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Supplementary Materials

Hierarchical core/shell meso-ZSM-5@mesoporous aluminosilicate-supported Pt nanoparticles for bifunctional hydrocracking

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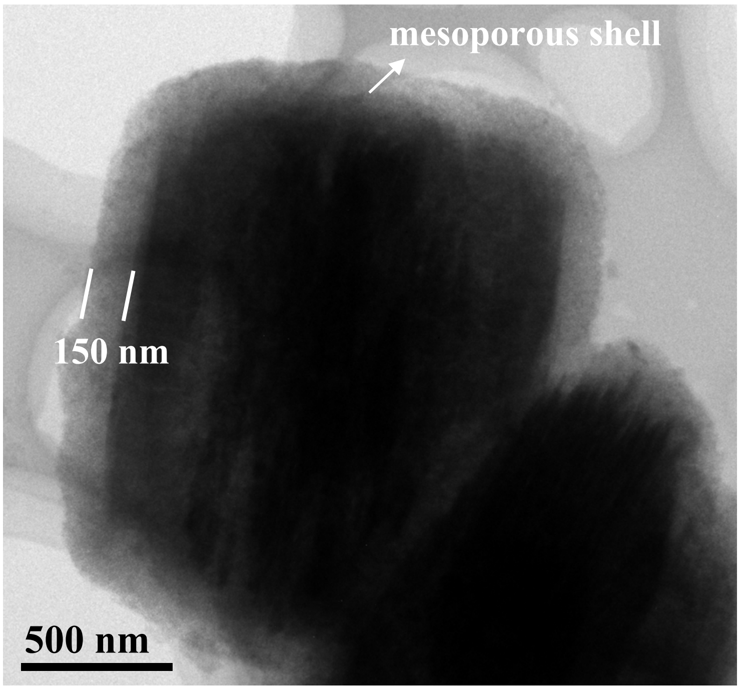

Fig. S1 TEM image of core-shell structured $MZ_{AT0.2\text{-}PI0.02}$@MSA, showing a uniform core-shell structure with a shell thickness of 150 nm.

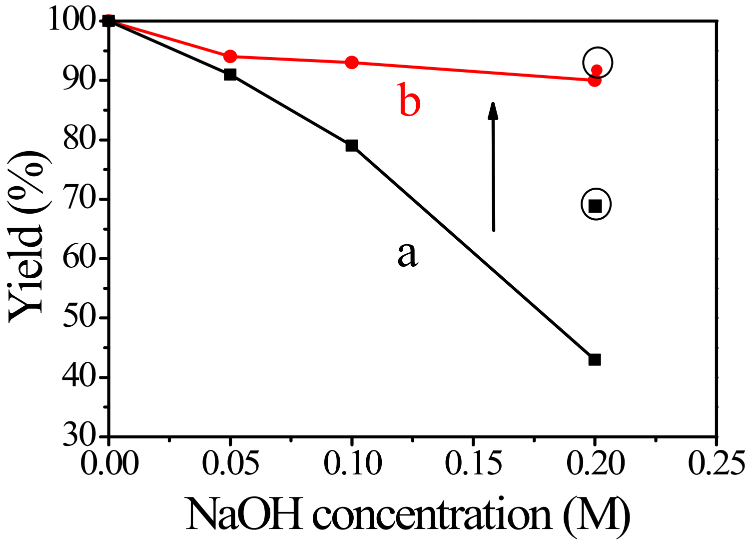

Fig. S2 Dependence of product yield on NaOH concentration for MZ_x samples (a) and core-shell structured composite materials MZ_x@MSA (b). The yield is defined as grams of solid after workup per gram of ZSM-5 used. Circled points represent $MZ_{AT0.2\text{-}PI0.02}$ and $MZ_{AT0.2\text{-}PI0.02}$@MSA both synthesized by desilication with 0.2 M NaOH in the presence of piperidine.

Table S1 Acidity properties and Si/Al molar ratios of different samples

No.	Samples	Si/Al[a]	Q^b (mmol g^{-1})		
			Weak	Strong	Total
1	ZSM-5	38	0.19	0.28	0.47
2	$MZ_{AT0.2-PI\ 0.02}$	28(63[c])	0.26	0.24	0.50
3	$MZ_{AT0.2-PI0.02}$@MSA	36	0.14	0.21	0.35
4	$MZ_{AT0.2-PI0.02}$&MSA	35	0.14	0.22	0.36
5	MSA	61	0.06	-	0.06

[a] Si/Al molar ratios measured by ICP. [b] Acidity determined by NH_3-TPD measurement. [c]The Si/Al molar ratio of the filtrate obtained from $MZ_{AT0.2-PI0.02}$.

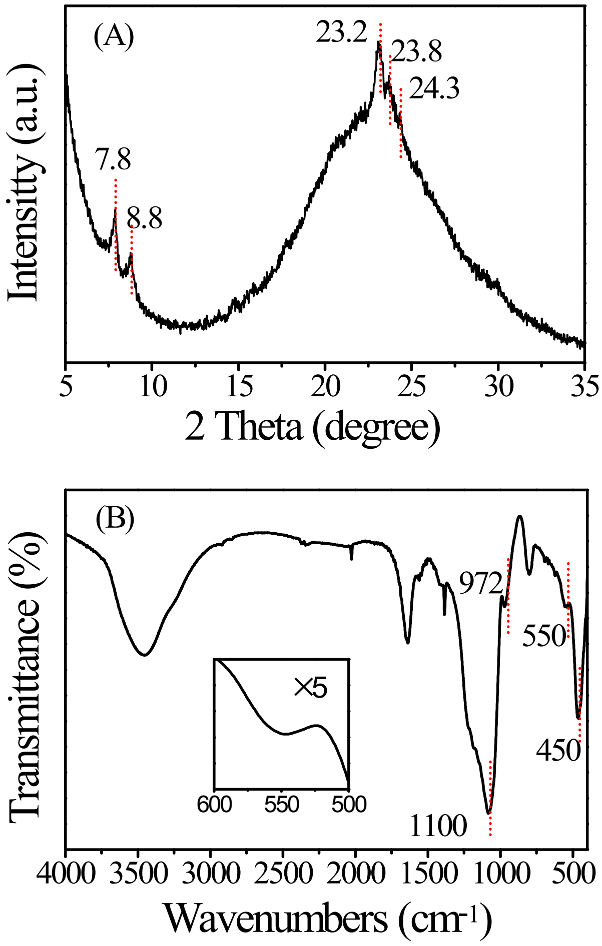

Fig. S3 XRD pattern (A) and FT-IR spectrum (B) of the MSA material. The pure Al-containing mesoporous silica was self-assembled from the filtrate of ZSM-5 desilication.

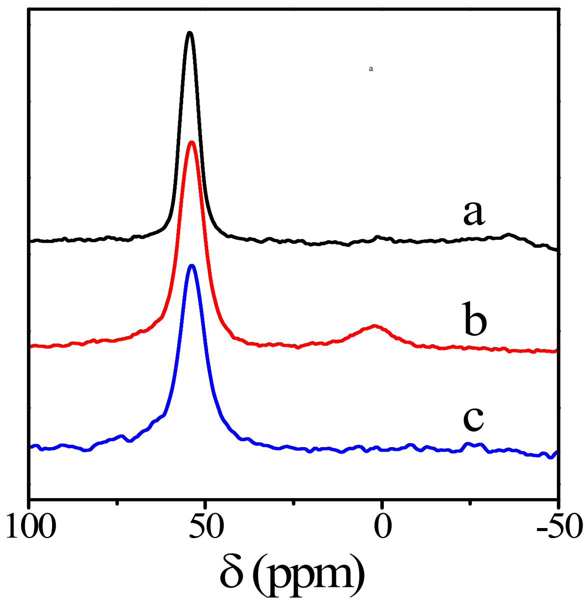

Fig. S4 ^{27}Al MAS NMR spectra of ZSM-5 (a), $MZ_{AT0.2\text{-}PI0.02}$ (b), $MZ_{AT0.2\text{-}PI0.02}$@MSA (c).

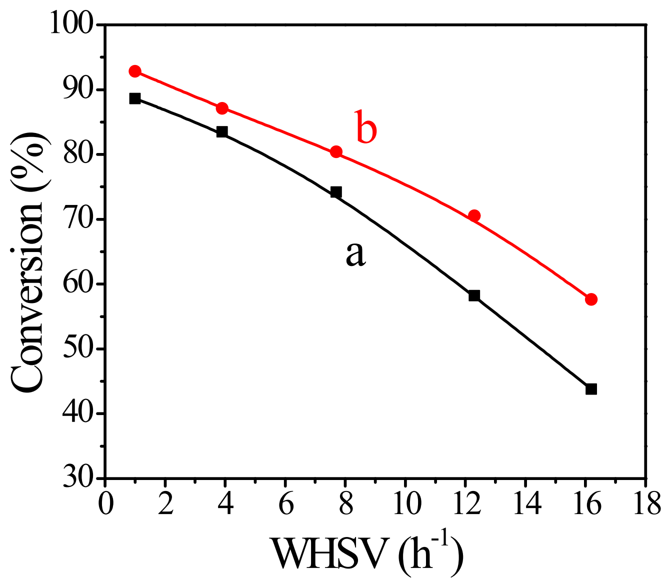

Fig. S5 The dependence of *n*-hexadecane conversion on space velocity in the hydrocracking over Pt/ZSM-5 (a) and Pt/$MZ_{AT0.2\text{-}PI0.02}$@MSA (b). Reaction conditions: catalyst, 0.1 g; WHSV, 1 ~ 16.2 h^{-1}; H_2:C_{16} molar ratio, 35; temperature, 573 K; atmospheric pressure. The WHSV was varied by changing the flow rate of C_{16} from 0.1 to 1.62 g h^{-1}.

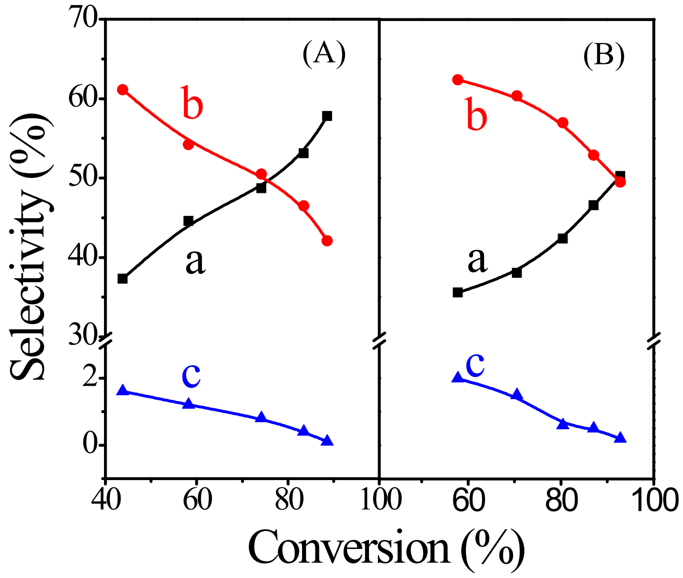

Fig. S6 The dependence of product selectivity on the *n*-hexadecane conversion of hydrocracking over Pt/ZSM-5 (A) and Pt/$MZ_{AT0.2\text{-}PI0.02}$@MSA (B). (a) C_1 - C_4 selectivity (a), (b) C_5 - C_{11} selectivity, and C_{12} - C_{15} selectivity. Reaction conditions: catalyst, 0.1 g; WHSV, 1 ~ 16.2 h^{-1}; H_2:C_{16} molar ratio, 35; temperature, 573 K; atmospheric pressure. The WHSV was varied by changing the flow rate of C_{16} in the range of 0.1 - 1.62 g h^{-1}.

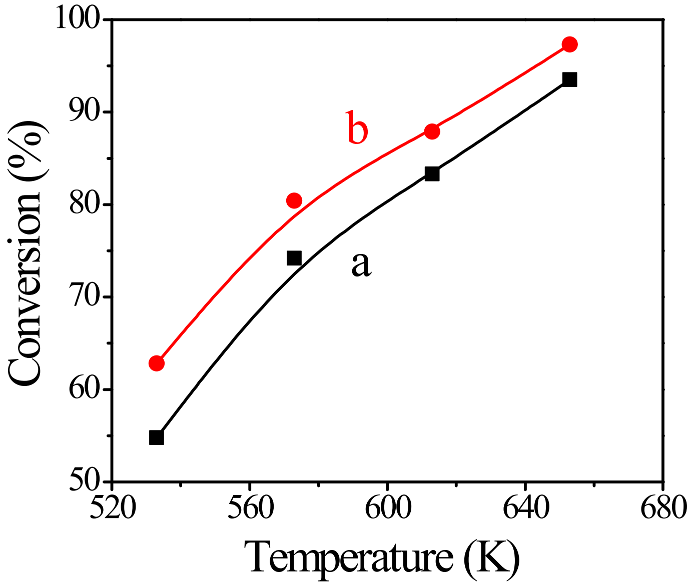

Fig. S7 The dependence of *n*-hexadecane conversion in the hydrocracking of over Pt/ZSM-5 (a) and Pt/$MZ_{AT0.2\text{-}PI0.02}$@MSA (b). Reaction conditions: catalyst, 0.1 g; WHSV, 7.7 h^{-1}; H_2:C_{16} molar ratio, 35; H_2 flow rate, 45 mL min^{-1}; temperature, 533 ~ 653 K; atmospheric pressure.

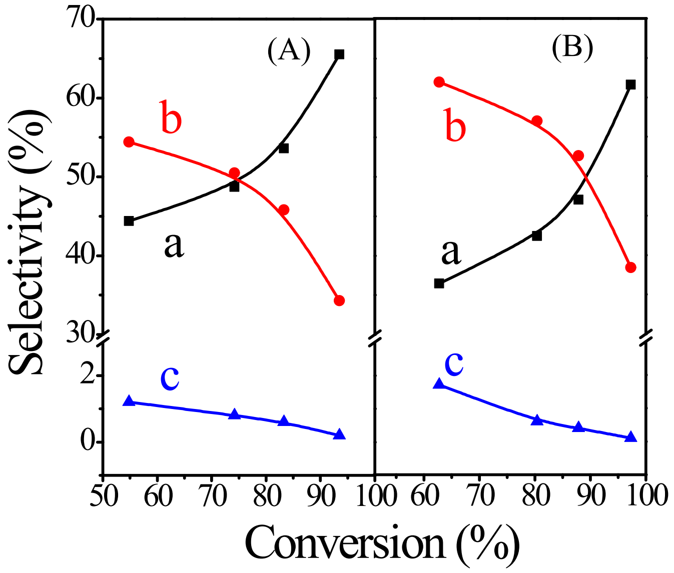

Fig. S8 The dependence of product selectivity on the *n*-hexadecane conversion of hydrocracking over Pt/ZSM-5 (A) and Pt/$MZ_{AT0.2\text{-}PI0.02}$@MSA (B). (a) C_1 - C_4 selectivity (a), (b) C_5 - C_{11} selectivity, and C_{12} - C_{15} selectivity. Reaction conditions: catalyst, 0.1 g; WHSV, 7.7 h^{-1}; H_2:C_{16} molar ratio, 35; H_2 flow rate, 45 mL min^{-1}; temperature, 533 ~ 653 K; atmospheric pressure.