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# **Electronic Supplementary Information (ESI)**

EU-7: a synthetic BIK type zeolite with high hydrothermal stability

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### 1. EU-7 Synthesis

Synthesis of EU-7 was performed similar to example 7 of patent US4,581,212.<sup>1</sup> A reaction mixture with molar oxide composition of  $60 \text{ SiO}_2 : 1 \text{ Al}_2\text{O}_3 : 9 \text{ Cs}_2\text{O} : 15 \text{ SDA} : 3000 \text{ H}_2\text{O}$  was prepared using 0.25 g of aluminum oxide trihydrate (BDH Chemicals, 62-67%), 10.77 g of 50 wt% cesium hydroxide monohydrate (Sigma-Aldrich, 99%), 5.77 g silica (CAB-O-SIL M5, Sigma-Aldrich), 2.19 g butane-1,4-diamine (Sigma-Aldrich, 99%) serving as structure directing agent (SDA) and the appropriate amount of deionized water.

First, aluminum oxide trihydrate ( $Al_2O_3.3H_2O$ ) was dissolved in cesium hydroxide solution by stirring on a magnetic stirrer hot plate at 50 °C until a clear solution was obtained. A second solution was made by adding silica and butane-1,4diamine to 72 g deionized water. The aluminate solution was slowly added upon stirring. An amount of 8.32 g of deionized  $H_2O$  was added, after using it to rinse the beaker to recover all aluminate. The mixture was stirred with a mechanical mixer until a homogeneous gel was formed. The resulting gel was transferred to a stainless steel autoclave and heated for 3 days at 180 °C under dynamic conditions (tumbling autoclave at 60 rpm). The solids were recovered by filtration, washed with deionized water and dried overnight at 40 °C. As-synthesized EU-7 was calcined for 16 h at 550 °C in a muffle furnace using a temperature ramp of 0.5 °C/min.

#### 2. Characterization

X-ray powder diffraction data were collected on a STOE Stadi MP diffractometer with focusing Ge(111) monochromator using CuK<sub> $\alpha1$ </sub> radiation at a wavelength of 1.54056 Å. Measurement occurred between 3 and 80 °2 $\theta$  in Debye-Scherrer geometry

with a linear position sensitive detector with a 6 °2θ window. The powder sample was dried overnight at 60 °C prior to sealing in a 0.7 mm glass capillary (Hilgenberg).

<sup>1</sup>H decoupled <sup>27</sup>Al spectra were measured on a Bruker 500 MHz spectrometer equipped with 4 mm H/X/Y MAS probe. Samples were filled in a 4 mm ZrO<sub>2</sub> rotor and spun at 15 kHz. Data acquisition was performed using a  $\pi$ /12 pulse at 87 kHz, 1s recycle delay and accumulation of 1024 transients. <sup>27</sup>Al spectra were referenced to 0.5 M aluminium nitrate solution at 0.00 ppm. 1H decoupling during acquisition was performed with spinal64 composite pulse decoupling sequence.<sup>2</sup>

The porosity of the zeolite was determined via nitrogen adsorption isotherms, recorded at -196 °C on a Quantachrome USA Autosorb-1 instrument. Prior to measurement, the samples were evacuated at 250 °C under vacuum for 12 h.

The chemical composition of the samples (Si, Al and Cu content) was determined on an axial simultaneous ICP-OES (Varian 720-ES) with cooled cone interface and oxygen free optics. The samples were introduced into the machine via a Varian SPS3 Sample Preparation System. The Cs content was determined via atomic absorption spectroscopy (Varian SpectrAA 20 Plus).

High-Resolution Scanning Electron Microscopy (HRSEM) images were obtained with a Nova NanoSEM450 (FEI, Hillsboro, OR). Samples were mounted on aluminum stubs, by drying a droplet of a zeolite dispersion in acetone on the stub and observed without any further modification.

# 3. NH<sub>3</sub>-SCR activity testing

Zeolite catalyst pellets with a size between 125 and 250  $\mu$ m were placed in a quartz tube with an internal diameter of 9 mm. This tube was placed in a reactor compartment which was first heated to 450 °C at a rate of 5 °C/min and kept at that temperature for 2 h. Testing occurred at different reaction temperatures. The conversion data refer to steady state conditions achieved typically after 30 minutes on stream. The gas was composed of 500 ppm NO, 450 ppm NH<sub>3</sub>, 5 vol% O<sub>2</sub>, 2 vol% CO<sub>2</sub>. N<sub>2</sub> served as balancing gas. The gas hourly space velocity was 30,000 h<sup>-1</sup>. Analysis of the outlet gasses was performed online with an ABB Limas 11HW UV analyzer for NO, NO<sub>2</sub> and SO<sub>2</sub> and an ABB Uras 26 NDIR analyzer for CO, CO<sub>2</sub> and N<sub>2</sub>O.

The reaction rate [mol g <sup>-1</sup> h<sup>-1</sup>] was expressed according to following formula:

$$Reaction rate = ([NO]in - [NO]out) * F_{tot} * \frac{1}{V_{molar} * m}$$

In which  $F_{tot}$  is the volumetric flow of feed gas [L h<sup>-1</sup>] under standard temperature and pressure,  $V_{molar}$  is the molar gas volume [22.4 L mol<sup>-1</sup>] and m is the mass of the catalyst [g].

#### 4. Hydrothermal stability

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The hydrothermal stability was determined by heating zeolite catalyst pellets at a rate of 5 °C/min to 900 °C in a quartz tube under air flow with an absolute humidity of 12 vol% for 3 h. Cooling was performed under a 40 mL/min dry nitrogen flow. Prior to this experiment, the powder was pelletized to a particle size between 125 and 250 µm to avoid pressure build-up in the quartz tube.

## 5. References

- 1 A. Araya and B.M. Lowe, Zeolite EU-7, US4581212, 1986.
- 2 B.M. Fung, A.K. Khitrin, K. Ermolaev, Journal of Magnetic Resonance, 2000, **142**, 97-101.