Supporting information

Materials

All chemicals were obtained and used from commercial suppliers and did not require further purification. Silica sol (40 wt% SiO_2, Qingdao Ocean Chemical Co., Ltd), sodium aluminate (Sinopharm Chemical Reagent Co., Ltd.), sodium hydroxide (AR, Tianjin Kemiou Chemical Reagent Co., Ltd), and gallium nitrate (Aladdin) were used as the source of silica, alkali, aluminum and gallium, respectively. Hexamethoniumbromide ($HMBr_2$, 98 wt%, J&K Chemical Ltd.) was used as the organic structure directing agent (OSDA) in this work.

Synthesis steps of ZSM-48

Typically, sodium aluminate and $HMBr_2$ are first added to a beaker with deionized water and stirred for 30 min at room temperature until a clear solution is obtained. Then ZSM-48 crystal seeds were added to the above solution and stirred for another 30 minutes. Then 25g of silica sol was added slowly dropwise and stirred vigorously for 3 hours to form a homogeneous gel. After that, the above gel was transferred to a 100 ml autoclave with Teflon liner. The autoclave was placed in an oven and subjected to hydrothermal crystallization at 180 °C.

The ZLC model is given by:

$$\frac{C}{C_0} = 2L\sum_{n=2}^{\infty} \frac{\exp\left(-\beta_n^2 \frac{D_{eff}}{R^2} t\right)}{\left[\beta_n^2 + L(L-1)\right]} \quad \text{* MERGEFORMAT (1.1)}$$

where β_n is given by the roots of the equation

$$\beta_n \cot \beta_n + L - 1 = 0 \quad \text{* MERGEFORMAT (1.2)}$$

And

$$L = \frac{1}{3}\frac{FR^2}{KV_S D_{eff}} \quad \text{* MERGEFORMAT (1.3)}$$

where F is the interstitial gas velocity, R is the crystal radius, K is the dimensionless Henry's constant, and D_{eff}/R^2 is the effective diffusion time constant. By plotting ln (c/c_0) versus time, the effective diffusion constant (D_{eff}/R^2) can be extracted based on the full range method.

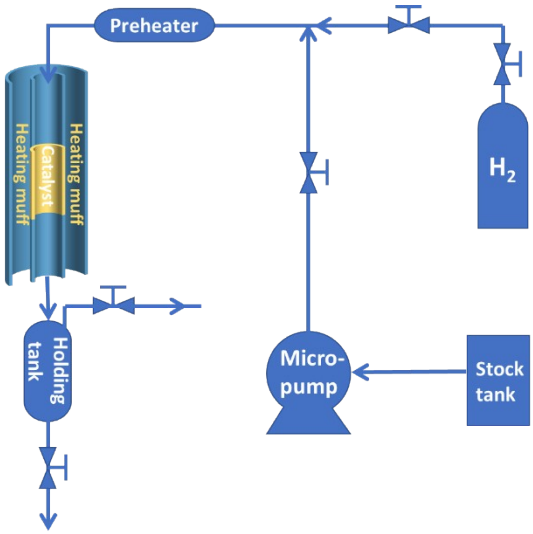

Fig. S1. the schematic diagram of the catalytic reactor

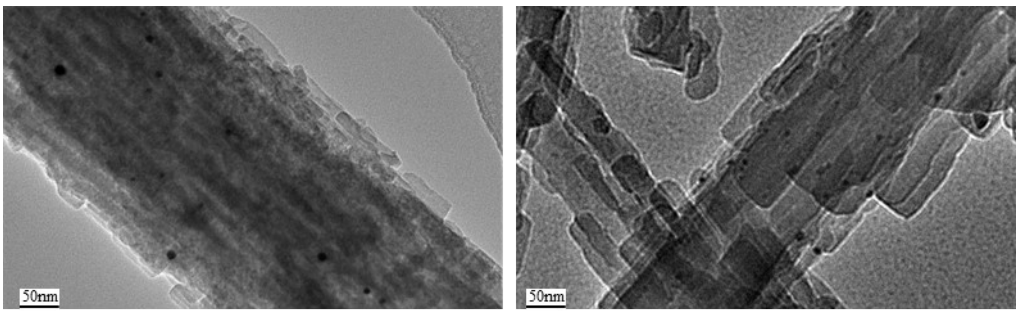

Fig. S2.TEM images of Pt loaded ZSM-48 and GaZSM-48-1

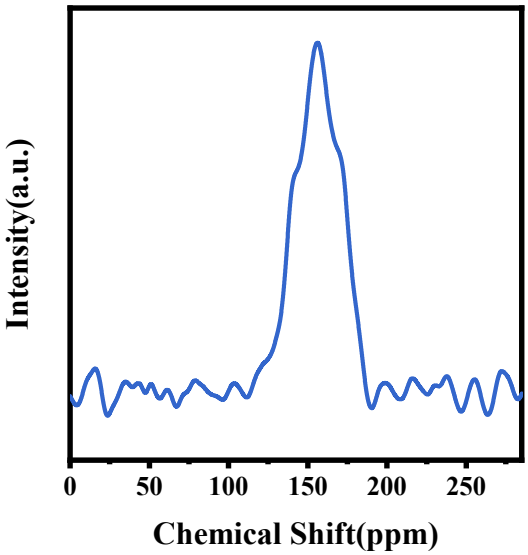

Fig. S3. ^{71}Ga NMR spectrum of GaZSM-48-1.

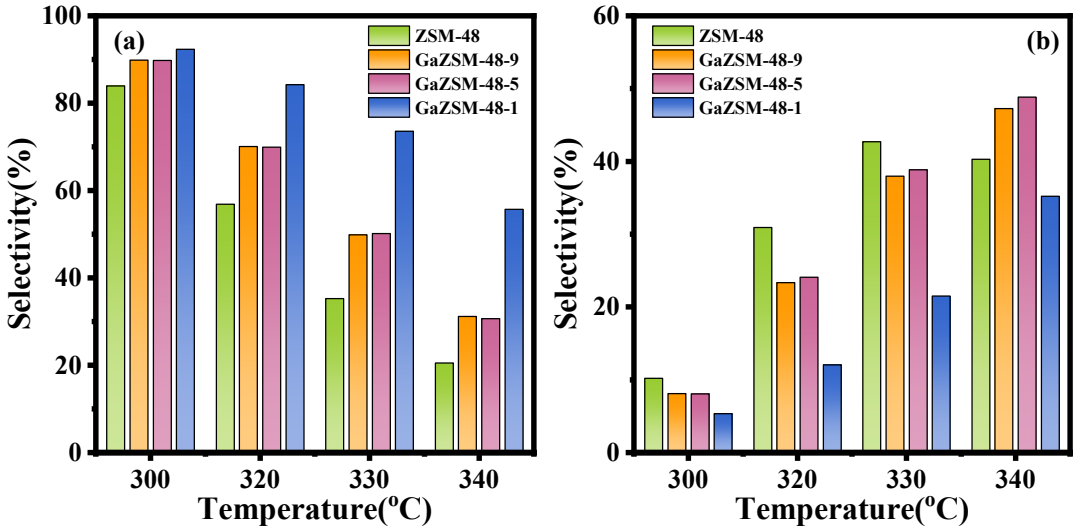

Fig. S4. The selectivity of MOB (a) and MUB (b) over different catalysts.

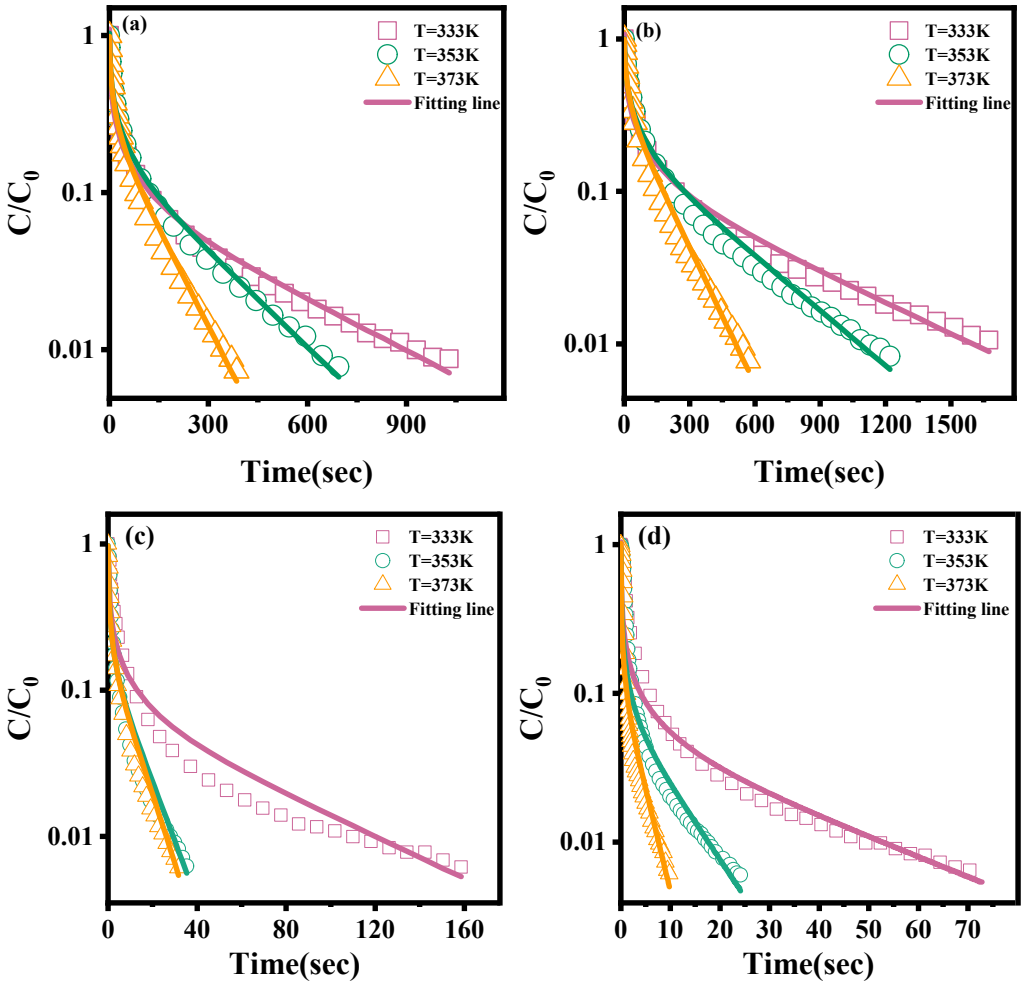

Fig. S5. Experimental data (symbols) and theoretical ZLC curves (lines) for *n*-hexane ((a) ZSM-48, (b) GaZSM-48-1) and 3-methylpentane ((c) ZSM-48 and (d) GaZSM-48-1) at different temperatures in

different samples.

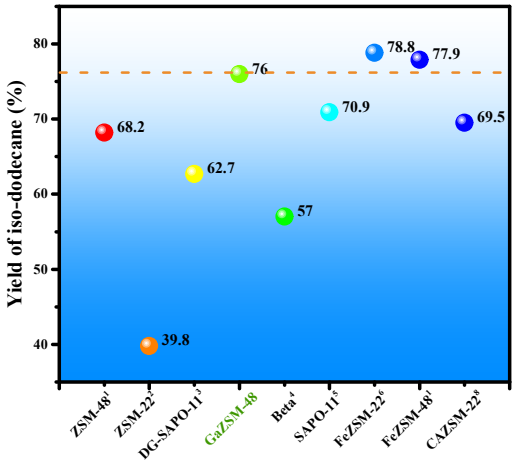

Fig. S6. Comparison of the yields of various catalysts in the hydroisomerization of *n*-dodecane. [1–7]

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