Oxygen Vacancy Induced Bismuth Oxyiodide with Remarkably Increased Visible-light Absorption and Superior Photocatalytic Performance

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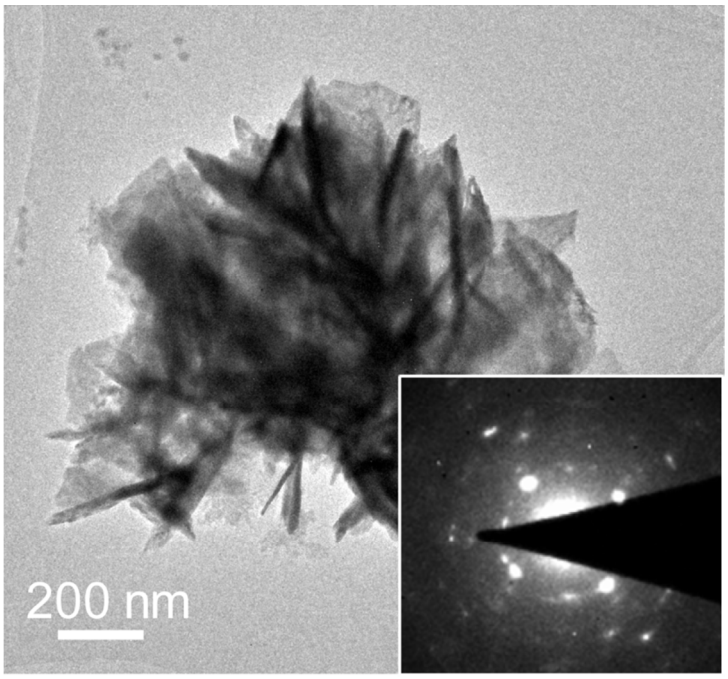

Figure S1. TEM image and SAED pattern of the as-prepared BiOI nanosheets.

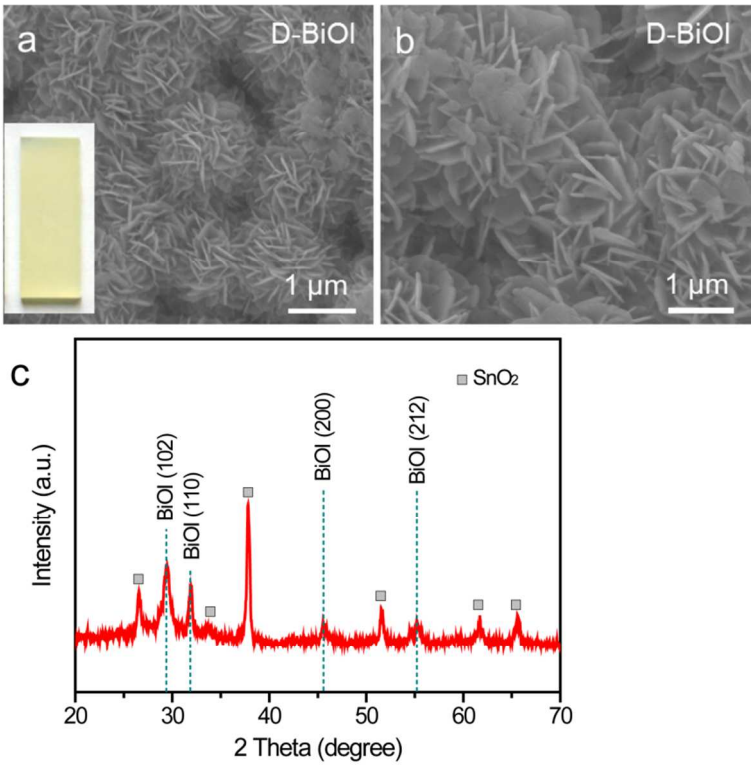

Figure S2. SEM images and XRD spectrum of the D-BiOI nanosheets. The inset in Figure S2a is its corresponding photograph

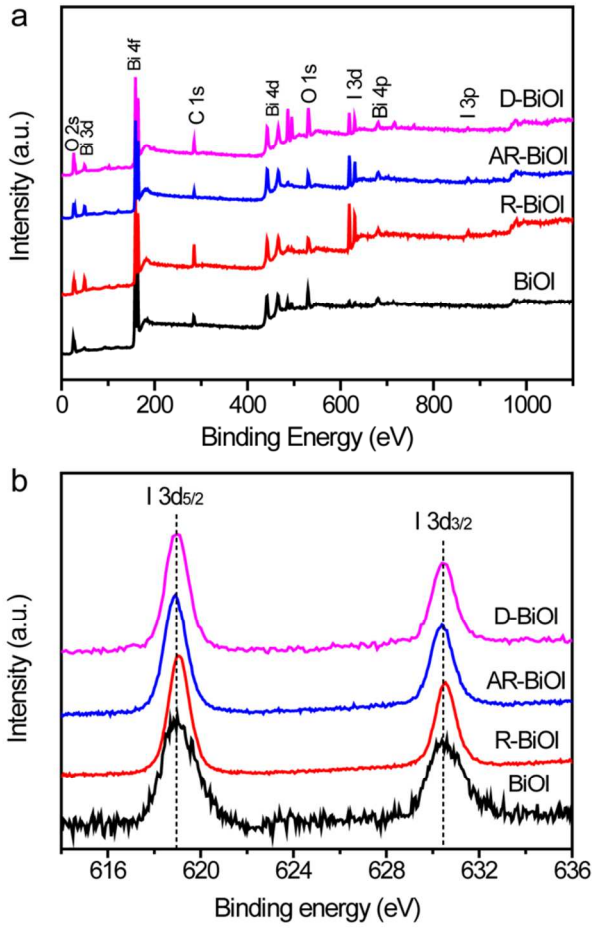

Figure S3. (a) XPS survey and (b) core level I 3d XPS spectra of the untreated BiOI, R-BiOI, AR-BiOI and D-BiOI samples.

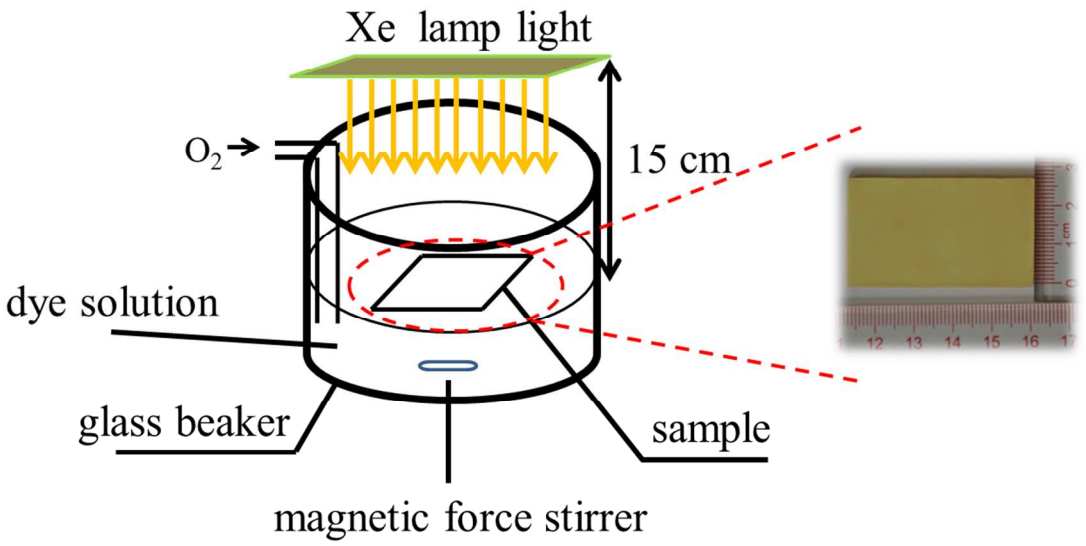

Figure S4. Schematic diagram of the set up for photocatalytic dye degradation over BiOI sample.

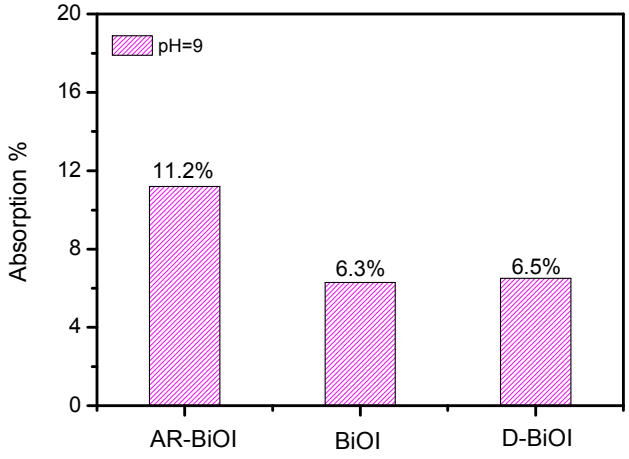

Figure S5. Adsorption capacity of MO over AR-BiOI solution with different pH after 60 min in the dark.

Table S1. Photocatalytic efficiencies of MO over BiOI-based photocatalysts under different conditions

Samples	**Solution**	**Light source**	**Photocatalytic efficiency**	**Ref.**
AR-BiOI (0.015 g)	100 mL MO (10 mg/L)	500 W Xe lamp coupled with a 420 nm cut-off filter	*T_{50}=30 min T_{100}=120 min	Our sample
Bi_2S_3/BiOI (0.10 g)	50 mL MO (10 mg/L)	500 W Xe lamp coupled with a 420 nm cut-off filter	T_{50}=3 h T_{90}= 5 h	[1]
BiOI/BiOBr (0.10 g)	50 mL MO (10 mg/L)	500 W Xe lamp coupled with a 420 nm cut-off filter	T_{50}=18 min T_{90}= 80 min	[2]
plate-like BiOI (0.1 g)	100 mL MO (10 mg/L)	500 W Xe lamp coupled with a 400 nm cut-off filter	T_{50}=1.5 h T_{90}=4 h	[3]
BiOI (0.05 g).	40 mL MO (20 mg/L)	350 W Xe lamp coupled with a 400 nm cut-off filter	T_{65}= 2 h	[4]
ZnO/BiOI (0.1 g)	100 mL MO (10 mg/L)	500 W tungsten lamp with a 420 nm cut-off filter	T_{50}=2 h T_{80}=4 h	[5]
BiOCl/BiOI (0.05 g)	100 mL MO (10 mg/L)	300 W Xe lamp coupled with a 400 nm cut-off filter	T_{100}=30 min	[6]
BiOI (0.1 g)	100 mL MO (10 mg/L)	500 W tungsten lamp with a 420 nm cut-off filter	T_{50}=75 min T_{80}=3 h	[7]

BiOI (0.03 g)	100 mL MO (10 mg/L)	150 W tungsten lamp with a 420 nm cut-off filter	T_{50}=40 min T_{100}=180 min	[8]
AgI/BiOI (0.1 g)	100 mL MO (10 mg/L)	300 W Xe lamp coupled with a 400 nm cut-off filter	T_{50}=25 min T_{90}=180 min	[9]
BiOI/TiO_2 (0.1 g)	100 mL MO (10 mg/L)	500 W tungsten lamp with a 420 nm cut-off filter	T_{50}=1 h T_{100}=4 h	[10]
Ag/BiOI (0.05 g)	50 mL MO (10 mg/L)	500 W Xe lamp coupled with a 420 nm cut-off filter	T_{50}=60 min T_{80}=4 h	[11]
BiOI/BiOBr (0.1 g)	50 mL MO (10 mg/L)	500 W Xe lamp coupled with a 420 nm cut-off filter	T_{50}= 4.5 h T_{65}=5 h	[12]
$ZnWO_4$/BiOI (0.1 g)	100 mL MO (10 mg/L)	400 W metal halide lamp with a 420 nm cut-off filter	T_{50}=1 h T_{86}=4 h	[13]

*T_{50} means the time needs for photocatalytic degradation of 50% MO.

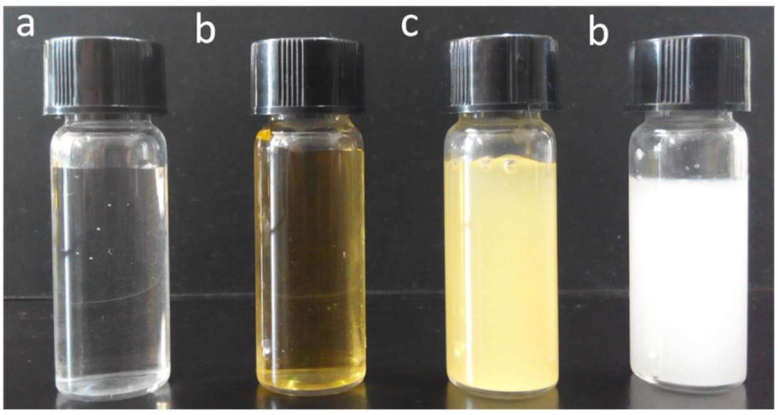

Figure S6. The photo image of (a) blank saturated $Ca(OH)_2$ solution, (b) MO solution before light irradiation, (c) Saturated $Ca(OH)_2$ after dropped 0.5 ml MO solution with light irradiation 15 min. (d) Saturated $Ca(OH)_2$ after dropped 0.5 ml MO solution with light irradiation 90 min.

Table S2 TOC, TC, IC, calculated generated CO_2, CO and efficiency of the MO degradation.

	TOC	TC	IC	W_{CO2}	W_{CO}	η
AR-BiOI	1355.8	3457.3	2101.5	2012.2	3526.1	86%
Blank	6894.1	6983.4	89.3	0	--	--
DI water	0.5214	0.7528	0.2314	0	--	--

Total Organic Carbon (TOC) and Inorganic Carbon (IC) were measured with total organic carbon analyzer. One milliliter of the solution after the 90 min reaction was diluted to 50 ml

with DI water before the analysis. The TOC was calculated from Eq (1):

$$TOC = TC - IC \qquad (1)$$

Where the TC is total carbon and IC is inorganic carbon. The generated CO_2 would dissolve into the base solution and form carbonate which the pH was 9.0 measured by pH meter, and then IC would contain the generated CO_2 and absorption of CO_2 As the IC of blank sample only can come from the absorption of CO2 in air, the generated CO_2 of each samples should be calculated from Eq(2):

$$W_{CO2} = IC - IC\ blank \quad (2)$$

After the reaction, the carbon of the initial carbon became TOC still in the solution, CO_2 transferring to carbonate and CO escaping into air. Then, we also can get the amount of the generated CO from Eq(3):

$$W_{CO} = TOC\ blank - TOC - W_{CO2} \qquad (3)$$

Furthermore, the efficiency of the glucose oxidation can be calculated by Eq (4):

$$\eta = [W(CO_2)+W(CO)]\times 100\% / W(MO) \qquad (4)$$

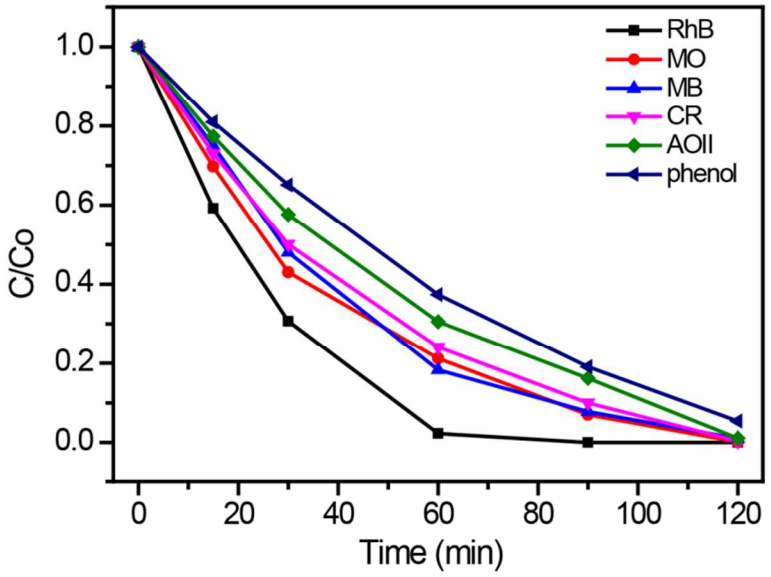

Figure S7. (a) Photocatalytic activity of AR-BiOI samples for degradation of different dyes under visible light irradiation

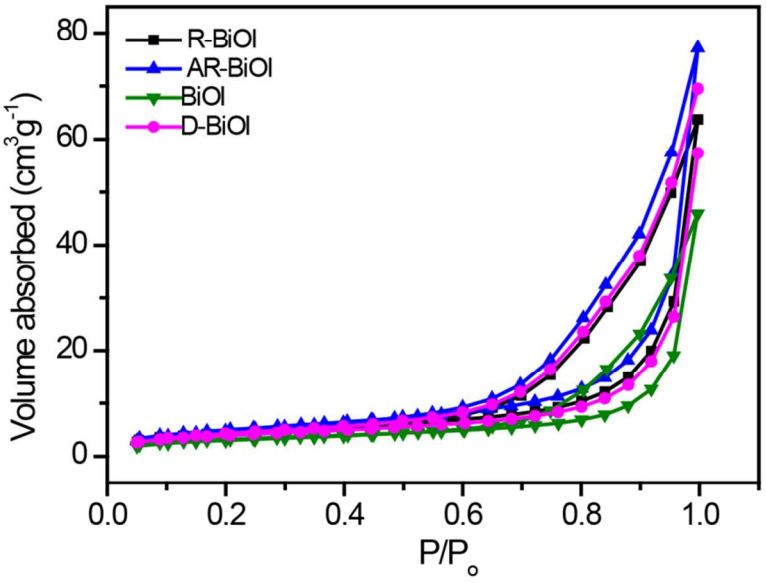

Figure S8. Nitrogen adsorption-desorption isotherm of untreated BiOI, R-BiOI, D-BiOI and AR-BiOI samples.

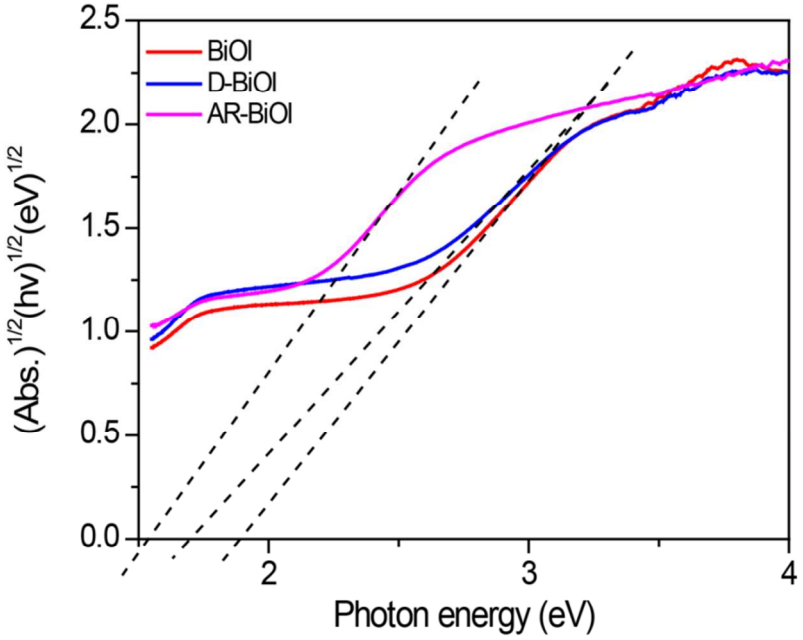

Figure S9. Plots of the $(\alpha h\nu)^{1/2}$ vs photon energy ($h\nu$) for untreated BiOI, D-BiOI and AR-BiOI samples.

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