Supporting Information

A Bio-inspired CO₂-philic Network Membrane for Enhanced Sustainable Gas Separation

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S1. Digital photos of PEO-526 treated at various stages. (a) original PEO-526, (b) treatment at 80°C for 6 hours, (c) and (d) treatment at 160 °C for 2 hours

To determine the possibility of PEO-526 forming cross-linked structure without DA, 8 g PEO-526 was heated at 80°C for more than 6 hours with stirring and the temperature was raised to 120 °C for another 6 hours, and then heated at 160 °C for 2 hours. The digital photos are shown below. Obviously, the pure PEO-526 cannot be cross-linked simply by thermal treatment without DA.

![Digital photos of PEO-526 treated at various stages.](image)

Fig. S1 Digital photos of PEO-526 treated at various stages. (a) original PEO-526, (b) treatment at 80°C for 6 hours, (c) and (d) treatment at 160 °C for 2 hours

S2. Digital photos of DA/PEO mixture treated (a) at 120 °C for 6 hours, (b) at 160 °C for 2 hours

To clarify the effect of oxygen environment on the reaction, PEO-526 and DA were mixed directly and then the mixture was treated under vacuum at 80 °C for 6 hours, 120 °C for another 6 hours, and 160 °C for 2 hours. Finally, canary yellow, hyaline solid was obtained, shown as below. It is clear that the reaction between DA and PEO-526 can readily happen without any oxygen (under vacuum).

![Digital photos of DA/PEO mixture treated.](image)

Fig. S2 Digital photos of DA/PEO mixture treated (a) at 120 °C for 6 hours, (b) at 160 °C for 2 hours
S3. Calculated activation energy of D-PEO and D-PEO-I

Table S1. Calculated activation energy (E_P, E_D and ΔH) of D-PEO and D-PEO-I

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<tr>
<th></th>
<th>D-PEO</th>
<th></th>
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<th></th>
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<th>D-PEO-I</th>
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<td></td>
<td>H_2</td>
<td>N_2</td>
<td>CH_4</td>
<td>CO_2</td>
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<td>H_2</td>
<td>N_2</td>
<td>CH_4</td>
<td>CO_2</td>
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<tr>
<td>E_P (kJ/mol)</td>
<td>39.4±0.5</td>
<td>50.2±0.8</td>
<td>58.6±0.6</td>
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<td>E_D (kJ/mol)</td>
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<td>ΔH (kJ/mol)</td>
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<td>-16.3±0.2</td>
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</table>
S5. Pure gas solubility (a) and diffusivity (b) of D-PEO-I compared with LCM at 35 °C and 10 atm.

Fig. S3 Pure gas solubility (a) and diffusivity (b) of D-PEO-I compared with LCM [1] at 10 atm.

References: