Supporting Information

Controllable synthesis of 3D ZnS@MoO$_3$ heterojunction via hydrothermal method toward efficient NO purification under visible light

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Fig. S1. XRD patterns and Raman spectra of as-prepared samples

The Raman spectra for as-prepared samples excited at room temperature by 633 nm were recorded, and the results are shown in Fig. S1 (The intensity of these two pictures of the Raman spectrum is inconsistent). The Raman peaks are observed at 151, 216 cm$^{-1}$ are assigned to ZnS$^{1, 2}$, and the peaks at 330, 439 cm$^{-1}$ are indexed to ZnO$^{1, 2}$. Furthermore, the peaks are positioned at 470, 819, 995 cm$^{-1}$ in ZZ-0.5, ZZ-1 and ZZ-1.5, which match well with the Raman spectrum reported for MoO$_3$.$^{3-5}$ And the peak at 180 cm$^{-1}$ are observed in ZZ-1.5, ZZ-2 and MoS$_2$. Additionally, others peaks at 372, 400, 450, 624 cm$^{-1}$ are the Raman modes of MoS$_2$.$^5$ It is worthy to note that the peaks of ZnO are not observed in ZZ-1 and the weak peak of MoS$_2$ appeared in ZZ-1.5, which are agreement well with the results of XRD.

Fig. S2. SEM images of MoS$_2$ (a-c)
Fig. S3. Photocatalytic activities of the samples for NO purification in dark.

Fig. S4. XRD patterns of ZM-1 before and after cycle tests.
Fig. S5. The position of VB and CB of ZnO$^6$, ZnS$^7$, MoO$_3$$^8$, MoS$_2$$^9$

**Table S1** Assignments of the FT-IR bands observed during adsorption and photocatalytic NO oxidation processes over ZM-1.

<table>
<thead>
<tr>
<th>Wavenumber (cm$^{-1}$)</th>
<th>Band assignment</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>940, 945,</td>
<td>NO$_2$</td>
<td>46</td>
</tr>
<tr>
<td>1034, 1410</td>
<td>NO</td>
<td>45</td>
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<tr>
<td>976, 1084, 1178, 1173</td>
<td>NO$_2^-$</td>
<td>46, 50</td>
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<tr>
<td>990, 1210, 1121, 1443,</td>
<td>NO$_3^-$</td>
<td>45, 47-49</td>
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<tr>
<td>1297</td>
<td>N$_2$O$_2^{2-}$</td>
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<tr>
<td></td>
<td>N$_2$O$_3$</td>
<td>52</td>
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Reference: