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Optimization of the Parameters of Elaboration of the Quaternary Chalcopyrite $CuInGaSe_2$ for Photovoltaic Applications

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Abstract:

Researches on solar cells with a basis of chalcopyrite structure materials have shown a major interest in photovoltaic conversion. They are carried out at low cost with a yield of more than 19%. These materials have a power of absorption much more important than that of silicon. The result is a less quantity of useful material, and a significant reduction in manufacturing costs.

This work is entered in the framework of the elaboration and the study of the quaternary $CuInGaSe_2$ compound, for the purpose of deposit it as an absorbent layer in the manufacture of solar cells. The elaboration parameters have been optimized. These parameters are consisting essentially of temperature and duration steps of heating, melting, crystallization and cooling.

A scanning electron microscopy (SEM), associated to an energy dispersive spectrometry (EDS) were used to execute a quantitative study of the chemical elements of the $CuInGaSe_2$ compound, obtained after optimization of the elaboration parameters. This study has shown us that this compound presents a good stoichiometry.

The analyses by X-ray diffraction have enabled us to study the crystalline structure of the quaternary elaborated and determine the different plans of crystallization. The preferred orientation following the plan (112) has been obtained. From the X-rays spectrum, we have calculated the mesh parameters a and c, the ratio c/a has been found close to 2.

These analyses have shown us that the $CuInGaSe_2$ compound obtained is polycrystalline and has a chalcopyrite structure.