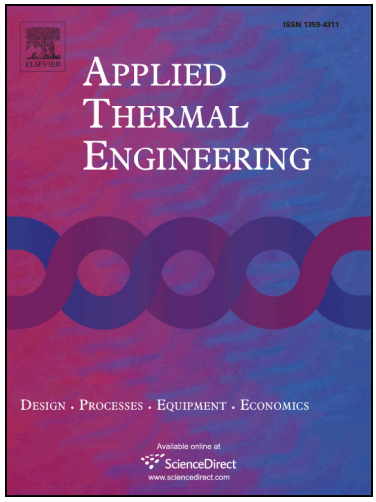

Development and studies of $Cd_{1-x}Mg_xTe$ thin films with varying band gaps to understand the Mg incorporation and the related material properties

Roger C. Palomera, Omar S. Martínez, J. Pantoja-Enriquez, N.R. Mathews, Martín G. Reyes-Banda, B. Krishnan, X. Mathew

PII: S1359-4311(16)32765-X
DOI: http://dx.doi.org/10.1016/j.applthermaleng.2016.10.163
Reference: ATE 9365

To appear in: *Applied Thermal Engineering*

Received Date: 25 February 2016
Revised Date: 25 October 2016
Accepted Date: 25 October 2016

Please cite this article as: R.C. Palomera, O.S. Martínez, J. Pantoja-Enriquez, N.R. Mathews, M.G. Reyes-Banda, B. Krishnan, X. Mathew, Development and studies of $Cd_{1-x}Mg_xTe$ thin films with varying band gaps to understand the Mg incorporation and the related material properties, *Applied Thermal Engineering* (2016), doi: http://dx.doi.org/10.1016/j.applthermaleng.2016.10.163

Development and studies of $Cd_{1-x}Mg_xTe$ thin films with varying band gaps to understand the Mg incorporation and the related material properties

Roger C. Palomera[1, 2, §], Omar S. Martínez[3], J. Pantoja-Enriquez[4], N. R. Mathews[1], Martín G. Reyes-Banda[1], B. Krishnan[5], X. Mathew[1,*]

[1] Instituto de Energías Renovables, Universidad Nacional Autónoma de México, Temixco, Morelos 62580, México

[2] Universidad Politécnica de Chiapas, Calle Eduardo J. Selvas s/n, Colonia Magisterial. C.P. 29082, Tuxtla Gutiérrez, Chiapas, Mexico

[3] Universidad Popular de la Chontalpa (UPCH), Carretera Cárdenas - Huimanguillo Km. 2.0.Cárdenas, Tabasco C.P. 86500, México

[4] Centro de Investigación y Desarrollo Tecnológico en Energías Renovables, UNICACH, Libramiento Norte No 1150, Tuxtla Gutiérrez, Chiapas 29039, México.

[5] Universidad Autonoma de Nuevo Leon, Facultad de Ingeniería Mecánica y Eléctrica, San Nicolas de los Garza, Mexico

* Corresponding author (X. Mathew), e-mail: xm@ier.unam.mx

§ e-mail: rcp@ier.unam.mx

Abstract:

In this paper we report a systematic work involving the development of $Cd_{1-x}Mg_xTe$ thin films by co-evaporation of CdTe and Mg. The evaporation rate of both materials were adjusted to obtain ternary films of varying stoichiometry and hence the band gap. We have deposited films with band gap ranging from 1.47 to 2.41 eV. The films were characterized for structural, morphological, optical, opto-electronic, and spectroscopic properties. The film stoichiometry was studied across the thickness using SIMS data. SEM images showed that the grain size has a dependence on Mg content in the film, which inhibits the grain growth. The structural parameters showed a systematic dependence on Mg content in the film, however, there was no noticeable change in the XRD reflections with respect that of pure CdTe for lower concentrations of Mg. XPS analysis shed light on the incorporation of Mg further supporting the band gap variations observed with the UV-Vis spectroscopic studies. The photoresponse of the film was affected by Mg incorporation. **Prototype devices of the type $Cd_{1-X}Mg_xTe$/CdS were fabricated and the results are discussed.**