Appendix A: Supporting information (SI):

Oxygen vacancies enhanced photocatalytic removal of NO over N-doped TiO$_2$ catalyst

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SI.1 Calculation of energy band

The Eg value was calculated by the Graetzel relation. The Graetzel relation:

\[ \text{Eg} = \frac{1240}{\lambda_g} \text{ (eV)} \]  
\[ (\lambda_g : \text{Absorption wavelength threshold}). \]

SI.2 XPS of TiO\textsubscript{2} sample

![Fig.S1.](image-url) 

**Fig.S1.** High-resolution XPS spectra for TiO\textsubscript{2} sample of fresh, after reacted in dark or under visible irradiation: (a) Ti 2p and (b) O 1s.

**Table S1** The High-resolution XPS spectra area for TiO\textsubscript{2} sample of O 1s.

<table>
<thead>
<tr>
<th>Name</th>
<th>Fresh sample (Area (P) CPS.eV)</th>
<th>Reacted in dark (Area (P) CPS.eV)</th>
<th>Reacted in light (Area (P) CPS.eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>O\textsubscript{(L)}</td>
<td>299486</td>
<td>296418</td>
<td>290087</td>
</tr>
<tr>
<td>O\textsubscript{(ad)}</td>
<td>51918</td>
<td>40309</td>
<td>40358</td>
</tr>
</tbody>
</table>

The electron binding energy for Ti2p and O1s of TiO\textsubscript{2} sample exhibited an increasing tendency from fresh to after reacted in dark and then reacted under visible light irradiation, suggesting that TiO\textsubscript{2} sample could be oxidized by O\textsubscript{2} gas and then O\textsubscript{2} gas got electrons forming O\textsubscript{2}\textsuperscript{-} species (O\textsubscript{2} + e\textsuperscript{-} \rightarrow O\textsubscript{2}\. In addition, as shown in table 1, the peak at about 530.15 eV was assigned to the lattice oxygen species.
**SI.3 \( \text{O}_2 \)-TPD of TiO\(_2\) sample**

**Fig. S2.** The \( \text{O}_2 \)-TPD-Ms results of TiO\(_2\) catalyst after pre-adsorb \( \text{O}_2 \) and He under visible light or not. (catalyst dosage: 0.1 g, He was injected during heating).

The \( \text{O}_2 \)-TPD testing grape of TiO\(_2\) samples showed a signal peaks at 225 °C, ascribed to the produce of H\(_2\)O species in combination with the mass spectrum result.
### SI.4 Assignment hydroxyl of FT-IR spectra

**Table S2** Assigned hydroxyl of FT-IR spectra of adsorbing NO or NO+O$_2$ over TiO$_2$ and N-TiO$_2$ samples under visible light irradiation, respectively.

<table>
<thead>
<tr>
<th>Sample bands</th>
<th>Terminal-OH</th>
<th>Bridged isolated -OH</th>
<th>Single coordinated -OH</th>
<th>Bridged -OH</th>
<th>Doubly coordinated -OH</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-TiO$_2$ (NO)</td>
<td>3730</td>
<td>3700</td>
<td>3670</td>
<td></td>
<td>3475</td>
</tr>
<tr>
<td>N-TiO$_2$ (NO+O$_2$)</td>
<td>3732, 3716</td>
<td></td>
<td>3679, 3652</td>
<td>3612</td>
<td>3470</td>
</tr>
</tbody>
</table>