Absorber properties and device characteristics of a 16 % efficiency solar cell based on $Cu(In,Ga)S_2$/CdS heterojunction

N. Barreau (1), E. Bertin (1,2), O. Durand (2), Th. Lepetit (1), A. Rockett (3), A. Crossay (4), L. Arzel (1), S. Harel (1), L. Assmann (1), D. Lincot (4)

Affiliations:

(1) Université de Nantes, CNRS, Institut des Matériaux Jean Rouxel, IMN, F-44000 Nantes, France
(2) Université de Rennes, INSA Rennes, CNRS, Institut FOTON - UMR 6082, F-35000 Rennes, France
(3) Colorado School of Mines, 1500 Illinois St., Golden CO 80401, USA
(4) CNRS UMR 9006 IPVF, 18 Boulevard Thomas Gobert, 91120 Palaiseau, France

The interest for $CuIn_{1-x}Ga_xS_2$ (CIGS) thin film based solar cell has recently been boosted by its possible use as top cell in tandem structures thanks its tunable band gap from 1.5 through 2.4 eV with increasing x. However, the performances of devices made from sulfide absorbers remain far below their selenide counterparts. The reasons for the limited performance of $Cu(In,Ga)S_2$ cells and particularly their low output voltage compared to theoretical predictions are multiple and cross-linked.

Recently, we as well as other research groups have demonstrated that cells based on CIGS films synthesized following the so called 3-stage process can reach efficiencies above 14 %. Further investigation of the crystalline structures formed during CIGS growth showed the co-existence and spatial segregation of numerous phases during the second stage of the growth process. These observations drove us to the development an alternative process, accounting for enlightened solid state chemistry issues.

The present contribution first aims at presenting the route followed to achieve the record cell efficiency of 16 % (in-house measurement, sent for certification). Second, some optoelectronic characteristics of this device will be shown. Finally, diverse options to further increase the performance of wide gap CIGS-based solar cells will be discussed.

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