

Author's Accepted Manuscript

Simultaneous regulation of electrical and thermal transport properties in CuInTe_2 by directly incorporating excess ZnX ($X = \text{S}, \text{Se}$)

Yubo Luo, Qinghui Jiang, Junyou Yang, Weixin Li, Dan Zhang, Zhiwei Zhou, Yudong Cheng, Yangyang Ren, Xu He, Xin Li



PII: S2211-2855(16)30588-2
DOI: <http://dx.doi.org/10.1016/j.nanoen.2016.12.023>
Reference: NANOEN1674

To appear in: *Nano Energy*

Received date: 7 September 2016
Revised date: 1 December 2016
Accepted date: 13 December 2016

Cite this article as: Yubo Luo, Qinghui Jiang, Junyou Yang, Weixin Li, Dan Zhang, Zhiwei Zhou, Yudong Cheng, Yangyang Ren, Xu He and Xin Li, Simultaneous regulation of electrical and thermal transport properties in CuInTe_2 by directly incorporating excess ZnX ($X = \text{S}, \text{Se}$), *Nano Energy*, <http://dx.doi.org/10.1016/j.nanoen.2016.12.023>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Simultaneous regulation of electrical and thermal transport properties in CuInTe₂ by directly incorporating excess ZnX (X = S, Se)

Yubo Luo, Qinghui Jiang, Junyou Yang*, Weixin Li, Dan Zhang, Zhiwei Zhou, Yudong Cheng, Yangyang Ren, Xu He, Xin Li

State Key Laboratory of Materials Processing and Die & Mould Technology, Huazhong University of Science and Technology, Wuhan 430074, P. R China

jyyang@mail.hust.edu.cn

Abstract

Developing high thermoelectric performance CuInTe₂ based materials is technologically and environmentally intriguing, in order to achieve this, nanoscale heterostructure barrier blocking is proposed and adopted in this work by directly incorporating excess ZnX (X=S, Se) to regulate the electrical and thermal transport properties of CuInTe₂. The results prove that part of the ZnX dissolves into the CuInTe₂ matrix during the hot press process while the residual ZnX acts as a nanoscale heterostructure barrier blocking for both the hole and phonon. As a consequence, three thermoelectric parameters of the CuInTe₂ have been optimized simultaneously by this approach, owing to the formation of Zn_{in} point defects to improve carrier concentration, the concurrent hindering to the minority carriers resulting from the energy level difference between matrix and nano-heterostructure to enhance the Seebeck coefficient, and intensive phonon scattering by the nanoscale heterostructure barrier blocking to reduce the thermal conductivity. Eventually, a 90% enhanced ZT value of 1.52 has been obtained in the 6 wt.% ZnS added CuInTe₂ sample.

Keywords: thermoelectrics, CuInTe₂, ZnS, ZnSe, nanoinclusions, barrier blockings

Introduction

The ever-growing energy demands and depleting of traditional fossil fuels have stimulated great interest in thermoelectric materials and devices due to their potential application in power generation and solid-state cooling. In general, the efficiency of a TE material is

Download English Version:

<https://daneshyari.com/en/article/5452094>

Download Persian Version:

<https://daneshyari.com/article/5452094>

[Daneshyari.com](https://daneshyari.com)