Electronic Supplementary Information (ESI)

Smart Nano-V$_2$O$_5$/ODA Coated Mesh: towards Co-responsive Photo-induced Wettability Transition and ROS Generation for In-situ Water Purification

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Figure S1. The EDX images of a) V$_2$O$_5$ coated mesh; b) V$_2$O$_5$/ODA coated mesh.
Figure S2. The high resolution spectrum of V2p orbit showed that no no V-C bond, V-H bond and V-N bond were observed.
Figure S3. The underwater OCAs of the V$_2$O$_5$-coated mesh to four different oils including toluene, n-hexane, gasoline and diesel were all larger than 150°.
Figure S4. The OCA a) and underwater OCA b) of the V$_2$O$_5$/ODA coated copper mesh before and after illumination.
Figure S5. Degradation test of orange II without modified meshes.
Table S1. The related oxidation-reduction potential (ORP) in this work.

<table>
<thead>
<tr>
<th>ROS</th>
<th>Reaction equation</th>
<th>ORP (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>O$_2$/·O$_2^-$</td>
<td>O$_2$ + e$^-$ → ·O$_2^-$</td>
<td>-0.046</td>
</tr>
<tr>
<td>·OH/ OH$^-$</td>
<td>·OH + e$^-$ → OH$^-$</td>
<td>1.99</td>
</tr>
<tr>
<td>·OH/H$_2$O</td>
<td>·OH + e$^-$ + H$^+$ → H$_2$O</td>
<td>2.68</td>
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</table>

The conduction band (CB) and valence band (VB) of V$_2$O$_5$ were 0.2 eV and 3.0 eV, respectively. The ORP of O$_2$/·O$_2^-$ (-0.046 eV) was lower than the CB of V$_2$O$_5$ (0.2 eV), while the ORP of ·OH/ OH$^-$ (1.99 eV) and ·OH/H$_2$O (2.68 eV) were lower than the VB of V$_2$O$_5$ (3.0 eV). As a result, the hole in the V$_2$O$_5$ could grab the electron from OH$^-$ and H$_2$O, and generate ·OH. But the electron in V$_2$O$_5$ could not migrate to O$_2$ to generate ·O$_2^-$. So we could confirm the major ROS generated by the meshes was ·OH.
The catalytic reactions in this work were typical first-order reaction, and their rate constants could be calculated by the equation:

\[-\ln \left( \frac{C_t}{C_0} \right) = kt + b\]

in which the \(C_t\) meant the orange II instantaneous concentration at a specific time \(t\), \(C_0\) meant the initial concentration, and slope \(k\) meant the rate constant. The reaction rate constant of \(V_2O_5/ODA\)-coated mesh was 23% lower than \(V_2O_5\)-coated mesh, indicating that the ROS generated by \(V_2O_5/ODA\)-coated mesh was lower than \(V_2O_5\)-coated mesh. Thus, we could learn that ODA had a few negative effects on the generation of ROS. But the degradation efficiency of orange II in this work was still satisfactory (Figure 4c).
Figure S7. The V$_2$O$_5$/ODA coated mesh was not homogeneous in the wettability transition. The part in the red circle was the part that touched the water. Some of the part turned superhydrophilic while the other part remained superhydrophobic. Therefore, it was necessary to use auxiliary mesh.
Figure S8. The in-situ water remediation process could not begin without UV light. As a result, it was easy to control the remediation process by UV light.
Figure S9. FT-IR spectra as well as XPS spectra indicated a small degree of decomposition happened to ODA.
Figure S10. The oil contact angles of $\text{V}_2\text{O}_5$/ODA-coated mesh after acid/alkaline solution treatment.
Figure S11. The V$_2$O$_5$/ODA-coated mesh still kept satisfactory wettability transition property after 6 months.