

**FIELD OF APPLICATION OF THERMOCOUPLE ELEMENT OF OIL-
AND GAS COMPLEX. DEVELOPING AND PRODUCING OF DEVICES
AND EQUIPMENT ON BASIS OF THERMOELECTRICITY
PHENOMENA**

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Because of deficient awareness and little publicity of thermoelectricity it is become learning and activity of the scientific work. Nowadays elements and devices based on thermoeffects are not used widely in oil and gas industry. The main thermoelectricity characteristic for applying it in oil-and gas field is big funds and time saving for realization of different operations and big ecological compatibility and attracting attention to completely new usage of thermo elements.

In introduction we would like to mention main problems and causes for this work.

Problems and ways of solving them are following:

1. Microfissures in walls of basins and pipelines. Creating a devise based on thermo fridge for freezing of an area and furthering object using until the the problem will be solved;
2. Stationary covers for heating of certain area of pipelines and etc. based on Peltier effect. (deleting of paraffin depositons in pipelines in the certain place);
3. Creating a devise for cleaning of basins walls via freezing (Peltier module);
4. Heat withdrawal from controlling and measuring apparatus via power active Peltier fridges;
5. Getting energy for stationary services;
6. Freezing of mechanisms Surfaces, devices, pumps, premises freezing and ventilation via thermo elements;
7. Using portable fridges and generators;
8. Expansion of field of application of thermoelectricity transducers.

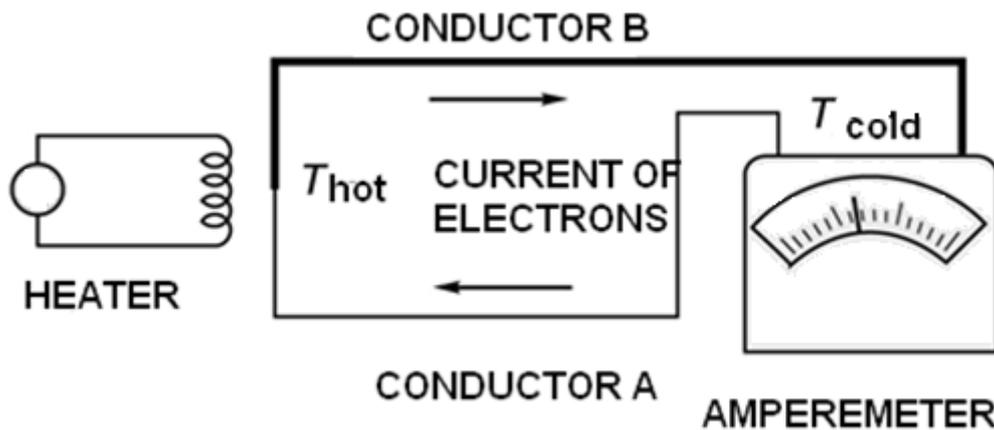
The phenomena of heat alternation into electricity in solid and liquid conductors and also opposite phenomena of direct heating and cooling of junctions of two conductors by conducting current.

The term thermoelectricity includes three effects : Seebeck effect (converting temperature to current), Peltier effect (converting current to temperature), and Thomson effect (conductor heating/cooling). All of these characterized by coefficients different for other materials. These coefficients are connected by Calvin correlation. They are detected by parameters of junctions as well as attributes of materials.

Describing of effects. Thermoelectric Seebeck effect

Important characteristic of thermoelectric attributes of materials in the circuit are voltage on the ends of open circuit because in close circuit current and voltage are depended

from wires resistivity. The open circuit voltage V_{AB} (T_1, T_2) depending from temperatures T_1 and T_2 of junctions (pic.1) it is called thermoelectric electromotive force.



Picture 1

Thermoelectric Seebeck effect

Current in the close circuit is caused by difference of temperatures in conductors A and B. Current direction depends on for what conductor thermoelectric electromotive force is bigger for absolute magnitude. Strength of current depends on difference of temperatures, specific thermoelectric electromotive forces of conductors and their resistivity.

Thermoelectric Peltier effect

When the current goes through two different conductors junctions temperature changes so when the current strength is big enough drop of water can be frozen or boiled changing current direction. Junction is heating or cooling depending on directing the current.

This is Peltier effect opposite to Seebeck effect.

Thermoelectric Thomson effect

If metal conductor to heat in one point and at the same time pass the current so on the ends of conductor appears the difference of temperatures. Where the current directed to the place of heating the temperature reduces and on the opposite end where the current directed from the point of heating the temperature raised. The Thomson coefficient is the only thermal-electric coefficient which can be measured homogeneous conductor. All these phenomena are concerned by Calvin correlation.

Thermocouples

Thermocouples and transducers refer to thermoelectric transformers based on Seebeck effect. When the temperatures of junctions of two conductors A and B are different the voltage on the ends of open circuit appears that is thermoelectric electromotive force.

According to functional capacity these transducers are often oriented for control of system work, measuring work temperature of substance or surface. Thanks to thermo transformers have construction simple enough inaccuracies are minimal and safety and longevity are high.

The choice of device depends on some factors. One of them is workspace of device or temperature range of measurable space.

Thermoelectric generator. The principle of work

Thermoelectric generator action is based on using of thermoelectric effects. So on thermoelectric phenomena direct transformation of heat energy into electric occurs.

The size of thermoelectromotive force is determined by the formula :

$$E = a(T_1 - T_2),$$

E is a thermoelectromotive force (volt),

T1 and T2 are temperatures of heating and cold junctions of thermocouple,

a is a coefficient of thermoelectric electromotive force depending on metal nature in the thermocouple (microvolt/degree).

If the temperature of cold junction of thermocouple is kept up permanently thermoelectromotive force will change proportionally to temperature changing of hot junction.

It gives opportunity to apply thermocouples for changing of temperature.

Note advantages of thermoelectric elements:

1. Stationary single-stage system of transforming of the first sort, absence of moving parts;
2. Long work recourse without service;
3. Opportunity to use the heat from any sources of energy;
4. Mobility;
5. Total autonomy;
6. High safety and longevity;
7. Large temperature range;
8. High power-intensive characteristics;
9. Ability to work in oxidation and inert environments.

In conclusion it should be mentioned that we presented effects based on thermoelectricity for acquaintance, researching of physical essence of these phenomena to try to make a device for cleaning of walls of reservoirs via freezing (Peltier module), device based on thermo fridge for freezing of area with microfissures in reservoirs and further using. And also cooling of surfaces of mechanisms, devices and pumps via thermo elements.

Stationary cover for heating of certain pipeline area without using the open flame based on Peltier effect that is deleting of paraffin depositons in pipelines in the certain place. There are also a lot of ways of solving problems which can be based on thermoelectricity effect.