

Supporting Information

Effective reduction of nitric oxide over core-shell Cu-SAPO-34@Fe-MOR zeolites catalyst

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This Supporting Information includes:

1. The detail information about Experiment section;
2. Figures S1-S3.

2. Experimental

2.2 Catalyst Characterization

The phase composition of all catalysts was identified by powder X-ray diffraction (TZL-20). Under 40k V and 40mA, using Cu Ka radiation ($\lambda=0.1546$), scanning is performed at 0.02° intervals in the range of $2\theta=5-40^\circ$. Scanning electron microscope (SEM) micrographs were measured by a JSM-7600 SEM. Transmission electron microscopy (TEM) micrographs were measured using a Hitachi-600. Disperse the trace amount of catalyst in a certain amount of ethanol, then draw one or two drops of the solution onto the microgrid, dry for a period of time at room temperature until the ethanol is completely volatilized, and then perform characterization.

The specific surface area and pore volume tester (Micromeritics ASAP 2020) is used to identify the specific surface area and pore volume. A 100 mg sample was process at 300°C for 6 hours to completely remove impurities and moisture on the surface, and then the degassed sample was subjected to N₂ adsorption/desorption analysis at -196°C.

The Brunauer-Emmett-Teller method was used to calculate the specific surface area of the sample, and the Barrett-Joyner-Halenda method was used to calculate the sample pore volume. A Hitachi UV-3000 spectrophotometer was used to measure the ultraviolet-visible diffuse reflectance spectrum (UV-vis-DRS) of the sample. With barium sulfate as the background, the 200-1000 nm spectrum was collected.

The H₂-TPR test was performed with the Chemi Sorb 2720 chemical adsorption analyzer. Pretreat 100 mg sample in He atmosphere at 300°C for 1 hour, then naturally cool to 50°C, switch to a reaction atmosphere of H₂/Ar. The reduction temperature

range is 50- 900 °C with heating rate at 10 °C/min.

Ammonia temperature programmed desorption (NH₃-TPD) test was carried out on the Chemi Sorb 2720 chemical adsorption analyzer. A 100 mg sample was pretreated at 300 °C under He atmosphere (50 mL/min) for 1 hour to remove moisture and impurities adsorbed on the catalyst surface. The reaction temperature was naturally cooled to 50 °C. 500 ppm of NH₃ was passed into the quartz tube reactor at a rate of 50 mL/min, and reacted for 1 hour. Switch to He and purge the sample for 1 hour to remove the weakly adsorbed NH₃ on the surface of the sample. After the NH₃ signal is stable, the temperature is raised to 550 °C at a heating rate of 10 °C/min, and the TCD signal curve is recorded.

The NO temperature programmed desorption (NO-TPD) test was conducted on the Chemi Sorb 2720 chemical adsorption analyzer. 100mg samples were pretreated at 300 °C under He atmosphere (50mL/min) for 1h to remove moisture and impurities adsorbed on the catalyst surface. The reaction temperature was naturally cooled to 50 °C. 500 ppm of NO was included in the quartz tube reactor at a rate of 50 mL/min, and reacted for 1 hour. Switch to He purge for 1 hour to remove the weakly adsorbed NO on the surface of the sample. After the NO signal stabilizes, the temperature increases to 750 °C at a heating rate of 10 °C/min, and the TCD signal curve is recorded.

In situ diffuse reflectance Fourier transform infrared spectroscopy (In situ DRIFTS) was tested on a Nicolet Nexus 6700 FTIR spectrometer. Before each experiment, the sample was pretreated under a N₂ (200 mL/min) atmosphere at 400 °C for 1 hour to remove surface impurities. Then cool naturally to the temperature required for the

experiment, stabilize for 10 minutes, collect the background of the sample under N₂ atmosphere, pass in the reaction gas, and record the stable spectrum. In order to adsorb NH₃ (or NO+O₂), the catalyst is exposed to 500ppm NH₃ (or NO+O₂) to obtain the drift spectrum that changes with time, then switch to the N₂ atmosphere to purge for 30 minutes, and record the NH₃ (or NO+O₂) adsorption spectrum. In the transient study, first pre-expose the catalyst to 500ppm of NH₃ (Or NO+O₂) for 40 minutes, then switch the gas to 500ppmNO+5%O₂(NH₃) atmosphere and record the infrared spectrum for 1/3/5/7/10/15/20 minutes to obtain the time correlation of the drift spectrum Variety.

In situ UV-Vis spectroscopy analysis of the copper zeolite samples were collected in diffuse reflectance mode on a Perkin Lambda 750 UV/Vis spectrometer in the range of 200~900 nm. The specific process is as follows: First, the sample is pretreated in 5% O₂/N₂ at 400°C for 10 min, and the total flow rate is 200 mL/min to remove trace impurities. The sample was then exposed to 500 ppm NO (NH₃) at 300°C, and the absorption spectrum was recorded. Then switch the gas to 500 ppm NO+5% O₂ and record the spectrum. Then switch the gas to 500 ppm NH₃ (NO) and record the spectrum. The time of spectrum recording is selected at 1/3/5/7/10/15/20min.

3. Results and Discussion

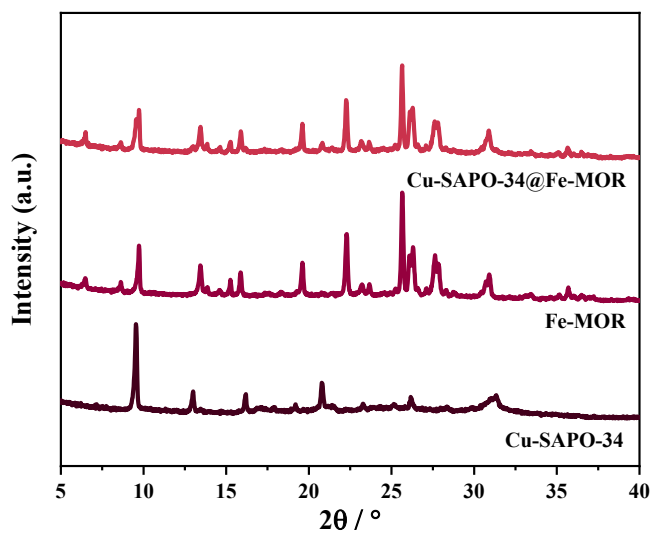


Fig. S1 The XRD patterns of Cu-SAPO-34, Fe-MOR and Cu-SAPO-34@Fe-MOR.

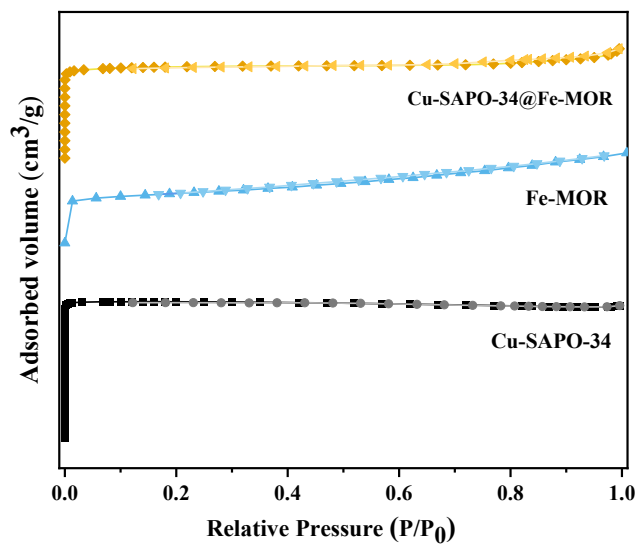


Fig. S2 N_2 adsorption of Cu-SAPO-34, Fe-MOR, Cu-SAPO-34@Fe-MOR and Cu-SAPO-34/Fe-MOR.

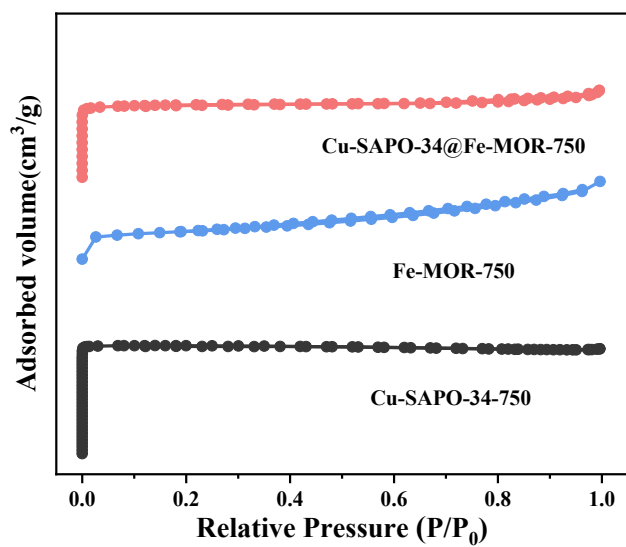


Fig.S3 N₂ adsorption-desorption isotherms of hydrothermally aged samples: Cu-SAPO-34-750; Fe-MOR-750; Cu-SAPO-34@Fe-MOR-750 and Cu-SAPO-34/Fe-MOR-750.