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INFLUENCE OF PRESSURE ON TRANSITION CHARACTERISTICS OF THE DIODE STRUCTURES

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It is found out, that change of velocity of after injecting EMF collapse at the pressure presence is caused by changing of nonbasic charge carriers' lifetime.

One of the most important fields of technical application of semiconductor diodes is their use in pulsing electronic circuits. In a basis of these devices inertness during switching mode are the accumulation phenomena's and the diffusion of nonequilibrium charge carriers inherent also other devices with p-n transition. At solution the problem of increasing of pulsing circuits fast operation the series of examinations has been carried out. We studied influence of pressure on a charge diffusion velocity or, in other words, on the after injecting EMF collapse velocity. Experiments were carried out on the selenic diodes prepared under various electro thermal conditions.

The impulse of a direct current from the generator was passed through the diode and drop of potential on loading resistances was measured by means of an oscillograph. The charge diffusion velocity depended on loading resistance. For observation the voltage form on p-n transition the oscillograph with high input resistance was used. On fig.1 the oscillograms of after injecting EMF on p-n transition at R_n=1кOhm are given. It was found out, that diffusion velocity depends on pressure (the curve 1, at P=O; the curve 4, at P~10 ^{7} Pa).

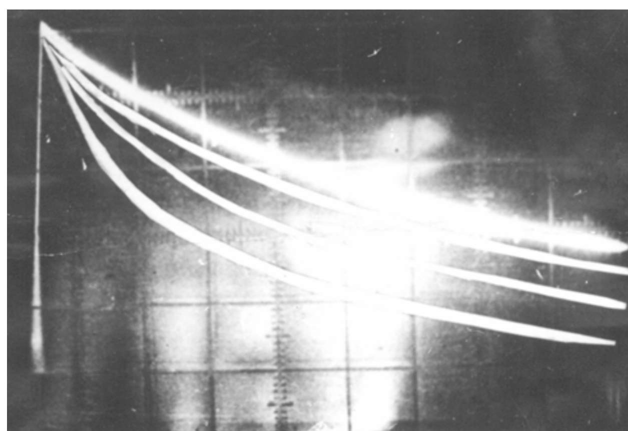

Fig. 1. The time dependence of a pulsing voltage at various pressures: 1-p=0; 2-p=3.10^6 Pa, 3-p=6.10^6 Pa, 4-p=1.10^7 Pa
(The scale of a cell on an axis X-5mcsec, on an axis Y-10 V)

A presence of resistance R_n in a circuit means, that after the termination of direct current passing through the diode the current of a backward direction caused by the p-n transition own EMF will start to run. Passing of the transitive backward current accelerates a diffusion of carriers from basis and a role of this process the more significantly, when the R_n value is less.

Activity of pressure can be understood, having considered influence of inverse resistance on after injecting EMF $u_{(t)}$ collapse. Two processes determine the charge diffusion velocity: recombination and current carriers' leakage through loading resistance. First we shall consider, that influence of loading resistance on a $u_{(t)}$ function view is negligible low until the loss of redundant carriers in the basis space due to recombination exceeds their loss due to a current running through loading resistance under acting the voltage $u_{(t)}$ on p-n transition. In this case $u_{(t)} = u_{(0)} - \frac{kT_0 t}{q\tau}$, where $u_{(0)}$-- voltage on p-n transition at the direct current impulse termination moment. After the carriers loss due to recombination becomes comparable with a loss due to passing a current through loading resistance, $u_{(t)}$- function view changed and passes in dependence:

$$u_{(t)} = u_{(0)} \exp\left(-\frac{t}{R \cdot Cg}\right) \tag{1}$$

where $$R = \frac{R_н \cdot R_{p-n}}{R_н + R_{p-n}}$$

Here Cg - p-n transition capacity.

At absence of pressure

$$R_{p-n} = \frac{kT}{q} \cdot \frac{1}{J_S} \tag{2}$$

Here J_S-saturation current. At presence of pressure

$$R_{p-n} = \frac{kT_0}{q} \cdot \frac{1}{J_S + J_p} \tag{3}$$

Having substituted (2) in (1), we shall receive expression for after injecting EMF velocity at absence of pressure:

$$u_{(t)} = u_{(0)} \cdot \exp\left(-\frac{kT_0 + qJ_S \cdot R_н}{kT_0 Cg \cdot R_н}\right) \tag{4}$$

Having substituted (3) in (4), we shall receive expression for after injecting EMF at the presence of pressure:

$$u_p(t) = u(0) \cdot \exp\left[-\frac{kT_0 + q(J_p + J_S)R_н}{kT_0 Cg \cdot R_н} \cdot t\right]$$

taking into account (4), we shall receive

:

$$u_p(t) = u(t) \cdot \exp\left[-\frac{q \cdot J_S}{kT_0 Cg} \cdot t\right]$$

We estimated the lifetime by falling down of after injecting EMF and transition characteristics of diode switching from a forward direction to revertive. Injecting impulse duration is10 mcs, following frequency is 1000 Hz. Estimated values τ according to these oscillograms were ~3 mcs for diodes on the basis of single-crystal selenium and ~1 mcs - for diodes on the basis of polycrystalline selenium. Proceeding from the values $\tau \sim 10^{-6}$ obtained by us should be attributed to the non-equilibrium carriers injected in p-lay.

Hence, collapse velocity of after injecting EMF should depend on pressure exponentially. According to analysis, these dependences differ from exponential a little, that is related to change of capacity growing with pressure [1] which retards the after injected EMF collapse

velocity. According to obtained data, change of after injecting EMF is direct consequence of τ change under pressure.

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1. *Akberov H.K., Mekhtiyeva S.I., Zeynalov V.Z.* Vliyaniye davleniya na yomkost p-n perekhodov na osnove selena. V sb. Fizika I tekhnika poluprovodnikov. Baku, Elm, 1991.

TƏZYİQİN DİODLARDA KEÇİD XARAKTERİSTİKALARA TƏSİRİ

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Müəyyən olunmuşdur ki, təzyiqin təsiri ilə injeksiyadan sonra elektrik hərəkət qüvvəsinin düşmə sürətinin dəyişməsi qeyri– əsas yükdaşıyıcıların yaşama müddətinin dəyişməsi ilə əlaqədardır.

ВЛИЯНИЕ ДАВЛЕНИЯ НА ПЕРЕХОДНЫЕ ХАРАКТЕРИСТИКИ ДИОДНЫХ СТРУКТУР

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Установлено, что изменение скорости спада послеинжекционной ЭДС при наличии давления обусловлено изменением времени жизни неосновных носителей заряда.