OPTIMIZATION OF CBD-CdS PROCESS FOR $Cu(In,Ga)Se_2$ MONOGRAIN LAYER SOLAR CELLS

SUMMARY

MEHMET ENDER USLU

In this study, firstly five different Cd sources were experimented on the monograin membranes at 55 °C for different times, in order to compare their thickness and also the effect of buffer structure on the monograin layer (MGL) solar cell performance. The microstructure of CdS on monograins and the evolution of average thickness of each buffer layer deposited from a different cadmium source were characterized by SEM. Then after, the current-voltage measurements (I-V) were performed to evaluate the main characteristics of solar cells with different buffer layers.

After first investigations, the cadmium sulfate as a source of cadmium in CBD was selected for the post-annealing experiments. In the second part of thesis, the effect of post-annealing of $CdS/Cu(In,Ga)Se_2$ in air was systematically investigated on the performance of monograin layer solar cells. CIGSe powder crystals covered with CdS were post-annealed in an air environment at temperatures between 150 - 300 ^{o}C for different time periods. Room- temperature (RT) Raman and photoluminescence spectroscopy (RT-PL) were used to identify any change in structural or optical properties of CdS buffer layer. XPS was used to study the air-annealing effect on the chemical composition of the surface of the CdS and on the heterojunction interface.

This thesis is divided into three main chapters. Following the introduction, the literature review includes an overview of the theory and principles of solar cell and the historical progression of photovoltaics, also a summary of absorber and buffer layer properties. The experimental part briefly describes the synthesis of monograin powders and gives an overview of parameters, which were used for CdS buffer layer deposition and for post-treatment experiments. The third part is divided into two sections of which first includes the results and discussion of the effect of different Cd sources on the CdS films properties and solar cell performance. In the second section, the results of the $CdS/Cu(In,Ga)Se_2$ post-annealing experiments are presented.