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Filling foaming agent into stacked layers: rapid synthesis of graphitic carbon nitride nanosheets decorated with ultrafined MX_Y ($X=\text{O}, \text{S}$) nanoparticles for enhanced photoresponsive abilities

Xi Zhang,[‡] Yaya Chang,[‡] Xiaoxia Jian, Zhida Gao,^{*} Yan-Yan Song^{*}

College of Sciences, Northeastern University, Shenyang 110004, China

^{*}Corresponding author. E-mail: gaozd@mail.neu.edu.cn, yysong@mail.neu.edu.cn

[‡] Xi Zhang and Yaya Chang contributed equally to this work.

Abstract

Exfoliation of graphitic carbon nitride ($\text{g-C}_3\text{N}_4$) into ultra thin nanosheets is usually the first step for its perspective applications. In contrast to the traditional time-consuming ultrasonication approach, a rapid and high-yield method to synthesis $\text{g-C}_3\text{N}_4$ nanosheets is desirable. In this study, we develop an efficiency and versatile strategy to exfoliate bulk $\text{g-C}_3\text{N}_4$ into 2D ultrathin nanosheets by combining foaming agent inserting with microwave digestion method. The proposed method significantly reduces the exfoliation time and can be further utilized to produce metal oxides (MO_Y) or metal sulfide (MS_Y) decorated $\text{g-C}_3\text{N}_4$ nanosheets. The as-formed ultra fined ZnO nanocrystals decorated $\text{g-C}_3\text{N}_4$ nanosheets ($\text{ZnO/g-C}_3\text{N}_4$) exhibit excellent solubility and dual-emission optical property, which can be served as fluorescence probes for metal ion sensing. The resulted CdS/ $\text{g-C}_3\text{N}_4$ decorated nanosheets demonstrate efficient photocatalytic properties, having great potentials in photodegradation application. This protocol can be a general strategy for the synthesis of $\text{g-C}_3\text{N}_4$ nanosheets as well as attractive in preparing a lot of functional hybrid nanosheets for future applications in sensing probes, solar cells, photoelectrical devices and water treatment.

Keywords: $\text{g-C}_3\text{N}_4$ nanosheets; exfoliation; foaming agent; dual-emission fluorescence; photocatalytic activity

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