Asian Journal of Chemistry; Vol. 26, No. 6 (2014), 1827-1828

ASIAN JOURNAL OF CHEMISTRY

http://dx.doi.org/10.14233/ajchem.2014.17368

Synthesis of BiOCl Nanosheets by a Simple Ultrasonic Route†

HANGMIN GUAN

Department of Chemical and Materials Engineering, Hefei University, Hefei 230601, Anhui Province, P.R. China

Corresponding author: Tel: +86 551 2158438; E-mail: guan@hfuu.edu.cn

Published online: 10 March 2014; AJC-14909

Ternary bismuth oxyhalide (BiOX, X = F, Cl, Br, I) with layered structure have emerged as promising photocatalysts for water splitting and environmental remediation. Ultrathin BiOCl nanosheets were achieved by a simple ultrasound way. The product was characterized by XRD, SEM and TEM.

Keywords: Ultrathin, Nanosheets, BiOX, Ultrasonic.

INTRODUCTION

Recently, considerable attention has been paid to the facet-controlled fabrication of single-crystalline materials with well-defined morphologies because of their facet-dependent photoelectric, photocatalytic and other surface-related properties[1]. Ternary bismuth oxyhalide (BiOX, X = F, Cl, Br, I) with layered structure have emerged as promising photocatalysts for water splitting and environmental remediation[2]. It's believed that the internal electric fields formed between negative halogen layers and $[Bi_2O_2]^{2+}$ positive layers induced an efficient separation of photogenerated electron hole pairs and enhanced photocatalytic activity of BiOX. More interestingly, the layered-structured BiOX crystals tend to exhibit remarkable (001) facet-dependent photocatalytic properties[3]. However, most of the BiOX crystals are synthesized *via* a template or surfactant-assisted wet chemical route. There still remains a challenge to develop a simple route to prepare uniform BiOX crystals with controllable crystallographic facets[4,5]. Herein, we put forward a novel and convenient strategy to synthesize ternary bismuth oxychloride (BiOCl) ultrathin nanosheets.

EXPERIMENTAL

The BiOCl plates were successively synthesized according to the previous report[4]. Ultrathin BiOCl nanosheets were achieved by a simple ultrasound way. In a typical experiment, 10 mg BiOCl plates were dispersed in 15 mL formamide solution. The mixture was stirred for 48 h and then ultrasonicated in iced water for 6 h. A light-yellow suspension was obtained and centrifuged at 2000 rpm for 15 min to remove the non-exfoliated component. Then the obtained supernatant was collected by centrifugation at 4000 rpm and washed with deionized water to remove residual ions. The final products were then dried at 60 ºC for 4 h for further characterization.

RESULTS AND DISCUSSION

The thick BiOCl plates prepared by a hydrothermal were characterized by XRD. As shown in Fig. 1(a), all the peaks of the sample could be well indexed to the tetragonal phase of BiOCl (JCPDS No. 6-249). No characteristic peak of any other phases and impurities was observed.

As shown in Fig. 1(b), the SEM image displayed that the sample had a square-like morphology. The diameter of the square-like BiOCl plates was about several μm.

In this study, the ultrathin BiOCl nanosheets were obtained by a simple ultrasound route. The crystallinity and phase purity of the products were confirmed by XRD. As shown in Fig. 2(a), all the peaks of the sample could be well indexed to the tetragonal phase of BiOCl (JCPDS No. 6-249). No characteristic peak of any other phases and impurities is observed, indicating of the high purity of the products. The morphology of as-prepared ultrathin BiOCl nanosheets were characterized by TEM technique, as shown in Fig. 2(b). All the samples had a sheet-like morphology, which were 10-20 nm in width.

Conclusion

BiOCl nanosheets were achieved by a simple ultrasound way. The product was charactered by XRD and SEM. The

†Presented at The 7th International Conference on Multi-functional Materials and Applications, held on 22-24 November 2013, Anhui University of Science & Technology, Huainan, Anhui Province, P.R. China

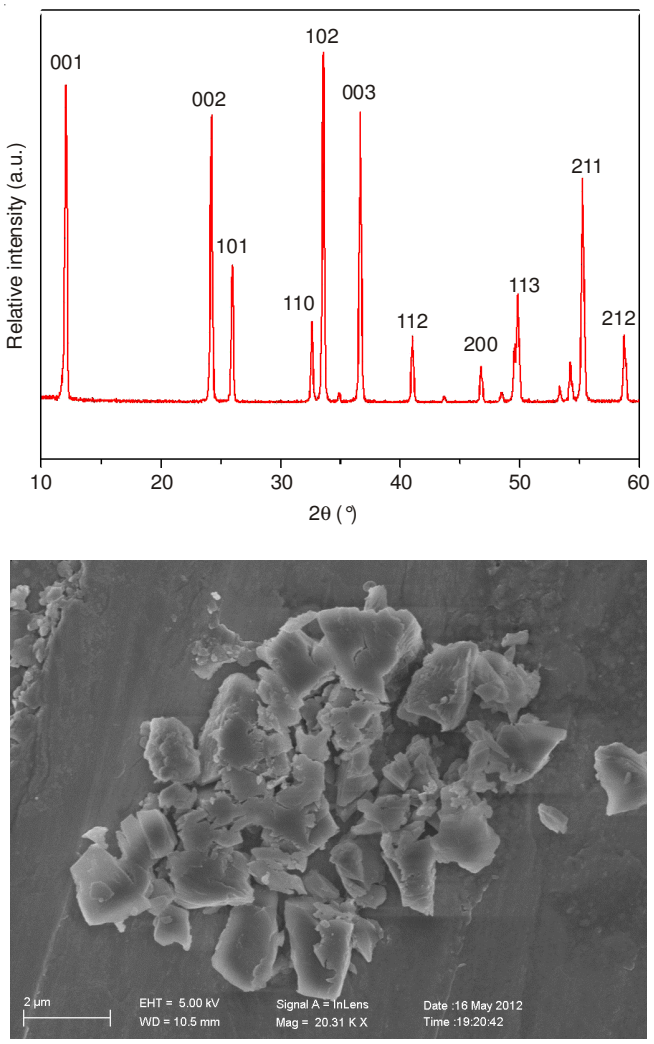

Fig. 1. (a) XRD pattern and (b) High-magnication SEM image of the BiOCl

result indicated that the samples had a sheet-like morphology, which is 10-20 nm in width. The method may be a good way to synthesize other nanosheets such as BiOBr and BiOI.

ACKNOWLEDGEMENTS

This work was supported by Natural Science Foundation of Anhui Education of China (KJ2013B227).

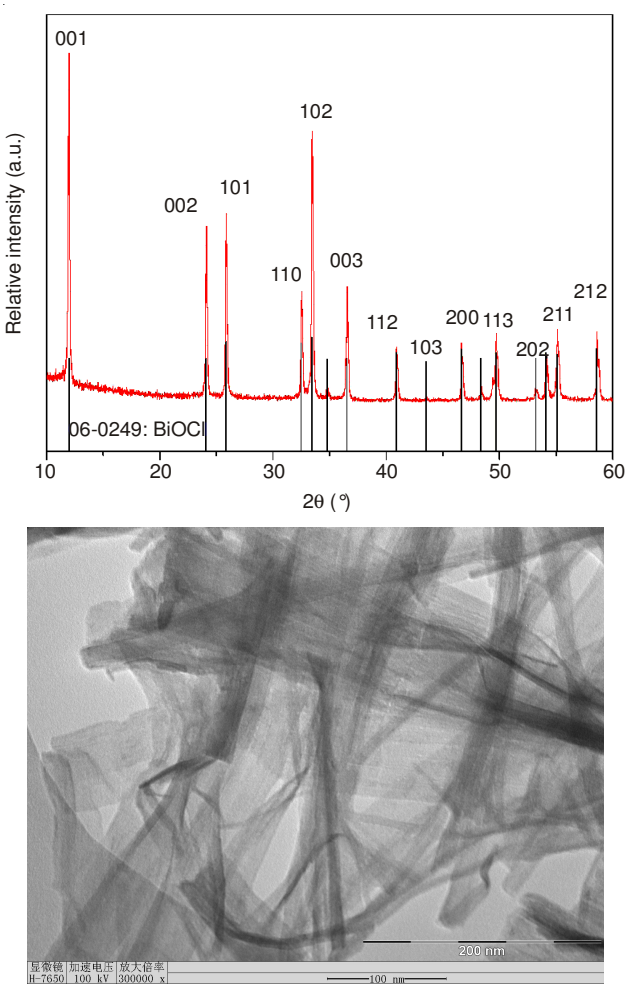

Fig. 2. (a) XRD pattern, (b) TEM image of the as prepared ultrathin BiOCl nanosheets

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