Supporting Information

Thermal processing of zeolite seed layers for the fabrication of compact oriented MFI zeolite films

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Experimental

Materials: Stainless-steel plates (20 × 20 mm), glass plates (25 × 20 mm), silicon wafers (20 × 20 mm) were immersed in hydrogen peroxide solution for 45 min, then rinsed with deionized water, and dried at 60°C before coating seed layers. Tetraethyl orthosilicate (TEOS, 98%) was purchased from J&K Scientific Ltd.. Tetrapropylammonium hydroxide (TPAOH, 25wt. %) was supplied by Sachem Suzhou.

Preparation of MFI zeolite seeds: Synthesis solution of molar composition 0.17 TPAOH:1 TEOS:165 H_2O was prepared by slowly adding TEOS to a solution of TPAOH and water under stirring. A clear synthesis solution was obtained after stirring at room temperature for 4 h. Then the synthesis solution was directly loaded into a Teflon-lined stainless-steel autoclave. The autoclave was sealed and fixed in the rotation shaft of a convection oven. It rotated with the axis at 20 rpm in the oven at 175°C for 130 min. After synthesis, the mixture was quenched. The sample was recovered, thoroughly washed with deionized water, and dried at 60°C. The size of the MFI zeolite seed crystals is ca. 1 μm.

***b*-Oriented MFI seed layer deposition and thermal processing:** *b*-Oriented MFI monolayers were prepared on three substrates by rubbing MFI zeolite seeds with a finger in latex glove.

Thermal processing was conducted in a convection oven. The seeded substrates were heated at 150 °C for 3 h. After cooling down, the substrates were taken out and ready for secondary growth.

Secondary hydrothermal synthesis: The seeded substrates were vertically placed in a Teflon-lined stainless-steel autoclave for secondary growth. The synthesis solution was prepared by slowly adding TEOS to a solution of TPAOH and water under stirring. The molar composition of the resulting gel was 0.2TPAOH : 1TEOS : 2000H_2O, which is an optimized protocol for synthesizing highly *b*-oriented MFI zeolite films in our previous work.[1] The seeded growth was carried out at 150 ^oC for 4 h. After synthesis, the film was rinsed with deionized water and dried at 60 ^oC.

Characterization: Morphologies of the MFI seed monolayers and the films were obtained with the scanning electron microscope SU-8010 (Hitachi). X-ray diffraction (XRD) patterns were collected on a Bruker D8 Advance diffractometer using Cu *K*α radiation. ATR-IR analysis of substrates and zeolite seeded substrates was performed on Thermo Fisher Nicolet iS10.

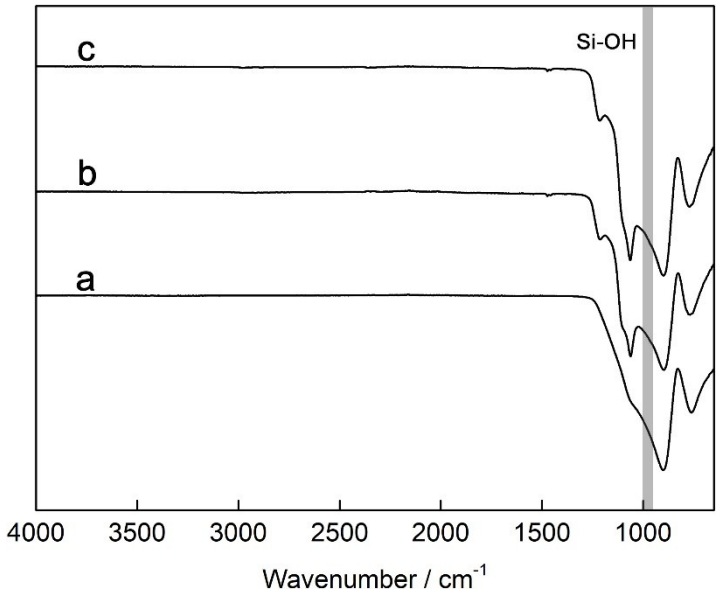

Figure S1. ATR -IR spectrum of glass plate (a), MFI zeolite seed layer on glass plate before thermal processing (b) and after thermal processing (c).

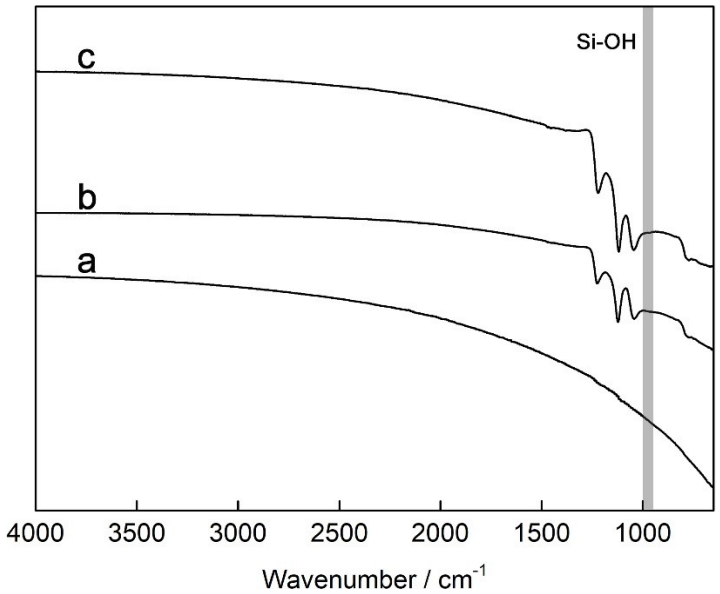

Figure S2. ATR -IR spectrum of silicon wafer (a), MFI zeolite seed layer on silicon wafer before thermal processing (b) and after thermal processing (c).

Reference

1. X. F. Lu, Y. Peng, Z. B. Wang and Y. S. Yan, Micropor. Mesopor. Mater., 2016, 230, 49–57.