AMERICAN JOURNALS
Open Access, Peer Reviewed Journals
American Journal of Technology and Applied Sciences
ISSN (E): 2832-1766| Volume 14, | July, 2023

INFLUENCE ON PHOTOELECTRIC PARAMETERS OF NON-UNIFORM LIGHT ABSORPTION IN STRUCTURES BASED ON a-Si:H

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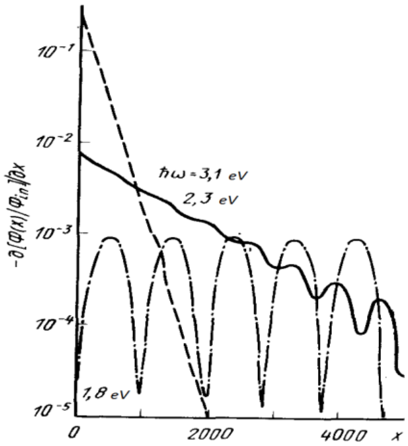
A B S T R A C T	***K E Y W O R D S***
In this manuscript gives the conclusion of an analytical expression that determines the dependence of the height of the potential barrier, which is obtained upon unevenly light absorption of over the thickness of the i-layer in the target of video with n-i-p structures based on a-Si:H, on the light intensity. In addition, it is investigated that the dependence of the width of space charge region (SCR) on certain features of a-Si:H .	Hydrogenated Amorphous Silicon(a-Si:H), target of Vidicon, tails of Conductive and Valence zones,State density, gap mobility.

Introduction

Various photoelectric devices have been created on the basis of amorphous hydrogenated silicon, including solar cells, field transistors, memory elements, and badge tubes. In recent years, however, intense research has been carried out to establish and enhance cascade solar cells[1,2,3,4] with a cascade structure based on a-Si:H/μk-Si:H .Given that the total layer in the cascade structure of solar cells is d ~ 6 μm thick, according to Buger's law, $I=I_0 \cdot e^{-\alpha d}$ Si:H in the layers causes uniform absorption (Figure 1). This results in an uneven distribution of photogenerated charges.

In this manuscript, some of the physical processes that appear from the illumination of light have been investigated.



Issue and Analysis of Results

It is known that incident light on the Vidicon target is absorbed by the i-a-Si:H layer at the surface. Therefore, i-a-Si:H forms a reservoir of charges that carry currents in the surface. Figure 2 shows the pre- and post-zone diagrams for illumination of the layers of the vidicon.

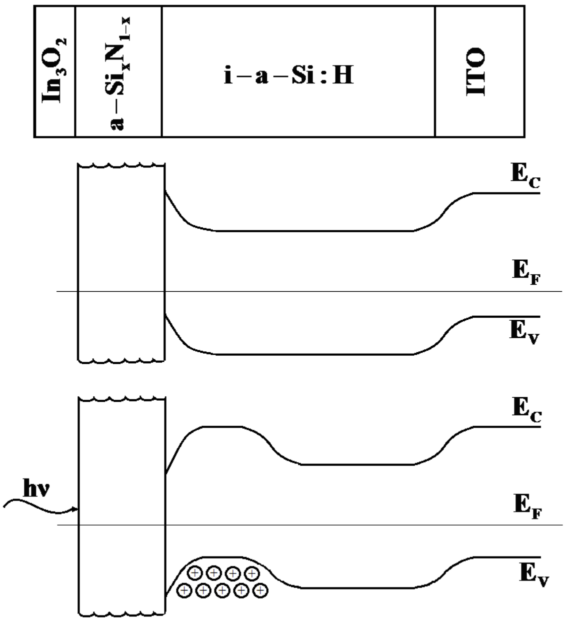


Figure 2. Pre- and post-zone diagrams of illumination of the layers of Vidicon target.

The illuminated light is absorbed by all the charged states in the i-a-Si:H layer, or the free electron and cavity formed are interacted with the charge states. It is known that the charged states of the i-a-Si:H in the slit of motion are as follows.

1. Charge states on the tale of Conductivity and Valence region.
2. In the literature review, For i-a-Si:H, we found that two types of D-centers occur in the recombination process Si:Si That is, D-centers with electronic handles, and D^0-centers for holes

With this in mind, we can derive the total charge density in the slope of the motion in the form of the sum of the density states above.

$$g(E) = g_v^{u_r}(E) + g_c^{u_r}(E) + g_D^G(E) + g_A^G(E)$$

$g_v^{u_r}(E)$ and $g_c^{u_r}(E)$ - the position densities of the valence field and the conductive sphere tail are subject to exponential distribution respectively.

$$g_v^{u_r}(E) = g_{v0} \cdot \exp\left(\frac{E_v - E}{E_D}\right) \quad (1)$$

$$g_c^{u_r}(E) = g_{c0} \cdot \exp\left(\frac{E - E_c}{E_A}\right) \quad (2)$$

Where g_{v0} and g_{c0} are the density of states above the valence field and below the permeability domain, respectively.

E_D and E_A are characteristic energies of cortical and receptor levels. As the D-centers are subordinate to the Gaussian distribution, we describe as follows:

$$g_D^G(E) = g_{D0}^G(E) \cdot \frac{1}{\sigma_D\sqrt{2\pi}} \cdot \exp\left[-\frac{(E - E_g + E_D)^2}{2\sigma_D^2}\right] \quad (3)$$

$$g_A^G(E) = g_{A0}^G(E) \cdot \frac{1}{\sigma_A\sqrt{2\pi}} \cdot \exp\left[-\frac{(E - E_A)^2}{2\sigma_A^2}\right] \quad (4)$$

Here, $g_{D0}^G(E)$ and $g_{A0}^G(E)$ correspondingly, the Gaussian distribution is the maximum value for the D- and D_0 -centers.

E_D and E_A - Energy role of maximum values.

The $\sigma_A - D^0 -$ is the energy width of the center distribution and is determined by the energy size Δ = 0.44 eV, which separates the D- and D_0-centers as determined by the experiments [1,2] according to Powell and Peone.Namely:

$$\sigma = \left[E_{v0}(T) \cdot (\Delta + U)\right]^{1/2} \quad (5)$$

U = 0.2-0.3 eV, D_0 and D- the energy difference between the maximums of the centers After determining the distribution of energy states of a-Si:H in the energy slot, we can estimate the electron (n) and cavity concentration at D- and D_0-centers.

But first we need to explain which Fermi levels shift due to which energy states the charge carriers hold.

As we know, we can omit expressions (1) and (2) because of the presence of holes only in the photoelectric conductance of the vidicon target. Furthermore, considering that $g_{v0} \approx 10^{21}$ cm^{-3}/eV and $g_{A0} \approx 10^{18}$ cm^{-3}/eV in expressions (1) and (4) are not applicable

$$E_v - E \ll E - E_A \quad (5)$$

the inequality is fulfilled. Then we can find the Fermi level shift in expression (3) only.

The results of the experiment confirm our experiments' results above.

In [6,7,8], the authors believe that step-by-step recombination does not occur in the visible spectral range of light at a room temperature of 10^4 V/cm or higher. Any recombination occurs only in the charge carriers held in one center.

According to the Rose model [9], the Lux-Amper characteristic is linear if non-primary current carriers are caught in only one type of handles during their movement.

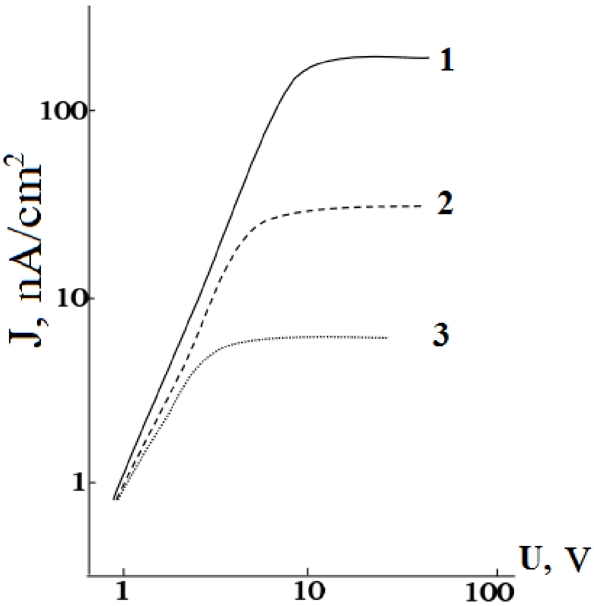


Figure 3. Photo-VACH that is corresponding to the illumination of different intensities.

Figure3 shows the graphics-VACH graphs corresponding to different intensities of illumination. Based on the LACH (Figure4) obtained from the graph to determine the intensity of each light intensity, we can assume that the main current carriers are buckets that interact with only one type of handles.

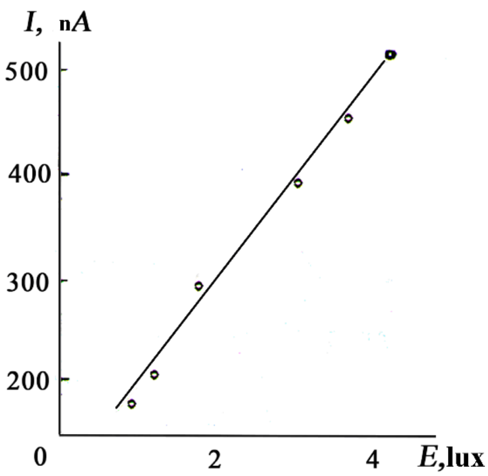


Figure 4. The Lux-Amper Characteristic of the vidicone target based on a-Si:H.

Assuming that the light absorbed by all of the above is absorbed, the concentration of holes in the handles is equal to the concentration of Δp produced by Φ. That is, Δp ≈ Φ. It is

$$\Delta p = \int_{E_v+E_a-\Delta E}^{E_v+E_a+\Delta E} [1 - f_D(E)] g_D^G(E) dE \qquad (6)$$

Here $f_D(E)$ is the charge coefficient.

We can find the value of ΔE by the consecutive approach of expression (6). Because the buckets are held in the D_0 centers, which are considered to be donors below the Fermi level, the Fermi level is shifted to E_F E_v towards 2ΔE, which can be considered as (8) φ≈2ΔE. The concentration of D- and D_0 -centers on the mobility rod a-Si:H does not exceed any value. Therefore, the number of photons targeted to the vidicon does not exceed these values. Also light intensity according to Buger's law

$$f_D(E) = \frac{2\exp[(E_F - E)/kT]}{1 + 2\exp[(E_F - E)/kT] + \exp[(2E_F - 2E - U)/kT]} \tag{7}$$

exponentially decreases depending on the Then, depending on the intensity, the i-a-Si:H concentration of non-core currents in the absorbed part of the light is increased, that is, the pores.

It is well-known that the potential barrier in the case of metal semiconductor contact dielectric barriers depends on the width of the charge field on the semiconductor surface. The structure of the vidicon sign can be calculated in the same way. Because we can dielectrically coat the a-Si_xN_{1-x} thin layer (thickness ~ 20 nm, E_g = 3.5 eV, ρ = 10^{14} Om*m) between the In_2O_3:Sn layer and the i-a-Si:H layer. If we assume that the surface charge distribution is distributed along the axis perpendicular to the surface, the concentration of these surface states decreases by exponential law with respect to the semiconductor [2,3].

As we look, the intensity of photogeneration in the deeper layer of
i-a-Si:H increases with increasing light intensity. This, in turn, affects the width of the voltage field and the potential for peak voltage. We show the variation of the width of the charge field as follows:

$$I = I_0 \cdot e^{-\alpha d}$$

- Debai length of shielding. According to (9), as the light intensity increases, the thickness of the volume charge field decreases due to the increase in the photogenerated pore concentration. According to ω ~ l_s [4,5], the charge distribution can be expressed by solving the Puasson equation when the width of the area of the volume charge is around the order l_s. l_s is a characteristic parameter for the exponential reduction of the semiconductor surface states [2].

Summary.

Analysing of the results shows that:

At the Large thicknesses of a-Si:H, uneven light absorption occurs along the thickness. This creates a potential barrier in the single layer. The potential barrier is caused by the defect states distributed by the Gaussian distribution on the gap mobility of a-Si:H.

According to the Rose model, recombination occurs mainly through single-charge centers. This property can be used for finite modeling of Si:H cascade structural elements.

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