Electronic Supplementary Material (ESI) for RSC Advances.

A Microfluidic Approach for the Synthesis and Assembly of Multi-Scale Porous Membranes

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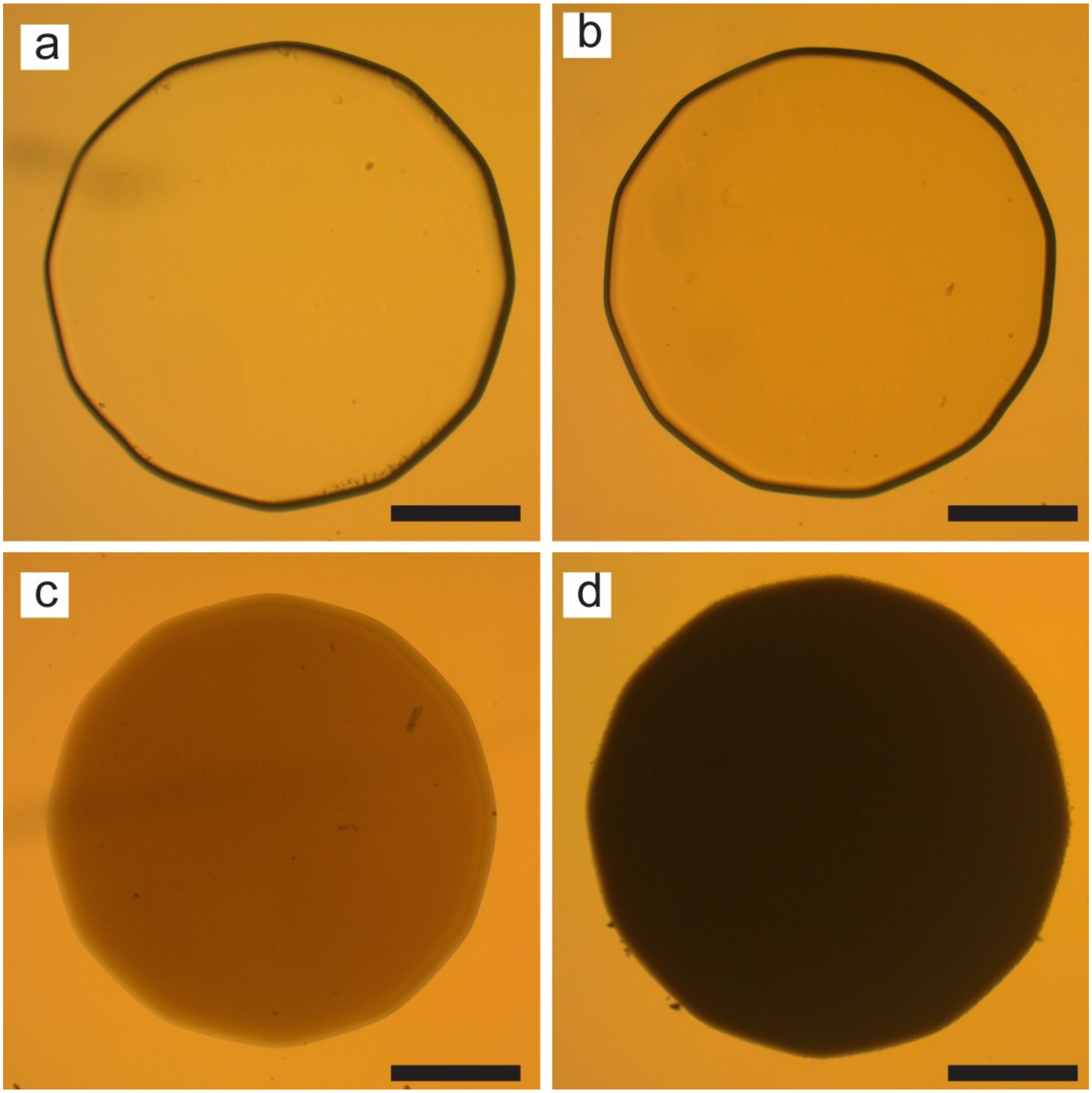

Figure S1 Microscope phase contrast images of the membranes synthesized with different concentrations of ethanol (v/v), (a) 40%, (b) 50%, (c) 60% and (d) 70%. These membranes formed from different concentrations of ethanol have different pore sizes and porosities and exhibit different light transparency under a light microscope. Scale bars are 1 mm.

In order to obtain approximate mechanical properties of our membranes, we performed simple bending tests of the membranes using our homebuilt bending tester, as shown in Figure R1 below. The membranes are supported by two steel sticks and bended under the gravity of another steel stick on the top. The bending modulus of a sample tested under this experimental setup is given by:

$$E_{bend} = \frac{L^3 F}{4wh^3 d}$$

where L is the span of the two supports, F is the gravity of the stick on the top of the membrane, w and h are the width and thickness of the membrane, respectively. d is the vertical deflection of the membrane under the force F. Particularly, for a sample with a rectangular cross-section, which is our case, the elastic modules equals the bending modulus of the membrane: $E = E_{bend}$. The parameters used in our experiments are: L = 3 mm, w = 4 mm, h = 0.1 mm and $F = 3.5\times10^{-3}$ N (0.36 g).

We tested 40% PEGDA and 100% PEGDA membranes to give a mechanical property range of the membranes. Based on our tests, the elastic moduli of our membranes are 1.9 MPa for 40% PEGDA membrane and 101.2 MPa for 100% PEGDA membrane.

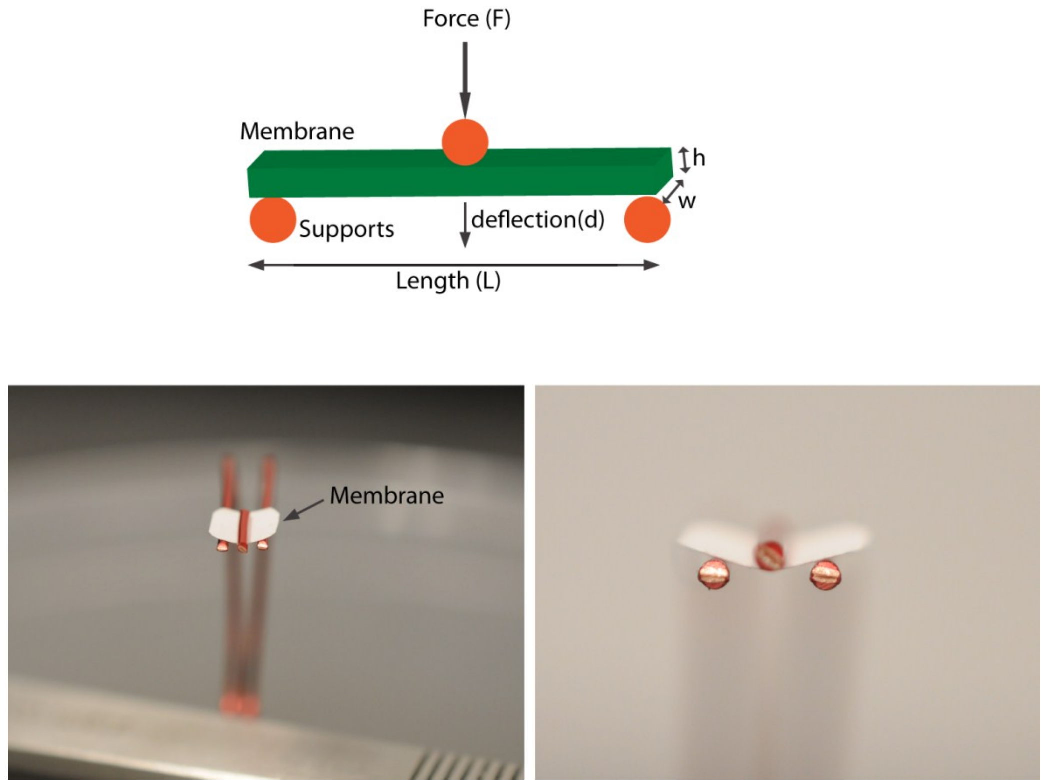

Figure S2 Simple bending test for the membrane.

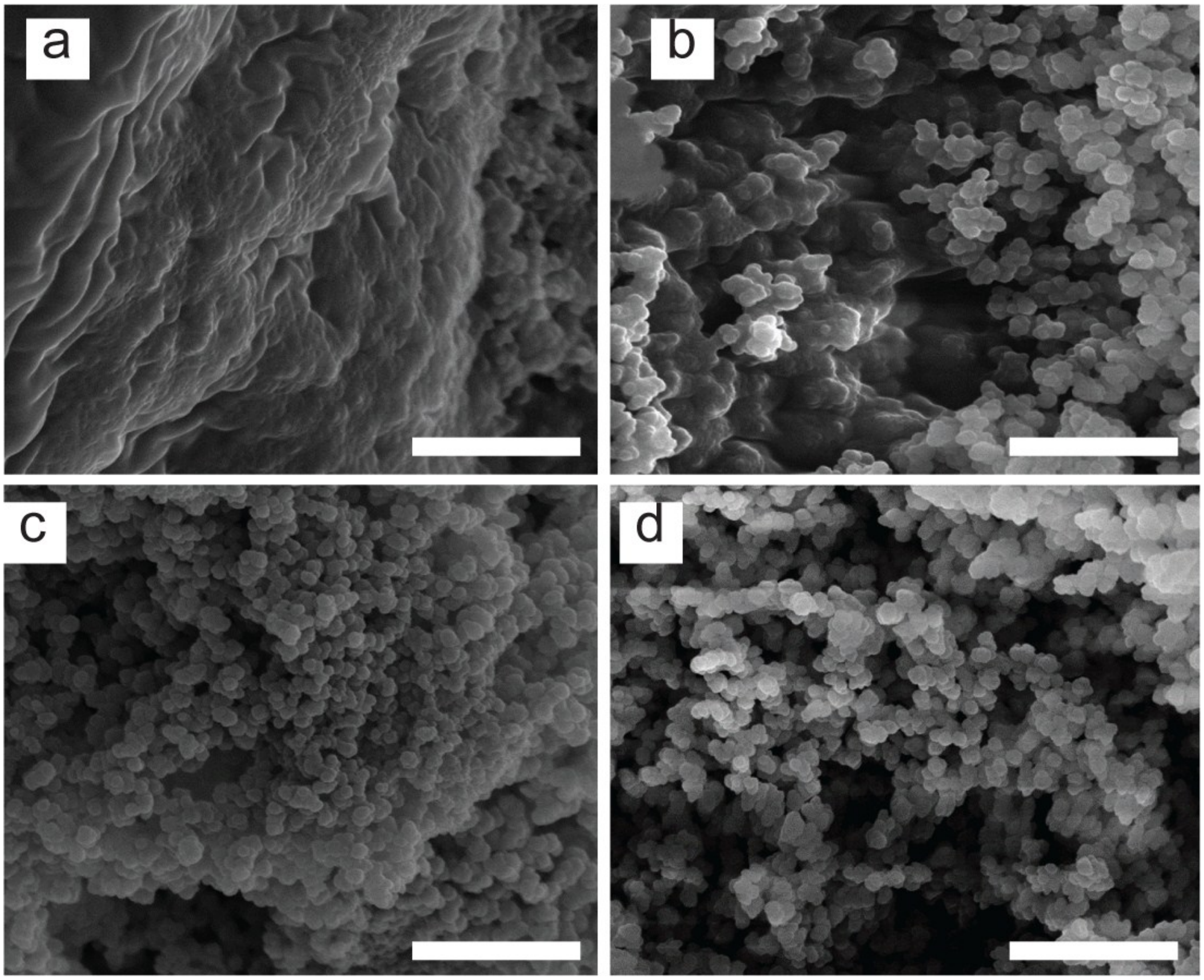

Figure S3. SEM cross sectional images of porous polymer sheets fabricated using slit channel lithography from 70% Ethanol (Porogen), 29% PEGDA 250 and 1.0% Photoinitiator at 2 seconds exposure. The full intensity of UV light is 280mW/cm2. a) Crossectional membrane morphology at 25% of full UV intensity b) Crossectional membrane morphology at 50% of full intensity c) Crossectional membrane morphology at 75% of full UV intensity and d) Crossectional membrane morphology at full UV full intensity. Scale bars are 2 um.

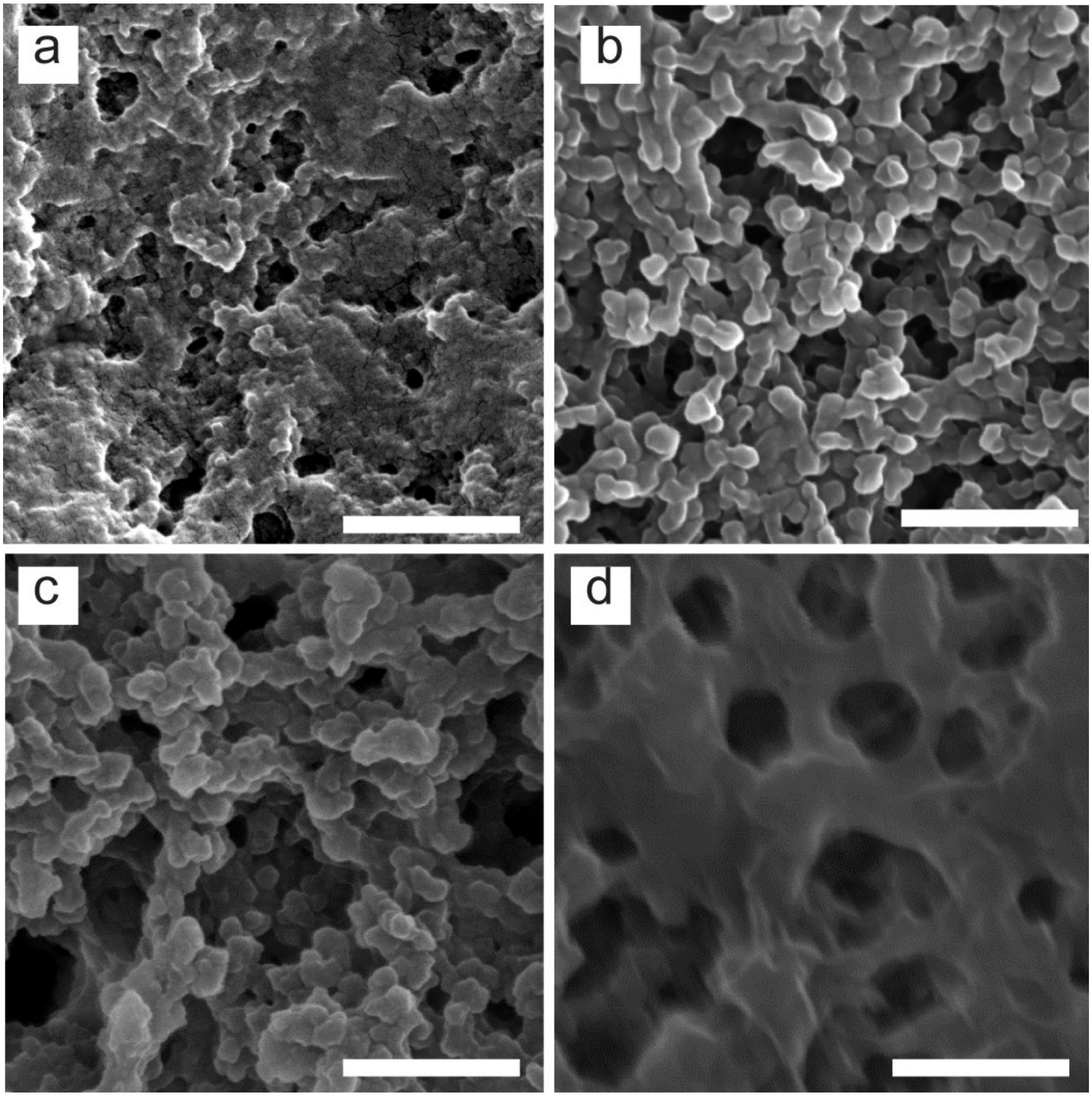

Figure S4. SEM cross sectional image of porous polymer sheets fabricated using slit channel lithography. A mixture of 70% (Porogen), 29% PEGDA 250 and 1.0% Photoinitiator at 2 seconds exposure and full UV intensity was used. a) Crossectional membrane morphology using PEG 200 as porogen , b) Crossectional membrane morphology using ethanol as porogen, c) Crossectional membrane morphology using methanol as porogen and d) Crossectional membrane morphology using ethanol and water as porogen. Scale bars are 1 um.

The solubility parameters of PEG 200, ethanol and methanol are obtained from the literatures,[1-3] while the solubility parameter of PEG-DA is calculated using the Small's method and subunits contributions. [4]

Table 1. Solubility parameters of different porogens

Porogen	**Solubility parameter, δ (MPa)$^{1/2}$**	**Δδ (MPa)$^{1/2}$**
PEG-250 DA	19.85	-
PEG 200	19.1	0.75
Ethanol	26	6.15
Methanol	29.7	9.85
Ethanol (v/v 50%) + water (v/v 50%)	37	17.15

Reference:

[1] Sakellariou, P., R. C. Rowe, and E. F. T. White. "The solubility parameters of some cellulose derivatives and polyethylene glycols used in tablet film coating."International journal of pharmaceutics 31.1 (1986): 175 – 177.

[2] Hansen, Charles M. Hansen Solubility Parameters: a user's handbook, Second Edition. CRC Press, 2007.

[3] Barton, A. F. M. CRC Handbook of Solubility Parameters and Other Cohesion Parameters, 2nd Edition, CRC Press, Boca Raton, FL, 1991.

[4]. Tanaka, Fumihiko. Polymer Physics: Applications to Molecular Association and Thermoreversible Gelation. Cambridge University Press, 2011. Cambridge Books Online. Web. 13 July 2013.