GROWTH AND ELECTRICAL PROPERTIES OF CdS-SiO_2-Si STRUCTURES

by

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(Rajendra Kumar Nahar)

ABSTRACT

In the present dissertation growth and electrical properties of CdS-SiO_2-Si structures are investigated in detail. It is shown that the introduction of a thin interfacial layer between CdS and Si yields improved and reproducible device characteristics compared to those from conventional CdS-Si heterojunctions. The device characteristics particularly, the reverse I-V characteristics, improves significantly by annealing in an optimised cycle. The effect of film CdS resistivity, substrate Si resistivity and oxide thickness are studied on the I-V and C-V characteristics of the CdS-SiO_2-Si structures.

The structure is fabricated typically on a p-type 1-10 ohm cm resistivity Si substrate. Thin 30-40 Å -oxide layer is grown by the solution growth method. Subsequently high resistivity CdS film is deposited using coevaporation technique. Ohmic contacts are formed by evaporated Al electrodes.

The I-V characteristics of the structure exhibit leakage current of about 10 uA at 15 Volts reverse bias. The breakdown voltage is typically around 35 volts. The leakage current increases as the CdS film resistivity is lowered in the structure. Forward current is affected in the low voltage region by the oxide layer, annealing and CdS film resistivity.

The C-V characteristics reveal that the structure behave essentially as an one sided abrupt junction.

Transitions at 1 volt and 5 volts reverse bias are the features of the C-V characteristics.

The observed results have been interpreted using the existing heterojunction models. Qualitatively the functional dependence of the I-V characteristics is explained. The C-V characteristics are partially explained.

The main contributions presented in the thesis are:

1. Growth of CdS film on passivated silicon substrate of controlled resistivity by co-evaporation technique.
2. The passivated SiO_2 layer helps in getting strikingly reproducible heterojunction structures (CdS-SiO_2-Si), with improved and sharply defined breakdown characteristics.
3. The devices give greater opportunity to put to test the existing heterojunction models.
4. The correlation between the experiment and theory suggests the future line of work in the above area.

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