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Implantation of Electrons into the Glass †

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Abstract: The objective of our work is to study the behavior of the glass subject to the electronic bombing. In the context of this work, we first studied theoretically the establishment of electrons in a material in this case glass. We postpone the penetration of the electrons according to their acceleration and the density of the material, then we establish the electric field within the material according to the fluence, we thus refer to the conditions of the destruction of the material. However that for some these that this breakdown depends on several parameters. In the second step we are interested in the realization of an electron cannon to provide a bundle of focused and energetic electrons, more precisely we discuss on this basis the practical design. In this instrument, the electrons are accelerated under high tension. We postpone in this work the thermal current as a function of the tension, and we discuss the assembly chosen.

Keywords: electronic bombing; fluency; the implementation of electrons; thermionic current

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1. Introduction

Ionic implantation is among the techniques used to synthesize nanoparticles buried in a material [1]. This technique, therefore, consists in introducing a foreign species into material targets with a given energy. During its passage in the matter.

As part of this work, we first have treated in the first part the theoretical study of the implantation of electrons in a material in this case glass.

Secondly, we are interested in the realization of an electron cannon to provide a bundle of focused and energy electrons

We are also interested in the study of the behavior of inorganic lenses subject to electronic irradiation.

Our problem is the behavior of the glass subject to electronic bombing, and the conditions of the destruction of this material.

For this, our purpose is the production of more powerful and energetic electrons which have since penetrated the glass and caused the spanch inside this material to be damaged.

The rest of this paper is organized as follows: in the second section, we present the proposed method with the result related to the thermal current. Finally, Section 3 summarizes the overall work in a conclusion and discusses some future directions.

2. Materials and Methods

2.1. Implementation Processing

The electrons are introduced into the glass which is located in a system of the system, these electrons emitted by a filament with an electrical voltage are applied to the outlet of the room allowing the acceleration of the latter. This beam then crosses an electric field, which is focused and then accelerated to energies between 10 Kev and 100 Kev.[2]

Thus a homogeneous beam strikes the target. So just count the number of loads arriving on this target to determine the dose of implants. To summarize this simple description, we can say in our case the electronic barrel is the electronic gun that provides electrons.

2.2. Canon A Electron Design

Practical Realization

The cannon is made in a tungsten -shaped v -shaped filament (cathode) in practice, you can use a tungsten filament, formed as a hairpin, which is heated by an electric current by joule effect to a temperature of the order from 1900 to 3000 °C [3]. The electrons are extracted from the filament and once out, these are attracted by the (positive) anode but meet the Wehnelt on the way.

Wehnelt has more negative potential than the cathode. Its role is to repel electrons on the axis. The emitted electrons passing the Wehnelt are focused on the crossover between the cathode and the electrode. This crossover plays the role of electron source for the optics of the microscope.

The anode is at a negative potential, creating a potential difference with the cathode (approximately 100 kV) responsible for the acceleration of electrons at the outlet of the filament

The distance between the cathode and the Wehnelt being very critical, we have equipped the barrel with an axial displacement system of the cathode (Figure 1) which allows it to be easily put in place.

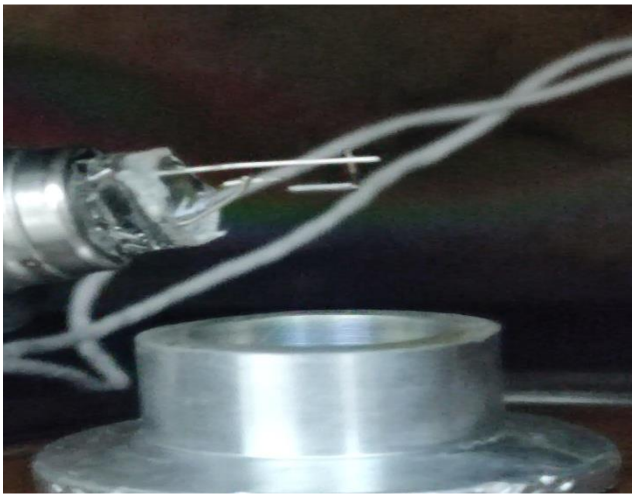

Figure 1. Canon A electron (the practical design of the latter made up of three important elements a filament of Tungsten, Wehnelt cylinder, and anode).

2.3. Theoretical Calculation

Operation of Canon A Electron

If now we apply a potential difference V between the anode and the cathode. We train part of the electrons which are located in the vicinity of the cathode towards the anode, thus creating a current, which is a fraction of JS [4], the number of electrons available for anodic current increases with the potential V. Their average speed V also increases with V.

Speed for production electron:

$$\frac{1}{2}mv^2=\frac{3}{2}kT \quad (1)$$

We deduce speed expression

$$v = \sqrt{\frac{3KT}{m}} \quad (2)$$

In this case, the value of the JS current density is:

$$JS = AT^2 \exp(-\frac{W0}{KT}) \quad (3)$$

Where

$$A = \frac{4mK^2 e\, \pi}{h^3} \quad (4)$$

Or the electron acceleration speed value is given by the following relationship

$$\frac{1}{2}mv^2 = eV \quad (5)$$

$$v = \sqrt{\frac{2eV}{m}} \quad (6)$$

We can deduce the density of the electrons

$$n = \frac{j}{ev} = \frac{AT^2 \exp(-\frac{W_0}{KT})}{e\sqrt{\frac{3KT}{m}}} \quad (7)$$

So

$$J = \frac{AT^2 \exp(-\frac{W_0}{KT})}{e\sqrt{\frac{2eV}{m}}}\ e\, v \quad (8)$$

and

$$J = \frac{AT^2 \exp(-\frac{W_0}{KT})}{e\sqrt{\frac{3kT}{m}}}\ e\sqrt{\frac{2eV}{m}} \quad (9)$$

In practice, we can show that:

$$I_C = BV^{1/2} \quad (10)$$

Or B is constant.

This expresses the proportionality of the current to the power 1/2 of the applied voltage, established for flat electrodes was still valid for any field of the form, as soon as the emission of electrons was intense enough for the phenomenon of the space charge to be significant.

And at the end, we can find that the value of the practical IC current is similar to proportional to the theory (see Table 1).

Table 1. current values as a function of voltage.

V	C1	C2	C3	C′1	C′2	C′3	C_T
3055	611	608.3	0.12	619	610	25.3	25.18
5150	613	612	0.21	621	620	26.8	26.59
8085	614	610	2.24	623	620.7	29.85	27.61
10,600	612	609	4.43	628	625	32.32	27.89

Where V: tension V; C1: Current 1 without filament UA; C2: Current 2 without filament UA; C3: Current 3 without filament UA; C′1: Current 1 with filament UA; C′2: Current 2 with filament UA; C′3: Current 3 with filament UA; C_T: thermionic current UA.

The table shows diference valus of currents with on without filament so the current without filament is produce for our generator.

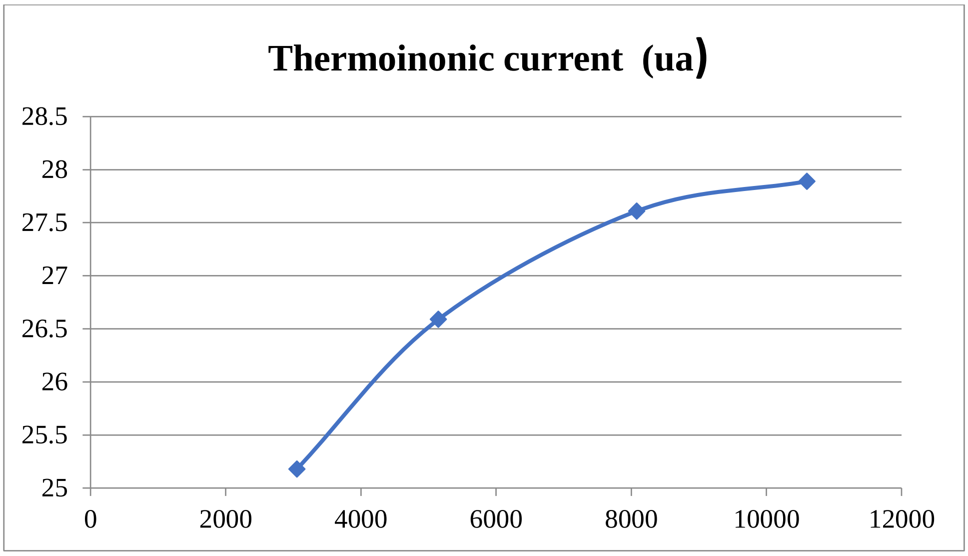

Figure 2. Thermionic current representation in a different function of the voltage value.

3. Conclusions

In this article, we have studied the phenomenon of implementation of electron in glass knowing that the major problem of how the latter created inside the very fine type glass. To do this, we are going to create an electron cannon that is produced the electron and accelerated in a way can penetrate the glass for a very short time and with a high tension

The experimental results show that the creation of these electron then we obtain a thermalic current which is properly of a tension root and on what minute we obtain the saturation.

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