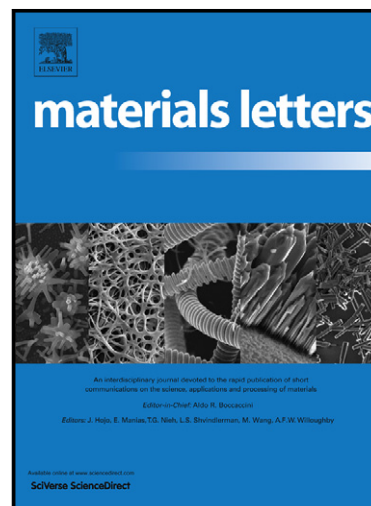


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PII: S0167-577X(14)01621-8  
DOI: <http://dx.doi.org/10.1016/j.matlet.2014.08.144>  
Reference: MLBLUE17665

To appear in: *Materials Letters*

Received date: 20 July 2014

Accepted date: 27 August 2014

Cite this article as: Ying Wang, Jia Yang, Wenliang Gao, Rihong Cong, Tao Yang, Organic-free Hydrothermal synthesis of chalcopyrite  $\text{CuInS}_2$  and its photocatalytic activity for nitrate ions reduction, *Materials Letters*, <http://dx.doi.org/10.1016/j.matlet.2014.08.144>

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# Organic-free hydrothermal synthesis of chalcopyrite CuInS<sub>2</sub> and its photocatalytic activity for nitrate ions reduction

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## Abstract

We performed a facile and organic-free hydrothermal method (thiourea-oxalic acid co-molten system) to prepare chalcopyrite CuInS<sub>2</sub> nano-crystallite. Its intrinsic photocatalytic activities to nitrate reduction in aqueous solutions was investigated in comparison to bulk CuInS<sub>2</sub> prepared by annealing Cu<sub>2</sub>S and In<sub>2</sub>S<sub>3</sub> at 600-750 °C under vacuum. All samples show good and similar photocatalytic activities for nitrate reduction, for example, the conversion rate is about 2 times of that in a blank experiment. All CuInS<sub>2</sub> catalysts were stable after the photocatalytic reactions, indicated by the identical XRD patterns before and after the reaction.

**Keywords:** Chalcopyrite; CuInS<sub>2</sub>; nanocrystalline materials; electron microscopy; photocatalysis; nitrate reduction.

## 1. Introduction

Chalcopyrite CuInS<sub>2</sub> is an important narrow band semiconductor ( $E_g = 1.5$  eV). People devoted a lot of efforts to develop morphology-controllable synthetic methods, however mostly involving organic reagents. [1-6] For example, the well-known hot-injection approach was reported in 2008 to prepare nearly monodisperse Cu-In-S nanocrystals (NCs) with either chalcopyrite or wurtzite structure. [1] A solvothermal route using triethylene glycol as the reaction medium was applied to prepare CuInS<sub>2</sub> hierarchical microarchitectures. [2] Monodisperse CuInS<sub>2</sub> NCs can be produced by injecting mixed metal-oleate precursors into hot organic solvents. Here we use a thiourea-oxalic acid mixed system to perform an

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