

Accepted Manuscript

Chemical crystallographic investigation on Cu₂S-In₂S₃-Ga₂S₃ ternary system

A. Thomere, C. Guillot-Deudon, M.T. Caldes, R. Bodeux, N. Barreau, S. Jobic, A. Lafond



PII: S0040-6090(18)30588-1
DOI: doi:[10.1016/j.tsf.2018.09.003](https://doi.org/10.1016/j.tsf.2018.09.003)
Reference: TSF 36859

To appear in: *Thin Solid Films*

Received date: 15 June 2018
Revised date: 3 September 2018
Accepted date: 3 September 2018

Please cite this article as: A. Thomere, C. Guillot-Deudon, M.T. Caldes, R. Bodeux, N. Barreau, S. Jobic, A. Lafond, Chemical crystallographic investigation on Cu₂S-In₂S₃-Ga₂S₃ ternary system. Tsf (2018), doi:[10.1016/j.tsf.2018.09.003](https://doi.org/10.1016/j.tsf.2018.09.003)

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 proof before it is published in its final 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.

Chemical crystallographic investigation on Cu_2S - In_2S_3 - Ga_2S_3 ternary system

A. Thomere ^{a,b,c}, C. Guillot-Deudon ^a, M. T. Caldes ^a, R. Bodeux ^{b,c}, N. Barreau ^a, S. Jobic ^a and A. Lafond ^{*a},
^a *Institut des Matériaux Jean Rouxel, Université de Nantes, CNRS, 2 rue de la Houssinière, BP 32229, 44322 Nantes cedex 3, France*
^b *EDF R&D, 30 Route Départementale 128, 91120, Palaiseau, France*
^c *Institut Photovoltaïque d'Île-de-France (IPVF), 30 Route Départementale 128, 91120, Palaiseau, France*
^{*}E-mail: Alain.Lafond@cnrs-imm.fr

Keywords:

Copper indium gallium sulfide, phase diagram, Crystal Structure, Copper-poor

Abstract

Sulfide chalcopyrites $\text{Cu}(\text{In,Ga})\text{S}_2$ (CIGS) have been proposed as top cell for tandem solar devices with silicon as bottom cell. In that context, the knowledge of the Cu_2S - In_2S_3 - Ga_2S_3 pseudo-ternary system is of prime importance. This study presents an overall investigation of this system on the basis of a chemical crystallographic approach on bulk materials. Particular attention was paid on the copper-poor side of the so-called stoichiometric CuInS_2 - CuGaS_2 line. Based on our investigations, it turns out that the sulfide CIGS system is much more structurally complex than the selenide $\text{Cu}(\text{In,Ga})\text{Se}_2$ one (CIGSe). Especially, the adaptability of the chalcopyrite structure towards Cu deficiency is significantly lower for the sulfides than for the selenide counterparts. Correlatively, a large 2-phase domain exists between the CuInS_2 - CuGaS_2 line and the very copper-poor region ($\text{Cu}(\text{In,Ga})_3\text{S}_5$ and $\text{Cu}(\text{In,Ga})_5\text{S}_8$). Additionally, the crystal structures of these very copper-poor compounds contain $[\text{InS}_6]$ octahedra and then are totally different than the chalcopyrite structure. These features could explain why CIGS-based-solar cells are, up to now, less efficient than the CIGSe ones.

1. Introduction

In the last decades, photovoltaic industry has grown rapidly and power conversion efficiency of several technologies approach now the Shockley Queisser (SQ) limit (e.g. over 26 % for silicon solar cell [1]). To overpass the SQ limit, tandem solar cells in which a wide

Download English Version:

<https://daneshyari.com/en/article/10147652>

Download Persian Version:

<https://daneshyari.com/article/10147652>

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