

Supplementary Materials

Photocatalytic CO₂ reduction to CH₄ and Dye Degradation Using Bismuth Oxychloride/Bismuth Oxyiodide/Graphitic Carbon Nitride (BiO_mCl_n/BiO_pI_q/g- C₃N₄) Nanocomposite with Enhanced Visible-Light Photocatalytic Activity

Yong-Ming Dai ¹, Wu-Tsan Wu ², Yu-Yun Lin ², Hsiao-Li Wu ², Szu-Han Chen ²,
Jih-Mirn Jehng ³, Jia-Hao Lin ², Fu-Yu Liu ², Chiing-Chang Chen ^{2,*}

¹ Department of Chemical and Materials Engineering, National Chin-Yi University of
Technology, Taichung 411, Taiwan

² Department of Science Education and Application, National Taichung University of
Education, Taichung 403, Taiwan

³ Department of Chemical Engineering, National Chung Hsing University, Taichung
402, Taiwan

* Author to whom correspondence should be addressed

E-mail: ccchen@mail.ntcu.edu.tw

Fax: +886-4-2218-3560

Tel: +886-4-2218-3406

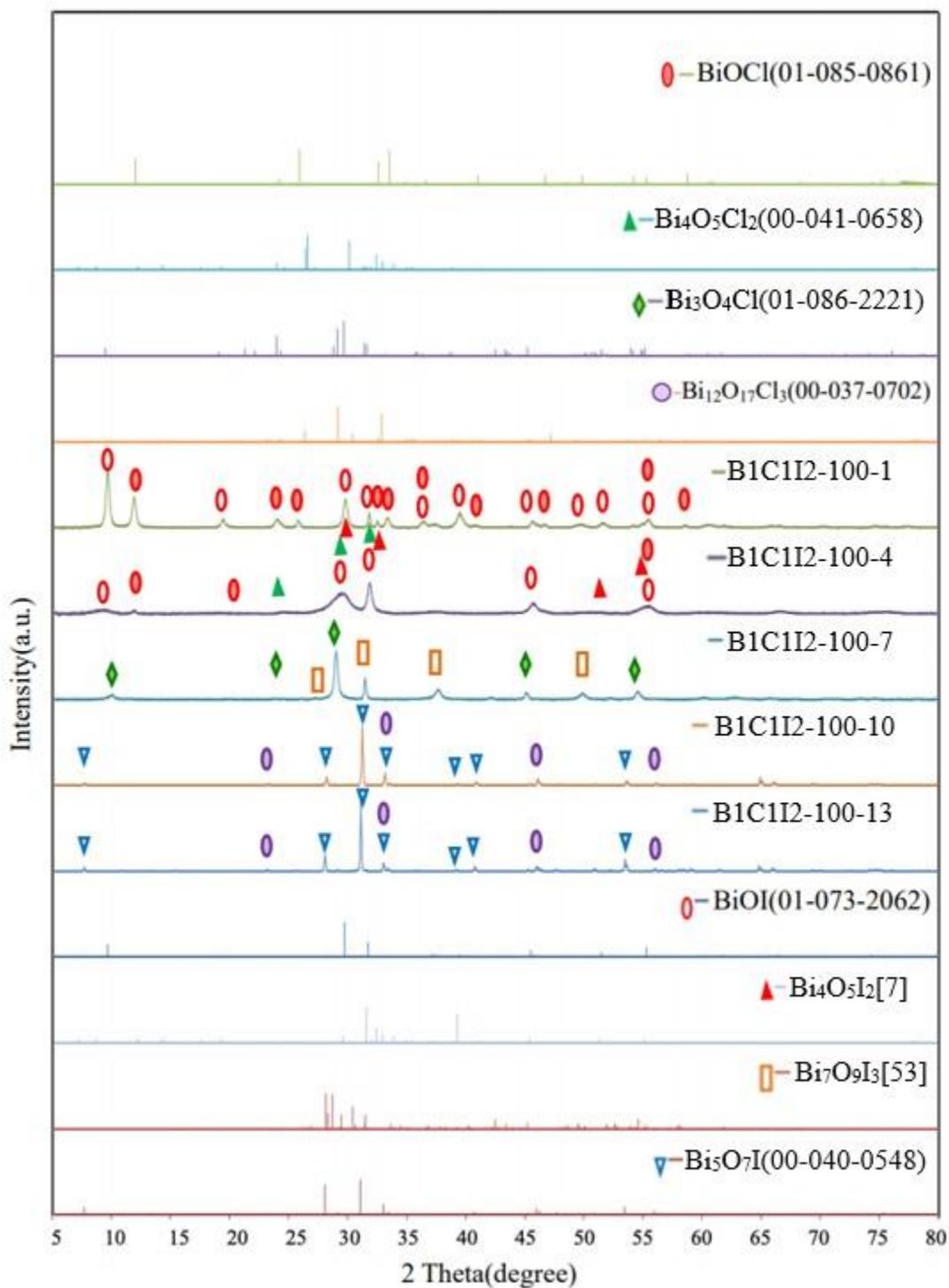


Figure S1. XRD patterns of the BiO_mCl_n/BiO_pI_q samples prepared under a KCl:KI molar ratio of 1:2, a pH of 1–13, a reaction time of 12 h, and a hydrothermal temperature of 100 °C.

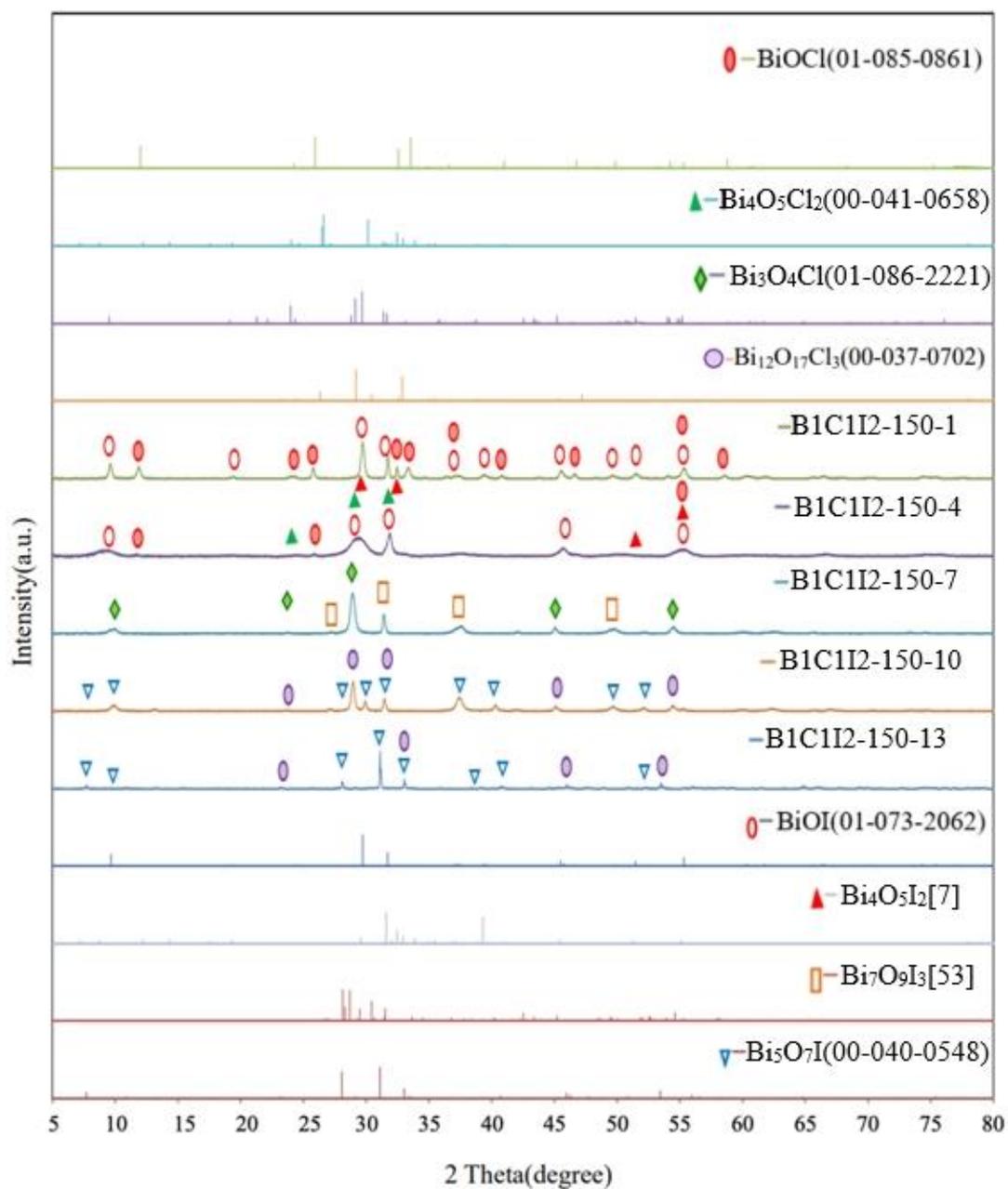


Figure S2. XRD patterns of the $\text{BiO}_m\text{Cl}_n/\text{BiO}_p\text{I}_q$ samples prepared under a KCl:KI molar ratio of 1:2, a pH of 1–13, a reaction time of 12 h, and a hydrothermal temperature of 150 °C.

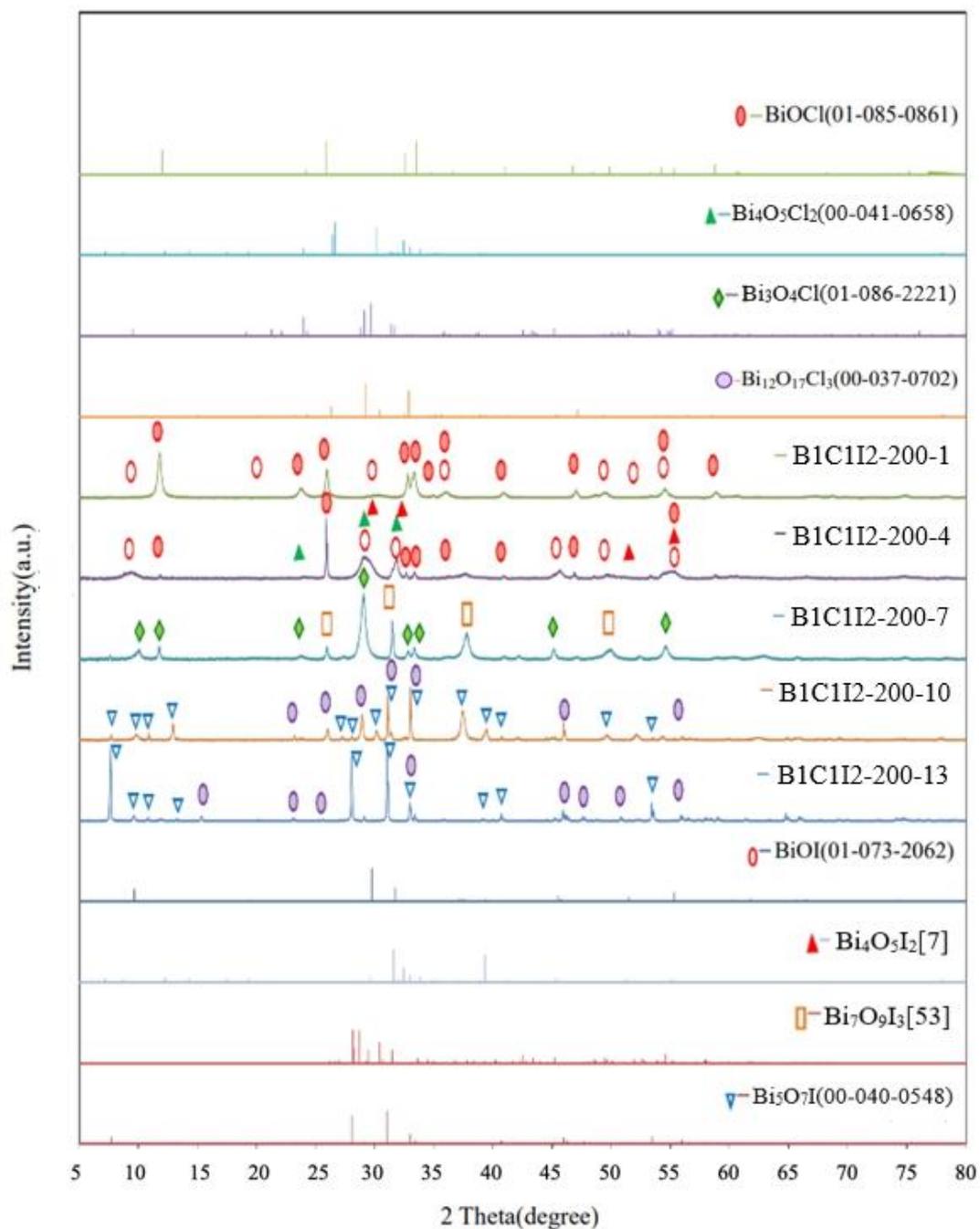


Figure S3. XRD patterns of the $\text{BiO}_m\text{Cl}_n/\text{BiO}_p\text{I}_q$ samples prepared under a KCl:KI molar ratio of 1:2, a pH of 1–13, a reaction time of 12 h, and a hydrothermal temperature of 200 °C.

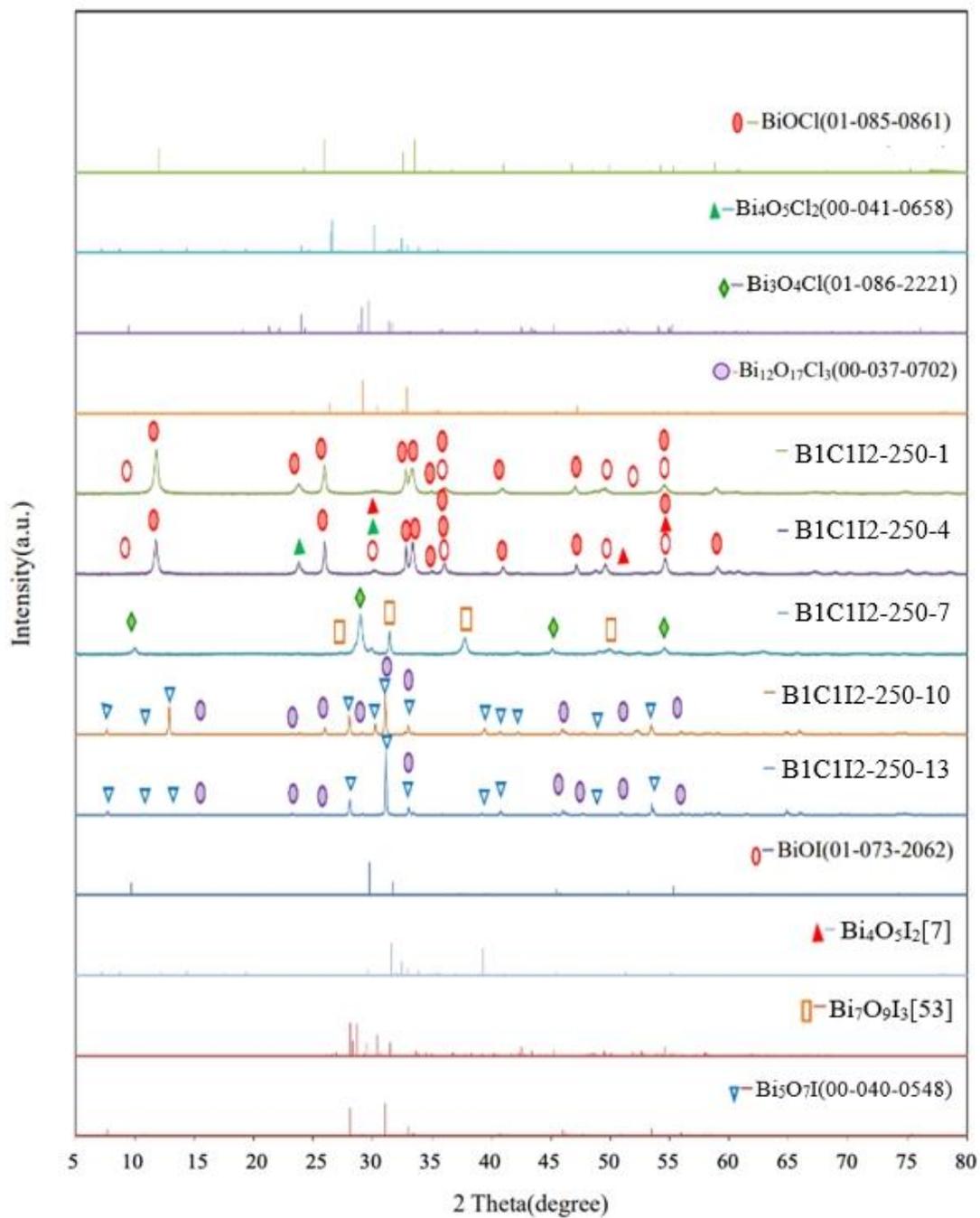


Figure S4. XRD patterns of the BiO_mCl_n/BiO_pI_q samples prepared under a KCl:KI molar ratio of 1:2, a pH of 1–13, a reaction time of 12 h, and a hydrothermal temperature of 250 °C.

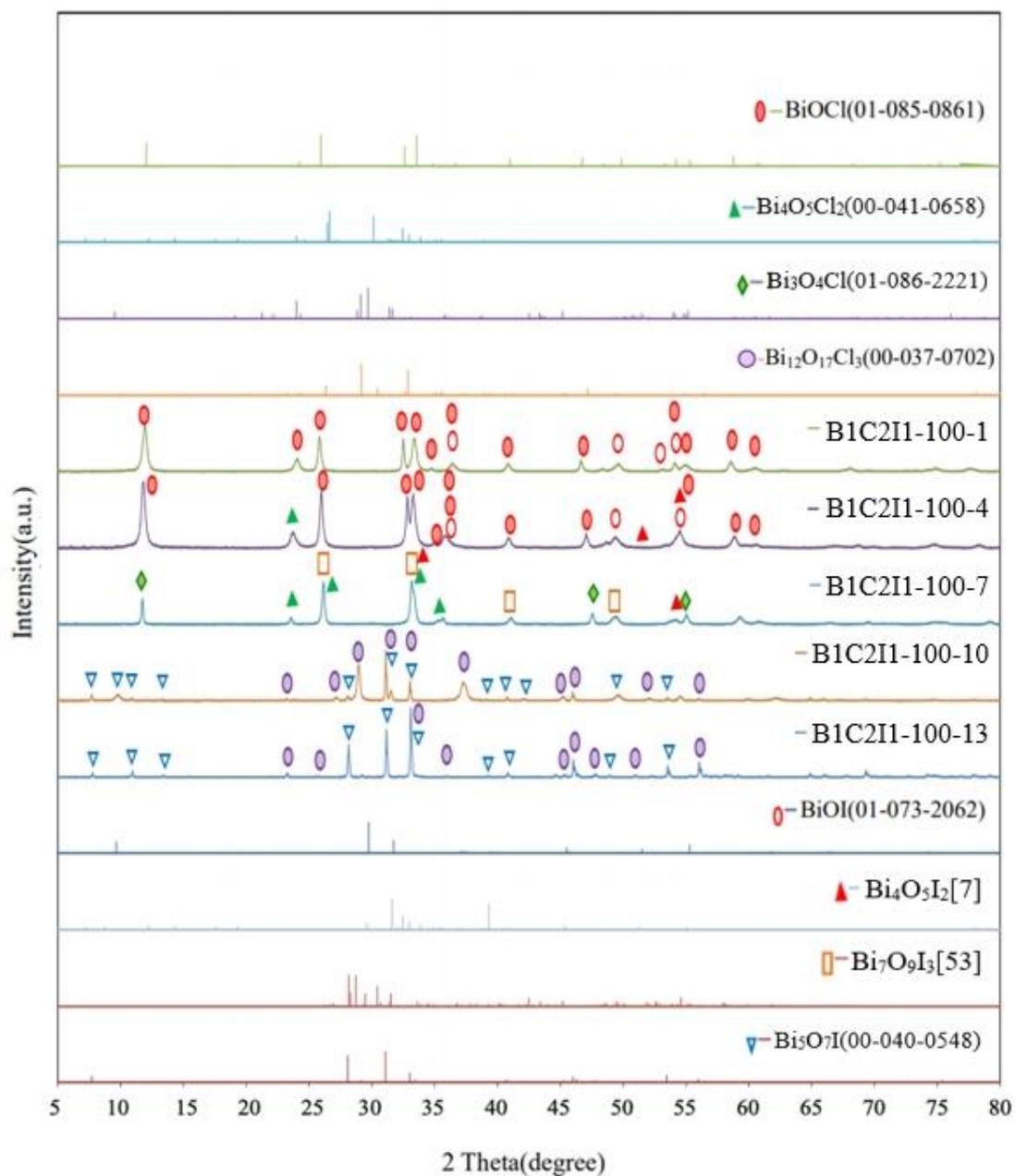


Figure S5. XRD patterns of the $\text{BiO}_m\text{Cl}_n/\text{BiO}_p\text{I}_q$ samples prepared under a KCl:KI molar ratio of 2:1, a pH of 1–13, a reaction time of 12 h, and a hydrothermal temperature of 100 °C.

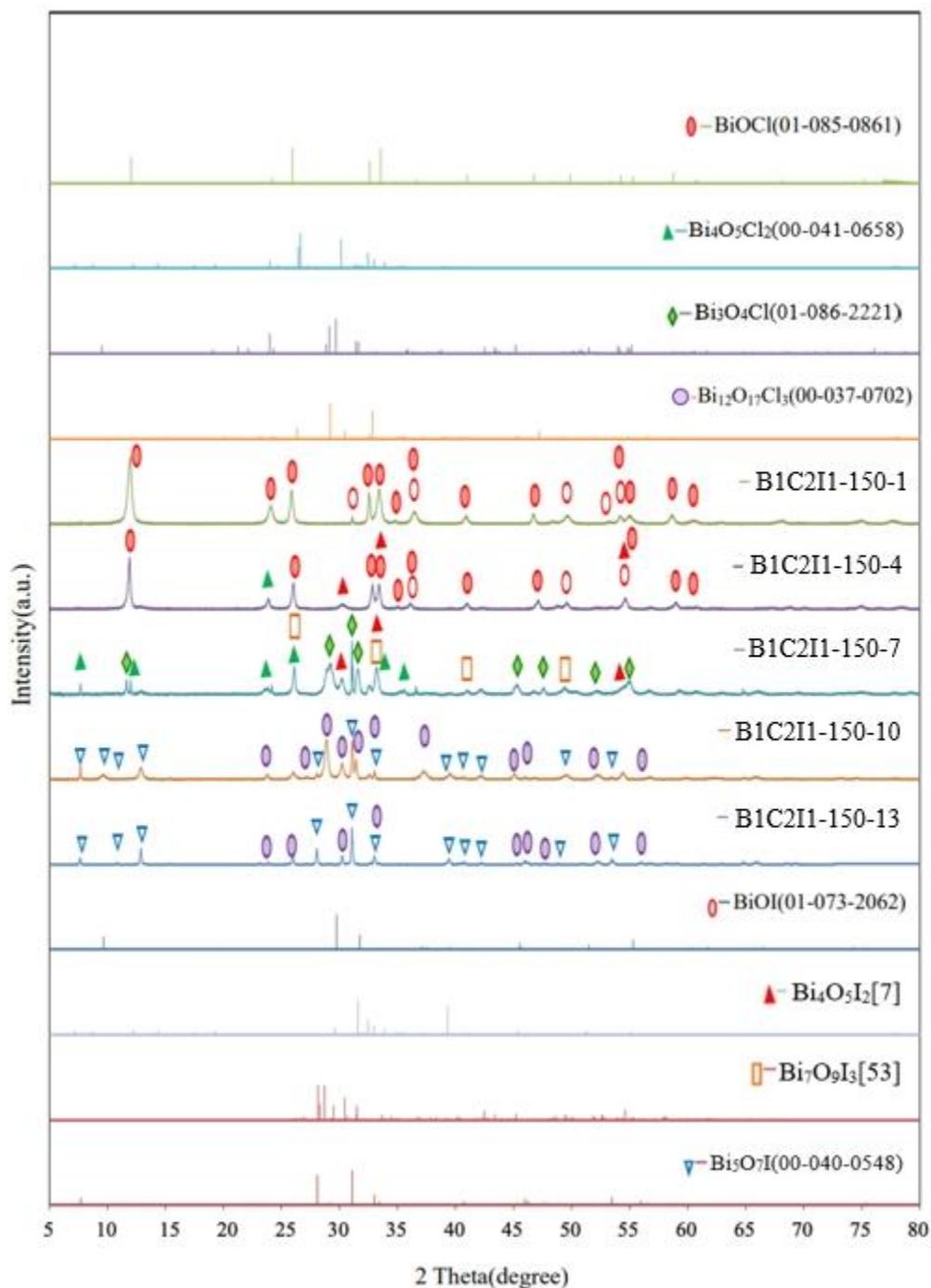


Figure S6. XRD patterns of the BiO_mCl_n/BiO_pI_q samples prepared under a KCl:KI molar ratio of 2:1, a pH of 1–13, a reaction time of 12 h, and a hydrothermal temperature of 150 °C.

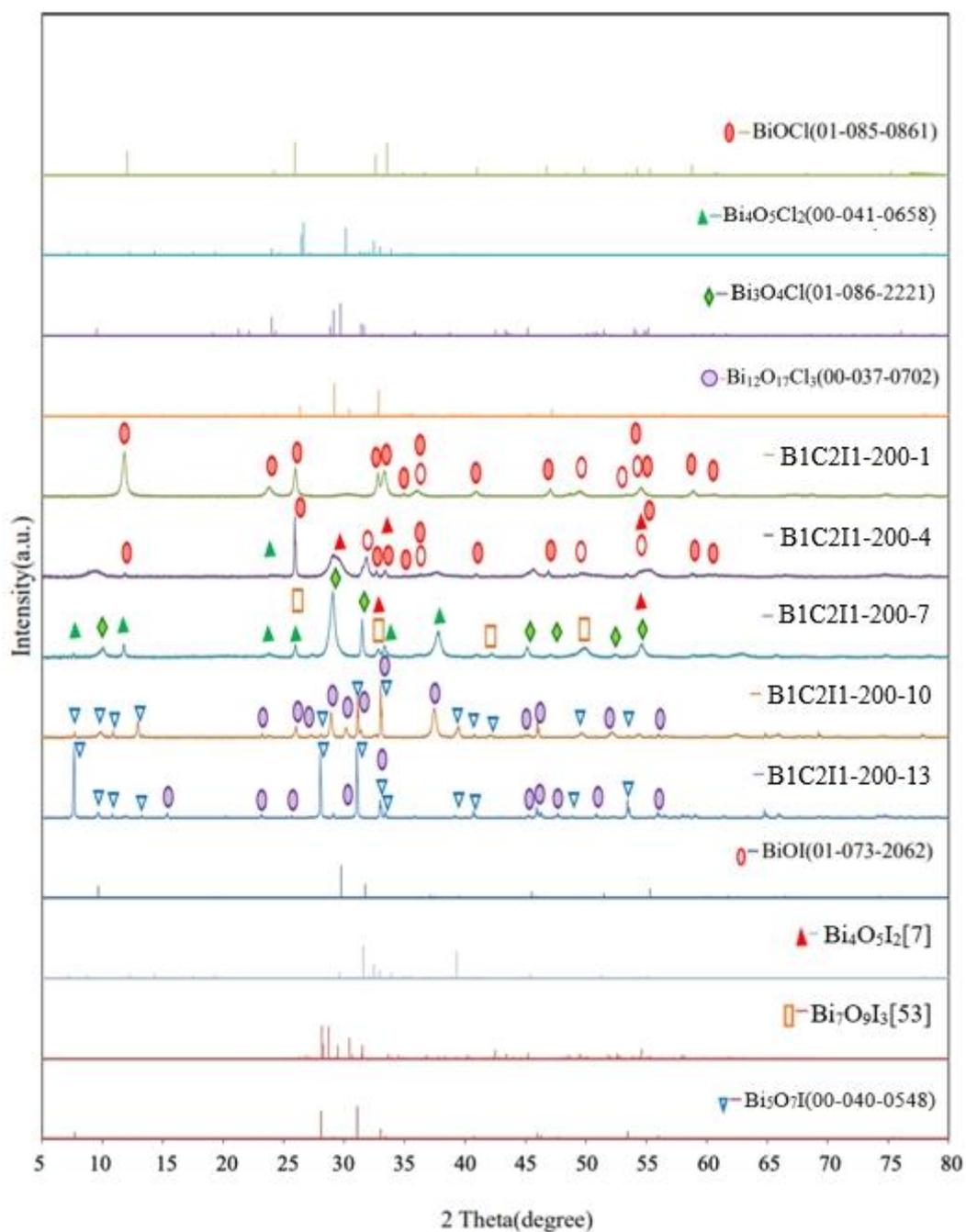


Figure S7. XRD patterns of the BiO_mCl_n/BiO_pI_q samples prepared under a KCl:KI molar ratio of 2:1, a pH of 1–13, a reaction time of 12 h, and a hydrothermal temperature of 200 °C.

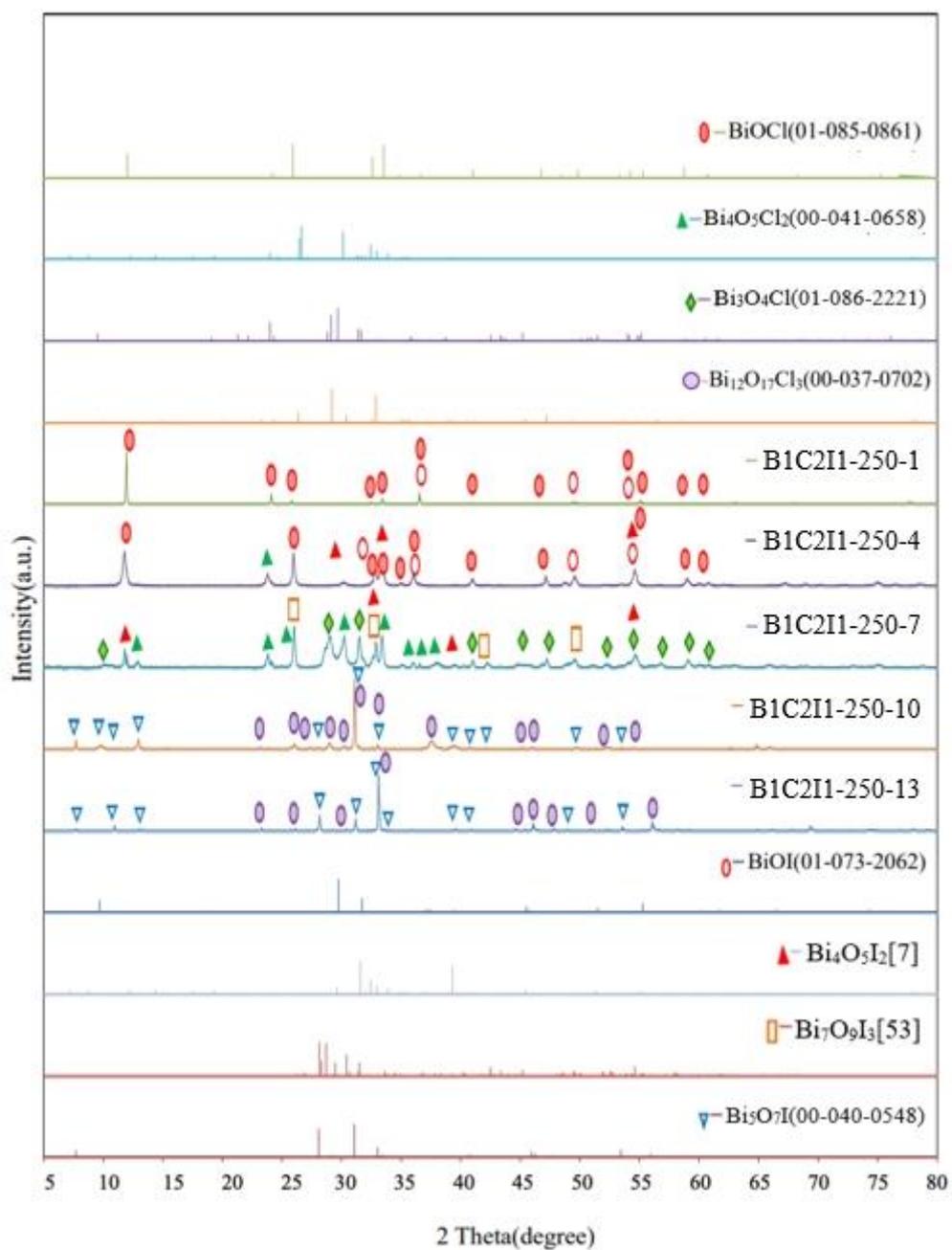
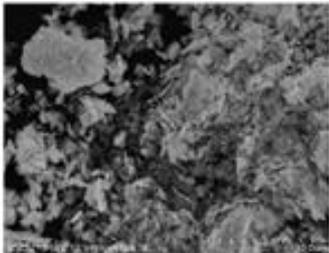
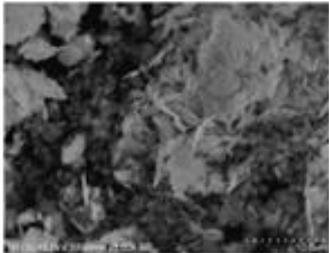
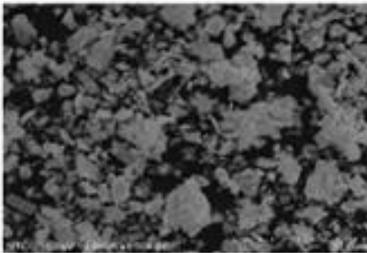
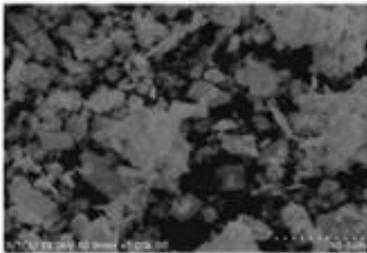
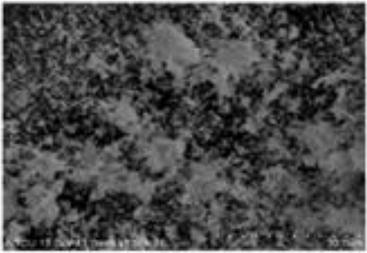
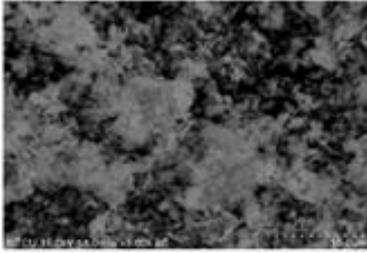
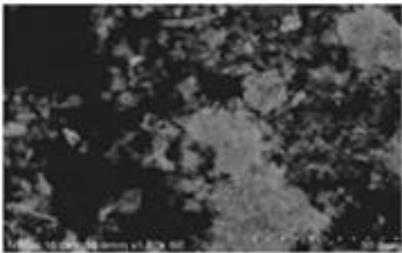
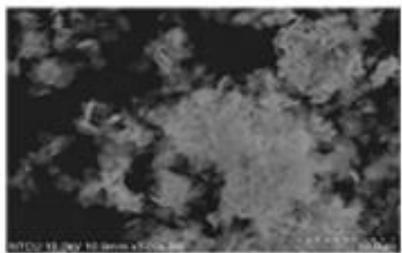


Figure S8. XRD patterns of the BiO_mCl_n/BiO_pI_q samples prepared under a KCl:KI molar ratio of 2:1, a pH of 1–13, a reaction time of 12 h, and a hydrothermal temperature of 250 °C.

B1C1I2-250-1	B1C1I2-250-1
1.5K	3K
	

B1C1I2-250-4	B1C1I2-250-4
1.5K	3K
	

B1C1I2-250-7	B1C1I2-250-7
1.5K	3K
	

B1C1I2-250-10	B1C1I2-250-10
1.5K	3K
	

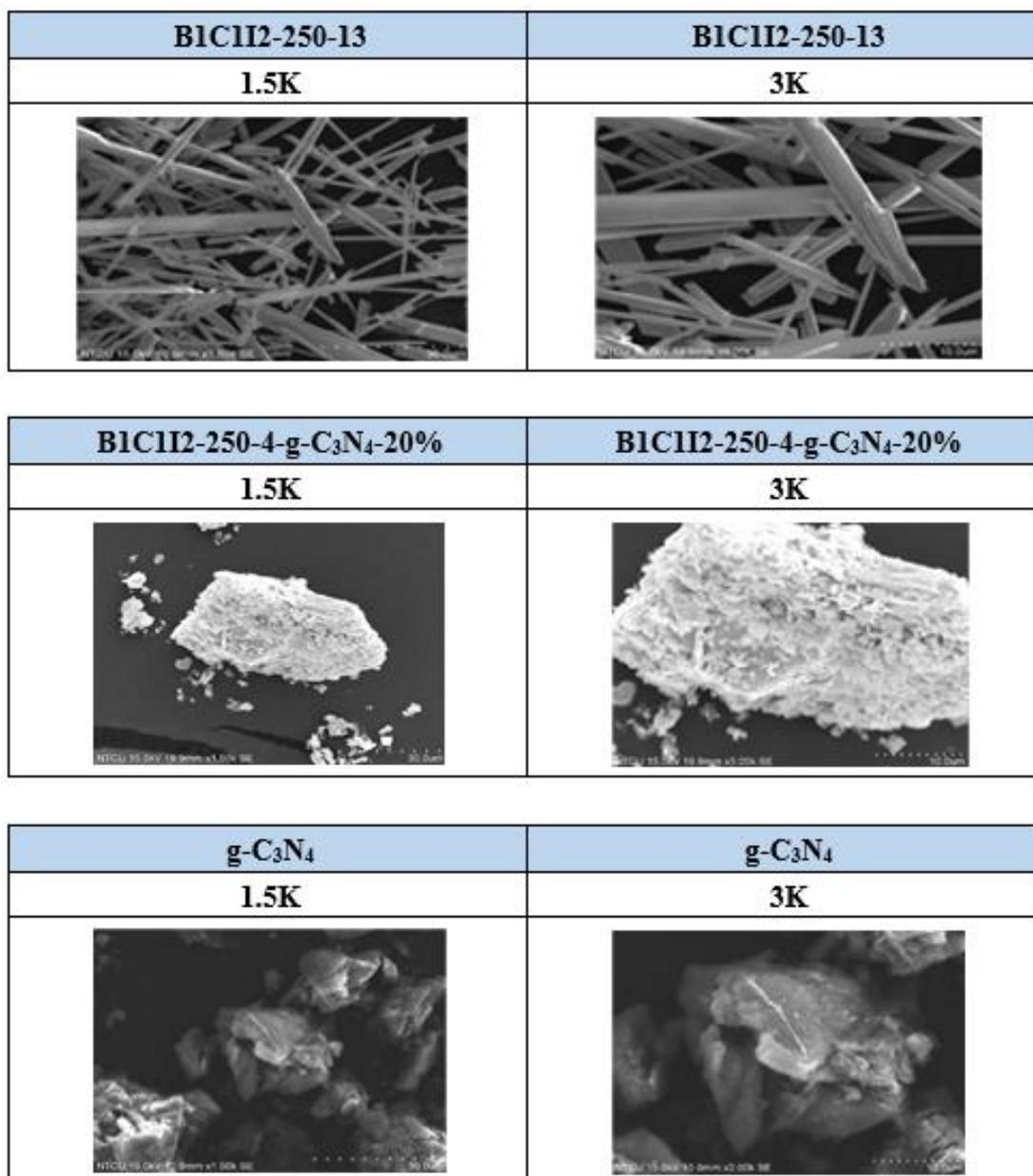


Figure S9. Scanning electron microscopy images of the $\text{BiO}_m\text{Cl}_n/\text{BiO}_p\text{I}_q/\text{g-C}_3\text{N}_4\text{-20\%}$ samples prepared using the hydrothermal autoclave method under a $\text{KCl}:\text{KI}$ molar ratio of 1:2, different pH values, a reaction time of 12 h, and a hydrothermal temperature of 250 °C.

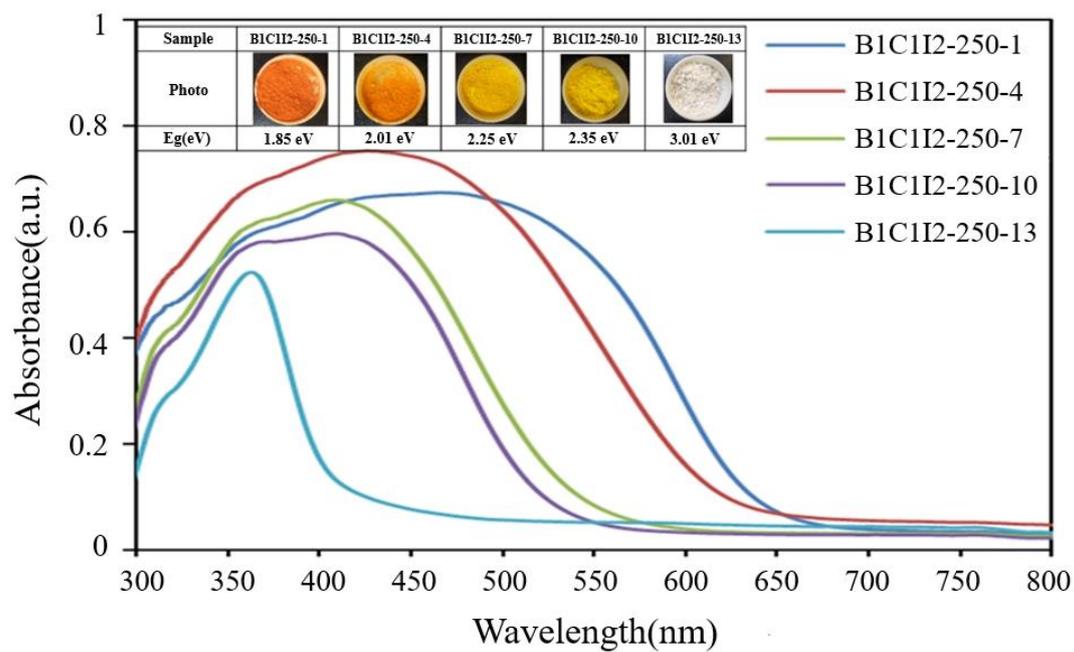


Figure S10. UV–vis absorption spectra of the $\text{BiO}_m\text{Cl}_n/\text{BiO}_p\text{I}_q$ photocatalysts prepared under a KCl:KI molar ratio of 1:2, a hydrothermal temperature of 250 °C, and various pH values.

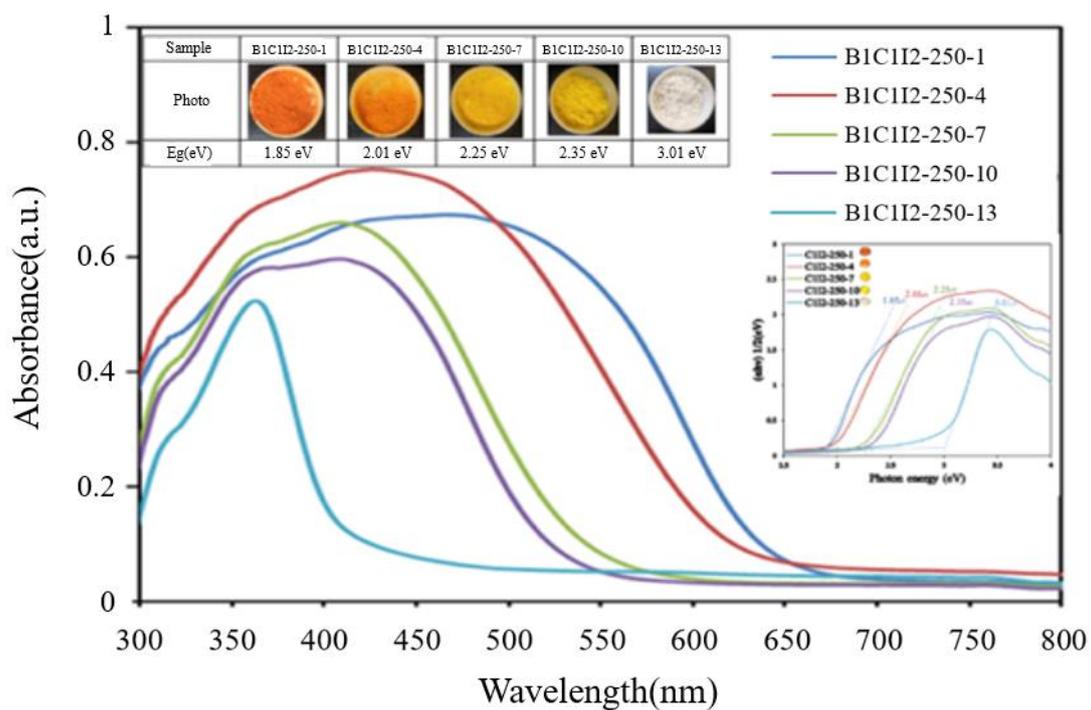


Figure S11. UV-vis absorption spectra of the $\text{BiO}_m\text{Cl}_n/\text{BiO}_p\text{I}_q$ photocatalysts prepared under a KCl:KI molar ratio of 1:2, a pH of 1–13, and a hydrothermal temperature of 250 °C.

Table S1. Chemical and physical properties of the BC1I2-4-250-g-C₃N₄-20% sample.

Catalyst code	EDS of atomic ratio(%)					E _g (eV)
	Bi	O	Cl	I	C N	
BC1I2-1-250-12	22.37	59.37	9.66	8.61	-	2.00
BC1I2-4-250-12	19.86	65.93	5.29	8.29	-	2.26
BC1I2-7-250-12	27.39	56.76	5.8	10.05	-	2.21
BC1I2-10-250-12	20.13	74.03	0	5.84	-	2.89
BC1I2-13-250-12	30.1	64.63	0	5.28	-	2.90
BC1I2-4-250-12	30.47	52.45	6.38	10.7	-	3.02
-g-C ₃ N ₄ 20%					-	
g-C ₃ N ₄	-	-	-	-	38.31	
					61.69	

Catalyst code	TEM of atomic ratio(%)					
	Bi	O	Cl	C	N	I
BC1I2-4-250-12						
-g-C ₃ N ₄ 20%	6.66	4.42	0.71	48.62	36.88	2.7