Supporting Information

TPA^+-Mediated Conversion of Silicon Wafer into Preferentially-Oriented MFI Zeolite Film under Steaming

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Experimental

In a typical method, a silicon wafer ((100) plane, Shin-Etsu) with ca. 50 nm-thick thermally-oxidized layer was cleaned in ethanol under ultrasonication for 30 min, followed by rinsing with ethanol and distilled water. The cleaned substrate was placed on a Petri dish, and then a small amount of tetrapropylammonium hydroxide aqueous solution (1.0 M TPAOH, Aldrich), the SDA for MFI-type zeolite, was dropped to the substrate. The TPAOH-coated silicon wafer was mounted horizontally on a Teflon holder and dried at 333 K for one hour. After drying about 80 percent of the substrate surface was covered with TPAOH. Crystallization was carried out at 373-473 K for different periods of time under steaming by addition of a small amount of distilled water (ca. one gram) to a 23-mL Teflon-lined Parr autoclave in which the silicon wafer mounted on the Teflon holder was placed. Finally, the product was thoroughly rinsed with distilled water, and subsequently dried at 333 K overnight. In some samples, the SDA was removed by calcination at 823 K under dry air atmosphere with a heating rate of 0.5 K min^{-1}. After maintaining at 823 K for 3 h, the samples were allowed to cool down to room temperature.

X-ray powder diffraction (XRD) patterns were collected on an M03X-HF (Bruker AXS) using Cu Kα radiation (40 kV, 40 mA). The morphology of the samples was observed on a field emission scanning electron microscopy (FE-SEM, Hitachi S-900 or S-4700). Fourier transform infrared (FT-IR) spectra were collected on a Magna-IR 560 (Nicolet Instrument).

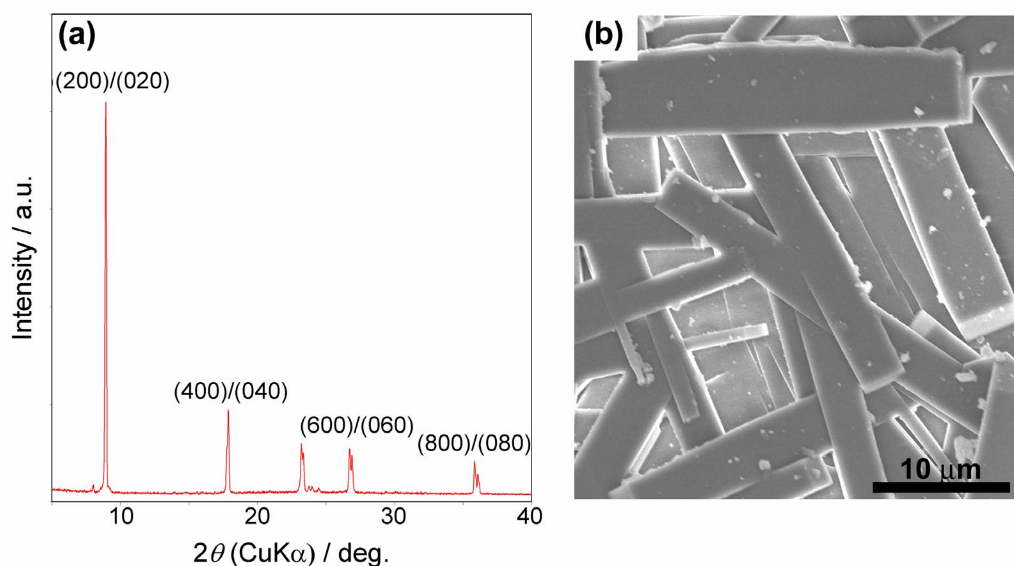

Figure S1. (a) XRD pattern and (b) FE-SEM image of the product prepared on the silicon wafer covered with a natively-oxidized layer. SAC was carried out at 423 K for 72 h.

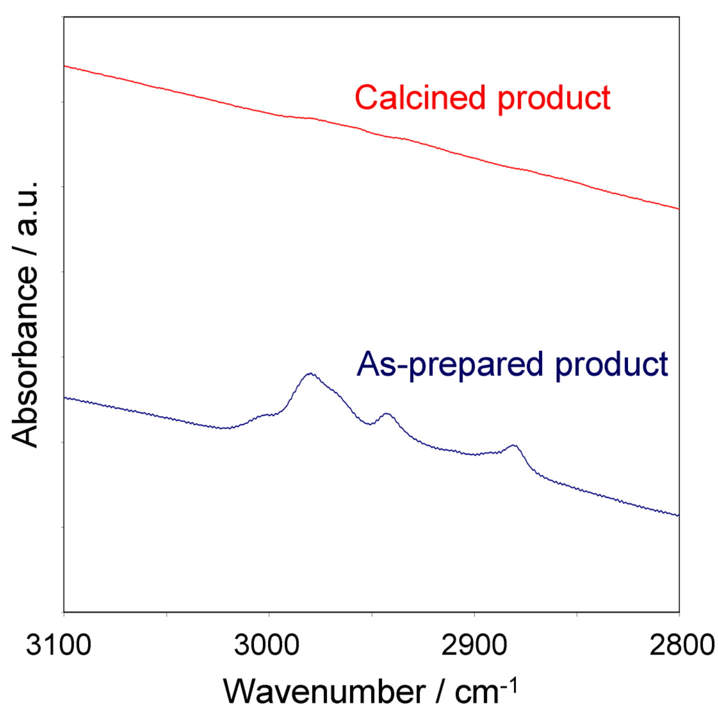

Figure S2. FT-IR spectra of the as-prepared (bottom) and the calcined (top) products crystallized at 448 K for 8 h.

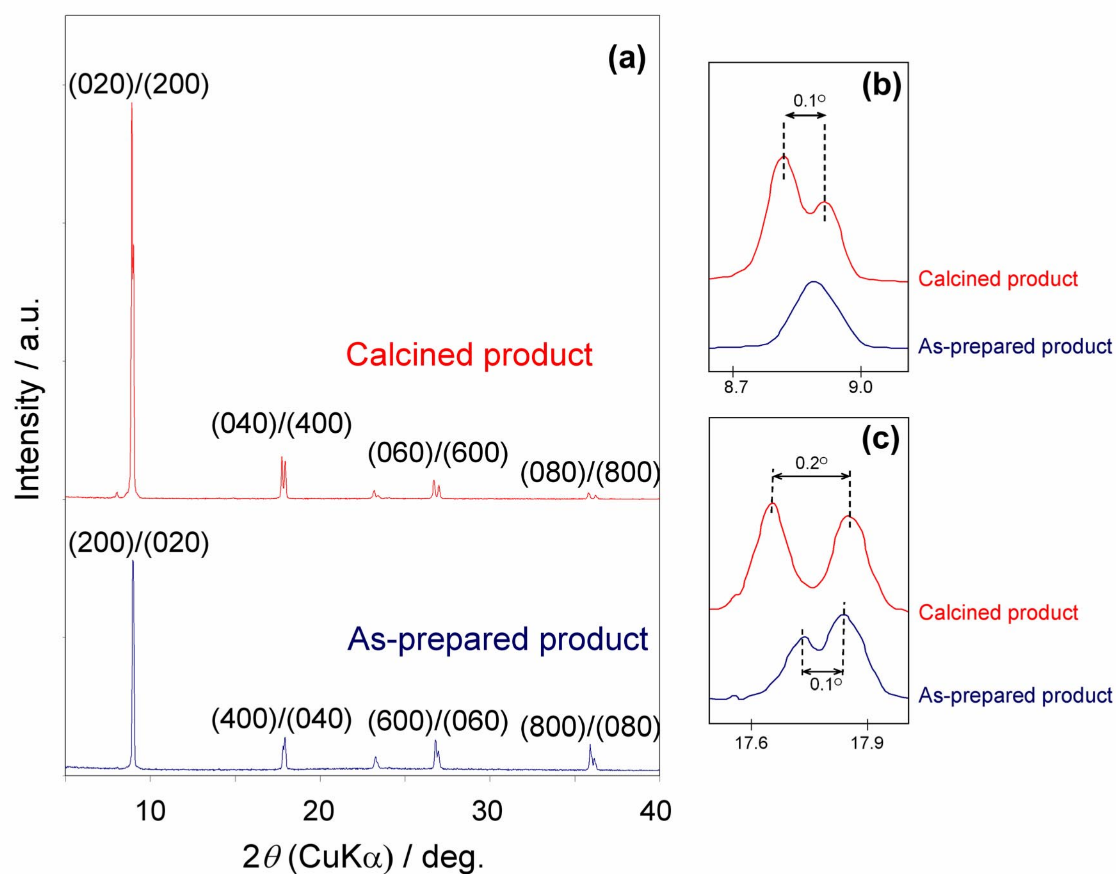

Figure S3. (a) XRD patterns of the as-prepared (bottom) and the calcined (top) products crystallized at 448 K for 8 h; (b) and (c) are magnified images in (200)/(020) and (400)/(040) regions, respectively. Peaks of the as-prepared and the calcined products are indexed with the orthorhombic and the monoclinic MFI, respectively.

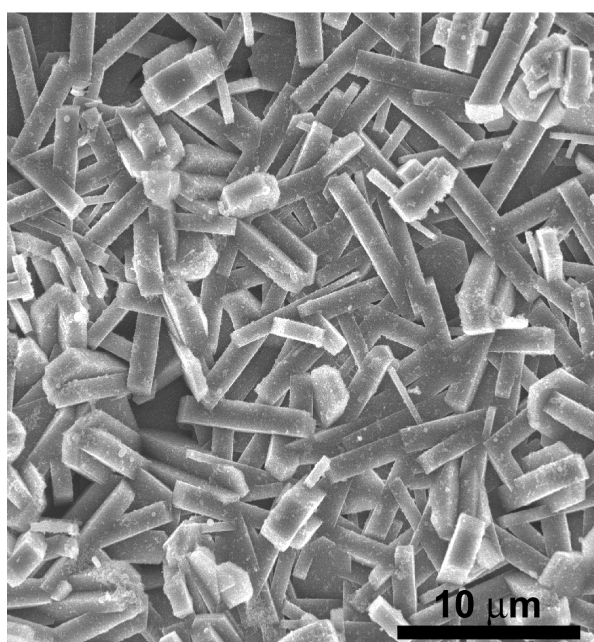

Fig. S4 FE-SEM image of the calcined product crystallized at 448 K for 8 h.