Supplementary Material (ESI) for Chemical Communications

Supplementary Information

Facile unidirectional alignment of mesochannels in a mesoporous silica film on a freshly cleaved mica surface

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Preparation of mesoporous silica film by the EISA method.

Nonionic surfactant Brij 56, polyoxyethylene 10 cetyl ether, was dissolved in ethanol (EtOH) and then water, 0.1 M hydrochloric acid, and tetraethoxysilane (TEOS) were sequentially added to this solution. The final composition of TEOS : Brij 56 : HCl : H_2O : EtOH in the precursor solution was 1 : 0.08 : 0.004 : 5 : 22. After stirring the mixture for 1.5 h, mica (ca. 2 × 2 cm) was dip-coated with this precursor solution and was subsequently dried at room temperature for 24 h in an air atmosphere. The relative humidity in dip-coating and drying processes was in the range between 17 % and 25 %. The surfactants on the main substrate were removed by calcination under an air atmosphere at 400 °C for 1 h at a rate of 0.5 °C min^{-1}, and the lowermost part of the substrate, which had a line of droplets, was cut and removed, resulting in the formation of mesoporous silica films.

Preparation of a mesostructured silica film by hydrothermal deposition method.

The mesostructured silica films were prepared hydrothermally through heterogeneous nucleation and growth of mesostructured silica seeds on the substrate from a strongly acidic reactant solution. TEOS was mixed with a solution containing HCl, H_2O, and Brij56 and the mixture was stirred for 2.5 min at room temperature. The composition of TEOS : Brij 56 : HCl : H2O in the precursor solution was 0.1 : 0.11 : 3: 100. After the stirring, the mixed solution was transferred into a

Teflon vessel. The vessel containing the mica and the reactant solution was sealed at 80 ^{o}C for the growth of the mesostructured silica films. The mica was held in the reaction solution using a substrate holder with the cleaved mica surface downward. The surface was covered with another silica glass plate with a 0.2 mm gap during the film deposition. After the reaction, the film was washed with distilled water and dried in air, resulting in the formation of mesostructured silica films.

Characterization.

Mesoporous silica films were observed with an optical microscope (Olympus BH2). In-plane XRD was performed with a 4-axis goniometer RIGAKU ATX-G diffractometer using Cu-Kα radiation under the operating conditions of 50 kV and 300 mA, and a soller slit with a perpendicular divergence of 0.48° was used to obtain a parallel beam. The incident angle of X-ray in the in-plane geometry was set to 0.2°. Mica was thinly cleaved due to the in-plane alignment control process for measurement. The θ-2θ scanning X-ray diffraction (XRD) was performed with a MAC Science M03XHP22 diffractometer using Mn-filtered Fe-Kα radiation under the operating conditions of 40 kV and 20 mA. Transmission electron microscopic (TEM) images were recorded on a JEOL JEM-2010 microscope at an accelerating voltage of 200 kV.

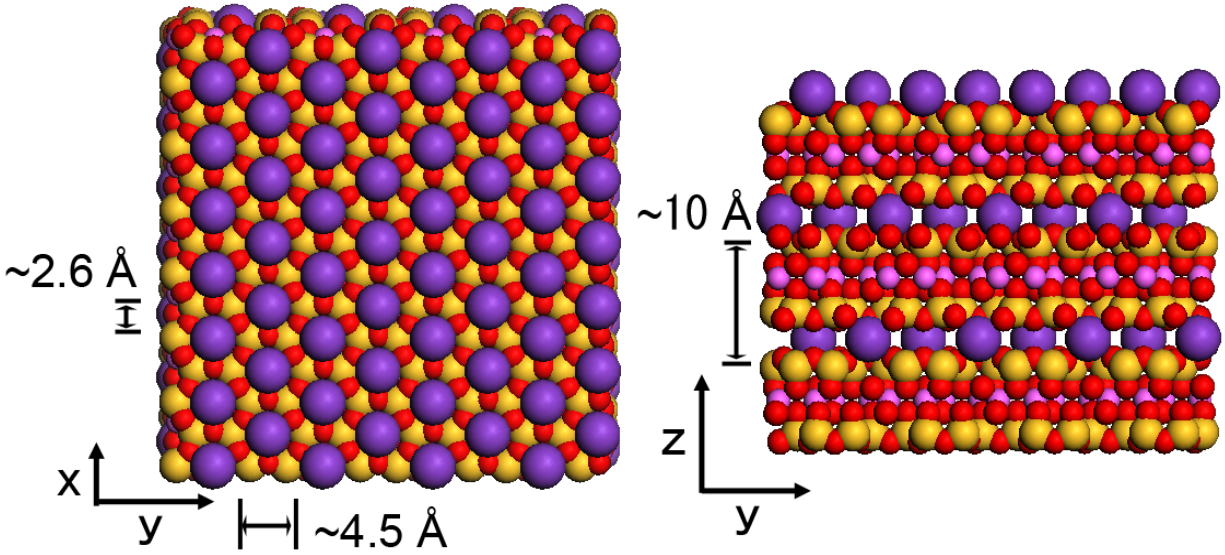

Figure S1. Crystal structure of mica created by using Material Studio software. Color spheres; red = O, yellow = Si, pink = Al, purple = K. A quarter of SiO_4 are replaced with AlO_4 tetrahedra.

Figure S1

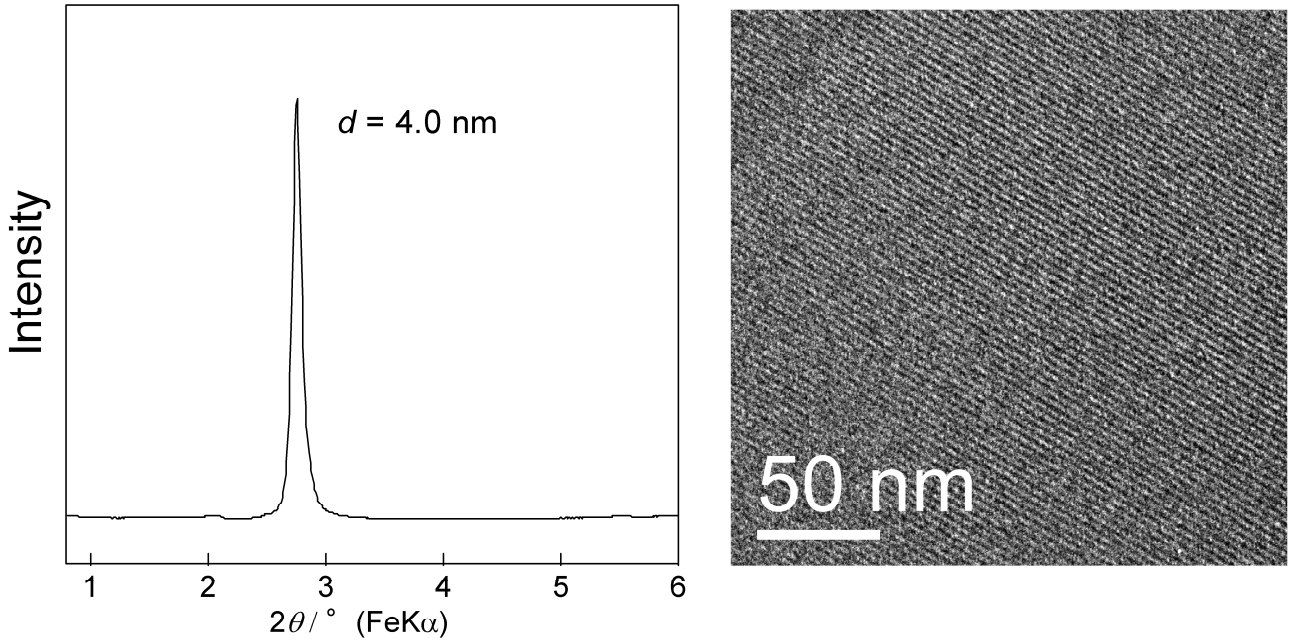

Figure S2. The conventional θ-2θ scanning XRD profile and TEM image of mesoporous silica film prepared by EISA method on a freshly cleaved mica surface.

Figure S2

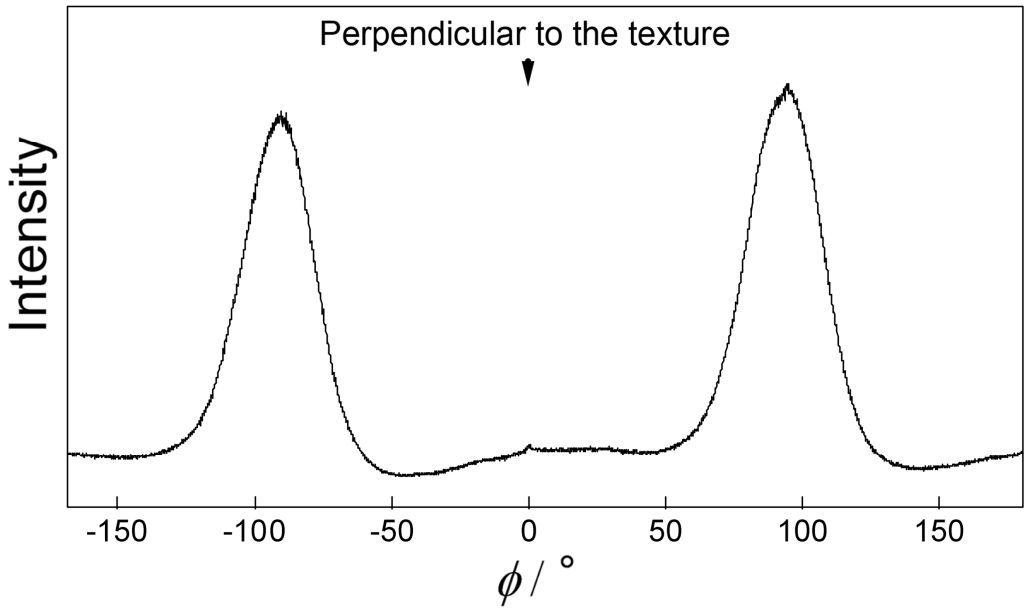

Figure S3 In-plane ϕ scanning profile of mesostructured film prepared by hydrothermal deposition method recorded for the diffraction peak at $2\theta\chi = 1.3°$.

Figure S3