Supporting Information

pH-Responsive Nano Sensing Valve with Self-monitoring State Property Based on Hydrophobicity Switching

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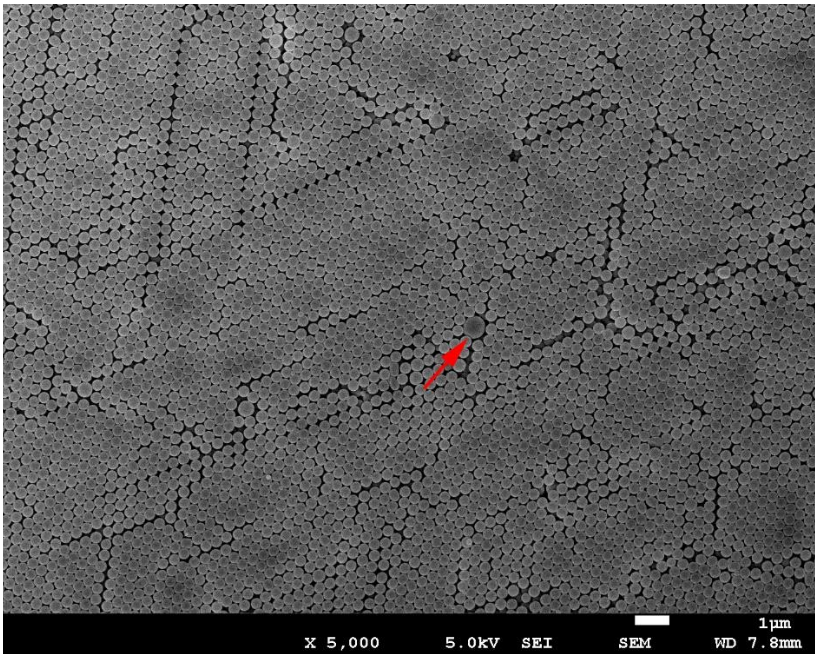

Fig. S1 SEM images of top surfaces of P(St–MMA–AA) opal. Big diameter spheres is highlighted by arrow heads.

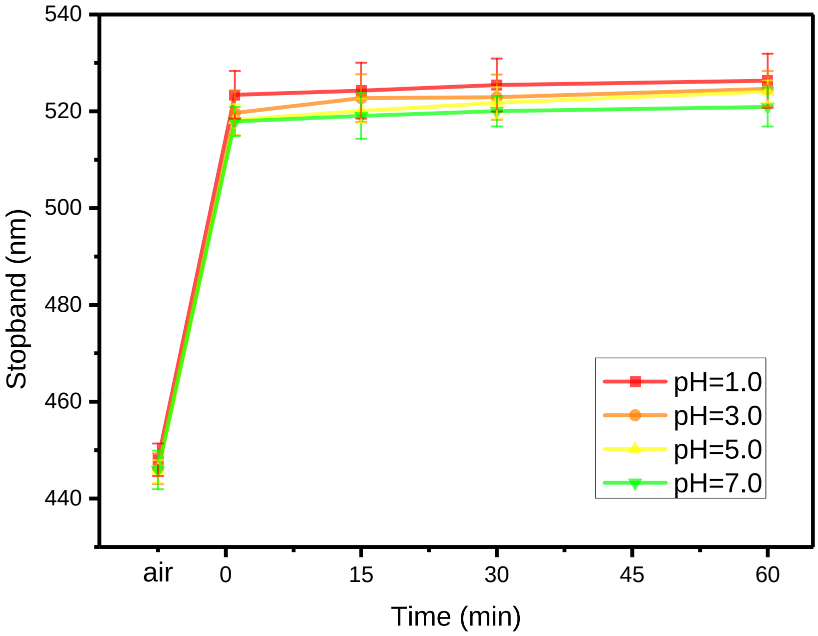

Fig. S2. Bandgaps of mIOPC-Ph (0:1) changed along with time in pH 7.0, pH 5.0, pH 3.0, and pH 1.0 solutions.

The mIOPC-Ph (0:1) without Ph groups had hydrophilic surface because of the silicone hydroxyl on the surface of mIOPC-Ph (0:1), which led to liquid invading the inverse opal structure quickly in spite of pH values. So the bandgap shifted from 445 nm to 520 nm in the first 1 min and kept immobile in the next 1 hour under any pH conditions.

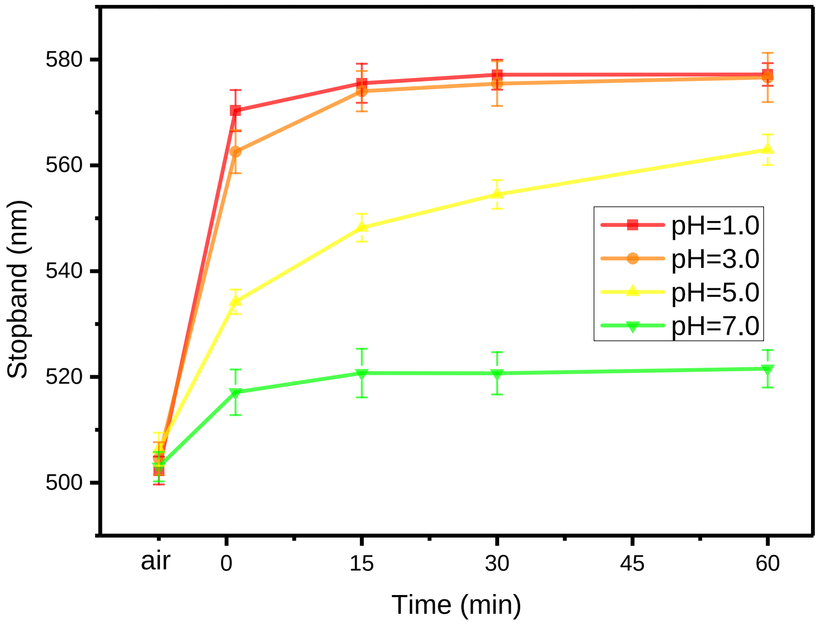

Fig. S3. Bandgaps of mIOPC-Ph (1:9) changed along with time in pH 7.0, pH 5.0, pH 3.0, and pH 1.0 solutions.

There were a few Ph groups on the surface of mIOPC-Ph (1:9), so it was hydrophobic enough to keep the solution with pH 7.0 outside the valves. But the liquid with pH 5.0 could switched on the valves gradually and the liquid invaded in. And there was a gradually bandgap red shift of mIOPC-Ph (1:9) from 505 nm to 562 nm in solution with pH 5.0. The solution with pH 3.0 and pH 1.0 were too acidic to invade in both inverse opal and mesoporous structure quickly, so a fast bandgap red shift was occurred.

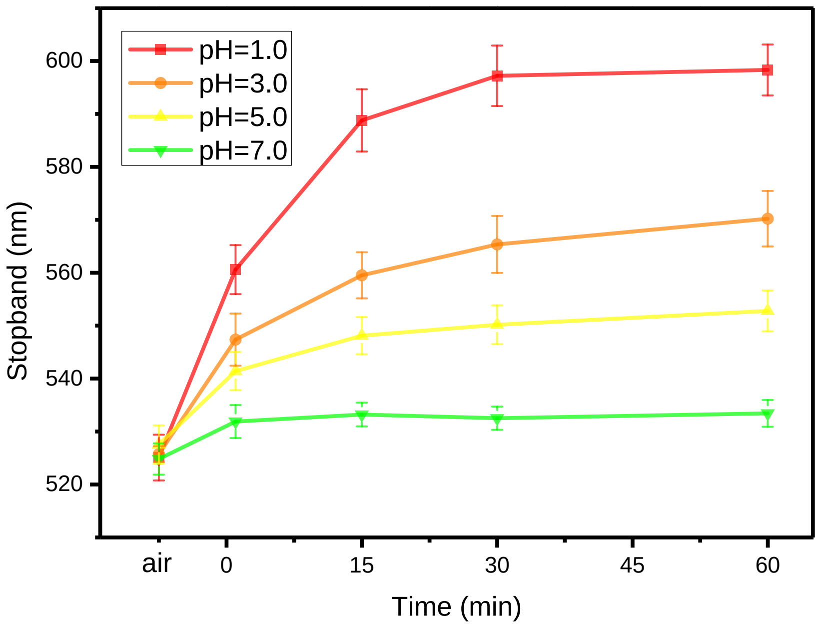

Fig. S4. Bandgaps of mIOPC-Ph (1:2) changed along with time in pH 7.0, pH 5.0, pH 3.0, and pH 1.0 solutions.

The mIOPC-Ph (1:2) owned a lot of Ph groups, which made the ability of solution with different pH value in invading in mIOPC-Ph (1:2) declined contrasted with mIOPC-Ph (1:9). So it was hydrophobic enough to differentiate bandgap red shift in pH 3.0 solution from that in pH 1.0 solution. Thus, 1:2 was the right ratio of PhAPTMS to TEOS to distinguish different solution with pH value from pH1.0 to pH 7.0.