INTERNATIONAL JOURNAL ON HUMAN COMPUTING STUDIES

www.journalsresearchparks.org/index.php/IJHCS e-ISSN: 2615-8159|p-ISSN: 2615-1898

Volume: 03 Issue: 2 March-April2021

Chalcogenideth in Films with Micro Transitions

Naymanboyev Raxmonali[1]

Docent, TATU Fergana branch, Uzbekistan

Yuldashev Abror Abduvositovich[2]

Teacher, Fergana State University, Uzbekistan

Yuldashev Shohjahon Abrorovich[3]

Doctoral student, Fergana State University, Uzbekistan

Yuldasheva Shahrizoda Abrorjon qizi[4]

Bachelor, Fergana State University, Uzbekistan

Email: yshohjahon@list.ru

--***--

Abstract: This paper presents the results of studies of thin films of chalcogenides with in homogeneities of the microp-n-transition type. The current-voltage dependence (I (V)) is obtained and the analysis is carried out in some special cases. Super linear and super linear regions of the I (V) dependence are found. It is shown that the super linear region of the dependence means that the recombination losses of the injection current in the pandn-regions make up a small fraction of the saturation current of a single transition. The linear region of the I (V) dependence at the origin of coordinates depends on the degree of shunting of micro-junctions.

Keywords: Thin film, chalcogenides, p-n-junction, in homogeneities, multilayer structure, saturation current, current-voltage dependence, recombination losses, shunting, leakage resistance.

INTRODUCTION

In specially prepared thin films of chalcogenides, in homogeneities of the microp-n-transition type are systematically observed [1].

The oretical and experimental studies [2] show that such chalco genide thin films are a longitudinal arranged multilayer chain of electron-hole transitions and aphotovoltaically inactivebutroto-conducting "volume" of the films huntingit. According to the theory [2, 3], for such a system, the current-voltage dependence can be represented as follows,

$$I = I_S \frac{\frac{V}{R_{sh} I_S} - \frac{aB}{I_S} - 1 + \left[(1+a)\frac{aB}{I_S} + (1-\alpha)\frac{V}{R_{sh} I_S} + 1\right] expA}{1 + (1-\alpha) \cdot expA} \quad (1)$$

$$A = \frac{2q}{N_{kT}} \left\{ V - R\left[(2-a)\left(I - \frac{V}{R_{sh}}\right) + aB(\eta - \alpha)\right]\right\},$$

I_s-currents at uration of transitions, R_{sh}-shuntresistance,

B-lightintensity, α-transfer coefficient,

R - Seriesresistance

The saturation currents of the transitions are the same, the photo currents are different, there is no compensation for the photo currents,, a-coefficient, which has the meaning of the photo sensitivity of the transitions [5].

Expression (1) is the dependence of the current-voltage regularity of a multilayerchalcogenide thin film with micro junctions. It does not take into account the leakage resistance of the microvias.

However, expressions (1) ingeneral formare difficult to analyze. Therefore, we will consideritinsomespecial cases.

I. Dark current-voltage dependence

If the intensity of the incident light on the film is in finitely small, then the shunting effect of the photo conductive "volume" can be ignored. In this case, a

RESEARCH PARKS
INTERNATIONAL JOURNAL ON HUMAN COMPUTING STUDIES
www.journalsresearchparks.org/index.php/IJHCS e-ISSN: 2615-8159|p-ISSN: 2615-1898
Volume: 03 Issue: 2 March-April2021

complex problem is considered much simplified and expression (1) takes the form [3].

$$I = I_S \frac{exp\left\{\frac{2a}{NkT}[V - RI(2-\alpha)]\right\} - 1}{1 + (1-\alpha)exp\left\{\frac{2q}{NkT}[V - RI(2-\alpha)]\right\}} \quad (2)$$

If, the length of the micro photo cells, the length of the base layer is small compared to the diffusion length W <Loftheminority carriers, then the microvias become inter connected. For such a homogeneous model of interconnected p-nandn-transitions, the expression takes the following form:

$$I = I_S exp\left\{\frac{2q}{NkT}[V - IR]\right\} - I_S \quad (3)$$

At relatively low currents, the current increases with voltage in a super linear manner. At sufficiently high currents, the current-voltage dependence is sub linear.

With an increase in the thickness of the films, the shunting effect of the volume is manifested. TheI - Vcharacteristic of the considered model, taking into account the shunt, takes the form:

$$I = \frac{V}{R_{sh}} + I_S\left\{exp\frac{2q}{NkT}\left[V - R\left(I - \frac{V}{R_{sh}}\right)\right] - 1\right\}$$
(4)

This expression describes the super linear region, which means that the recombination losses of the injection current in the p- and n-regions makeup a small fraction of the saturation curren to fasing letransition.

2. Analysis of the dependence of the length of the linear section at the beginning of the dependence on the series resistance of the junctions (R).

$$V = (I_1 - I_2)R + \frac{NkT}{2q}\left[ln\left(\frac{I_1}{I_2} + 1\right) - ln\left(\frac{I_2}{I_{S_2}} + 1\right)\right]$$
(5)

Weenter; $X_1 = \frac{I_1}{I_S}$; $X_2 = \frac{2}{I_S}$notation and expand the logarithmic terms in aseriesin powers of X.

$$ln(1 + X_1) = 1 + X_1 - \frac{1}{2}X_1^2 + \frac{1}{3}X_1^3 - \cdots$$
$$ln(1 + X_2) = 1 + X_2 - \frac{1}{2}X_2^2 + \frac{1}{3}X_2^3 - \cdots$$
(6)

$$ln(1 + X_1) - ln(1 + X_2) = X_1 - X_2 - \frac{1}{2}(X_1^2 - X_2^2) + + \frac{1}{3}(X_1^3 - X_2^3) - \cdots X_1 - X_2 = \frac{I_1 - I_2}{I_S} = \frac{(2-\alpha)\left(I - \frac{V}{R_{sh}}\right) + (\eta - \alpha)aB}{I_S};$$

$$V = \left[(2-\alpha)\left(I - \frac{V}{R_{sh}}\right) + (\eta - \alpha)aB\right]R + \frac{NkT}{2q}\left[\frac{(2-\alpha)\left(I - \frac{V}{R_{sh}}\right) + aB(\eta - \alpha)}{I_S}\right] - \frac{1}{2}\frac{(2-\alpha)\left(I - \frac{V}{R_{sh}}\right) + aB(\eta - \alpha)}{I_S} \cdot \frac{(2+\alpha)aB + \alpha\left(I - \frac{V}{R_{sh}}\right)}{I_S}$$
(7)

Restrictingourselvestothequadratic terminformula (6), wenotethatthelengthofthelinearsectionofthedarkdependenceattheoriginof coordinatesdependsonthedegreeofshuntingofthemicro-junctions.

3. Light volt-ampere dependence.

With long-wave excitation, weak absorption of light occurs, inaddition, in the region of short waves, due to an increase in the absorption coefficient, generation occurs only near the illuminated surface. Therefore, the shunting effect of the volume can be ignored even then forth elight dependenceI (V).

$$I = I_S \frac{\left[1 + \frac{aB}{I_S}(1+\alpha)exp\frac{2q}{NkT}\{V - R[I(2-\alpha) + aB(\eta - \alpha)]\} - \frac{aB}{I_S} - 1\right]}{1 + (1-\alpha)exp\{V - R[I(2-\alpha) + aB(\eta - \alpha)]\}}$$

At highlighting intensities (B → 0) forI (V) on the linear section (7), one can obtain the expression

$$I = V\gamma B - \frac{(\eta - \alpha)}{(2-\alpha)}aB$$
(8)

It can be seen from (8) that in the linear section at B = const, one can find the parameterγ associated with the conductivity of the photo conductive volume of the film

$$\left(\frac{1}{R_{sh}} = \frac{1}{R_{sh_0}} + \gamma B\right)$$

$$\gamma = \frac{I + \frac{(\eta-\alpha)}{(2-\alpha)} aB}{VB}$$

Knowing [4], according to the result of the light characteristic, from the formula (9) it was found that it agrees with the valuesfound from the photomagnetic measurements [4].

REFERENCES

1. Сб. Фотоэлектрическиеявлениявполупроводниковыхиоптоэлектроникапод.ред. Э.И.Адировича, 143. «ФАН», Ташкент 1972
2. Ю.М. Юабов, Р.Найманбоев. ФТП, 12, 1942 1978
3. В.И. Стафеев. ФТП, 5, 1971
4. Э.И. Адирович., Э.М.Мастов., Ю.М.ЮабовДАНСССР, 1969, Т. 188, №6
5. Д.А.Аронов, Ю.М. Юабов, ФТП. 1984. Т.18. №7 С.1318-1321