Electronic Supplementary Information (ESI) available:

**Photocatalytic Property of Hierarchical Structure Based on Fe-doped BiOBr Hollow Microspheres**

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1. Experimental

0.6 g of Bi(NO$_3$)$_3$·5H$_2$O and appropriate amounts of FeCl$_3$ was dissolved in 60 mL of 2-methoxethanol to form a clean solution, then 1.2 g of CTAB were added slowly to the solution by magnetic stirring. The resultant solution was transferred into a Teflon-lined stainless steel autoclave, followed by a solvothermal treatment at 160 °C for 0-24 h. After cooled to room temperature, the precipitates were washed with deionized water and ethanol six times, dried in a vacuum oven at 60 °C for 12 h.

2. Characterization

Structures of the as-prepared samples were analyzed with a SIEMENS Diffraktometer D5000 X-ray diffractometer using Cu Kα radiation source at 35 kV, with a scan rate of 0.02° s$^{-1}$ in the 2θ range of 10-80°. The morphologies were investigated by ULTRA-55 field-emission scanning electron microscopy (FE-SEM) equipped with an energy dispersive X-ray spectrum (EDS, Inca Energy-200) at an accelerating voltage of 10 kV and JSM-2100 transmission electron microscopy (TEM). The Brunauer-Emmet-Teller (BET) specific surface area of the samples were determined by a high speed automated area and pore size analyzer (F-Sorb3400, China). UV/Vis diffuse reflectance spectra were recorded with a UV-vis spectrometer (U-3010, Hitachi).

3. Measurement of photocatalytic activity

The photocatalytic activity of the as-prepared samples was investigated by the photo-degradation of RhB. The photo-degradation experiments were carried out under visible light irradiation whose source was an 11 W daylight lamp (25 Hz) equipped with UV cutoff filter to provide visible light ($\lambda \geq 400$ nm). 50 mg of the as-prepared catalysts was suspended in 50 mL RhB aqueous solution ($C_0 = 10$ mg·L$^{-1}$) with constant stirring. Prior to irradiation, the suspensions were stirred in the dark for 1 h to ensure the adsorption-desorption equilibrium. The temperature of suspensions was maintained below 283 K by a flow of cooling water during the reaction. The change of RhB concentrations (C) in accordance with the irradiation time was measured by JASCO V-570 UV/Vis/NIR spectrophotometer (Japan).

4. Electrochemical Measurement

Cyclic voltammetry test of the as-prepared samples was measured on a CHI 660D electrochemical workstation under ambient conditions. A three-electrode cell with 1 M KCl electrolyte was used, in which Pt foil was used as the counter electrode, glass carbon electrode as
the working electrode and an Hg/Hg$_2$Cl$_2$/KCl electrode as the reference electrode. And cyclic voltammetry was performed between -1.0 V and 0.5 V with scan rates of 20 mV s$^{-1}$, 50 mV s$^{-1}$, 100 mV s$^{-1}$. The photocurrent transient response toward glucose and Nyquist impedance plots were measured in 0.1 M Na$_2$SO$_4$ solution under an 11 W daylight lamp (25 Hz) equipped with UV cutoff filter to provide visible light ($\lambda \geq 400$ nm) irradiation.

5. HR-TEM image

![HR-TEM image of Fe-doped BiOBr samples.](image)

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6. EDS spectra

![FE-SEM images and corresponding EDS spectra.](image)

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**Figure S2** (A, B) FE-SEM images and (a, b) the corresponding EDS spectra of the different sections on Fe-doped BiOBr microsphere, (A, a) and (B, b).
7. The summary table of each element

<table>
<thead>
<tr>
<th>Element</th>
<th>Weight%</th>
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<tbody>
<tr>
<td>C K</td>
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<tr>
<td>O K</td>
<td>8.14</td>
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<tr>
<td>Si K</td>
<td>5.27</td>
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<tr>
<td>Fe K</td>
<td>4.16</td>
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<tr>
<td>Br L</td>
<td>15.21</td>
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<tr>
<td>Bi M</td>
<td>59.47</td>
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<tr>
<td>Totals</td>
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</tr>
</tbody>
</table>

8. Plot of Kubelka-Munk function versus energy

![Graph of Kubelka-Munk function versus energy](image)

**Figure S3** The plot Kubelka-Munk function versus energy of BiOBr and Fe-doped BiOBr samples.

9. N₂ adsorption-desorption

![Graph of N₂ adsorption-desorption](image)

**Figure S4** Nitrogen desorption isotherms and corresponding pore-size distribution of the Fe-doped BiOBr and BiOBr samples.
10. XRD patterns

Figure S5 XRD patterns of the as-prepared Fe-doped BiOBr samples under different stages.

11. FE-SEM images and EDS spectra

Figure S6 FE-SEM images and EDS spectra of the Fe-doped BiOBr samples with different Fe doping content, (A, a) 3 % and (B, b) 15 %.
12. Cyclic voltammetry curves

Figure S7 CV curves of the Fe-doped BiOBr samples in KCl solution at different scan rates from 20 to 100 mV s\(^{-1}\).

13. The plot of photocurrent transient response and Nyquist impedance

Figure S8 The photocurrent transient response and Nyquist impedance plots of BiOBr and Fe-doped BiOBr samples in 0.1 M Na\(_2\)SO\(_4\) solution under visible light irradiation.
14. Cycling degradation test

![Graph showing the rate of cycling degradation on RhB of Fe-doped BiOBr samples.](Image)

**Figure S9** The rate of cycling degradation on RhB of Fe-doped BiOBr samples.