

# PROCESSES FOR PREPARING CHALCOPYRITE-TYPE COMPOUNDS SUCH AS $\text{CuInS}_2$

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## BACKGROUND

The (I-III-VI<sub>2</sub>) compound semi-conductors have very interesting electrical and optical properties, which can be exploited for use in various fields. Chalcopyrite semi-conductors, most particularly  $\text{Cu(In,Ga)Se}_2$  (CIGS), has been used extensively in solar cell technologies for its following characteristics: (i) band-gap energy at room temperature (1.0 - 1.7 eV) and (ii) high absorption coefficient (i.e. photons can be absorbed within very short distances), which leads to relatively high device conversion efficiencies (up to 13 % for modules). Typically, chalcopyrite films are prepared via rapid thermal sintering of  $\text{Cu(In,Ga)(S or Se)}_2$  [called CIGS] layers evaporated on molybdenum-coated substrates and is therefore costly.

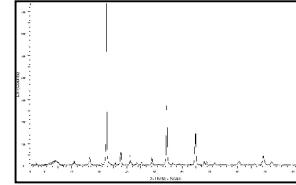
## TECHNOLOGY

The technology entails synthesis of very pure nanosized binary, tertiary and quaternary chalcopyrite particles ( $\text{CuInS}_2$ ,  $\text{AgInS}_2$ ) through a simple colloidal route using very mild conditions (room temperature and atmospheric pressure). This method constitutes an important technical breakthrough as  $\text{CuInS}_2$  is very difficult to obtain with such a high crystallinity using the costly conventional methods.

## COMPETITIVE ADVANTAGES

- Cheap, non toxic and functions at room temperature and atmospheric pressure
- Particle size can be varied by changing the reaction time

- Material crystallinity is strongly dependent upon the temperature and time of annealing (see Fig. below)



**Legend:** X-Ray Diffraction of  $\text{CuInS}_2$  particles synthesized at room temperature and annealed at 500° C

## APPLICATIONS

Absorption layer in chalcopyrite based solar cells.

## PATENT STATUS

Inventors: Benoît Marsan and Amer Hammami  
Patents:

US 7591990  
CA 2,604,495

## BUSINESS OPPORTUNITY

Partnering/licensing opportunities

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