Electric Current through Conductors

Anatoli Bedritsky

Abstract. This article gives the reason for the propagation of electrons from an electric charge over conductors, that is, it gives the principle of formation of electric current. It also gives the reason for the fact that the electrons of electric current move in conductors at a high velocity.

1 Acceleration of Current Electrons in a Crystal Passage

Electric current is a unidirected motion of electrons when the electrons rarely collide with each other. Therefore when electric current passes through a conductor, only the collisions of electrons with the nuclei of the crystal and with the ethermats present resistance to the motion of electrons. In metals electrons are passing through crystals, in which the nucleuses of atoms locate symmetrically, forming passages, through which passes the electrons. The electrons have an identical attraction to symmetric nucleuses, due to that they move in the middle between the nucleuses in passages of crystals. Only in the joint of crystals the electrons collide with the nucleuses of atoms. As the electrons at motion through the pass of a crystal have no collisions with nucleuses, then they there have an accelerated free motion, because of which the electrons at passing through the crystal increase the velocity of the motion in a greater measure than at motion in other directions. The crystals with passages are called *accelerating crystals*.

But upon transition of a free electron from a crystal of a body into another crystal, the electron may collide with node nucleuses of the crystal, because the axes of symmetry of crystal lattices are non-parallel in different crystals of the same body. When coming into a new crystal, an electron acquires a new direction of motion depending on the positioning of passages in the new crystal with respect to the previous crystal. Fig. 1 shows a longitudinal cross-section of a conductor, where one can see the crystals and the nuclei which form the crystals.

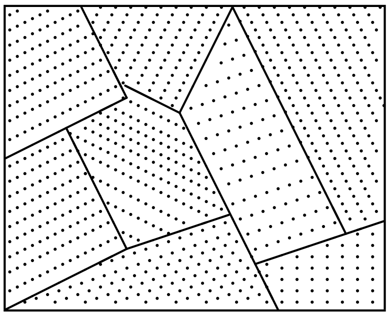

Figure 1: Cross-section of a conductor

The limitation of the velocity of the current electrons in a conductor forms mainly due to the collisions of these electrons with the node nuclei at the butting of crystals. Within a crystal, that is, between collisions with the node nuclei, the current electrons have the highest velocity, but it is lower than the limit velocity of electrons in cosmos, since the density of the body ether is lower than that of the ambient rarefaction.

The larger are the crystals of a conductor, the less is the frequency of the electrons' collisions upon transition from a crystal to a crystal, and correspondingly the less is the resistance to the motion of electrons in a conductor. If a conductor consists of a single large crystal, it has the least resistivity to the motion of electrons; this phenomenon is called *superconductivity* and the crystal a *monocrystal*.

Despite the fact that electrons change their direction of motion upon transitions from a crystal to a crystal due to the different directions of passages in different crystals, the general direction of the current electrons's propagation corresponds to the direction of propagation from the end of the conductor with a higher potential to the end with a lower potential, that is from the site of their higher concentration to the site of their lower concentration, since only wwhen moving in that direction the electrons have the least number of collisions with each other.

The current electrons move in wires at velocities, which are lower than their limit velocity but of the same order of magnitude, that is, about 100,000 km/s. The velocity of current electrons may be measured more accurately by determining the velocity of the passage of electric signals through wires.

2 Charge-Generated Current. Non-release of Electrons from a Conductor

If a conducting body that has a higher potential of charge is pressed to another conducting body with a lower potential, then free electrons from the body with a higher potential will pass into the other body with a lower potential. In each of the bodies, the electrons will propagate until the concentration of electrons within each body becomes equal.

If one end of a long non-charged conducting body is put to a body that has an electronic or hole charge, the motion of electrons will be unidirectional along the long conducting body from the end of the body, where potential is higher to the end with a lower potential until the charge propagates uniformly through the entire body. If, however, one connects the other end of the conducting body to the "earth", the unidirectional motion of electrons will continue until the charge is fully discharged to the "earth."

Upon propagation of a charge, its electrons collide with other electrons met on their trek and push them in the same direction. The predominantly unidirectional motion of electrons is called *electric current.* Thus, the charge-generated current originates due to the propagation of the electrons of the charge along the direction of the least resistance throughout the entire body and not due to the action of the electric field formed by the charge.

Free electrons of conducting bodies, which are not having an electronic charge and an electric current, do not leave these bodies, since the average velocity of motion of free electrons is not high and upon the release of an electron from the body, the electrons are being pushed back into the body by the surface nuclear field of the body.

The current electrons have a big velocity, but they do not take off from conductors, because at a start of motion from a body the electrons are being pushed back into the body by electric field. The electric field around of a conductor is formed due to that, what the current electrons collide with atoms of the conductor, owing to that these atoms are ionized, i.e. become positive ions which create an electric field. The current electrons move in parallel an axis of the conductor, therefore through the sharp parts of the conductor there can be a exitting of current electrons, as there the electric field is weaker than on a flat surface.

Only an insignificant current flows over the surface of a conductor. An insignificant electric current may also flow over the surface of a dielectric. The current is called *surface current.*

Conclusions

1. Electric current in a conducting body occurs due to the propagation of free electrons of the charge in the direction of the least resistance to their motion, that is in the direction where they collide with other free electrons more rarely.

2. The electric field formed by the charge is not the cause of electric current from the charge, since electric fields have limited distance of action, while the distance that can be reached by electric current is unlimited.

3. The electrons of electric current increase their velocity up to the velocity of the passage of electric signals through a given conductor. Such a high velocty of the current electrons in conductors is explained by the fact that crystals of conductors have always passages where current electrons do not collide with nuclei.

4. Conductivity of conductors is the velocity of motion of electrons through a conductor; it depends only on the length of free travel of electrons between the collisions with the nuclei located at the butts of crystals.

5. The electrons of electric current do not leave the conducting body, since current electrons mobe along the conductor; due to that, the surface nuclear field presses the exiting electrons back into the conductor.