Supplementary information for

Hydroxyl-assisted iodine ions intercalating $Bi_2O_2CO_3$ nanosheets to constructure the interlayered bridge for enhanced photocatalytic activity of phenol

1. Tables

2. Figures and results

1. Tables

Table S1. Reaction conditions and final phase of products.

No.	Solvent	Solvent ratio	$Bi(NO_3)_3 \bullet 5H_2O$ (mmol)	Urea (g)	KI (mmol)	Phase of products
1	H_2O	-	2	1	4	I-$Bi_2O_2CO_3$
2	EG	-	2	1	4	$Bi_4O_5I_2$
3	Et and EG	8:2	2	1	4	BiOI
4	EG and H_2O	1:9	2	1	4	I-$Bi_2O_2CO_3$
5	EG and H_2O	2:8	2	1	4	I-$Bi_2O_2CO_3$
6	EG and H_2O	5:5	2	1	4	I-$Bi_2O_2CO_3$
7	EG and H_2O	2:8	2	1	-	$Bi_2O_2CO_3$
8	Et and H_2O	2:8	2	1	4	$Bi_2O_2CO_3$ & BiOI
9	Et and H_2O	5:5	2	1	4	$Bi_2O_2CO_3$ & BiOI
10	Et and H_2O	8:2	2	1	4	$Bi_2O_2CO_3$ & BiOI
11	Et and H_2O	9:1	2	1	4	BiOI

No.		a (Å)	b (Å)	c (Å)	α (°)	β (°)	γ (°)	V (Å^3)	Bandgap (eV)
1	$Bi_2O_2CO_3$	5.56958	28.07291	5.54626	90	90	90	867.1814	1.98
2	$Bi_2O_2CO_3I_4$	5.89126	33.05380	6.37392	90	90	90	1241.1840	0

Table S2. Structure parameters of $Bi_2O_2CO_3$.

2. Figures and results

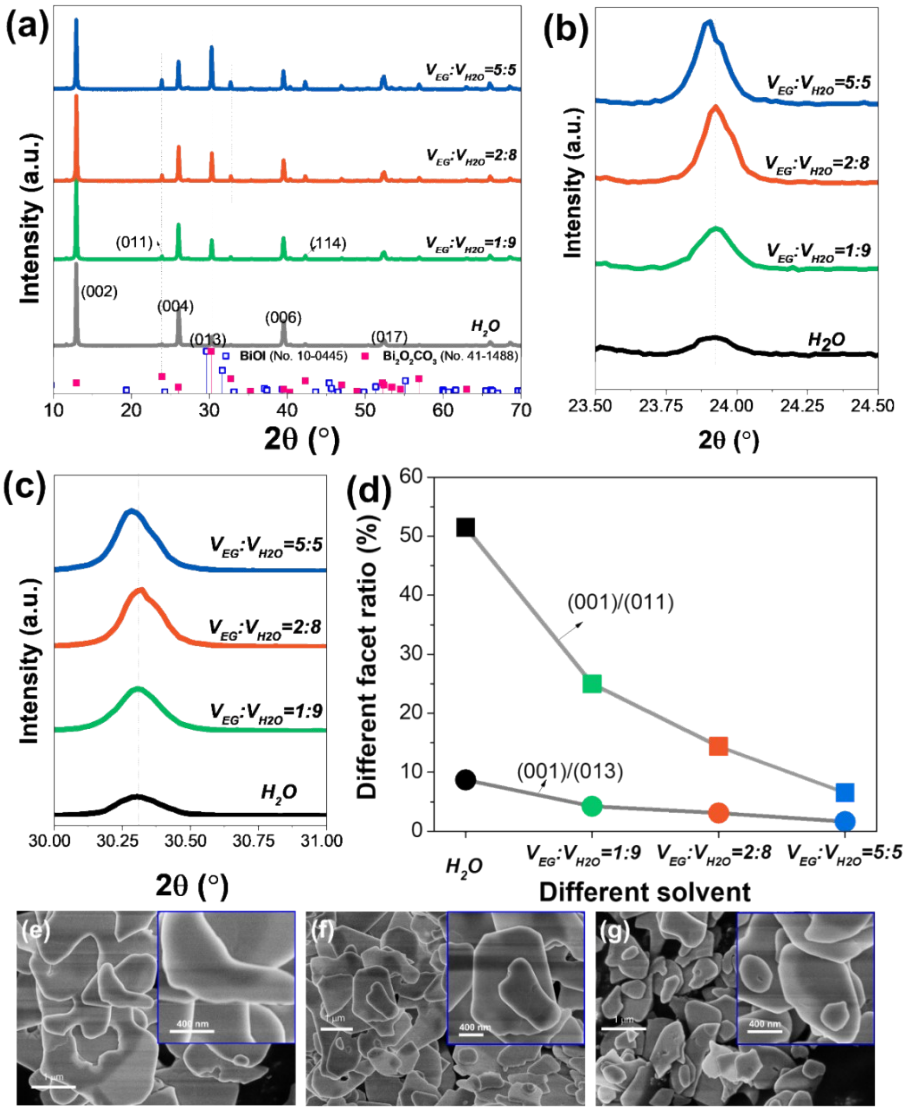

Fig. S1. (a) XRD patterns of samples obtained from different solvents, local magnified XRD patterns of (b) (011) and (c) (013) planes. (d) Different plane ratio of (001)/(011) and (001)/(013).

According to **Fig. S1**, the water was of benefit to the formation of $Bi_2O_2CO_3$, while the hydroxyl groups of solvent was contributed to the generation of BiOI. Employing EG and water mixture as solvent and altering the volume of EG in the mixture, the resulted XRD patterns of products were showed in **Fig. 1a**. In the pure H_2O, all the characteristic peaks were indexed to the tetragonal $Bi_2O_2CO_3$ (JCPDS No. 41-1455)

although the concentration of KI was relatively high. By reducing the volume of H_2O and increasing the volume of EG correspondingly, the XRD patterns without impurity characteristic peaks were also obtained, which were indexed to $Bi_2O_2CO_3$. But, partial characteristic peaks of resulted $Bi_2O_2CO_3$ were shifted to lower 2θ when altering the volume ratio of EG and water, as magnified some local characteristic peaks. Especially, when the volume of EG increasing over 50% of the mixed solvent, such as, the 2θ corresponded to (011) and (013) planes of $Bi_2O_2CO_3$ were down-shifted significantly (**Fig. 1b** and **1c**). The down-shifted characteristic peaks indicated that the crystal structure of $Bi_2O_2CO_3$ was expanded due to the intercalation of iodine ions into the structure of $Bi_2O_2CO_3$ [1, 2]. Furthermore, the intensity of some characteristic peaks increased gradually when increasing the volume ratio of EG. For instance, the planes ratio value of (001)/(011) and (001)/(013), were decreased by increasing the volume of EG. Especially, the value of (001)/(011) decreased dramatically, implying that the (011) planes in the final products increased when increasing the volume ratio of EG in the mixed solvent (**Fig. 1d**). All the products were maintained in 2D sheet-like morphology, regardless of the volume ratio of H_2O and EG. But, the size and morphology of the products were slightly adjusted. In the pure water, the resulted sheets present much irregular shape and the size of final $Bi_2O_2CO_3$ sheets was over microscale (**Fig. 2a**). When decreasing the volume of water and increasing the volume of EG simultaneously, the size of products was decreased from ~3 μm to ~800 nm (**Fig. 2b** to **2d**). Because, increasing the volume of EG will increase the viscosity of solvent, depressing the corresponding growth rate of products and forming smaller size of products [3]. Apparently, massive hydroxyl groups stemmed from EG played distinctive role on the structure expansion of $Bi_2O_2CO_3$ and size regulation.

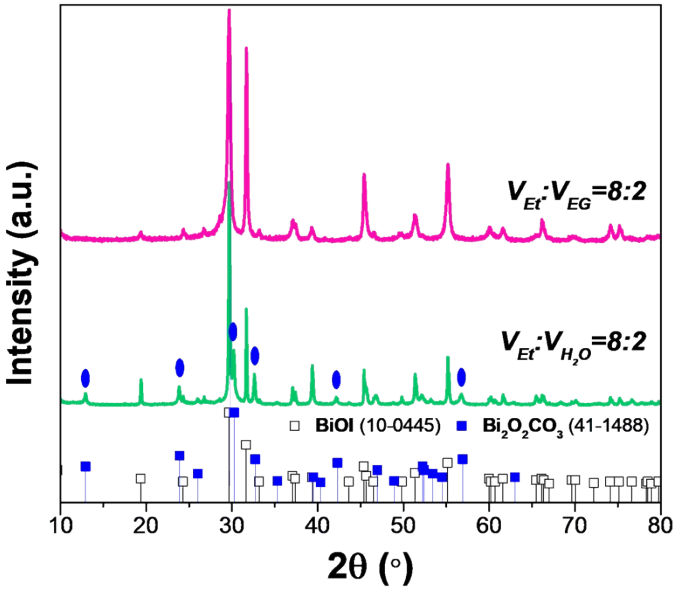

Fig. S2. XRD patterns of different products.

Fixing the volume ratio of Et but altering another solvent, the final phase of products was significantly different (**Figure S2**). When selecting water to mix with Et, the final products were mixed phase of BiOI (JCPDS No. 10-0445) and $Bi_2O_2CO_3$ (JCPDS No. 41-1488) caused by the different reaction rate of BiOI and $Bi_2O_2CO_3$ (**Fig. 1b**). Comparatively, employing EG to replace water, the final phase of products was homogenous one that only tetragonal BiOI (JCPDS No. 10-0445) were obtained.

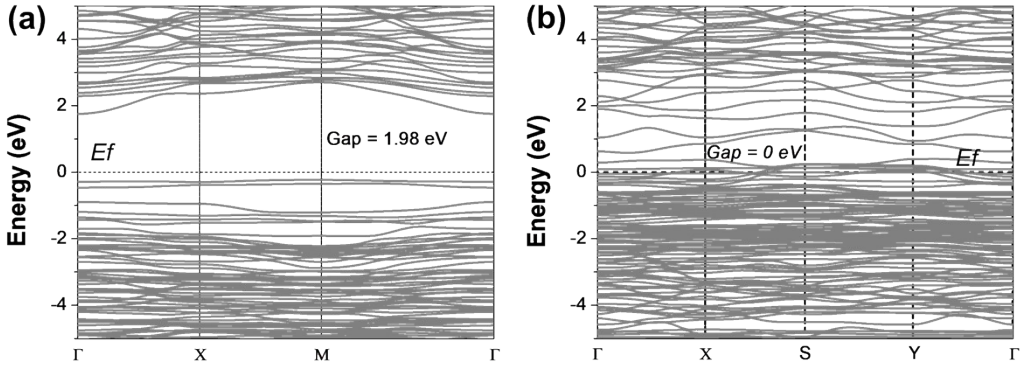

Fig. S3. Calculated band structure of (a) $Bi_2O_2CO_3$ and (b) I-$Bi_2O_2CO_3$.

References

1 Y. X. Xing, J. Zhang, Z. L. Liu, C. F. Du, Steering photoinduced charge kinetics via anionic group doping in Bi2MoO6 for efficient photocatalytic removal of water organic pollutants, *Rsc Advances*, 2017, **7**, 35883-35896.

2 L. Liang, J. Cao, H. L. Lin, X. M. Guo, M. Y. Zhang, S. F. Chen, Enhancing visible light photocatalytic and photocharge separation of (BiO)(2)CO3 plate via dramatic I- ions doping effect, *Materials Research Bulletin*, 2016, **80**, 329-336.
3 W. W. Zhou, B. Yan, C. W. Cheng, C. X. Cong, H. L. Hu, H. J. Fan, T. Yu, Facile synthesis and shape evolution of highly symmetric 26-facet polyhedral microcrystals of Cu2O, *Crystengcomm*, 2009, **11**, 2291-2296.