

Investigation of the feasibility of Atomic Layer Deposition of CuInS_2 as absorber for thin films solar cells

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Abstract:

Atomic layer deposition (ALD) has gained a great interest in the recent years in the field of photovoltaic applications, in particular in cadmium-free materials for buffer layers in CIGS based solar cells^{[1],[2],[3]}. So far, very few studies on the deposition of the CuInS_2 (CIS) absorbers have been done by this method^{[4],[5]}. The aim of this study is the investigation of the feasibility of preparing thin layer of CIS by this method for making a complete solar cell by ALD.

First, we tried to grow directly a thin layer of CuInS_2 by ALD on glass and molybdenum substrates using chloride precursors for Indium and Copper and Hydrogen sulphide for sulphur at different deposition temperatures. We also studied the precursor temperature and the pulses duration. Composition, optical and physical properties of these films were studied.

In a second stage, we studied the insertion of the copper into a Indium sulphide layer to form a layer of CuInS_2 and control the stoichiometry of the films. A study of the properties of these films have been also done.

These studies show that there is a competition between different chemical reactions in the ALD chamber. In particular, it appears that the copper chloride reacts strongly with the indium sulphide to form copper sulphide by a displacement reaction, resulting to a strong indium depletion in the final layer. Strategies for solving this issue will be presented.

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