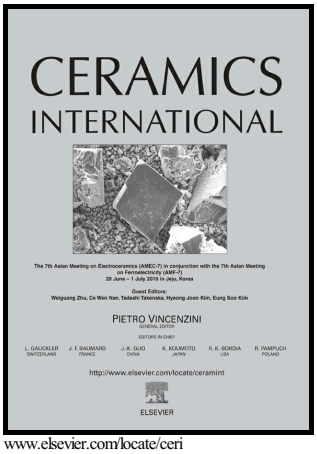

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PII: S0272-8842(18)31314-2
DOI: https://doi.org/10.1016/j.ceramint.2018.05.167
Reference: CERI18342

To appear in: *Ceramics International*

Received date: 28 April 2018
Revised date: 18 May 2018
Accepted date: 19 May 2018

Cite this article as: Yu Zhang, Dongyue Jiang, Yingrui Sui, Yanjie Wu, Zhanwu Wang, Lili Yang, Fengyou Wang, Shiquan Lv and Bin Yao, Synthesis and Investigation of environmental protection and Earth-abundant Kesterite $Cu_2Mg_xZn_{1-x}Sn(S,Se)_4$ thin films for Solar Cells, *Ceramics International,* https://doi.org/10.1016/j.ceramint.2018.05.167

Synthesis and Investigation of environmental protection and Earth-abundant Kesterite $Cu_2Mg_xZn_{1-x}Sn(S,Se)_4$ thin films for Solar Cells

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Abstract

We have synthesized $Cu_2Mg_xZn_{1-x}Sn(S,Se)_4$ ($0 \le x \le 0.6$) thin films by a facile sol-gel method, and studied the influence of Mg concentration on the crystal structure, surface morphology and photoelectric performance of $Cu_2Mg_xZn_{1-x}Sn(S,Se)_4$ thin films systematically. It was shown that the smaller Zn^{2+} in Kesterite phase $Cu_2ZnSn(S,Se)_4$ will be replaced by larger Mg^{2+}, forming uniform pure phase $Cu_2Mg_xZn_{1-x}Sn(S,Se)_4$. The band gap of $Cu_2Mg_xZn_{1-x}Sn(S,Se)_4$ films can be adjusted from 1.12 to 0.88 eV as the x value changes from 0 to 0.6. Furthermore, the $Cu_2Mg_xZn_{1-x}Sn(S,Se)_4$ thin films with large grain size, smooth surface and less grain boundaries was obtained at an optimized condition of x=0.2. The carrier concentration of $Cu_2Mg_xZn_{1-x}Sn(S,Se)_4$ thin film reaches the maximum 6.47×10^{18} cm^{-3} at x=0.2, which is a potential material to be the absorption layer of high efficiency solar cells.

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