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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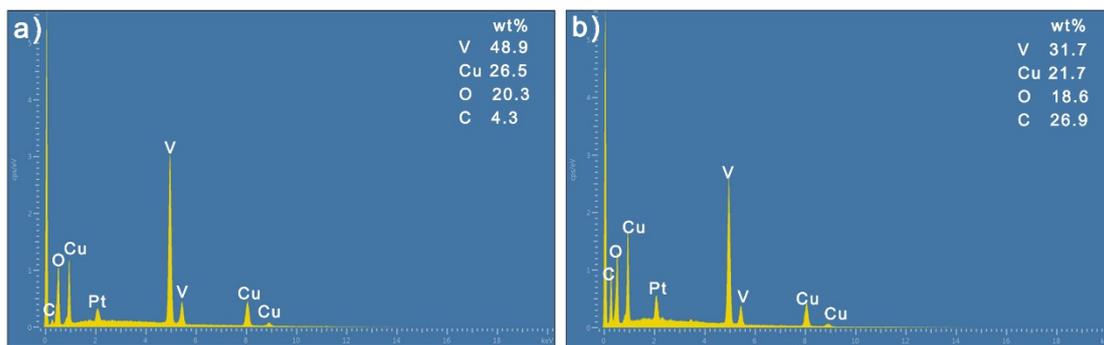
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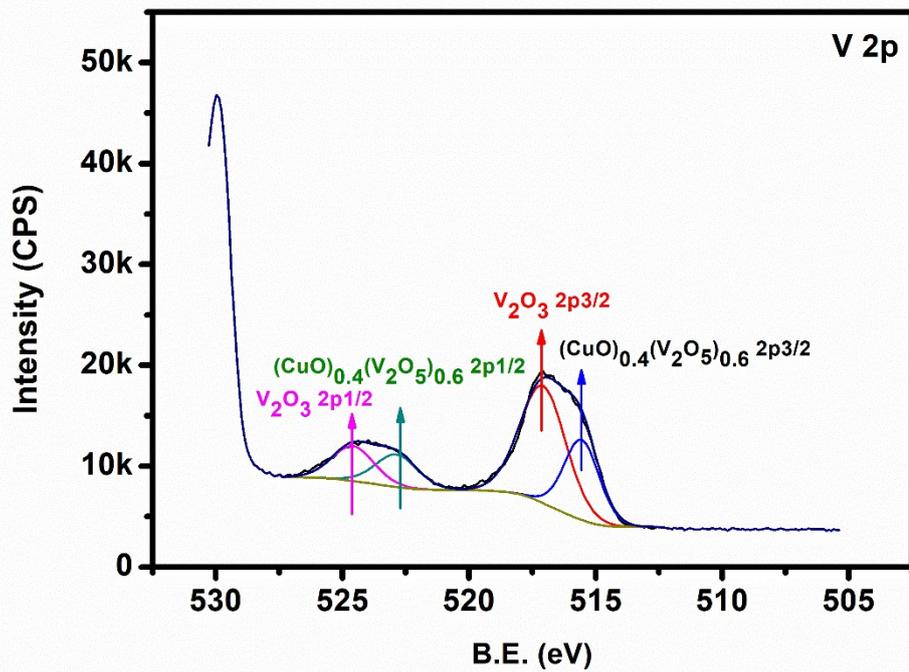**Figure S1.** The EDX images of a) V_2O_5 coated mesh; b) V_2O_5/ODA coated mesh.

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.
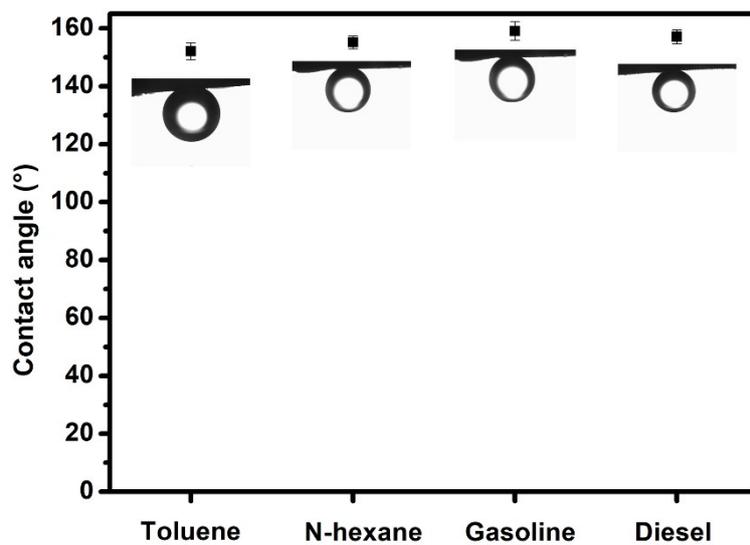
Figure S3. The underwater OCAs of the V_2O_5-coated mesh to four different oils including toluene, n-hexane, gasoline and diesel were all larger than 150°.
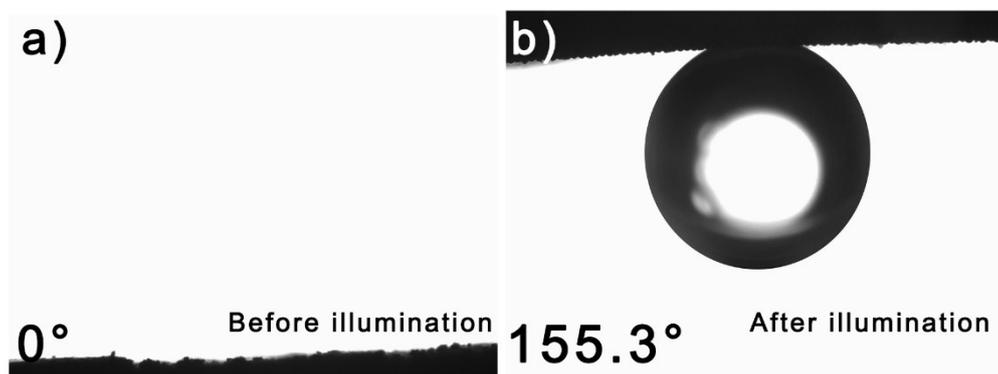
Figure S4. The OCA a) and underwater OCA b) of the V_2O_5/ODA coated copper mesh before and after illumination.
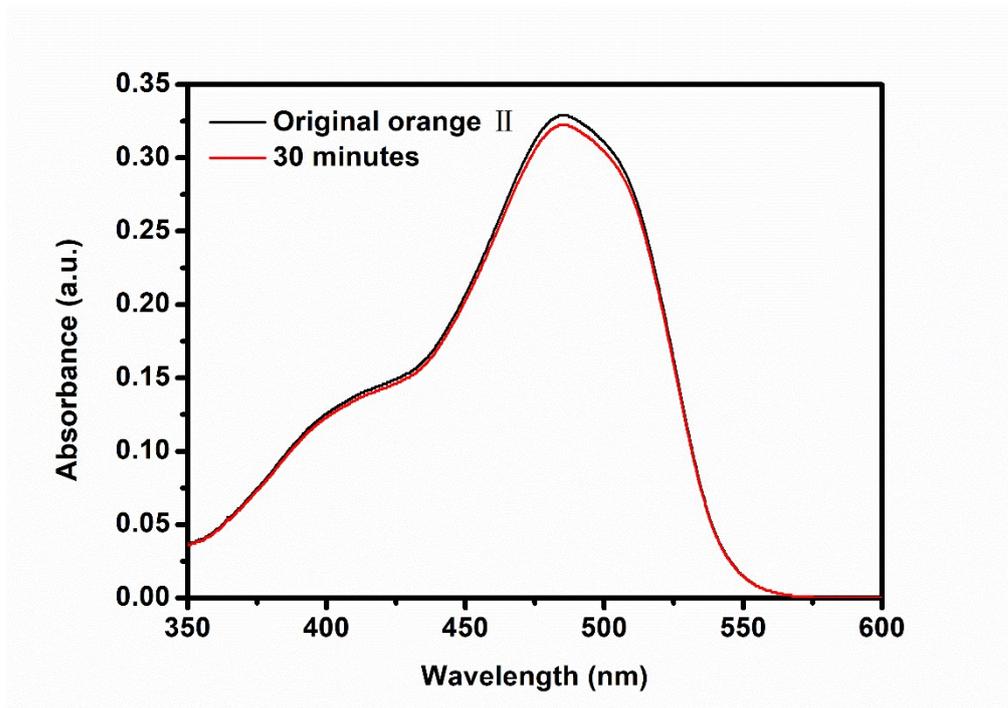
Figure S5. Degradation test of orange II without modified meshes.

Table S1. The related oxidation-reduction potential (ORP) in this work .

ROS	Reaction equation	ORP (eV)
$O_2/ \cdot O_2^-$	$O_2 + e^- \rightarrow \cdot O_2^-$	-0.046
$\cdot OH/OH^-$	$\cdot OH + e^- \rightarrow OH^-$	1.99
$\cdot OH/H_2O$	$\cdot OH + e^- + H^+ \rightarrow H_2O$	2.68

The conduction band (CB) and valence band (VB) of V_2O_5 were 0.2 eV and 3.0 eV, respectively. The ORP of $O_2/\cdot O_2^-$ (-0.046 eV) was lower than the CB of V_2O_5 (0.2 eV), while the ORP of $\cdot OH/OH^-$ (1.99 eV) and $\cdot OH/H_2O$ (2.68 eV) were lower than the VB of V_2O_5 (3.0 eV). As a result, the hole in the V_2O_5 could grab the electron from OH^- and H_2O, and generate $\cdot OH$. But the electron in V_2O_5 could not migrate to O_2 to generate $\cdot O_2^-$. So we could confirm the major ROS generated by the meshes was $\cdot OH$.
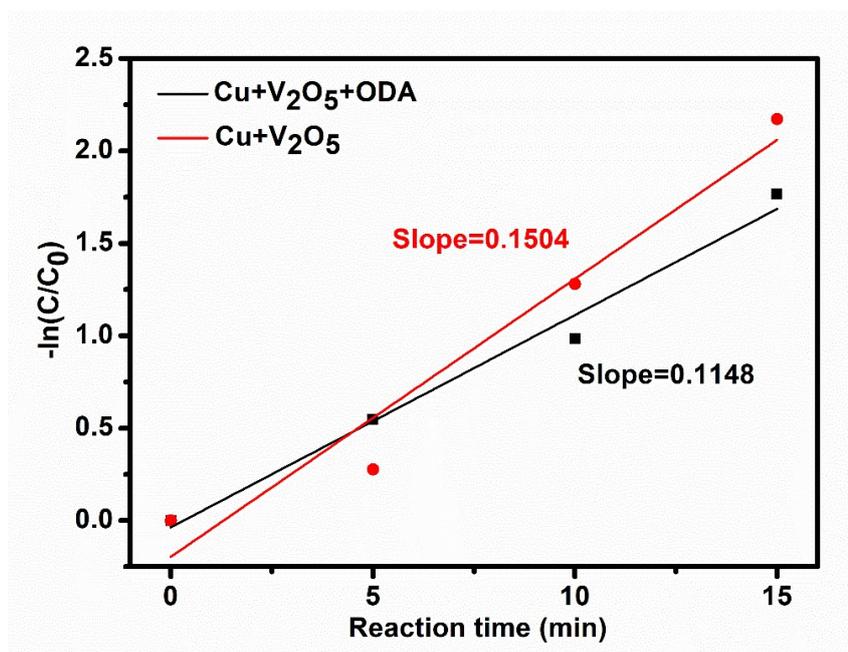
Figure S6. The rate constant of the orange II degradation reaction.

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).
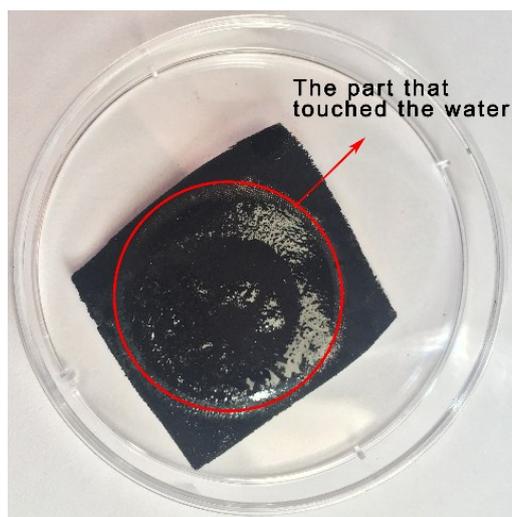
Figure S7. The V$_2$O$_5$/ODA coated mesh was not homogeneous in the wettability transition. The part in the red circle was the part that touched the water. Some of the part turned superhydrophilic while the other part remained superhydrophobic. Therefore, it was necessary to use auxiliary mesh.
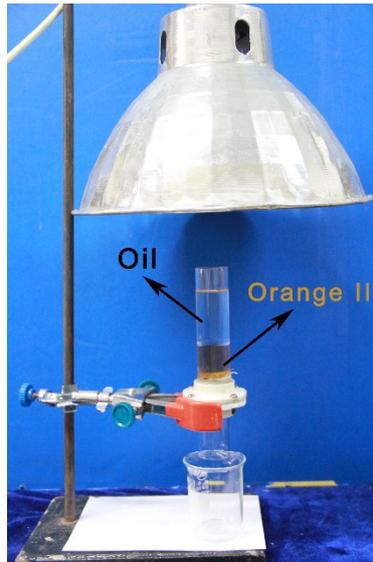
Figure S8. The in-situ water remediation process could not begin without UV light. As a result, it was easy to control the remediation process by UV light.
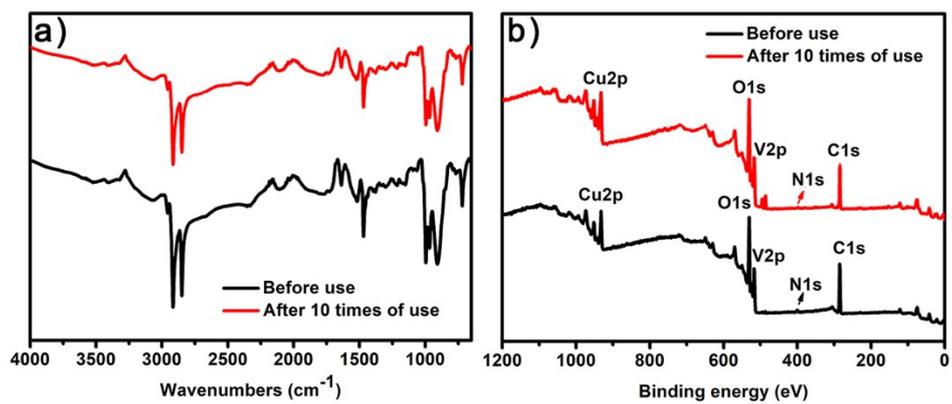
Figure S9. FT-IR spectra as well as XPS spectra indicated a small degree of decomposition happened to ODA.
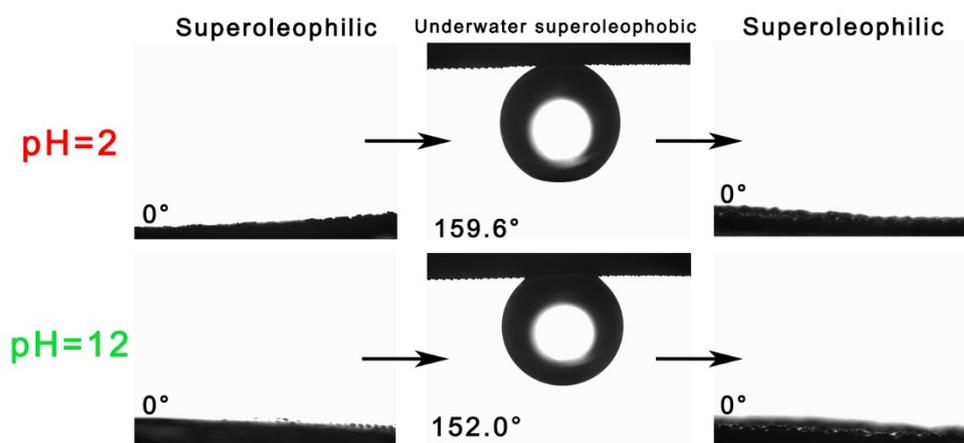
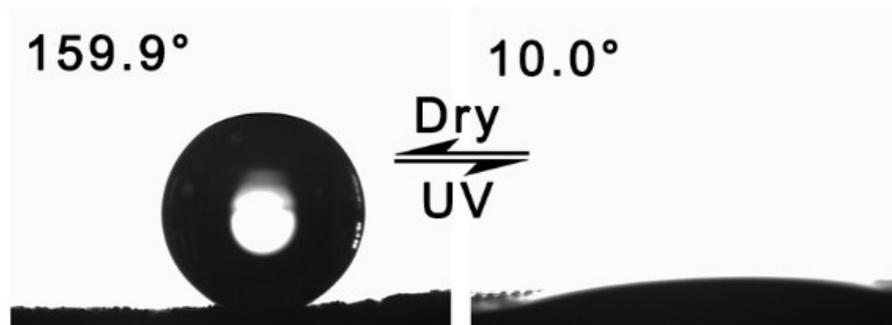**Figure S10.** The oil contact angles of V_2O_5/ODA-coated mesh after acid/alkaline solution treatment.

Figure S11. The V_2O_5/ODA-coated mesh still kept satisfactory wettability transition property after 6 months.