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Electronic supplementary information

Emergence of photoluminescence enhancement of Eu^{3+} doped BiOCl single-crystalline nanosheets at reduced vertical dimension

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Experimental Section

Sample Preparation

Eu_2O_3 (4N), $Bi(NO_3)_3.5H_2O$ (AR), HNO_3 (AR) and KCl (GR) were used as starting materials. All materials were used as received without further purification. $Eu(NO_3)_3$ were prepared by dissolving the corresponding Eu_2O_3 in HNO_3 solution at elevated temperature followed by evaporating superfluous HNO_3 under vacuum. Eu^{3+} (1.0 mol %) single-doped BiOCl nanosheets were synthesized by the hydrothermal synthesis. In a typical synthesis procedure, stoichiometric amounts of $Eu(NO_3)_3$, $Bi(NO_3)_3.5H_2O$ and KCl were mixed together to form the precursor. Then the pH value of the mixed solution was adjusted to 1, 3, and 6 by adding NaOH (1M). After being continuously stirred for 0.5 h, the mixture was transferred into a closed Teflon-lined stainless steel autoclave with 100 mL capacity, and subsequently heated at 160 °C for 12 h. Naturally cooled to room temperature, the precipitates were washed with absolute alcohol and deionized water for several times and dried at 80 °C in air. To eliminate the oxygen defects and improve the crystallinity of the nanocrystals, the final products were annealed at 450 °C for 2 h in air. The BiOCl: Eu^{3+} polycrystalline was synthesized prepared by solid state reaction.

Characterization

The crystalline structure of the samples were characterized by X-ray diffraction (XRD) (Bruker D8-Advance diffractometer using Cu $K\alpha$ (λ=1.5406 Å) radiation). Chemical composition is determined by inductively coupled plasma optical emission spectrometry (ICP-OES, Teledyne Leeman Labs). The morphology and particle sizes

were determined by a scanning electron microscopy (SEM, Hitachi SU8000) and transmission electron microscopy (TEM, JEM-2100). The UV-vis absorption spectra of the samples were measured on a Hitachi U-4100 spectrophotometer. Photoluminescence (PL) spectra and luminescence lifetimes of samples were measured on an Edinburg Instruments FLS980 spectrofluorimeter equipped with both continuous and pulsed xenon lamps. Fourier transform infrared absorption (FT-IR) was detected by (Bruker TENSOR2). All the measurements were performed at room temperature.

Results Section

Table S1 Diffraction intensity ratios ($I_{(110)}/I_{(001)}$ and $I_{(200)}/I_{(001)}$) of the BiOCl: Eu^{3+} samples with different pH value.

pH value	$I_{(110)}/I_{(001)}$	$I_{(200)}/I_{(001)}$
1	0.23	0.11
3	0.65	0.46
6	1.56	0.83

Table S2. ICP-OES measured results of Eu^{3+} ions mole ratios in the samples.

pH value	**Nominal ratio**	**ICP-AES result**
1	1	0.009
3	1	0.112
6	1	0.121

Table S3. The intensity ratio of $^5D_0 \rightarrow {}^7F_4$ to $^5D_0 \rightarrow {}^7F_2$ ($R_{4\rightarrow2}$) in the BiOCl: Eu^{3+} samples prepared at different pH value under excitation at 321 and 465 nm.

pH value	**λ_{ex}=321nm**	**λ_{ex}=465nm**
1	3.24	2.88
3	4.65	2.75
6	6.58	2.56

Table S4. The intensity ratio of 614 nm to 620 nm in the BiOCl: Eu^{3+} samples prepared at different pH value under excitation at 321 and 465 nm.

pH value	**λ_{ex}=321nm**	**λ_{ex}=465nm**
1	0.95	0.73
3	1.27	0.69
6	1.91	0.62

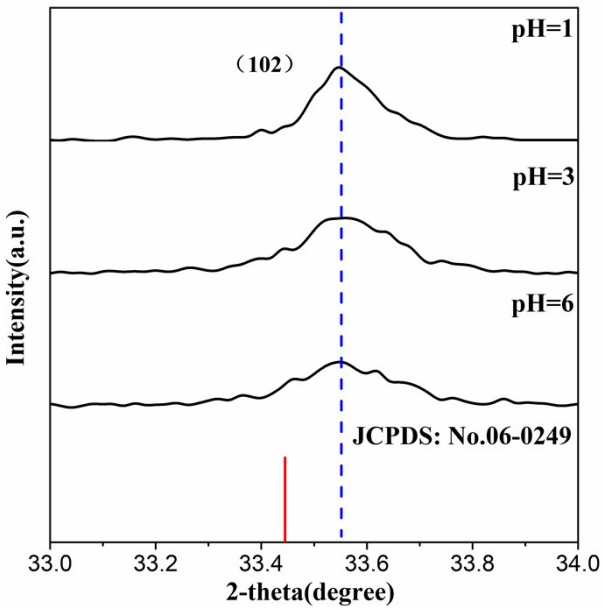

Fig. S1. The main diffraction peak near 2θ = 33º~34º with increasing pH value.

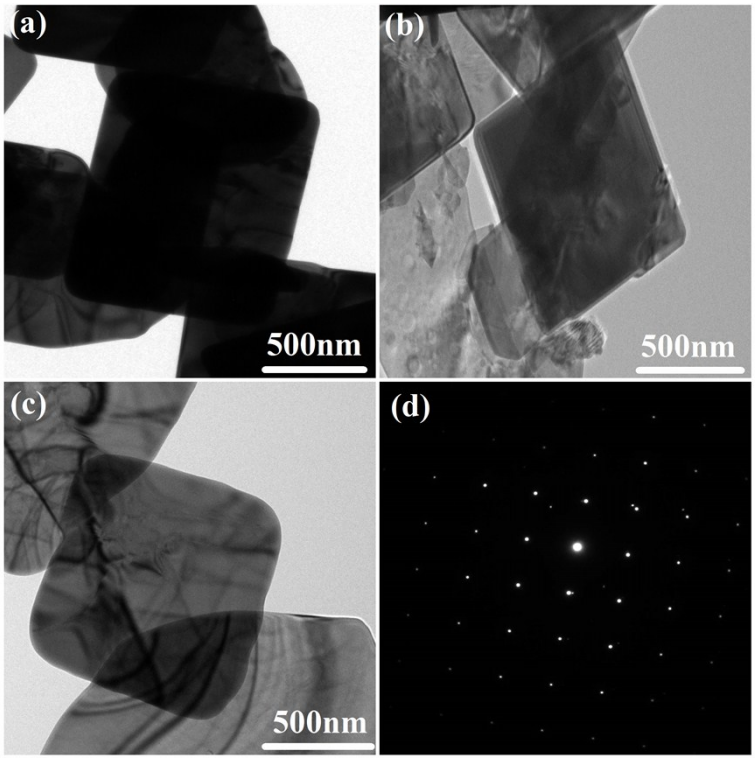

Fig. S2. TEM images of individual nanosheets. (a) pH = 1; (b) pH = 3; (c) pH = 6； (d) SAED pattern of samples prepared in pH = 6.

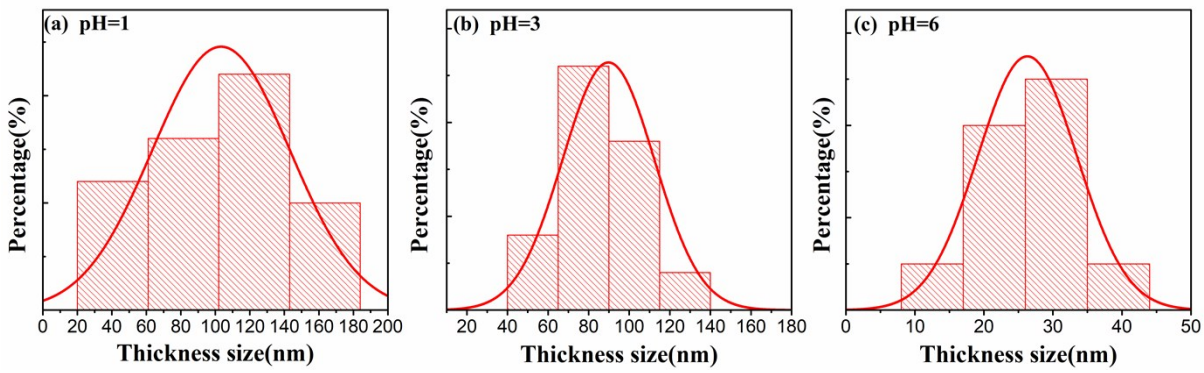

Fig. S3. Thicknesses size distribution histograms of the BiOCl: Eu^{3+} nanosheets with different pH value. (a) pH = 1; (b) pH = 3; (c) pH = 6.

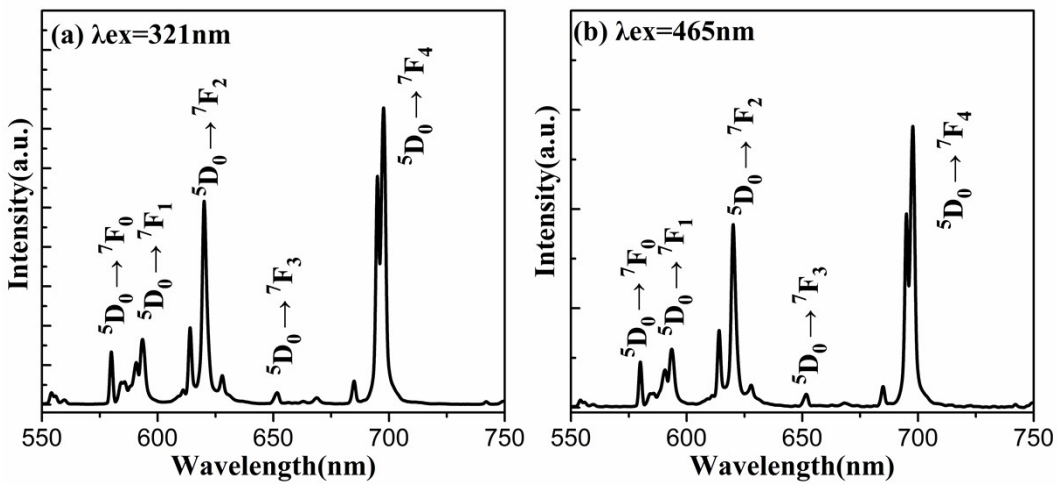

Fig. S4. Emission spectra of Eu^{3+}(1 mol%)-doped BiOCl polycrystalline.

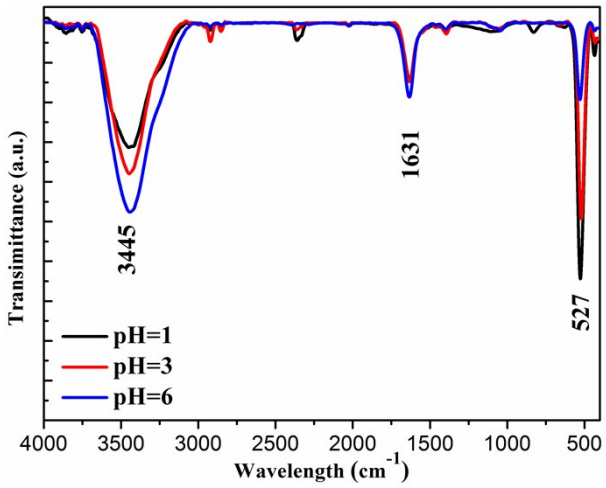

Fig. S5. FT-IR of prepared BiOCl: Eu^{3+} nanosheets with different pH value.

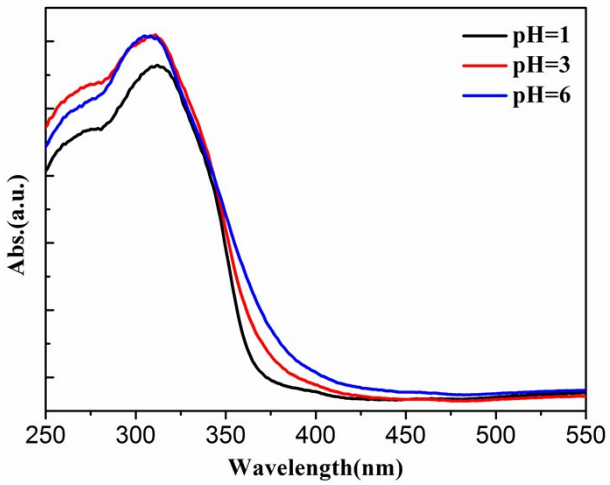

Fig. S6. UV-vis absorption spectra of prepared BiOCl: Eu^{3+} nanosheets with different pH value.