Electronic Supplementary Material (ESI) for Catalysis Science & Technology.


# Impact of pore topology and crystal thickness of nanosponge zeolites on the hydroconversion of ethylbenzene

## Electronic Supplementary Information

### *Zeolites synthesis*

***Bulk-*MRE.*** A conventional *MRE zeolite was synthesized using pyrrolidine (Fluka) as the SDA. The starting mixture had the following molar composition 110 $SiO_2$: 0.5 $Al_2O_3$: 50 pyrrolidine: 43 NaOH: 20 $H_2SO_4$: 5000 $H_2O$. Fumed silica was added to an aqueous solution of NaOH (Merck) (90 wt.% $H_2O$ of total amount of $H_2O$ used for the synthesis) under vigorous stirring. To this solution, pyrrolidine, $Al(NO_3)_3.9H_2O$ (Merck) dissolved in $H_2SO_4$ (98%), and remaining $H_2O$ were added. Stirring was continued at room temperature for 3 h. The gel was hence heated in a Teflon-lined autoclave in a tumbling oven at 453 K for 2 days. The recovered solid was extensively washed with distilled water, dried at 373 K, and calcined at 823 K under oxygen flow for 10 h. The *MRE zeolite was ion-exchanged with $NH_4^+$ using 1 M aqueous solution of $NH_4NO_3$ (repeated four times) at room temperature.

***Bulk-MFI.*** A conventional MFI zeolite was synthesized using tetrapropylammonium bromide (TPABr, TCI) as the SDA. The starting mixture had the following molar composition of 100 $SiO_2$: 1 $Al_2O_3$: 8 TPABr: 50 $NH_4F$: 2000 $H_2O$. TPABr, aluminum sulfate (98%, Aldrich), and ammonium fluoride (Aldrich) were first dissolved in distilled water under stirring. The solution was then added to colloidal silica (Ludox AS-40, Aldrich) at once. The mixture was vigorously shaken for 30 min. The resultant gel mixture was then heated in a Teflon-lined autoclave at 443 K for 3 d under static conditions. Bulk-MFI was calcined at 853 K for 6 h to remove the remaining surfactant and converted to the $H^+$ form in the same manner as previously described.

***Bulk-MTW.*** A conventional MTW was synthesized using aluminum nitrate ($Al(NO_3)_3.9H_2O$, Aldrich) as an aluminum source, methyltriethylammonium chloride (MTEACl, Aldrich 97%) as a SDA, and tetraethylorthosilicate (TEOS, Junsei) as a silica source. $Al(NO_3)_3.9H_2O$ was added to the NaOH solution and stirred till dissolving. Subsequently, MTEACl was added and dissolved. TEOS was added to the solution at once and the mixture was stirred at ambient temperature for 3 h. The gel of molar composition 100 $SiO_2$: 0.5 $Al_2O_3$: 20 MTEACl: 10 $Na_2O$: 2000 $H_2O$ was loaded into a teflon-lined autoclave and heated under static conditions at 418 K. After four days the product was collected by filtration, roughly washed with distilled water, dried and calcined at 823 K for 6 h. The calcined zeolite was converted to $H^+$ form in the same manner as previously described.

## *Pt on alumina characterization*

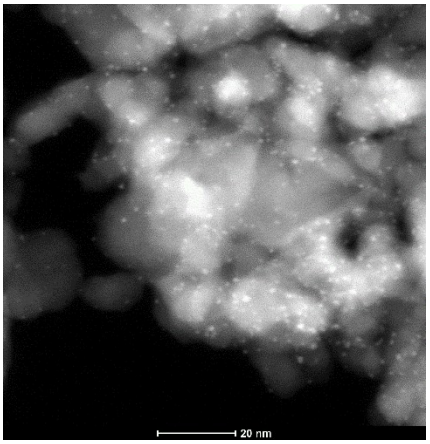


**Fig. S1.** STEM image of Pt dispersed on alumina. The metallic phase is present in the form of round particles with a particle size up to 1.2 nm.

## *Zeolites characterization*

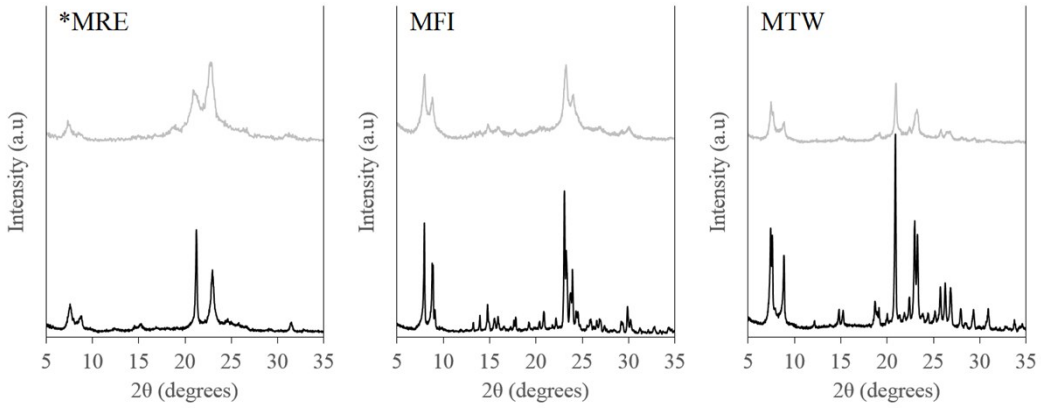


**Fig. S2.** High-angle XRD patterns for bulk (black) and nanosponge (grey) *MRE, MFI, and MTW zeolites.

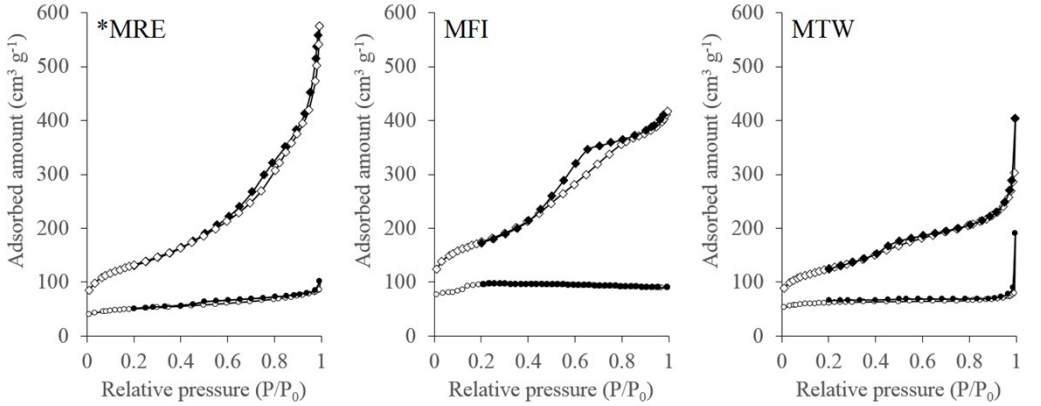


**Fig. S3.** $N_2$ adsorption isotherms for bulk (○) and nanosponge (❋) *MRE, MFI, and MTW zeolites. Solid points denote desorption.

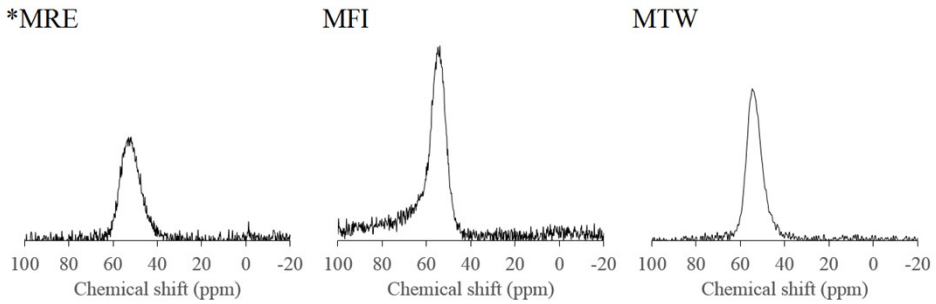


**Fig. S4.** $^{27}$Al NMR spectra of *MRE, MFI, and MTW nanosponge zeolites.

## *Ethylbenzene hydroconversion*

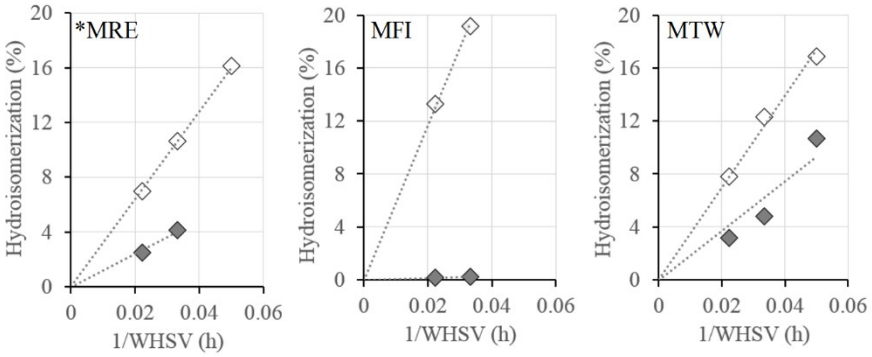


**Fig. S5.** Comparison of the hydroisomerization yield against conversion over bulk (grey) and nanosponge (white) *MRE, MFI, and MTW based catalysts, at initial reaction rates.

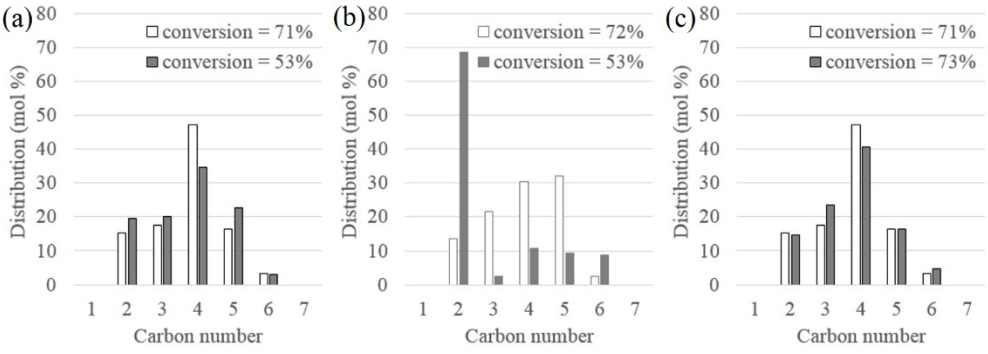


**Fig. S6.** C1-C7 cracked products distribution (mol %) *per* carbon number over bulk (grey) and nanosponge (white) *MRE (a), MFI (b), and MTW (c) based catalysts, at high conversion levels.