Electronic Supplementary Information (ESI):

**A Water-soluble Phosphorescent Polymer for Time-Resolved Assay and Bioimaging of Cysteine/Homocysteine**

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1. Low-temperature (77K) photoluminescence spectra of P1 in CH₂Cl₂
2. The excitation spectra of P1.
3. The time-dependent spectra of P1.
5. Relative phosphorescence intensity changes of P1-Hcy.
7. Confocal luminescence images of P1.
9. Photophysical Properties of P1
10. Calculation results of M1 and M1-Cys
1. Low-temperature (77K) photoluminescence spectra of P1

![Graph](image1)

Fig. S1 Low-temperature (77K) photoluminescence spectra of P1 in CH$_2$Cl$_2$.

2. The excitation spectra of P1

![Graph](image2)

Fig. S2 The excitation spectra of P1 in the presence of different concentrations of Cys/Hcy in the PBS at 28 °C.

3. The time-dependent spectra of P1

![Graph](image3)

Fig. S3 The time-dependent spectra of P1 in the presence of 160 eq of Cys/Hcy in the PBS at 28 °C.
4. Changes in the phosphorescence emission spectra of P1

![Phosphorescence emission spectra](image)

**Fig. S4** Changes in the phosphorescence emission spectra of P1 (20 μM) in PBS at 45°C with different amounts of Hcy (0-160 equiv). Inset: titration curve of P1 with Hcy (0-160 equiv).

5. Relative phosphorescence intensity changes of P1-Hcy

![Relative intensity changes](image)

**Fig. S5** Relative phosphorescence intensity changes of P1-Hcy in the temperature range of 28-45°C.
1. **Z-scan images of P1**

![Z-scan image of P1](image)

**Fig. S6** The overlap Z-scan confocal luminescence image of living KB cells incubated with 50 μM P1 in PBS for 45 min at 25°C.

2. **Confocal luminescence images of P1**

![Confocal images of P1](image)

**Fig. S7** Confocal luminescence images of living KB cells: cells incubated solely with 50 μM P1 in PBS for 45 min at (a) 4°C and (b) 25°C.

3. **Confocal luminescence images of P2**

![Confocal images of P2](image)

**Fig. S8** Confocal luminescence images of living KB cells: cells incubated solely with 50 μM P2 in PBS for 45 min at (a) 25°C and (b) 37°C.
9. Photophysical Properties of P1

Table S1. Photophysical Properties of P1

<table>
<thead>
<tr>
<th>polymer</th>
<th>solvent</th>
<th>( \lambda_{abs} ), nm (log ( \varepsilon ))</th>
<th>( \lambda_{em}(298K) ), nm</th>
<th>( \lambda_{em}(77K) ), nm</th>
<th>( \Phi_{em} )</th>
<th>( \tau, \text{ ns} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH(_2)Cl(_2)</td>
<td>532</td>
<td>541(max), 567</td>
<td>0.141</td>
<td>810</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P1</td>
<td>EtOH</td>
<td>552</td>
<td>0.051</td>
<td>296</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBS</td>
<td>276(4.77), 380(3.91)sh, 419(3.70)sh</td>
<td>564</td>
<td>0.023</td>
<td>366</td>
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</table>

10. Calculation results of M1 and M1-Cys

Table S2. Calculated excited triplet states, emission wavelength, dipole, character of the transitions for M1 and M1-Cys

<table>
<thead>
<tr>
<th>Complex</th>
<th>State</th>
<th>( \lambda_{em} ), nm*</th>
<th>( E_{em} ), eV</th>
<th>( \mu_{em} ), D</th>
<th>Main configuration(CI coeff)</th>
<th>character</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>T(_1)</td>
<td>543</td>
<td>2.28</td>
<td>12.70</td>
<td>HOMO→LUMO(0.62)</td>
<td>3MLCT/3LLCT</td>
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<td></td>
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<td></td>
<td></td>
<td>HOMO-1→LUMO(0.27)</td>
<td>3MLCT/3LLCT</td>
</tr>
<tr>
<td>M1-Cys</td>
<td>T(_1)</td>
<td>585</td>
<td>2.12</td>
<td>9.28</td>
<td>HOMO→LUMO(0.70)</td>
<td>3MLCT/3LLCT</td>
</tr>
</tbody>
</table>

*Calculated in water solution