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## **Supplementary Data for:**

#### An outstanding efficient visible light-driven BiOI/LaCoO<sub>3</sub> Z-scheme system

toward cefixime degradation

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# Supplementary Data:

**SDT1.** Information for the crystallite size determination by Scherrer equation

	For BiOI NPs								
20	FWHM	β	Cosθ	β cosθ	d (nm)	d (nm)			
9.6813	0.246	0.00429	0.9964	0.00463	31.8238				
19.4367	0.3936	0.00686	0.9856	0.00794	19.6743				
24.4519	0.246	0.00429	0.9773	0.00512	31.2137				
29.7577	0.2952	0.00515	0.9665	0.00634	25.7240				
31.773	0.1968	0.00343	0.9618	0.00427	38.3984				
33.2796	0.246	0.00429	0.9581	0.00539	30.6005				
37.3043	0.6888	0.01201	0.9475	0.01544	10.8078				
39.4293	0.1968	0.00343	0.9414	0.00446	37.5839				
45.5064	0.246	0.00429	0.9222	0.00575	29.4539	24.64			
46.6045	0.2952	0.00515	0.9184	0.00694	24.4438	24.04			
49.8714	0.5904	0.01029	0.9068	0.01412	12.0675				
51.4261	0.3936	0.00686	0.901	0.00949	17.9855				
55.2691	0.3444	0.00600	0.8859	0.00846	20.2104				
60.1767	0.492	0.00858	0.8653	0.01239	13.8183				
61.7023	0.3936	0.00686	0.8585	0.00999	17.1371				
69.8947	0.1968	0.00343	0.8374	0.00511	33.4319				
74.1956	0.7872	0.01373	0.8197	0.02085	8.18132				
75.264	0.2952	0.00515	0.7976	0.00800	21.2286				
	0.1968	0.00343	0.7919	0.00536	31.6154				
For LaCoO <sub>3</sub> NPs									
20	FWHM	β	Cosθ	β cosθ	<b>d</b> ( <b>nm</b> )	d (nm)			
23.442	0.1476	0.00257	0.9791	0.00305	52.1187				
33.1074	0.1968	0.00343	0.9586	0.00431	38.2706				
33.4988	0.1476	0.00257	0.9576	0.00324	50.9743				
40.8717	0.1968	0.00343	0.9371	0.00449	37.4123				
41.5263	0.246	0.00429	0.9351	0.00564	29.8659				
47.7059	0.246	0.00429	0.9146	0.00582	29.2112				
53.4646	0.2952	0.00515	0.8931	0.00719	23.7704				
53.9923	0.246	0.00429	0.891	0.00601	28.4574	32.01			
59.1381	0.2952	0.00515	0.8698	0.00740	23.1503				
59.9379	0.246	0.00429	0.8663	0.00619	27.6685				
69.1261	0.1968	0.00343	0.8235	0.00519	32.8769				
70.0774	0.1968	0.00343	0.8188	0.00521	32.6893				
74.3327	0.7872	0.01373	0.7969	0.02135	7.95375				
78.9153	0.1968	0.00343	0.7721	0.00547	30.8249				
78.9153	0.1968	0.00343	0.7684	0.00549	30.6772				
For BiOI/LaCoO <sub>3</sub> NPs									
20	FWHM	β	Cosθ	β cosθ	<b>d</b> ( <b>nm</b> )	d (nm)			
9.6581	0.1968	0.00343	0.9965	0.00371	39.7837				
19.3584	0.3936	0.00686	0.9858	0.00794	19.6782				
23.2716	0.246	0.00429	0.9794	0.00508	31.2808				
24.3803	0.3936	0.00686	0.9794	0.00819	19.5126				
29.6898	0.3444	0.00600	0.9666	0.00739	22.0514	24 54			
31.7238	0.1968	0.00343	0.9619	0.00427	38.4024	27.37			
32.9478	0.1968	0.00343	0.9589	0.00430	38.2826				
33.3281	0.1476	0.00257	0.958	0.00323	50.9956				
37.2259	0.492	0.00858	0.9477	0.01102	15.1342				
39.3814	0.2952	0.00515	0.9415	0.00669	25.0586				

40.7171	0.1968	0.00343	0.9375	0.00449	37.4282
45.4514	0.2952	0.00515	0.9224	0.00690	24.5502
47.5505	0.1968	0.00343	0.9151	0.00465	36.5339
51.393	0.492	0.00858	0.9011	0.01186	14.3900
55.2108	0.3444	0.00600	0.8862	0.00846	20.2172
58.9736	0.3936	0.00686	0.8705	0.00986	17.3767
59.9053	0.3936	0.00686	0.8664	0.00990	17.2948
61.6437	0.3936	0.00686	0.8588	0.00999	17.1431
66.2165	0.3936	0.00686	0.8376	0.01022	16.7199
69.9405	0.3936	0.00686	0.8194	0.01042	16.3566
74.179	0.3936	0.00686	0.7977	0.01066	15.9234
75.251	0.3936	0.00686	0.792	0.01073	15.8097

For BiOI NPs								
20	FWHM	В	cosθ	β cosθ	sin 0	d (nm)		
9.6813	0.246	0.00429	0.9964	0.00463	0.0844			
19.4367	0.3936	0.00686	0.9856	0.00794	0.1688			
24.4519	0.246	0.00429	0.9773	0.00512	0.2118			
29.7577	0.2952	0.00515	0.9665	0.00634	0.2568			
31.773	0.1968	0.00343	0.9618	0.00427	0.2737			
33.2796	0.246	0.00429	0.9581	0.00539	0.2864			
37.3043	0.6888	0.01201	0.9475	0.01544	0.3198			
39.4293	0.1968	0.00343	0.9414	0.00446	0.3373			
45.5064	0.246	0.00429	0.9222	0.00575	0.3868			
46 6045	0 2952	0.00515	0.9184	0.00694	0 3956	32.61		
49 8714	0.5904	0.01029	0.9068	0.01412	0.4216			
51 4261	0.3936	0.00686	0.901	0.00949	0.4339			
55 2691	0.3444	0.00600	0.8859	0.00846	0.4638			
60 1767	0.3444	0.00000	0.8653	0.01239	0.4030			
61 7023	0.472	0.00696	0.8585	0.01237	0.5015			
66 2608	0.3930	0.00080	0.8383	0.00535	0.5128			
60.2098	0.1908	0.00343	0.0374	0.00311	0.5400			
09.0947	0.7672	0.01373	0.0197	0.02083	0.5728			
75 264	0.2932	0.00313	0.7970	0.00800	0.5728			
75.204	0.1908	0.00343	0.7919 For Lot	$\frac{0.00330}{C_{0}O_{0}NB_{0}}$	0.0100			
20	FWHM	R			sin A	d (nm)		
20	0.1476	0.00257	0.0701	0.00305	0 2031	u (IIII)		
23.442	0.1470	0.00237	0.9791	0.00303	0.2031			
33.1074	0.1700	0.00343	0.9576	0.00431	0.2882			
<i>4</i> 0 8717	0.1470	0.00237	0.9370	0.00324	0.2002			
40.8717	0.1908	0.00343	0.9371	0.00449	0.3492			
41.3203	0.240	0.00429	0.9551	0.00504	0.3343			
47.7039 52.4646	0.240	0.00429	0.9140	0.00382	0.4044			
52,0022	0.2932	0.00313	0.8951	0.00719	0.4498	10.57		
50.1291	0.240	0.00429	0.891	0.00001	0.4339	19.37		
59.1381	0.2952	0.00515	0.8098	0.00740	0.4935			
59.9379	0.246	0.00429	0.8003	0.00619	0.4995			
09.1201	0.1968	0.00343	0.8255	0.00519	0.56/3			
/0.0//4	0.1968	0.00343	0.8188	0.00521	0.5741			
/4.3327	0.7872	0.01373	0.7969	0.02135	0.6041			
/8.9153	0.1968	0.00343	0.7721	0.00547	0.6355			
/9.5784	0.1968	0.00343	0.7684	0.00549	0.64			
20		D	FOR BIOL/	LaCoU <sub>3</sub> NPS	a <b>:</b> 0	J ()		
20	<b>FWHM</b>	<u>B</u>	<u>соя</u>	<u>р соя</u>	<b>SIN U</b>	a (nm)		
9.6581	0.1968	0.00343	0.9965	0.003/1	0.0842			
19.5584	0.3936	0.00686	0.9858	0.00794	0.1681			
23.2/16	0.246	0.00429	0.9794	0.00508	0.2017			
24.3803	0.3936	0.00686	0.9775	0.00819	0.2112			
29.6898	0.3444	0.00600	0.9666	0.00739	0.2562			
31.7238	0.1968	0.00343	0.9619	0.00427	0.2733	47.24		
32.9478	0.1968	0.00343	0.9589	0.00430	0.2836			
33.3281	0.1476	0.00257	0.958	0.00323	0.2868			
37.2259	0.492	0.00858	0.9477	0.01102	0.3192			
39.3814	0.2952	0.00515	0.9415	0.00669	0.3369			
40.7171	0.1968	0.00343	0.9375	0.00449	0.3479			
45.4514	0.2952	0.00515	0.9224	0.00690	0.3863			

**SDT2.** Information for the crystallite size determination by Williamson-Hall equation.

47.5505	0.1968	0.00343	0.9151	0.00465	0.4032
51.393	0.492	0.00858	0.9011	0.01186	0.4336
55.2108	0.3444	0.00600	0.8862	0.00846	0.4634
58.9736	0.3936	0.00686	0.8705	0.00986	0.4922
59.9053	0.3936	0.00686	0.8664	0.00990	0.4993
61.6437	0.3936	0.00686	0.8588	0.00999	0.5124
66.2165	0.3936	0.00686	0.8376	0.01022	0.5462
69.9405	0.3936	0.00686	0.8194	0.01042	0.5732
74.179	0.3936	0.00686	0.7977	0.01066	0.6031
74.179	0.3936	0.00686	0.792	0.01073	0.6105

SDT3. Comparation of Scherrer and Williamson-Hall data

Catalyst	Crystallite size (nm)				
Catalyst -	Scherrer	Williamson-Hall			
BiOI	24.6	32.6			
LaCoO <sub>3</sub>	32.1	195.1			
<b>BiOI/ LaCoO3</b>	24.5	47.2			

BiOI:LaCoO <sub>3</sub>	BiOI	LaCoO <sub>3</sub>	BiOI	LaCoO <sub>3</sub>	Rem.	C/Co± SD
Mole ratio	<b>(g</b> )	( <b>g</b> )	W%	W%	Eff.%	( <b>n=3</b> )
1:1	0.008	0.005	61.5	38.5	50	0.493±0.101
1:2	0.008	0.01	44.4	55.5	19.5	$0.829 \pm 0.053$
1:3	0.008	0.015	34.8	65.2	8.2	0.919±0.003
1:4	0.008	0.02	28.6	71.4	3.2	$0.969 \pm 0.022$
2:1	0.016	0.005	76.2	23.8	67	0.331±0.082
3:1	0.024	0.005	82.7	17.2	44	0.541±0.18
4:1	0.032	0.005	86.5	13.5	65.9	0.351±0.13

**SDT4.** The results of the effect of different molar ratios in BiOI/LaCoO<sub>3</sub> catalysts on the degradation of cefixime pollutant.

**SDT5.** The experimental results for Cefexim degradation by  $BiOI/LaCoO_3$  nano photocatalyst

			Factor 1	Factor 2	Factor 3	Factor 4	Response 1
Std	Block	Run	A: pH	B: Catal. dosage	C: Irrad. time	D: CEF	degradation
				g/L	min	mg/L	%
1	Block 2	1	7	0.8	105	11	75.51
2	Block 1	2	4	1	80	6	96.98
3	Block 1	3	10	0.6	30	6	89.18
4	Block 2	4	7	0.8	55	11	78.26
5	Block 1	5	4	1	30	16	61.74
6	Block 2	6	7	0.8	5	11	68.17
7	Block 2	7	4	0.6	30	6	81.23
8	Block 1	8	4	1	30	6	83.82
9	Block 1	9	10	0.6	80	6	65.1
10	Block 2	10	4	0.6	80	16	67.53
11	Block 2	11	13	0.8	55	11	66.42
12	Block 1	12	7	0.4	55	11	60.53
13	Block 2	13	7	0.8	55	11	78.12
14	Block 1	14	4	0.6	80	6	94.56
15	Block 1	15	7	0.8	55	21	51.74
16	Block 2	16	7	0.8	55	11	78.23
17	Block 1	17	10	1	80	6	64.56
18	Block 1	18	10	0.6	80	16	46.76
19	Block 2	19	7	0.8	55	1	91.53
20	Block 2	20	10	0.6	30	16	50.95
21	Block 3	21	10	1	80	16	71.68
22	Block 3	22	7	0.8	55	11	78.15
23	Block 3	23	7	1.2	55	11	88.7
24	Block 3	24	7	1	30	6	89.59
25	Block 3	25	7	0.8	55	11	78.29
26	Block 3	26	7	0.8	55	11	78.65
27	Block 3	27	4	1	80	16	93.96
28	Block 3	28	1	0.8	55	11	81.53
29	Block 3	29	4	0.6	30	16	33.37
30	Block 3	30	10	1	30	16	77.79

## **Supplementary Data Figures:**



**SDF1**. W-H plot based on the XRD patterns of (A) BiOI, (B) LaCoO<sub>3</sub> and (C) BiOI/LaCoO<sub>3</sub> samples.





**SDF2.** (A) DRS reflectance spectra of the samples; Typical Tauc plot for (B) n =3/2, (C) n =3 used for estimation of samples' Eg values.





**SDF3**. Results obtained in condition of condition: catalyst dosage: 0.006 g L<sup>-1</sup>, C<sub>CEF</sub>: 10 mg L<sup>-1</sup> and irritation time of 40 Min for photodegradation of (A) BiOI/LaCoO<sub>3</sub>, (B) BiOI and (C) LaCoO<sub>3</sub>.



**SDF4**. Diagnostic plots obtained by RSM.



**SDF 5.** (A) Plot of actual vs predicted values in CEF photodegradation by BiOI/LaCoO<sub>3</sub> photocatalyst.(B) Plot of residual values versus predicted values.