SWITCHING DIODE ON THE BASE OF CdS FILMS

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ABSTRACT

MOS - structures on the base of CdS films prepared by the method of deposition from solution on heat substrate. It was established from current voltage ($I-V$) characteristics, that switching effect with stable and reproduced low and high-conductivity states takes place. On basis this switching diode development of the one-vibrator.

Keywords: structures, switching, one-vibrator, switching, effect.

I. INTRODUCTION

The intensive development of solid state electronics stimulates the investigation of the physical properties of complex semiconductors with different defect degree and the range of their functional applications.

As reported earlier, in several works some characteristics CdS films have been described [$1 \div 6$].

II. EXPERIMENT AND DISCUSSION

In this paper the preparation of CdS films, their electro-physical and contact properties have been investigating.

The CdS films deposited on aluminium substrates, by method of chemical deposition, from aqueous solution, containing, cadmium chloride ($Cd\ Cl_2$), thiourea ($(NH_2)_2CS$) and a complexing agent. The films were characterised by spectral, x-ray diffraction, and chemical analyses. X -ray patterns showed that CdS films were single – phase and had a hexagonal structure. The grain size, evaluated by scanning electron microscopy, ranged from 1230 to 1900 Å. Samples fitted with current leads in a planar configuration, with a contact separation of ~ 2 mm.

MOS – structures on the base of CdS Al -Al_2O_3– -CdS were prepared by the method of deposition of from solution on heat substrate.

The $I-V$ characteristic is linear at low voltages and is characterized by hysteresis at high voltages. It was established from current–voltage characteristics, that switching effect with stable and reproduced low and high–conductivity states takes place (fig.1).

The volt-ampere characteristics of really Schottky diodes is given by

$$I = I_0 \exp(qv/nkT)[1-\exp(-qv/kT)]$$

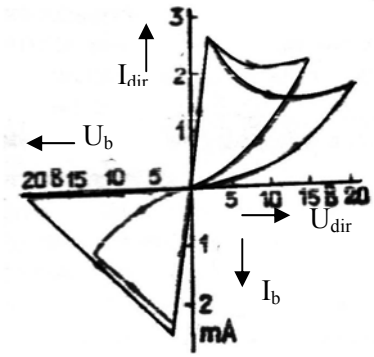

Fig.1. The $I-V$ characteristics.

At direct direction, $I_{dir} = I_0 \exp(qv/nkT)$, where applied voltage $v \geq 3kT/q$, n - is the coefficient of ideality, for our samples. $n = 2 \div 3$, I_0 - is the saturation current.

$$I_0 = AT^2 \exp(-q\varphi_B/kT)$$

The curve of $\ln I - V$ dependence is linear, for our samples. And $\ln I_0$ has been determined by crossing of this straight line with vertically axis. The measurements of $I-V$ characteristic lines in the several range of temperatures governs the I_0, as function T. The dependence $\ln(I_0/T^2) \sim 1/T$ agree with the theory of thermoelectron emission. The curve of this dependence has a linear character.

For structure Al - Al_2O_3 – CdS at $T < 250K$ characteristic is, stable linear, tunnel processes are dominate and when $T > 250K$, I_{dir} increasing of

voltage, emission–recombination mechanisms of current transport take place (fig.2).

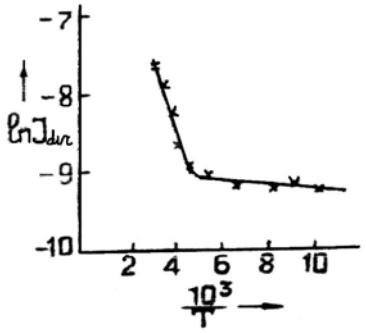

Fig.2. Dependence $\ln I_{dir} \sim 10^3 / T$ for Al–Al_2O_3–CdS structure.

On basis of the switching diode development of the one–vibrator. The purpose of development is improvement of parameters of the one–vibrator 's target signal. The one–vibrator contains the semiconductor diode - D with the self–recovering characteristic and the time setting RC – circuit (fig.3).

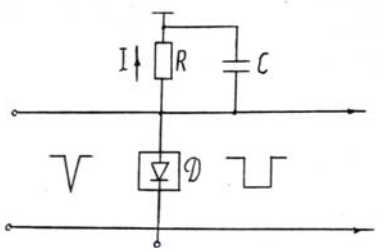

Fig.3. The circuit of the one-vibrator.

This development can find application in the field of computing and pulsing engineering for formation of rectangular pulses in pulsing and switching devices.

III. CONCLUSION

By method of chemical deposition from solution on heat aluminium substrate preparation of CdS films and MOS – structures Al - Al_2O_3 – CdS. Analysis showed, that CdS films were single–phase and had a hexagonal structure.

It was established from current-voltage characteristics, that switching effect with stable and reproduced low and high-conductivity states takes place.

Temperature dependence switching phenomena and the conduction mechanism is discussed and can find application, as one-vibrator.

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