

# Supporting Information

## for

### **Postsynthesis of hierarchical core/shell ZSM-5 as efficient catalyst in ketalation and acetalization reactions**

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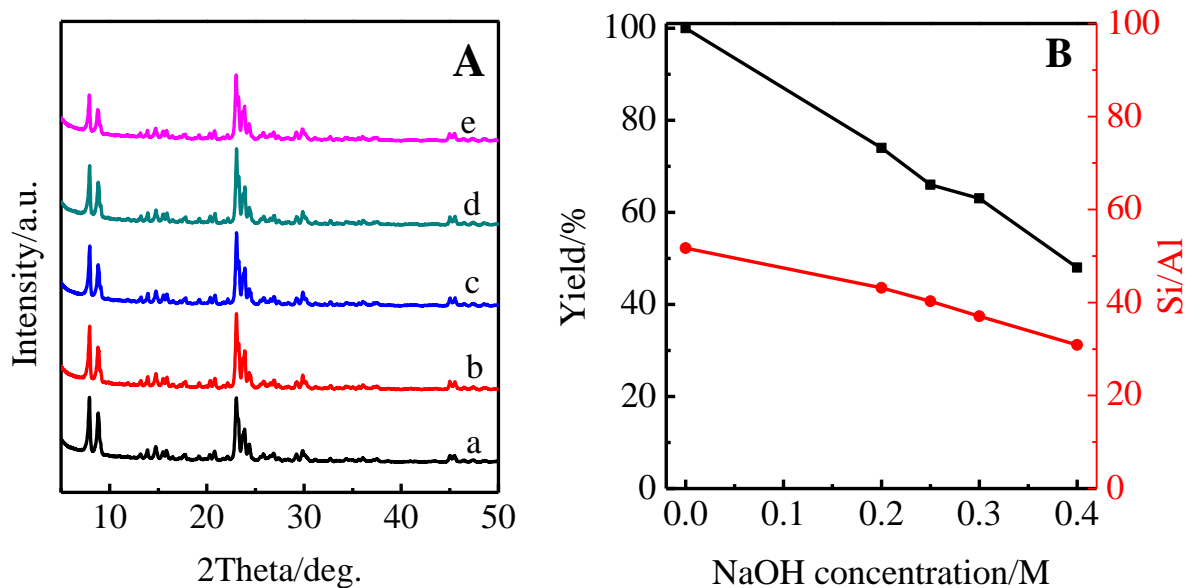
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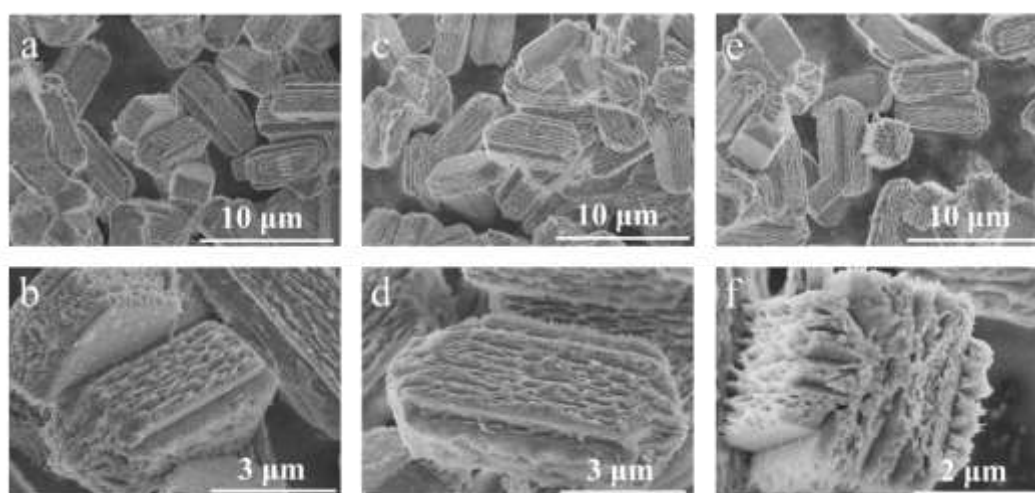
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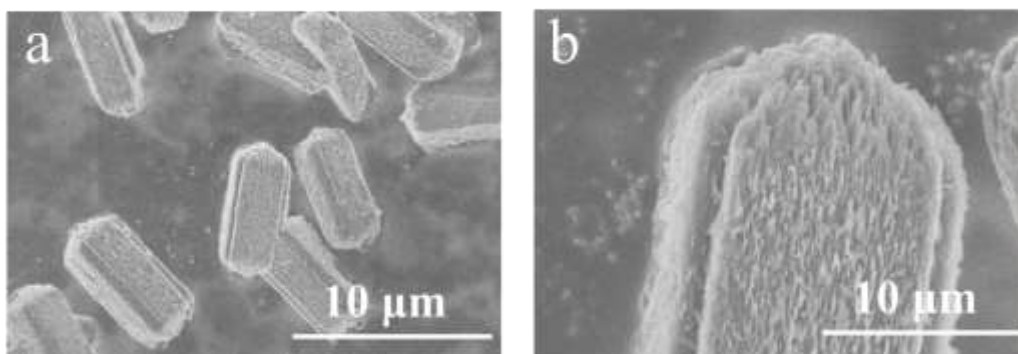
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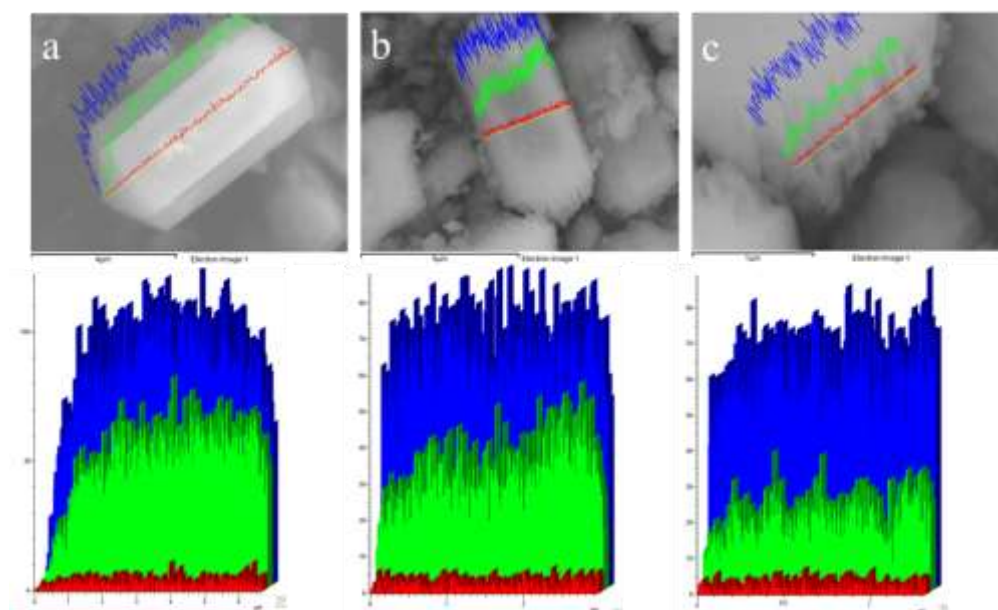
**Fig. S1** XRD patterns (A) and corresponding yield and Si/Al ratio (B) of pristine ZSM-5 zeolite and the samples treated by NaOH solutions with different concentrations in the absence of C<sub>18-6-Pr</sub>. Pristine ZSM-5 (a), ZSM-5-0.20 (b), ZSM-5-0.25 (c), ZSM-5-0.30 (d), ZSM-5-0.40 (e). Treatment condition: ZSM-5: x NaOH: 55 H<sub>2</sub>O, 423 K, 20 h.



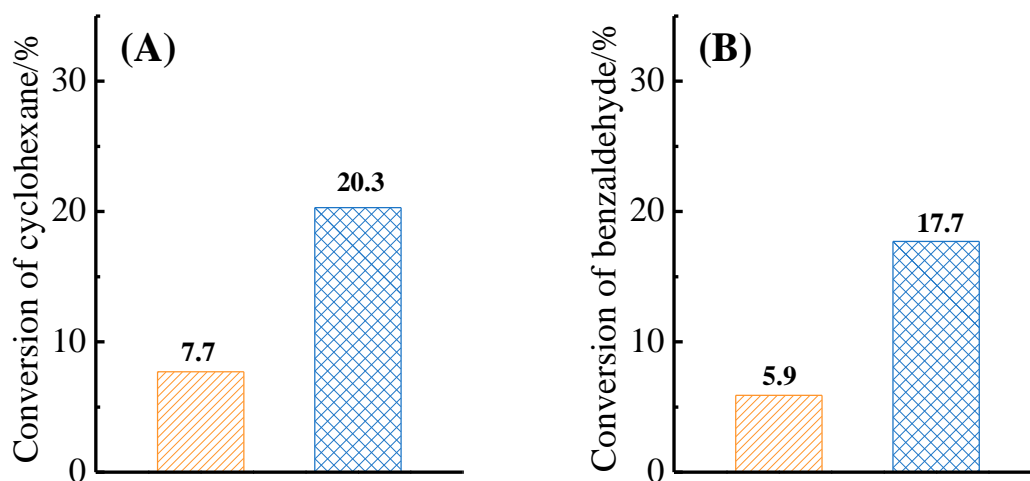
**Fig. S2** SEM images of Re-ZSM-5-0.25 (a and b), after ultrasonic treatment in water for 1 h (c and d), and after ultrasonic treatment in ethanol for 1 h (e and f).



**Fig. S3** SEM images of Re-ZSM-5-0.25 (a and b) after the steaming treatment. Steaming condition: zeolite, 0.5 g; flow rate of water, 0.5 mL/h; temp., 423 K; time, 4 h.



**Fig. S4** Linear EDX analyzed element results (the red, green, blue lines represent Al, O and Si elements respectively) of pristine ZSM-5 (a) and Re-ZSM-5-0.25 (b and c).



**Fig. S5** The catalytic performance of recycled pristine ZSM-5 (pink color) and Re-ZSM-5-0.25 (blue color) in the ketalation of cyclohexanone (A) and the acetalization of benzaldehyde with pentaerythritol (B). Reaction condition: Benzaldehyde or cyclohexanone (20 mmol); pentaerythritol (10 mmol); toluene (8 mL); cat., 50 mg; temp., 393 K; reaction time, 2 h. After 1st reactions, the mixture of catalyst and pentaerythritol was calcinated at 823K for 6 h to obtain catalyst for cyclic reaction test.