Supporting Information

Hierarchical ZSM-5 nanosheets for production of light olefins and aromatics by catalytic cracking of oleic acid

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Experimental

Preparation of Conventional ZSM-5

A conventional ZSM-5 specimen was produced according to the method of Wu et al [1]. Briefly, 13.1 g of TPAOH and 20 g of water were combined and stirred at 35 °C for 0.5 h, after which 0.4 g AIP and 0.1 g NaOH were added successively followed by further stirring until all reagents were completely dissolved. Following this, 20.5 g of TEOS was slowly added to the mixture with subsequent stirring for 16 h to obtain a gel having the molar ratios 50 SiO_2:0.5 Al_2O_3:13 NaOH:8.5 TPAOH. This gel was transferred to a hydrothermal reactor and held at 180 °C for 48 h. After centrifugation and washing, the solid product was dried at 100 °C for 10 h and calcined at 550 °C for 6 h to obtain the ZSM-5 zeolite. This material is referred to herein as CZSM-5.

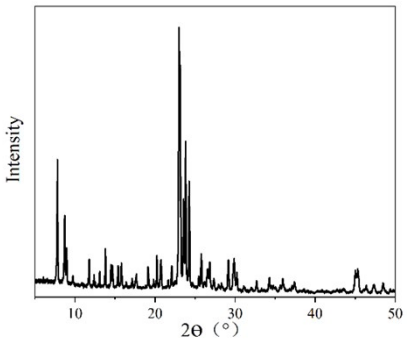

Fig. S1 The low-angle XRD pattern of the CZSM-5.

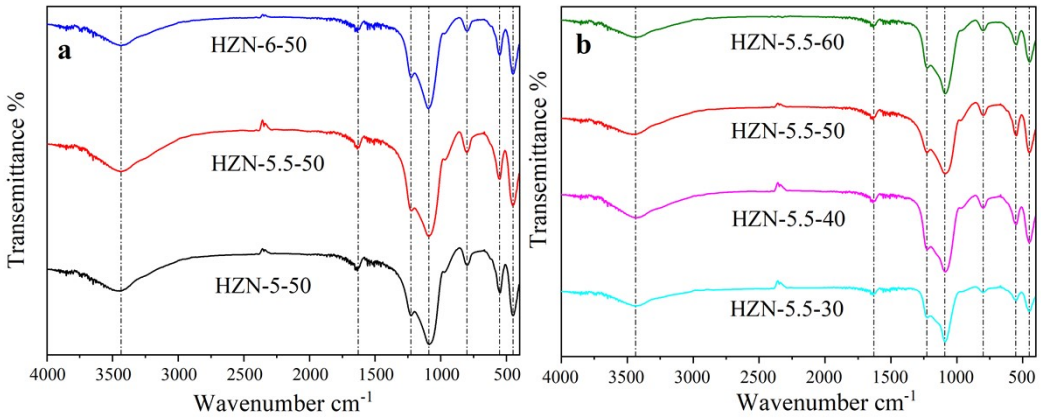

Fig. S2 FTIR spectra of (a) HZN-X-50 and (b) HZN-5.5-X.

The FTIR spectra were obtained from the HZN specimens to further confirm the formation of a ZSM-5 crystal phase. As shown in Fig. S2a and b, each material generated peaks characteristic of a highly siliceous MFI structure. The peaks at 450 and 553 cm^{-1} are assigned to the bending vibrations of TO_4 units (T = Si, Al) and the asymmetric stretching mode of five-membered pentasile rings, respectively.[2] These peaks would not be obtained from amorphous materials. The peak at 1228 cm^{-1} is attributed to the external asymmetric stretching mode involving T-O-T linkages between TO_4 tetrahedra and is typical of a highly siliceous MFI structure. The peaks at 1091 and 800 cm^{-1} are assigned to the internal asymmetric and external symmetric

stretching modes of T-O-T linkages, respectively.[3] The peak at 3436 cm^{-1} corresponds to the Al-OH framework (meaning the Brønsted acid sites) in an MFI-type framework.[4]

The bending vibration of water molecules observed at 1630 cm^{-1} is ascribed to the absorption of moisture.[5] As shown in Fig. S2a, the FTIR spectra negligibly changed with different HZN Na^+ contents, as the exchange of Na^+ ions for –OH group protons is difficult because of the larger hydration radius of the former; therefore, HNZ possesses a low ion exchange capacity, which negligibly impacted the MFI structure.[6] Thus, both the XRD and FTIR results confirmed that the synthesized HZN zeolite had a typical MFI structure.

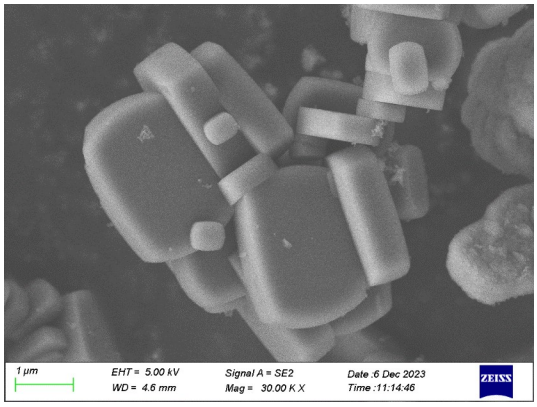

Fig. S3 The SEM images of CZSM-5 samples.

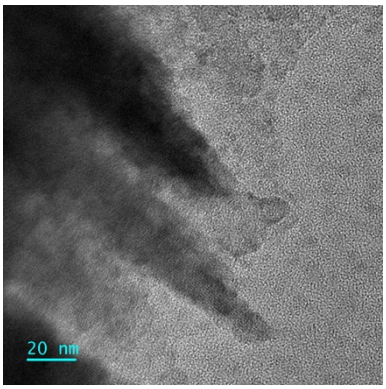

Fig. S4 The TEM images of uncalcinedHZN-5.5-50 series samples.

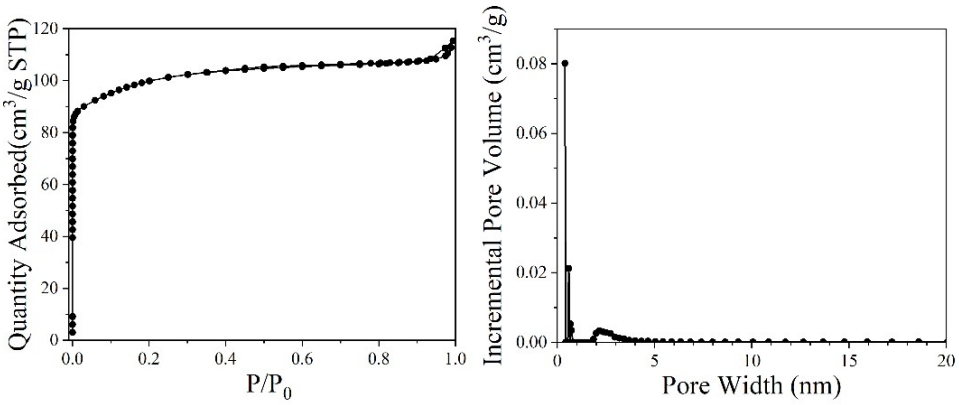

Fig. S5 Adsorption-desorption curves and pore size distributions of CZSM-5.

Table S1 The lattice parameters of HZN-X-X

Samples	a (nm)	b (nm)	c (nm)	V_{cell} (nm^3)
HZN-5-50	2.033	1.997	1.356	5.505
HZN-5.5-50	2.047	1.991	1.366	5.567
HZN-6-50	2.044	1.994	1.370	5.584
HZN-5.5-30	2.035	2.001	1.358	5.530
HZN-5.5-40	2.026	1.997	1.365	5.523
HZN-5.5-60	2.012	1.998	1.350	5.427

References

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