Electronic Supplementary Information

Cross-Linked Perforated Honeycomb Membranes with Improved Mechanical and Chemical Properties

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Table S1. Statistical analysis of perforated honeycomb membranes prepared from different PS-b-PDMAEMA/SIS ratios. The concentration of PS-b-PDMAEMA was fixed at 1 mg mL$^{-1}$. $d_t$: Pore diameter of top surface, $d_b$: pore diameter of bottom surface, $l_t$: pore center-to-center distance of top surface, and $l_b$: pore center-to-center distance of bottom surface.

<table>
<thead>
<tr>
<th>PS-b-PDMAEMA/SIS</th>
<th>$d_t$(µm)</th>
<th>$d_b$(µm)</th>
<th>$l_t$(µm)</th>
<th>$l_b$(µm)</th>
<th>$d_t/d_b$</th>
<th>$l_t/l_b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:1</td>
<td>5.3±0.2</td>
<td>4.0±0.2</td>
<td>7.4±0.3</td>
<td>7.5±0.3</td>
<td>1.3</td>
<td>1.0</td>
</tr>
<tr>
<td>1:2</td>
<td>4.2±0.2</td>
<td>3.9±0.2</td>
<td>5.7±0.3</td>
<td>5.8±0.3</td>
<td>1.1</td>
<td>1.0</td>
</tr>
<tr>
<td>1:3</td>
<td>3.3±0.2</td>
<td>3.4±0.2</td>
<td>4.3±0.2</td>
<td>4.3±0.3</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>1:4</td>
<td>7.0±1.3</td>
<td>9.0±2.4</td>
<td>8.7±1.7</td>
<td>16.8±3.1</td>
<td>0.8</td>
<td>0.5</td>
</tr>
</tbody>
</table>
Fig. S1 (a) Digital photographs of the prepared honeycomb membranes with different PS-\(b\)-PDMAEMA weight fractions. (b) Effects of PS-\(b\)-PDMAEMA weight fractions (from 0% to 100%) in PS-\(b\)-PDMAEMA/SIS blends on the membrane area and membrane thickness.
Fig. S2. Vulcanization mechanism of SIS chains reacting with $S_2Cl_2$. 
Fig. S3 Top-down SEM images of perforated honeycomb membranes with different vulcanization time. (a) 5 min, (b) 10 min, (c) 20 min, (d) 40 min.
Fig. S4 SEM image of a cross-linked perforated honeycomb membrane after immersed in liquid nitrogen for 2 h.
**Fig. S5** SEM image of a perforated honeycomb membrane after thiol-ene cross-linking with TRIM at a concentration of 40 mg/mL.
Fig. S6 Water contact angles of the nascent and cross-linked perforated honeycomb membranes after being immersed in toluene for different time.
Fig. S7 XPS spectra of nascent (a) and cross-linked (b) perforated honeycomb membranes before and after being immersed in toluene for 180 min.
**Fig. S8** (a,b) SEM images of fluorinated perforated honeycomb membranes. (c) XPS spectra of the nascent and fluorinated perforated honeycomb membranes. The concentration of PFDT was 40 mg mL$^{-1}$ and the thiol-ene click reaction time was 2.5 h.
Fig. S9 Optical photographs of water droplets on fluorinated honeycomb membranes with different tilted angles.