

Electric Current through Air

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Abstract.

In given article is specified the principle of passage of electric current between cathode and anode through air at heating the air or at heating the cathode.

1 Electric Charge and Electric Field of Cathode and Anode

If two conducting bodies are located in air or in a separate gas, at a distance from each other, and if one of the bodies (called the cathode) is connected to the negative pole of a source of electric current and the other body (the anode) is connected to the positive pole, then an electronic charge will form on the cathode, and on the anode an hole charge is formed.

The hole charge of the anode represents a lack of free electrons in the anode and on its surface. In this case the atoms of air collide with the atoms of the surface of the anode, due to that these atoms are ionized and deetherized with formation of an electric field directed to the anode.

If the voltage on the cathode is not sufficiently high, then on the cathode will be formed predominantly an surface electronic charge, which not form an electric field.

If the voltage of the cathode is sufficiently high, then above the cathode an external charge is formed in form of electronic plasma. The electrons of the plasma collide with the nucleuses of the cathode, due to that occurs ionization and deetherization of atoms of surface of cathode and is formed an electric field, directed to the cathode. The electric field push the electronic plasma to the cathode.

2 Electric Current through Air upon Air's Heating

Air at atmospheric pressure has the big resistance for passage of an electric current because the atoms of air are located chaotically. Due to that the free electrons in air often collide with the nucleuses of atoms of air and due to that the electrons often decrease the velocity and change the direction of motion. Free electrons extend in all sides until then when they will not enter in "earth". Therefore concentration of free electrons in air is insignificant.

If to heat up air which located between the cathode and the anode, i.e. if to irradiate this air with light, x-ray or ultra-violet photons, there will be a photon ionization of atoms of air, i.e. will be released a part of orbital electrons and the atoms of air become ions.

The free electrons, which have entered in electric field of anode, is attracted to the anode, where they extend on the conductor up to the source of charges. The free electrons, which collided with the cathode, do not pass further in the conductor, due to the collisions with the superficial electronic charge of the cathode. After collisions the electrons remain on the surface of the cathode or leave back to the outside electronic charge.

Atoms and ions have mainly chaotic motion in the electric field. But at a strong electric field they can move in a direction of the field. At collision with the cathode or the anode, the atoms and ions do not enter inside of an conductor and do not remain in attraction to nucleuses of the conductor, and change the direction of motion and leave from the conductor because of the big inertial velocity.

The passage of the electric current through gas can be measured by an instrument connected as shown in Fig. 1.

If the voltage of the source of the current is being stepped up, the electric current will be increased until it becomes constant; but after a certain voltage the electric current will again increase, as shown in Fig. 2.

That the electric current initially increases, is explained by the fact that upon the stepping up of the voltage, the strength of the electric field of anode, acting in the direction of the anode, increases; due to this, a greater number of electrons, released upon ionization of the air, move in the direction of the anode. The direct current is explained by the fact that all the electrons, released upon the ionization of the air, move in the direction of the anode. The repeated increase in an electric current is explained by the fact that at some big voltage the strength of the electric field of anode

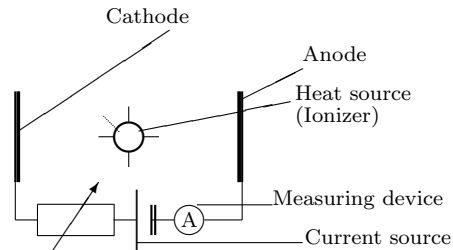


Figure 1: Passage of current through gas

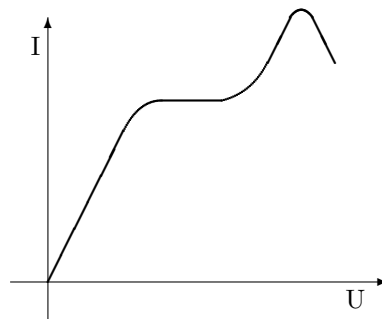


Figure 2: Passage of current through gas

becomes so big that the electric field pushes not only the electrons to the anode, but also pushes the neutral atoms and ions. At collision of atoms and ions with the anode there is an additional releasing of electrons from the atoms and the released electrons are absorbed by the anode, forming an electric current. The more the voltage on the anode and the cathode, the more atoms collide with the anode with releasing electrons and formation of an electric current. But, if the air is in the closed vessel, then after a while all atoms of the air will collide with the anode and from atoms of air will be released all electrons which can be released, that explains the decrease in the current's strength. If in the anode to make apertures through these apertures will pass electrons and ions.

Since at a strong electric field the atoms and ions move not only to the anode, but also to the cathode, then the positive ions at collision with the

cathode, attract to themselves the electrons of charge of the cathode and become neutral atoms which can be repeatedly ionized by light. It is visible by a falling part of an electric current on the figure.

Conclusions

1. The electric current passes through air at its heating due to ionization of atoms of air at its heating. The released electrons collide with the nuclei of atoms of air, due to that they move in different directions with acceleration. When the electrons move nearby the anode, the electrons are absorbed by the anode.

2. The repeated increase in electric current through air at increasing of the voltage between cathode and anode occurs due to that what in this case is increased the strength of the electric field of the anode, which pushes the atoms and ions of air to the anode and there from collision occurs ionization of atoms and the released electrons are absorbed by the anode.