Breath Figure Patterns Made Easy

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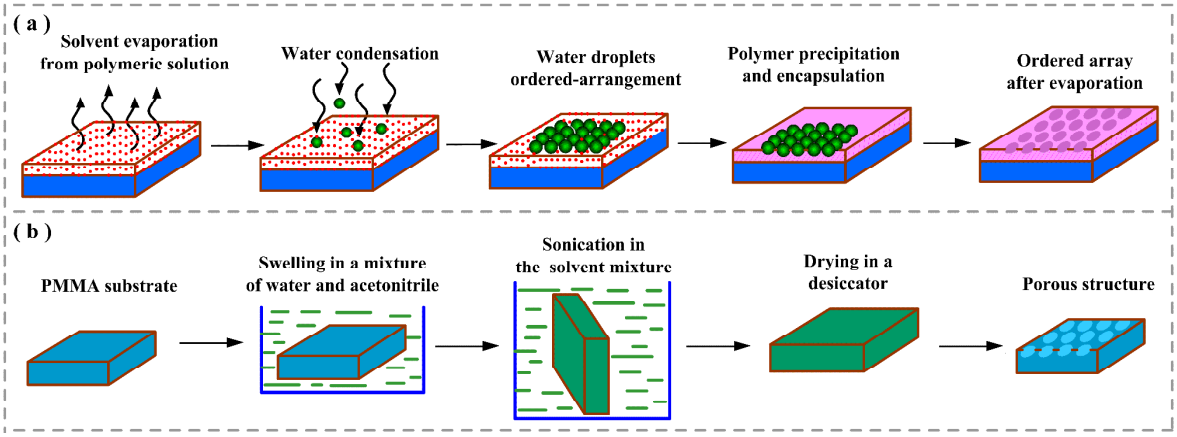
1. Schematic representation of different breath figure methods



Scheme S1. (a) Schematic representation of normal breath figures (NBF) casting technique for the formation of honeycomb structured polymer film. (b) Schematic representation of direct breath figures (DBF) method for the formation of honeycomb structures on PMMA substrates.

2. Characterization

The optical images and the fluorescence images of the honeycomb structures were observed under a Nikon Eclipse E400 epifluorescence microscope equipped with a CCD camera.

Scanning electron microscope (Thermal Field Emission SEM LEO 1560 (Zeiss, Oberkochen, Germany)) was used to observe the surface morphology of the honeycomb structures.

3. Breath figure patterns under a low RH value

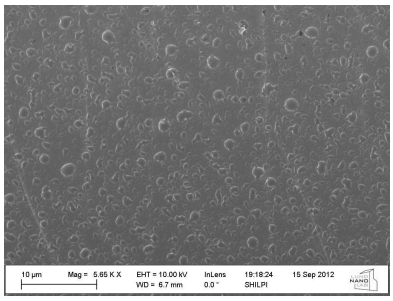


Figure S1. SEM image of breath figure patterns under a RH value of 50%.

4. Solvent remained and amount of PS dissolved (W_d)

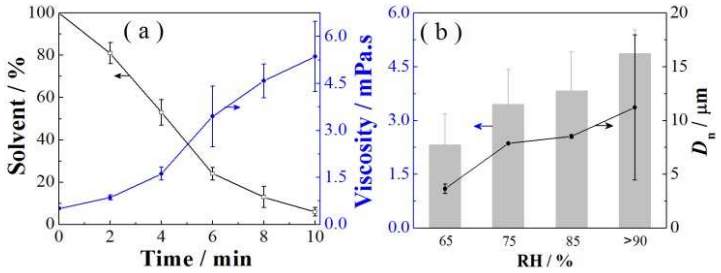


Figure S2. (a) Solvent remained and viscosity change in a typical sDBF process (RH = 75%); (b) Solution viscosity at $t_{1/2non\text{-}flow}$ and diameter of the pores (Dn) on PS Petri dish under different RH. The viscosity was calculated (using the data in Figure 2) based on the Linear equations from literature (Streeter, D. J.; Boyer, R. F. *Ind. Eng. Chem.* **1951**, *43*, 1790).

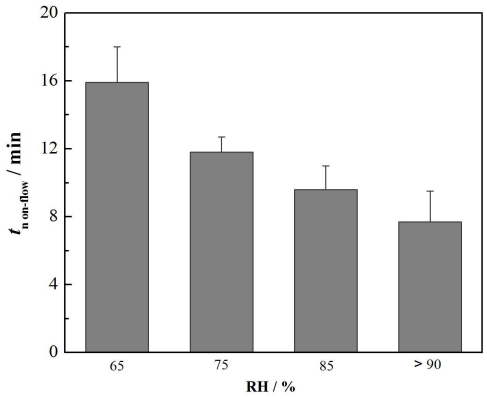


Figure S3. Time for the formation of non-flow state ($t_{non\text{-}flow}$) under different RH in the sDBF process.

5. Effects of soaking time on the breath figure formation

To confirm that the solution viscosity affects the BF pattern, different the soaking time (the solvent has been added into the dishes but Petri dish has not been placed into the humidity condition) was conducted. It is seen that the solution viscosity at $t_{1/2non\text{-}flow}$ was enhanced when the soaking time was increased, while the $t_{non\text{-}flow}$ value was decreased simultaneously. Because of these effects, D_n of the pores was increased when we increased the soaking time. Moreover, the increasing of the soaking time

would destroy the Petri dish (Figure S10). To avoid this, no soaking was used during the sDBF process.

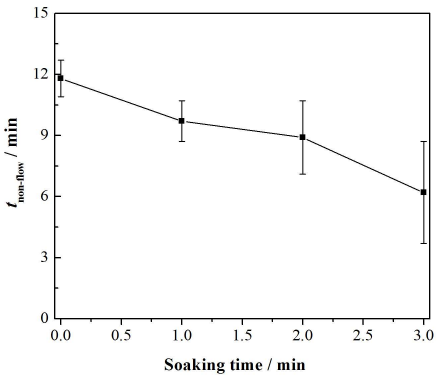


Figure S4. Time for the formation of non-flow state ($t_{non\text{-}flow}$) with different soaking time under a RH value of 75%.

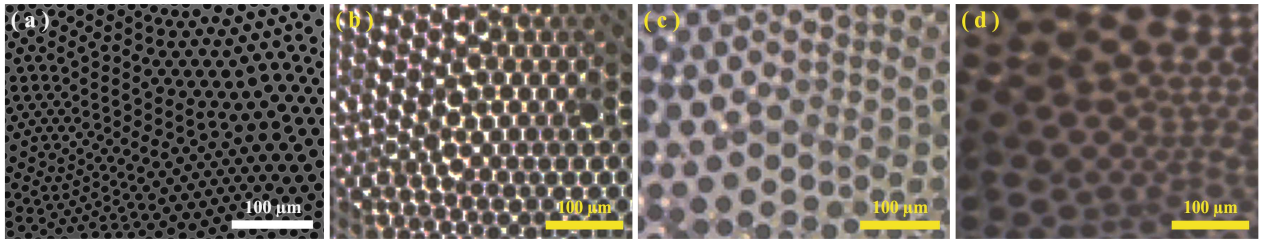


Figure S5. (a) SEM image of breath figure patterns without soaking; Optical microscope images of the honeycomb on the PS Petri dish with a soaking time of 1 min (b), 2 min (c) and 3 min (d) under a RH value of 75%. D_n of the pores was 7.9 ± 0.02 μm, 10.2 ± 0.33 μm, 12.7 ± 0.27 μm and 16.9 ± 0.46 μm for the soaking time of 0 min, 1 min, 2 min and 3 min, respectively.

Figure S6. Photograph of bottom (outside) of the PS Petri dish after an sDBF process with a soaking time of 0 min (Left) and 2 min (Right). The Petri dish on the right has been destroyed.

6. Stability of the breath figure patterns

The breath figure patterned glass slide (BF-patterned glass side) and the honeycomb-structured Petri dish were carefully observed using a microcopy. When no damage on the surface breath figure was found on both films, the breath figure patterned glass slide (BF-patterned glass side) and the honeycomb-structured Petri dish were placed into an oven at 37 ^{o}C for 36 h. After this treatment, damages of the film were clearly observed on the BF-patterned glass side. However, no clear change was found on the surface morphology of the honeycomb-structured Petri dish after a same treatment

(similar to Figure 1e, data was not shown).

7. Photograph of breath figure patterns

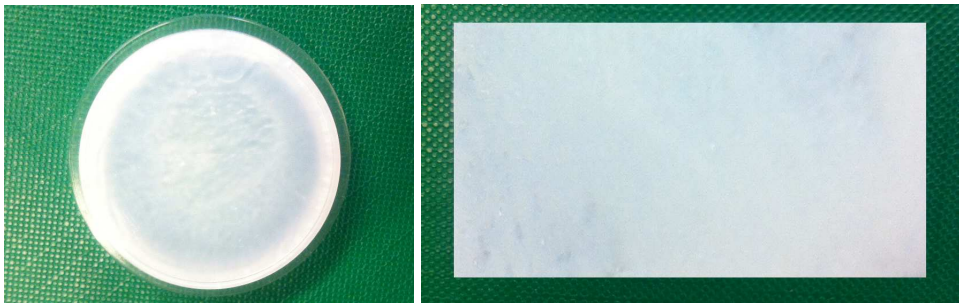


Figure S7. Left: Photograph of breath figure patterns on the PS Petri dish (3.5 cm in diameter); Right: Photograph of breath figure patterns on PMMA substrate (5 cm × 3 cm).

8. Cell attachment on the Petri dish

Cultivation of GFP expressing *Escherichia coli* (*E. Coli*) cells: *Escherichia coli* TG1 cells expressing green fluorescent protein (GFP) (using a pTrc99a vector) were cultivated following protocol. The cells were inoculated in 10 mL of LB-media containing ampicillin (100 μg mL^{-1}) and cultivated for 17 h at 37 °C in a shaking incubator. This culture (0.8 ml) was used to inoculate 100 mL of TB-media in a 500 mL flask, supplemented with 100 μg mL^{-1} ampicillin and 1 mM IPTG. The cells were cultivated at 37 °C in a shaking incubator to give an OD_{600} of 7 (in approximately 5 h), which corresponds to the exponential phase of the bacteria. The cells were harvested by centrifugation. The cells were washed two times in phosphate buffered saline (pH 6.8, 0.1 M), and collected by centrifugation.

After the last washing, the cells were resuspended in PBS buffer (pH 6.8) and adjusted to give an optical density of OD_{600} = 0.2. This cell suspension was subsequently used in the cell attachment experiments. Typically, 1 mL of the above cell suspension was added into a honeycomb-strutured PS Perti dish with a diameter of 3.5 cm. The mixture was gently stirred at 4 ^{o}C for 30 min or 3 h. After incubation, the remained cells in the solution were tested. With a calculation, the attached cells on the Petri dish were obtained (see Table 1).

After removal of the cells in the solution by dumping, the honeycomb-structured PS Perti dish was gently washed with 1 mL of PBS buffer (2 times). The honeycomb structures attached with GFP expressing *E. Coli* cells were observed using a fluorescence microscopy.