Supplementary Material (ESI) for Chemical Communications

Supporting Information for

"Silica Nanowires with New Mesopore Structures by Space-Confined Self-Assembly within Nano-Scale Channels"

by

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Experimental Section

Materials. TEOS, $Si(OC_2H_5)_4$, from J. T. Baker Inc. was used as the precursor of silica. Absolute EtOH, C2H6O, was purchased from AAPER Alcohol Chemical Co. (absolute-200 proof). HCl aqueous solution with pH of 2.00 was prepared from diluting HCl (6.000 ± 0.030 N) provided by VWR with deionized water. The pH value of the solution was adjusted via a pH meter. Tri-block co-polymer P123, from BASF Corporation, was used as a self-assembly template.

Anodized aluminum oxide membrane (AAO) and track-etched polycarbonate membrane (EPC) were used as substrates to space-confine the silica-P123 hybrid self-assembly. The diameters of the channels used in AAO were 200, 73, 55, 35, and 13 nm, respectively; those in EPC were 200, 80, 50, 30, and 10 nm, respectively. EPC was the PVP-treated standard white membranes purchased from SPI SUPPLIES. Polycarbonate is inherently hydrophobic. However, in order to increase the wetability of the membrane surface, all SPI-Pore standard white membranes were given a final treatment with PVP (polyvinylpyrolodone) by SPI SUPPLIES. The polycarbonate track etch membranes by SPI do not have an inherent positive or negative charge.

The 200 nm AAO was purchased from WHATMAN. The membrane is hydrophilic and compatible with most solvents and aqueous material. No monomers, plasticizers, adhesives, surfactants or wetting agents were used in the manufacturing process, which eliminated sample contamination and ensured low protein binding and minimal loss of sample. The AAO substrates with diameters less than 80 nm were provided by Synkera.

Synthesis. The synthesis procedure is schematically shown in Figure S1 in details. Evaporation-induced self-assembly, sol-gel, and space-confinement are involved in the procedure for the formation of silica-P123 wires inside a substrate channel.

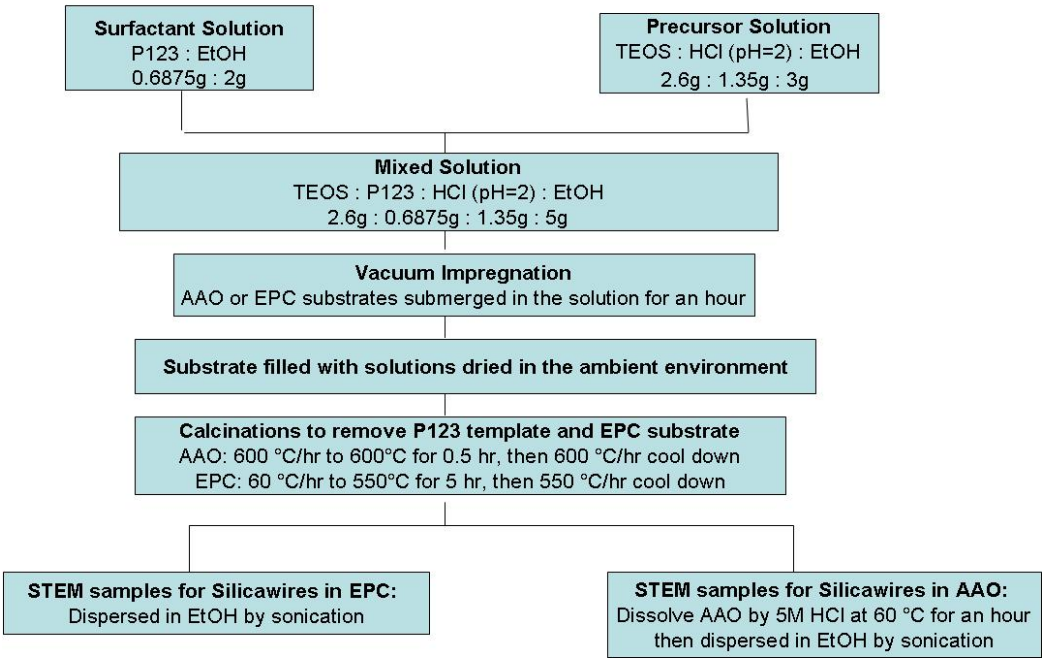

Figure S1. The flowchart of the experimental procedure.

Characterization. To prepare the specimen for the scanning transmission electron microscopy (STEM), the AAO or EPC substrates were removed for dispersion of the nanowires. EPC was removed by calcinations shown in Figure 1. The AAO membrane was completely dissolved in 5 M HCl at 60^{o}C for approximately one hour. Then the free-stand nanowires were dispersed in EtOH using ultrasonication. The suspension solution was dropped onto the porous carbon coated TEM grid and dried in air. The cross-sectional view of silica wires were prepared by microtome. The epoxy used to make the microtome block was Araldite 6005 (mass used for the reaction mixture: Araldite 6005 - 10.38 g, DDSA - 7 g, and DMP-30 - 0.2326 g) and it was cured overnight in an oven at 60°C. The ultramicrotome used was a Leica Ultracut UCT with a Diatome diamond knife at a 4°clearance angle.

For each sample of silica wires, at least three different observed spots were randomly chosen and usually eight to ten images of different position of nanowires or different nanowires were taken to present the overall reliable morphology of the intra-wire nanoporous structure.