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Supporting Information

Facet-dependent Nonlinear Optical Properties of Bismuth Oxychloride Single-Crystal Nanosheets

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1. Z-scan Measurements of BiOCl single-crystalline nanosheets.

The NLO properties of BiOCl single-crystalline nanosheets were studied by Z-scan setup as shown in Figure S1. Z-scan is a technique developed to measure the nonlinear refractive index.[1] The basis of this procedure is that a sample is translated longitudinally through the beam-waist region of a focused gaussian laser beam, and the variation of the on-axis intensity in the far field is measured as a function of sample position. In Z-scan, the intensities of incident and transmitted lights through samples were collected in reference and signal detectors, respectively to obtain the transmittance. Herein, we used normalized transmittance, which equals to the ratio of nonlinear and linear transmittance, as a standard to study the NLO properties of BiOCl single-crystalline nanosheets.

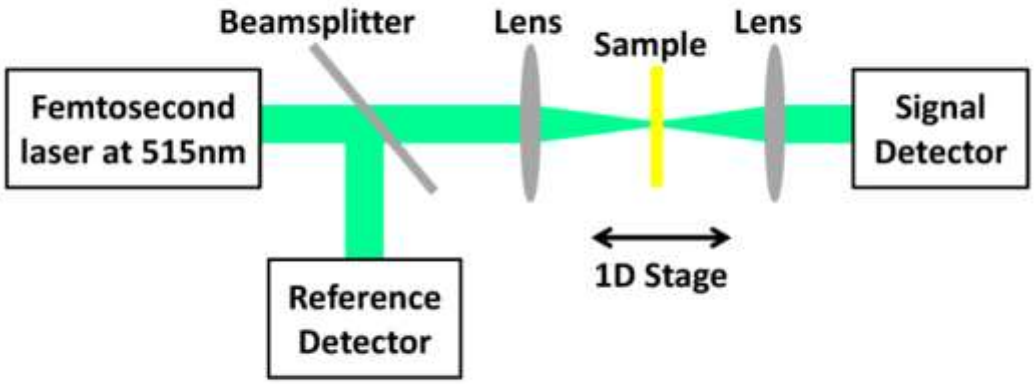

Figure S1 Setup of z-scan measurement.

2. Characterization on the different size of {010} facet BiOCl single-crystalline nanosheets.

The XRD patterns of the {010} facet samples reacted in different hours. From this figure, we could clearly see that no other phases and peaks of impurities such as Bi_2O_3 and $BiCl_3$ were detected and the intensity ratios of the (002) and (200) peaks were about 1~2 for BiOCl{010} samples. The samples reacted in different times were well-crystallized. Thus, the XRD studies confirmed that we get well-crystallized, different-facets samples. The SEM image was shown that the particles are square with a size in the range of 500nm−1.34μm. And we can change the reaction time to get different size of BiOCl{010} single-crystalline nanosheets.

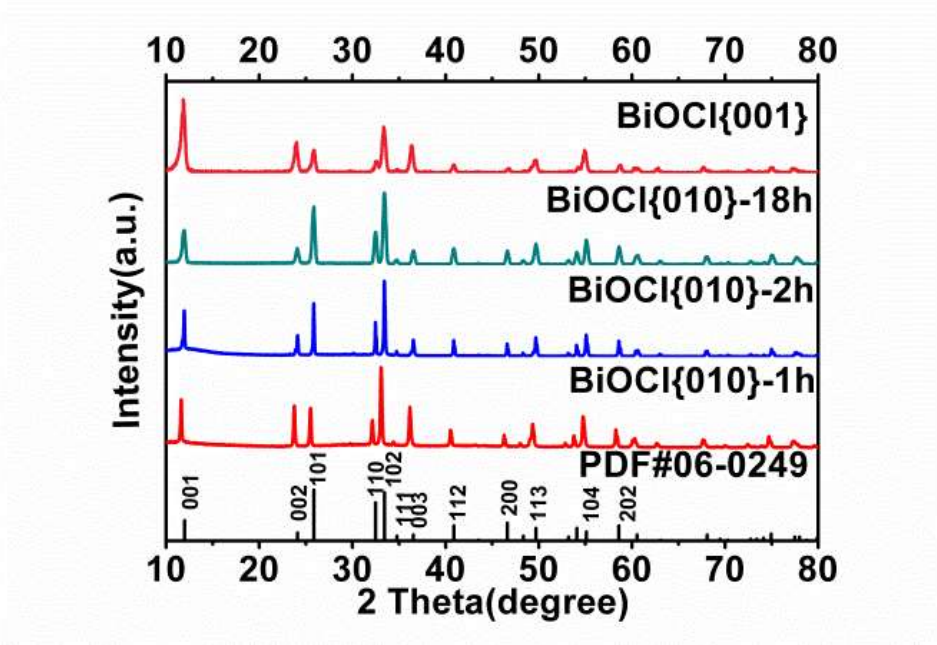

Figure S2. XRD patterns of the BiOCl single-crystalline nanosheets.

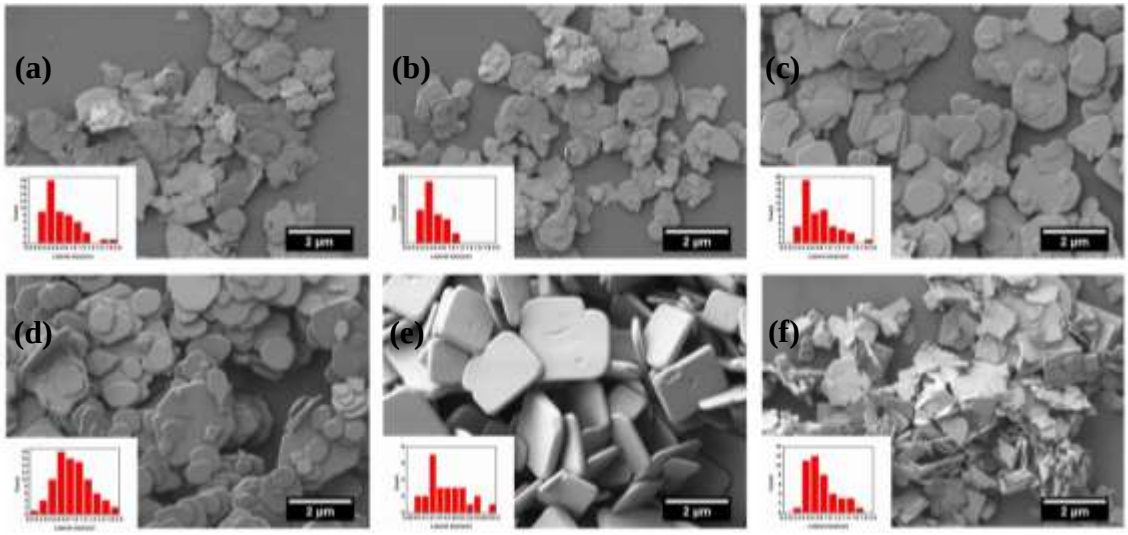

Figure S3. SEM images and the size distributions of BiOCl{010} synthesized by different times: (a) BiOCl{010} reacted in 0h, (b) BiOCl{010} reacted in 0.5h, (c) BiOCl{010} reacted in 1h, (d) BiOCl{010} reacted in 2h, (e)BiOCl{010} reacted in 18h, and (f) BiOCl{001} reacted in 18h.

Table S1 The statistics widths of {010} facet BiOCl single-crystal nanosheets.

React Time	**0h**	**0.5h**	**1h**	**2h**	**18h**
Width(μm)	0.52±0.17	0.51±0.19	0.54±0.12	0.69±0.21	1.34±0.09

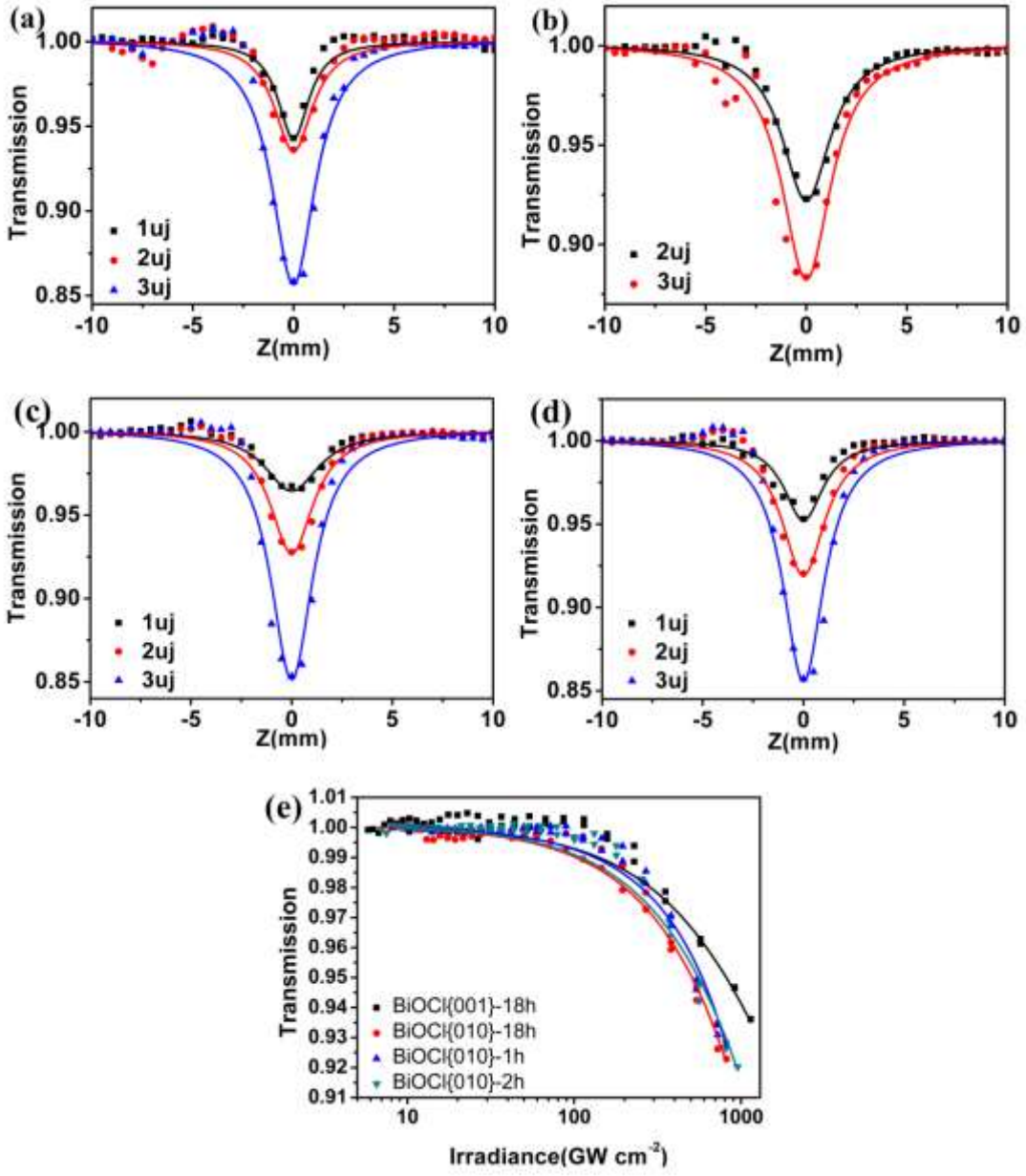

Figure S4 Z-scan results for the BiOCl samples: (a) BiOCl{001} reacted in 18h, (b) BiOCl{010} reacted in 18h, (c) BiOCl{010} reacted in 1h, (d) BiOCl{010} reacted in 2h, and (e) Normalized transmission as a function of fluence for the samples. (excitation laser = 515 nm, 340 fs)

Table S2 Linear and NLO Parameters of BiOCl single-crystal nanosheets Measured Using the Z-scan Technique.

Materials	T [%]	α_0 [cm-1]	β_{eff} [cm GW^{-1}]	Im$\chi^{(3)}$ [esu]	FOM [esu cm,×10^{-16}]
BiOCl{001}	91.97	0.837	8.17±1.13×10^{-4}	2.37±0.49×10^{-16}	2.83±0.46×10^{-16}
BiOCl{010}-18h	92.45	0.785	11.6±0.1×10^{-4}	3.36±0.03×10^{-16}	4.02±0.03×10^{-16}
BiOCl{010}-1h	91.42	0.789	10.75±1.09×10^{-4}	3.31±0.36×10^{-16}	3.69±0.40×10^{-16}
BiOCl{010}-2h	91.12	0.920	11.53±1.3×10^{-4}	3.34±0.48×10^{-16}	3.54±0.61×10^{-16}

Table S3 The physical parameters used for the fitting based on the two-photon absorber model.

Materials	Nolinear absorption	Absorber density [cm^{-3}×10^{17}]	β_{eff} [cm GW^{-1}]	Absorption cross section σ_2 [GM×10^2]
BiOCl{001}	RSA	2.31	8.17±1.13×10^{-4}	0.68±0.09
BiOCl{010}-18h	RSA	2.31	11.6±0.1×10^{-4}	0.96±0.008
BiOCl{010}-1h	RSA	2.31	10.75±1.09×10^{-4}	0.88±0.09
BiOCl{010}-2h	RSA	2.31	11.53±1.3×10^{-4}	0.96±0.11

We measured the NLO properties of different size of BiOCl{001}. As shown above, different size of BiOCl{001} samples excisted almost the same properties in the β_{eff} and other fields.

Reference

1. R. W. Boyd, *Nonlinear Optics, 2nd Edition*. 2017.