

Supporting Information

Experimental Section

Synthesis of the mesoporous silica: 2.0 g Pluronic[®] P-123 (EO₂₀PO₇₀EO₂₀, averaged M_w 5800, Sigma Aldrich), was dissolved in 50 ml of deionized water with 10 ml of hydrochloric acid (32%, Aldrich). The solution was stirred vigorously in a water bath at 40 to 45 °C to dissolve the P-123. After half an hour, the solution was cooled and fed into the VFD at a flow rate of 1 ml/min with the rotational speed set at 7000 RPM, with a 45° tilt angle, operating at room temperature, ca 20 °C. After collecting the pre-sheared micelles solution, the solution was then fed into the VFD again through liquid feed 1. At the same time, 4.4 ml of tetraethyl orthosilicate (TEOS, 98%, Sigma Aldrich) was added through liquid feed 2 (Figure 1). This resulted in some sol gel precipitation arising from surfactant micelle assembly and aggregation,¹ and the mixture was then fed separately into a VFD for further shear induced processing. The resulting white material was collected by filtration, washed with deionized water, and dried at 80 °C overnight, prior to calcining in air at 550 °C for 6 hours to remove the polymer template. The final chemical composition of the mixture was 2 g P-123: 0.02 mol TEOS: 0.32 mol HCl: 2.78 mol H₂O. Approximately 0.8 g of calcined sample is collected and the yield is calculated to be 67.5%. The sample is denoted as S-1. For comparison, mesoporous silica SBA-15 was prepared using the method reported by Zhao et al,^{2,3} with the sol gel precipitate dried at 80 °C overnight then calcined at 550 °C for 6 hours. The final chemical composition of the mixture was 2 g P-123: 0.02 mol TEOS: 0.32 mol HCl: 2.78 mol H₂O.

Characterization: Scanning electron micrographs (SEM) were obtained using a ZEISS 1555 instrument at an accelerating voltage of 5 – 15 kV. Transmission electron micrographs (TEM) were obtained using a JEOL 2100 instrument operating voltage of 120 kV. Small-angle powder X-ray diffraction (SAXRD) data were collected on a PANalytic Empyrean diffractometer system, using Nickel-filtered Cu K α radiation at 40 kV and 40 mA. Thermogravimetric analyses (TGA) were performed under the flow of air on a TA Instruments TGA- Q50 unit with a heating rate of 10 °C/min. Nitrogen adsorption- desorption studies were performed using a Micromeritics TriStar[™] II 3020 system. The samples were outgassed at 200 °C for 16 hours prior to gas adsorption which was carried out at 77K. The specific surface area, S_{BET}, was determined from the linear part of the BET equation ($P/P_o = 0.09 - 0.40$). Equating the rate of condensation of gas molecules to the rate of evaporation from the adsorbed layer, led to determining the surface area using the following equation:⁴

$$\frac{P}{V_a(P_o - P)} = \frac{1}{V_m C} + \frac{C-1}{V_m C} \left(\frac{P}{P_o} \right)$$

where V_a refers to the adsorbed volume, V_m is the micropore volume, and P_o is the saturation pressure of the gas. The pore size distribution and pore volume were evaluated using the Barrett- Joyner- Halenda (BJH) method. The total pore volume reported was taken from the amount of gas adsorbed at a relative pressure (P/P_o) at 0.995.

Molecular modeling: Materials Studio V6.0 was used for modeling of the Pluronic[®] P-123 structures. The Sketch Atom module was used to draw a molecule of the triblock copolymer and the structure was then ‘cleaned’ for unorthodox bond lengths and angles. For micelle construction, a manual structure manipulation of a molecule was undertaken to produce a ‘v’ shape as a starting geometry which was further

cleaned and minimized. For energy minimization, the Discover Module was used with the PCFF forcefield and the Atom-based summation method with Fine quality. The Steepest Descent method was used with a convergence criterion of 0.001 kcal/mol/Å. Molecular dynamics simulations were carried out using the NVT ensemble at 298 K with a time step of 1.0 fs and 100,000 steps using the Nose thermostat.

S1. Vortex Fluidic Device

Photograph and schematic drawing of the vortex fluidic device are shown in Figure S1a and S1b respectively.

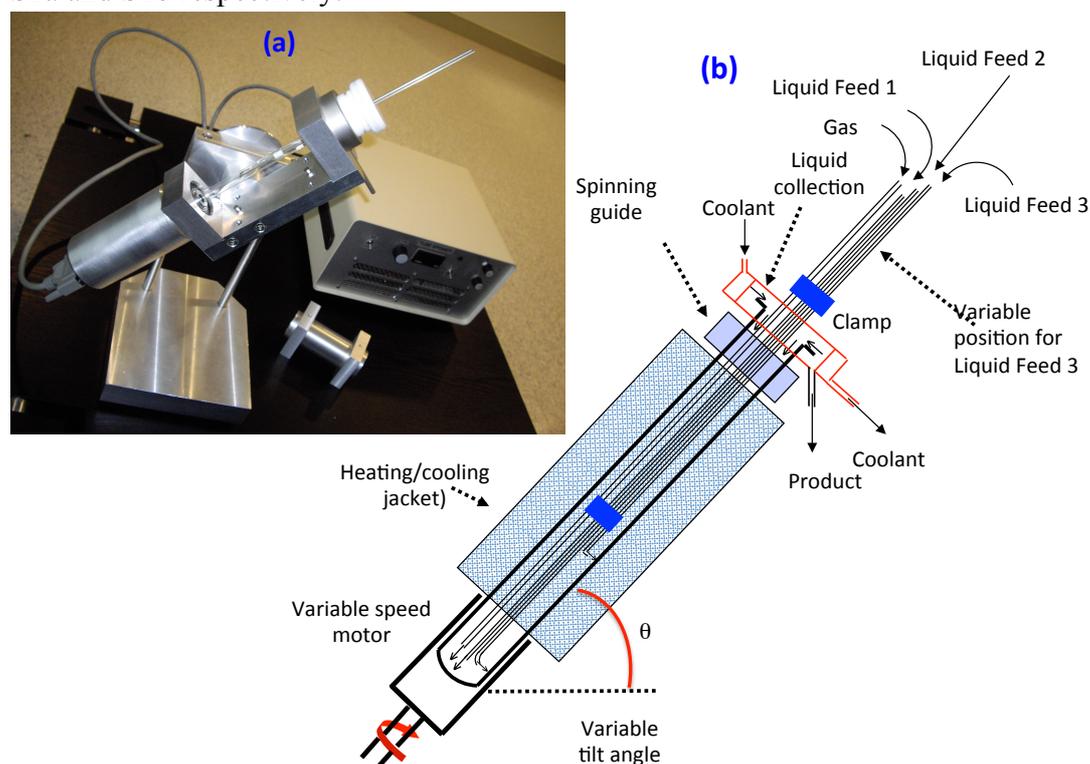


Figure S1 (a) Photograph (a) and schematics (b) of the vortex fluidic device.

S2. Thermogravimetric Analyses (TGA)

TGA measurements were undertaken to determine the weight loss of the sample in relation to temperature incremental changes in temperature, for the as-synthesized and calcined samples for S-1-7000.

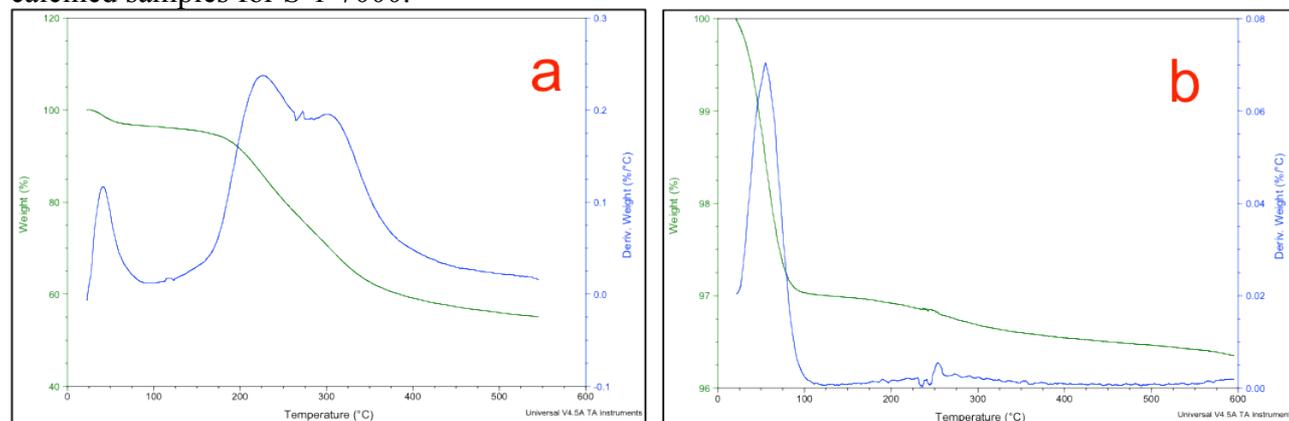


Figure S2 (a) TGA data showing the weight loss of as-synthesized sample S-1-7000 as a function of temperature between 10 to 550 °C. (b) TGA data showing the weight

loss of the calcined sample S-1-7000 as a function of temperature between 10 to 600 °C. The negative of the first derivative (%/°C) is also plotted for each analysis.

S3. BJH Pore Size Distribution

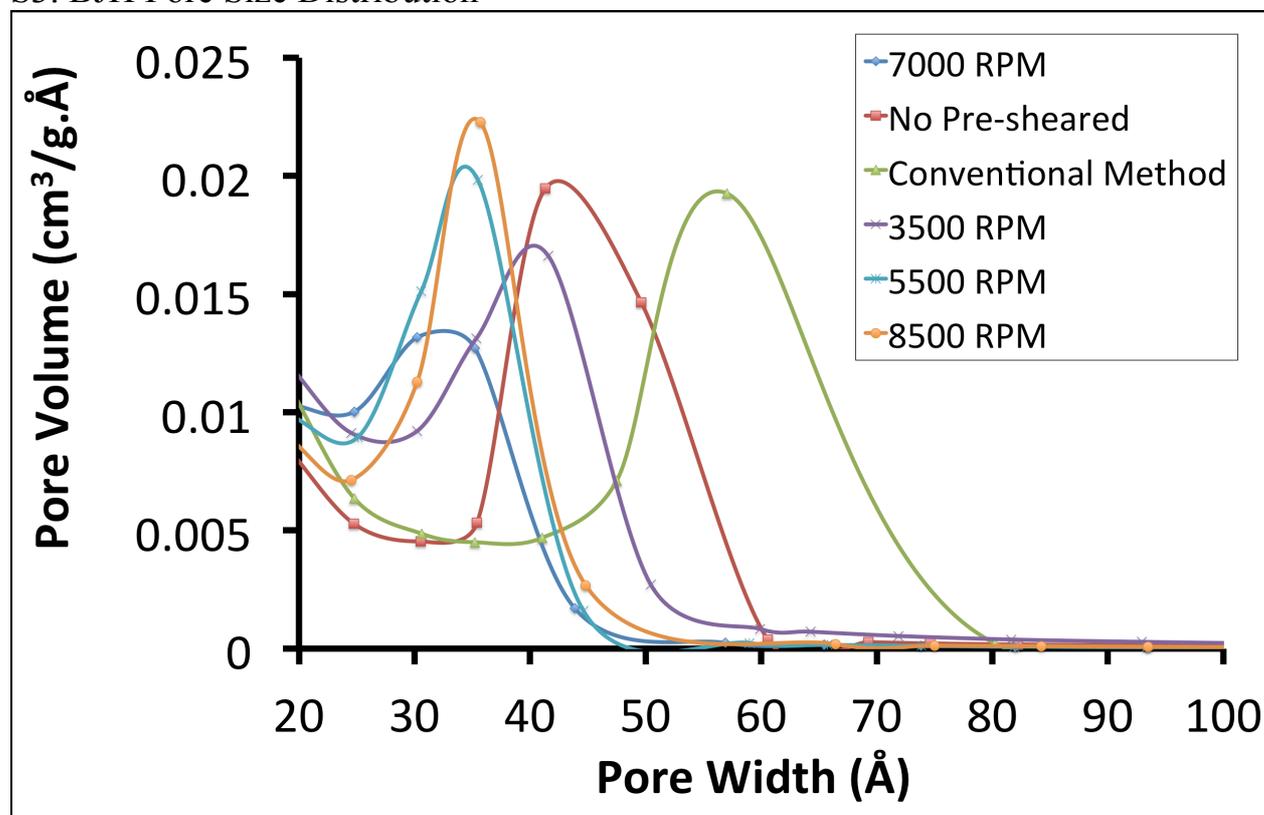
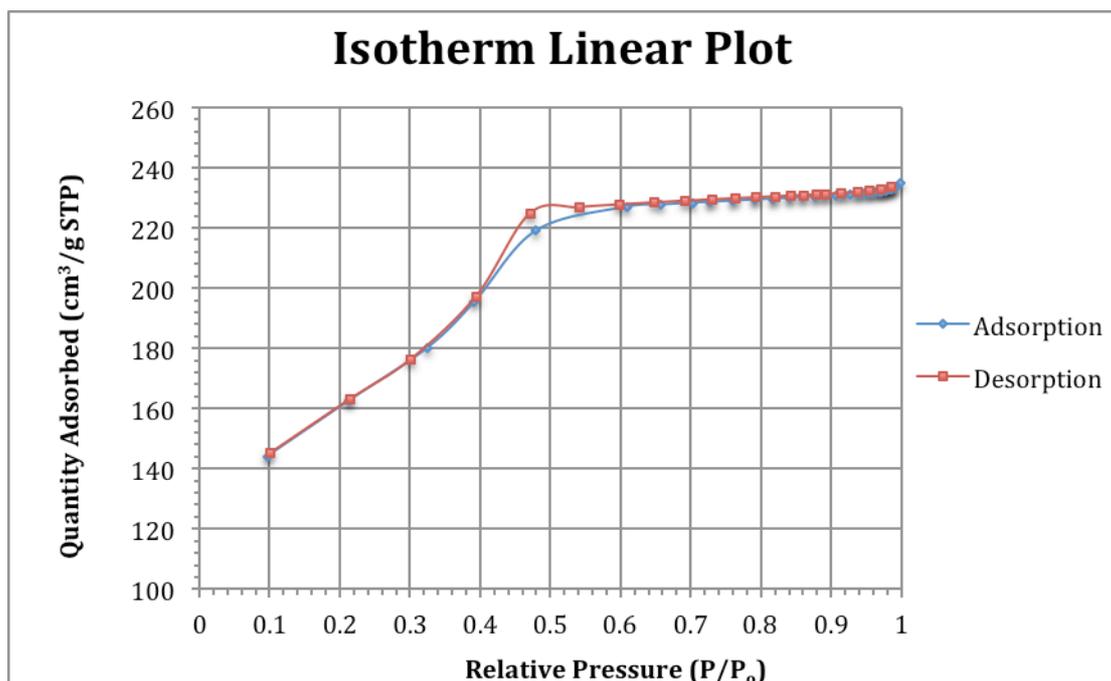


Figure S3 Pore size distribution of sample S-1-7000 (Table 1) associated with variation in shear rates associated with change in rotational speed of a 10 mm diameter tube in the VFD, inclined 45 degrees, and with flow rates of reactants at 1 mL/min.

S4. N₂ adsorption isotherm for S-1-7000



Reference:

1. Z. Li, J. C. Barnes, A. Bosoy, J. F. Stoddart and J. I. Zink, *Chemical Society Reviews*, 2012, **41**, 2590-2605.
2. D. Zhao, J. Feng, Q. Huo, N. Melosh, G. H. Fredrickson, B. F. Chmelka and G. D. Stucky, *Science*, 1998, **279**, 548-552.
3. H. Yu and W. Jiang, *Macromolecules*, 2009, **42**, 3399-3404.
4. W. Paul A, Clyde Orr, in *Analytical Methods in Fine Particle Technology*, Micromeritics Instrument Corporation, Georgia 1997, ch. 3, p. 59.