Supporting Information (SI) for

A Facile One Pot Synthetic Approach for C₃N₄-ZnS Composite Interfaces as Heterojunctions for Sun Light Induced Multifunctional Photocatalytic Applications

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The chemical composition of the prepared samples was analyzed by FTIR. The sharp peak at 805 cm⁻¹ corresponded to the breathing mode of the s-triazine units of C₃N₄.¹ The absorption bands between 1200-1650 cm⁻¹ were attributed to the typical stretching of CN heterocycles. Peak at 1635 cm⁻¹ was assigned to the C=N stretching vibration modes, while the aromatic C-N stretching vibrations were characterized by the peaks at 1568, 1406, 1319, and 1248 cm⁻¹.² The FTIR spectra of composite samples prepared at different temperatures implied that the C₃N₄ formation was completed only at 550 °C as the FTIR peaks matched with that of pure g- C₃N₄ bands.
spectral analysis revealed that the incorporation of ZnS by thermal decomposition of the precursor mixes does not alter the graphitic nature of C$_3$N$_4$. The FTIR spectra of the samples with varying ZnS indicated similar IR patterns confirming the presence of C$_3$N$_4$.

![FTIR spectra](image)

**Fig. S1** IR spectra of pure C$_3$N$_4$ and CZx compositions

![TEM micrographs](image)

**Fig. S2** TEM micrographs of g-C$_3$N$_4$ (a and b), CZ72 (c) and CZ67 (d)
**Fig. S3** EDAX spectrum of CZ14

**Fig. S4** HRTEM images of CZ14 showing ZnS nanoparticles (marked by red circles) on C3N4 sheets
Fig. S5 HRTEM images of CZ14 showing close interface between C$_3$N$_4$ and ZnS.

Fig. S6 TEM image and EDAX spectrum of CZ11.
**Fig. S7** Uv-vis absorption spectrum of ZnS

**Fig. S8** Nitrogen adsorption-desorption isotherms of heterostructures
Fig. S9 MB degradation kinetic curves of CZx, C$_3$N$_4$, and ZnS compositions under sunlight

Fig. S10 Rate constants of MB degradation under sunlight irradiation
**Fig. S11** Photoluminescence spectra of CZ14 with a) terephthalic acid, after irradiation under sunlight b) with luminol, after irradiation under sunlight

**Fig. S12** Species trapping using EDTA, PBQ, and IPA
Fig. S13 Fluorescence decays of CZx heterostructures obtained by 375 nm excitation.

Table S1 Fitted results of the fluorescence kinetic measurements of CZx heterostructures in water obtained by exciting at 375 nm and probed at 460 nm

<table>
<thead>
<tr>
<th>Sample</th>
<th>$T_1$ (ns)</th>
<th>$a_1$</th>
<th>$T_2$ (ns)</th>
<th>$a_2$</th>
<th>$T_3$ (ns)</th>
<th>$a_3$</th>
<th>$&lt;T&gt;$ (ns)</th>
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<tr>
<td>$C_3N_4$</td>
<td>1.1</td>
<td>32.6</td>
<td>4.0</td>
<td>47.9</td>
<td>17.85</td>
<td>19.5</td>
<td>5.7</td>
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<tr>
<td>CZ14</td>
<td>0.3</td>
<td>81.0</td>
<td>2.5</td>
<td>12.4</td>
<td>11.5</td>
<td>6.6</td>
<td>1.3</td>
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<tr>
<td>CZ20</td>
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<td>77.3</td>
<td>3.8</td>
<td>18.1</td>
<td>16.9</td>
<td>4.6</td>
<td>2.3</td>
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<tr>
<td>CZ67</td>
<td>0.2</td>
<td>69.4</td>
<td>2.3</td>
<td>19.7</td>
<td>11.5</td>
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<tr>
<td>CZ72</td>
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<td>60.0</td>
<td>2.2</td>
<td>25.1</td>
<td>10.1</td>
<td>14.9</td>
<td>2.2</td>
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**Fig. S14** Mechanism of photocatalytic activity of CZ heterostructures under sunlight illumination.

**Fig. S15** Cycle runs of CZ 14 heterostructures for MB degradation under sunlight.
References