THERMOELECTRIC HEAT GENERATOR'S FUNCTIONING PRINCIPLE

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Abstract: This article explores the principle of operation of thermoelectric heat generators and their use in various aspects, as well as the useful and unprofitable aspects of this type of generators. In contrast to thermoelectric generators, the Seeback effect is also emphasized, because this type of generator is built on the same basis.

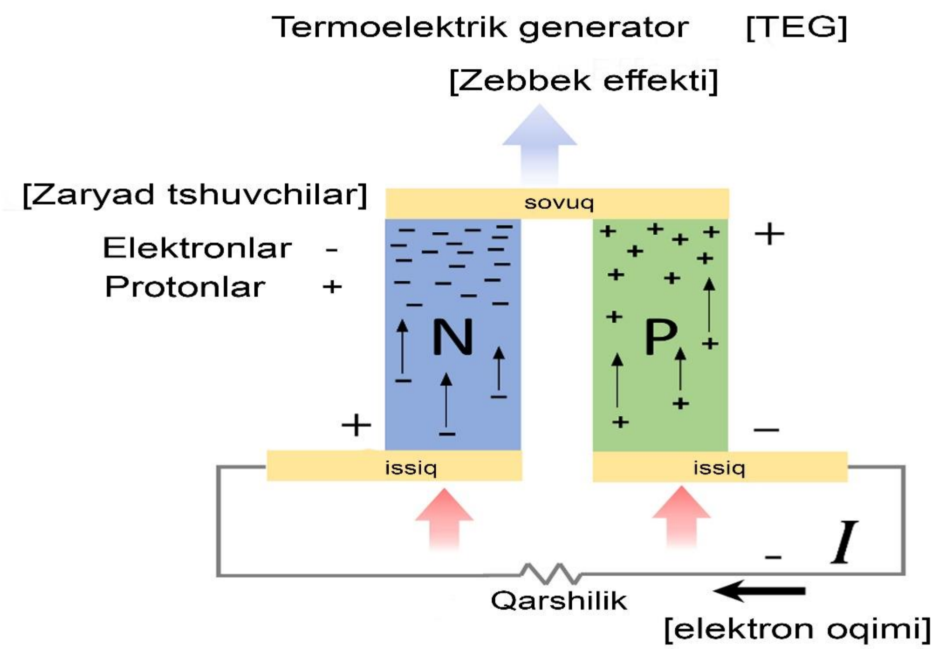
Key words: Seeback's effect, depletion , TEG, charge carriers, holes, p- type , n- type

Introduction

Until recently, scientists thought that the Zebek effect, now known by its current name, was discovered by Thomas Seeback. However, one thing is clear now that in fact the Zebbek effect was invented by Allesandro Volta 27 years before Seeback, that is, 224 years ago. In 1794, Volta conducted an experiment by bending a steel rod into a U shape. One end of the steel is dipped in boiling water. When one end of the disproportionately heated metal accidentally touches the leg of a dying frog, an electric current is created there, and the frog's leg moves involuntarily [1-2].

MAIN PART

A thermoelectric generator, also called a zebbek generator in some sources, is a solid-state device that converts heat directly into electricity. Although thermoelectric generators work like heat engines, they are much smaller and, unlike other generators, have almost no moving parts. However, thermoelectric heat generators are economically more expensive, and the efficiency and useful work coefficient are significantly lower. Thermoelectric heat generators are also used in power station buildings to convert waste heat energy into electricity, thus increasing fuel efficiency in cars. In addition, radioisotope types of thermoelectric generators are used for partial powering of spacecraft in space [3-4]. The use of thermoelectric generators is not limited to the methods listed above, they are also used when they are attached to solar panels. The operation of thermoelectric generators is based on the Seeback effect. Seeback effect; the phenomenon of electric current when two different conductors are given temperature. It should also be noted that the current released during the heat transfer depends on the distance between the conductors made of two different materials. Generators of this type are mainly devices consisting of p-type and n-type semiconductors, p-type holes see n-type electrons and move towards n-type electrons. For each p-type hole, an n-type electron is placed in place of the hole. Soon, each displaced electron and hole begins to gather at one point and acts as a barrier for the passage of other electron holes. And this place is called the depletion zone [5-6].



In this image the effect Seeback is explaind in a simple way.

Speaking of their advantages, thermoelectric generators are all solid state and do not require any moving parts, fuel or cooling, and this feature allows them to be used anywhere in a small area. Along with other devices, thermoelectric generators play an important role in NASA's space exploration due to their adaptability to different environments. In addition to the above-mentioned conveniences, generators of this type can be installed on other types of generators, increasing their efficiency and at the same time preventing unnecessary waste of heat from them [7-10]. In many situations a thermoelectric generator (TEG) can be an economical method of impressing current for CP systems. They are often used when AC grid power is unavailable, intermittent, or too costly to access. According to TEG manufacturer Global Thermoelectric, Inc., the systems produce power by the direct conversion of heat into electricity. By maintaining a temperature difference across an assembly of semi-conductor thermoelectric elements (thermopile), a steady power level is produced. Combustion of fuel such as propane, butane, or natural gas provides the heat, while natural convection provides the cooling required to create this temperature differential. The result is a stable source of electrical power and clean, dry heat [11-15].

Because thermoelectric conversion is a solid-state phenomenon, TEGs have no moving parts and operate reliably for long periods of time without maintenance or supervision. Fuel consumption is minimal. For example, a Global generator can impress 10 A continuously into a 1 ohm ground bed at 10 V and consume 1,100 gal of liquid propane gas or 114 million ft^3 of natural gas per year.

Global TEGs are normally located near the ground bed, and are supplied with fuel from tanks, a wellhead, or a pipeline. The current can be adjusted by means of an integral variable resistor so the output current is matched to the ground bed resistance. There are no batteries, unlike solar sites [15-19].

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