Poly(ionic liquid) Based Thermo-Responsive Hydrogels

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The need for stimuli-responsive materials for microfluidic sensor platforms

- Autonomous sensor platforms for water quality are available
- High cost, high maintenance, high power usage
- Evolutionary engineering approach
- Revolutionary materials research

![Image of sensor platforms]
New polymeric ionic liquids that are thermo-responsive have been recently reported.

\[ \text{poly}(70\% A + 30\% B) \]


Preparation of thermo-responsive poly(IL) gels

<table>
<thead>
<tr>
<th></th>
<th>MBIS</th>
<th>PEG 256 diacrylate</th>
<th>PEG 700 diacrylate</th>
<th>PPO 800 diacrylate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cracks, no stable shape,</td>
<td>Cracks, no stable</td>
<td>Stable, transparent</td>
<td>Stable, transparent</td>
</tr>
<tr>
<td></td>
<td>excessive swelling</td>
<td>shape</td>
<td>gel (up to 9 %mol)</td>
<td>gel (up to 9 %mol)</td>
</tr>
</tbody>
</table>
Preparation of thermo-responsive poly(IL) gels

\[ \text{[P}_{4,4,4,4}\text{][SS]} + 10 \% \text{ MBIS} \]

\[ \text{[P}_{4,4,4,6}\text{][SPA]} + 5 \% \text{ PPO800 diacrylate} \]

Swollen gels

polyIL gels
Immediately after polymerisation

Only longer chain crosslinkers allow mechanically stable hydrogels
Thermal analysis of poly(IL) gels (DSC)

<table>
<thead>
<tr>
<th>Crosslinker content [%]</th>
<th>LCST Max [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>52.6</td>
</tr>
<tr>
<td>7</td>
<td>46.1</td>
</tr>
<tr>
<td>8</td>
<td>42.9</td>
</tr>
</tbody>
</table>

Crosslinker amount allows LCST tuning

Crosslinking significantly broadens the LCST peak

Manuscript submitted
Thermal behaviour of poly(IL) gel

Heating 25 °C to 50 °C

1 mm

Speed 64x
Conclusions

- Hydrogels from monomeric LCST phosphonium-based ILs can be produced
- Only using longer chain crosslinkers results in mechanically stable gels
- Crosslinker amount controls the LCST
- Crosslinking significantly broadens the IL’s LCST peak
Acknowledgements

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Poster P42
Poster P332
Poster P399