Supplementary Information

Design and synthesis of Ga-doped ZSM-22 zeolites as highly selective and stable catalyst for n-dodecane isomerization

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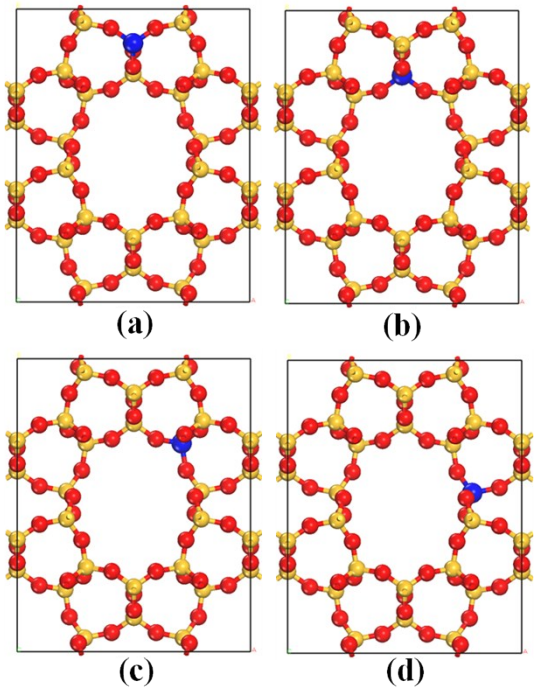

Fig. S1 The schematic views of the unit cells of ZSM-22 with the four independent positions, (a) T4, (b) T3, (c) T2, and (d) T1, shown with blue (the red and yellow balls represent for the O and Si atoms, respectively).

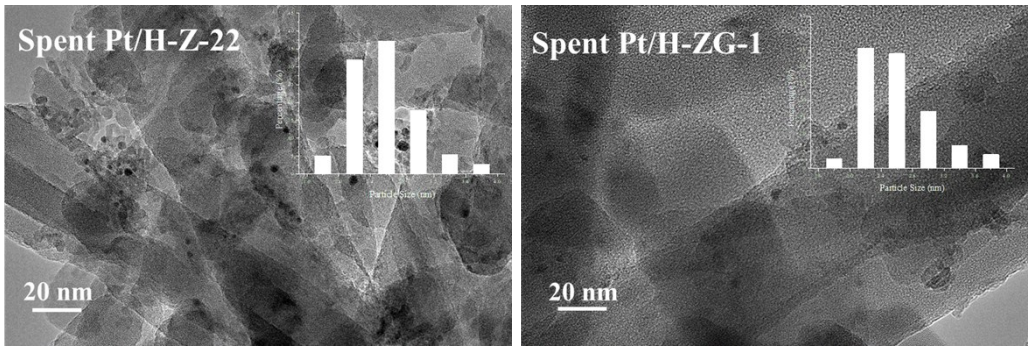

Fig. S2 TEM images of representative bifunctional catalysts after n-C_{12} isomerization.

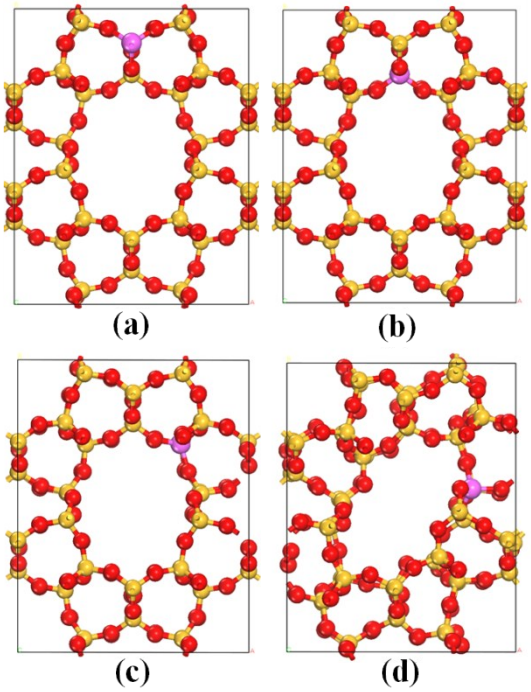

Fig. S3 The structures of the Al substituted ZSM-22 unit cells at the (a) T4, (b) T3, (c) T2, and (d) T1 positions (the red, yellow, and purple balls represent for the O, Si, and Al atoms, respectively).

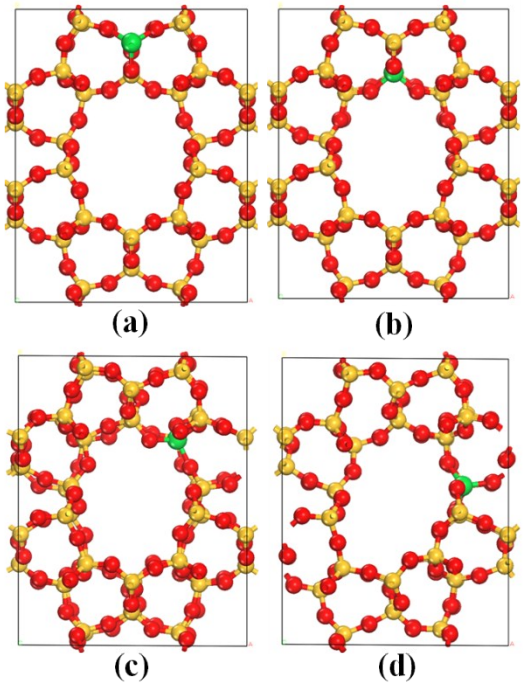

Fig. S4 The structures of the Ga substituted ZSM-22 unit cells at the (a) T4, (b) T3, (c) T2, and (d) T1 positions (the red, yellow, and green balls represent for the O, Si, and Fe atoms, respectively).

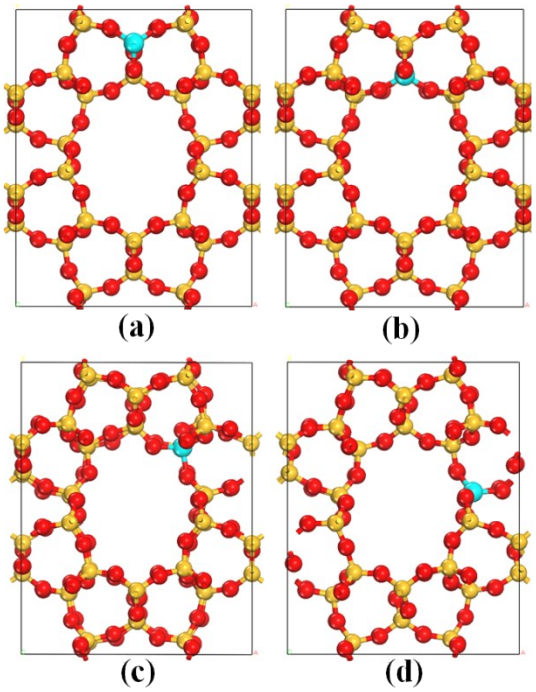

Fig. S5 The structures of the Fe substituted ZSM-22 unit cells at the (a) T4, (b) T3, (c) T2, and (d) T1 positions (the red, yellow, and cyan balls represent for the O, Si, and Fe atoms, respectively).

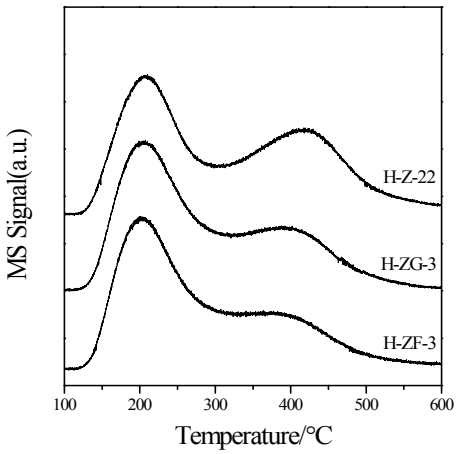

Fig. S6 NH_3-TPD spectra of H-Z-22, H-ZG-3, and H-ZF-3 samples

(Content of Fe and Ga is 0.76 wt. % and 0.79 wt. % as determined by ICP-AES, respectively.)

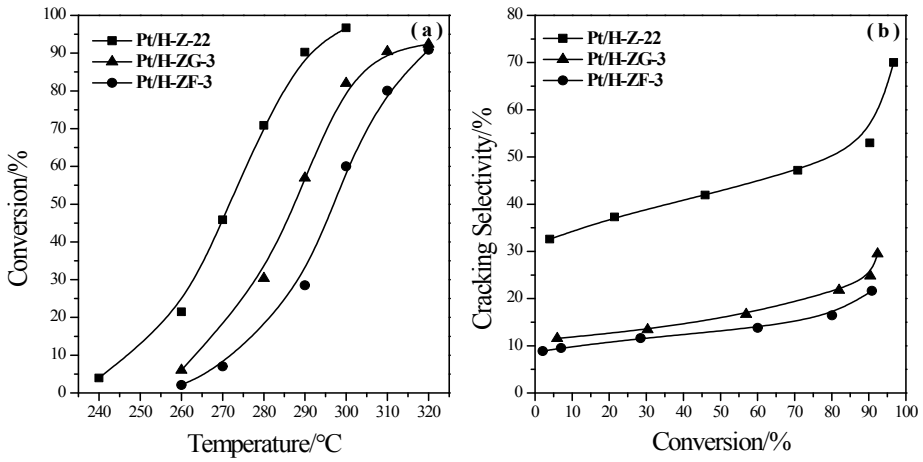

Fig. S7 n-dodecane conversion (a) and cracking selectivity (b) over Pt/H-Z-22, Pt/H-ZG-3, and Pt/H-ZF-3 catalysts

(Reaction condition: H_2/n-dodecane=600, LHSV=2.0 h^{-1}, P=2.0 MPa)

Table S1 Acidity of Fe- and Ga-doped samples determined by Py-FTIR spectra

Samples	Acidity types (μmol/g)			
	B acid sites		L acid sites	
	200 °C	350 °C	200 °C	350 °C
H-Z-22	104	88	79	24
H-ZF-3	79	65	73	22
H-ZG-3	89	75	73	20

Table S2 Crystallinity and textual properties of protonic samples treated at the same conditions

Sample	Cryst. [a] (%)	Surface area (m^2/g)			Micropore volume (cm^3/g)
		S_{BET}	S_{mic}	S_{ext}	
Fresh H-ZG-3	91	211.8	132.2	79.6	0.25
Fresh H-ZF-3	90	192.4	105.1	87.3	0.22
Treated H-ZG-3	88	205.9	128.7	77.2	0.23
Treated H-ZF-3	64	145.8	72.2	73.6	0.16

[a] Calculated from XRD.