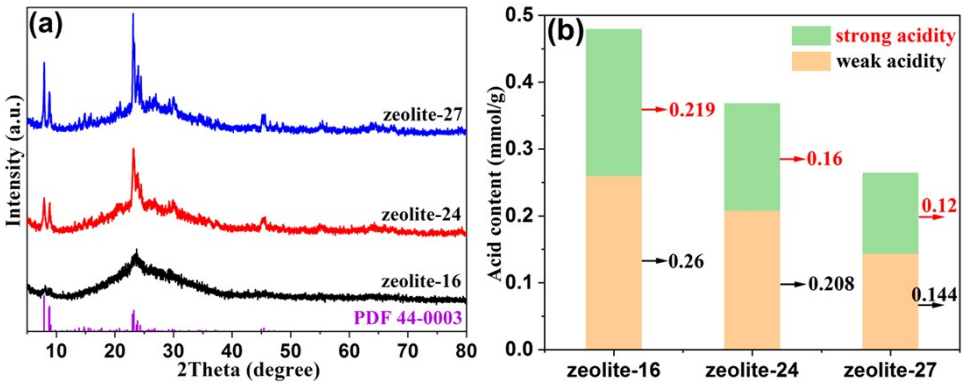

Fig.S4 XRD patterns (a) and acid content (b) of the zeolites.

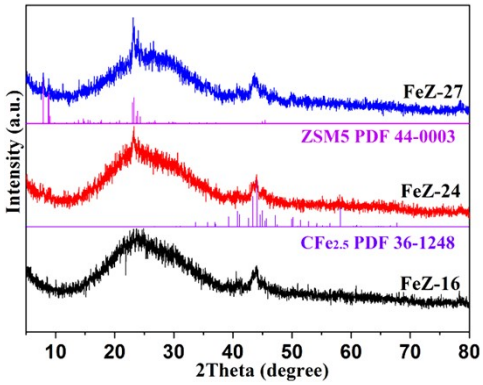

Fig.S5 XRD patterns of the zeolite-introduced catalysts.

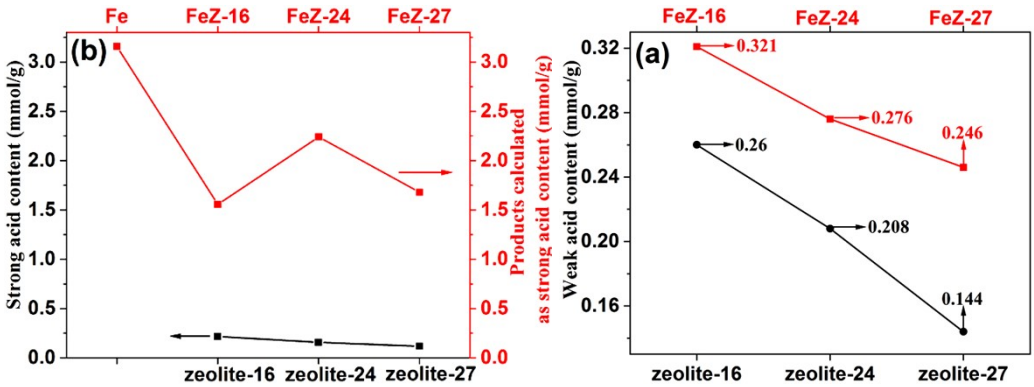

Fig.S6 NH_3-TPD results of the reduced catalysts: (a) a lower temperature, (b) a higher temperature.

Table S1 Performances of the reduced catalysts

Performance	Surface area (m^2/g)	Pore size (nm)
Fe	27.5	3.10
FeZ-16	116.7	7.08
FeZ-24	193.0	6.04
FeZ-27	212.5	9.96

Table S2 Catalytic performance of the hybrid catalysts at the given reaction condition

Reaction conditions		CO conv. (%)	Hydrocarbons selectivity (wt%)					Products in C_{5+} (%)	
			CH_4	C_2-C_4^0	C_2-$C_4^=$	C_5-C_{11}	C_{12+}	aromatic	i-C_{5+}
Fe	280 °C	74.9	15.3	10.8	26.7	35.6	11.6	6.38	24.9
FeZ-16	280 °C	75.2	16.4	11.1	16.0	53.8	2.70	9.19	77.4
FeZ-24	260 °C	58.3	18.5	13.2	5.84	59.9	2.56	28.1	41.2
	270 °C	71.2	17.7	13.3	2.88	63.8	2.32	36.3	60.1
	280 °C	78.1	19.1	14.6	2.34	63.5	0.46	25.7	60.5
	290 °C	82.0	23.3	16.5	1.48	56.5	2.22	50.8	41.8
	300 °C	90.4	26.5	18.7	0.99	49.3	4.51	51.2	45.8
	310 °C	94.5	32.5	21.2	0.77	42.6	2.93	64.4	27.8
FeZ-24-0	280 °C	75.3	16.4	12.3	4.41	64.8	2.09	24.6	42.8
FeZ-24-1	280 °C	80.5	18.8	15.7	1.85	60.5	3.15	42.3	30.7
FeZ-27	280 °C	83.7	17.1	12.9	3.83	63.9	2.27	25.2	64.5