

TECHNOLOGY FOR DEVELOPING DEVICES FOR CONVERTING THERMAL ENERGY INTO ELECTRICAL ENERGY

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Introduction and Background

The aim of the research is to develop the technology and construction of thermoelectric converters consisting of strings of bi-component wires welded together by an active resistance method based on the Joule–Lenz effect, occurring when pulsed electric current passes through their contact areas, and subsequently assembled according to specific schemes into panels embedded in bodies with heat radiation absorption properties. The scientific outcome of the research consists in the development of a manufacturing technology for micro-couples and the construction of a new class of devices for converting thermal energy into electrical energy, based on couples formed by micro-welded metal wires of different natures, obtained by applying pulsed electric discharge machining (PEDM). The active energy conversion element consists of a converter that comprises a row of bi-component wires welded together using the PEDM method. The construction of the active element enables the transformation of thermal radiation energy into electrical energy through the Peltier–Seebeck effect.

Methodology

The developed devices present at least two wires of different metal welded by applying PEDM. To create the power electric discharge that will be used for the microwelding of metal wires, the pulse generator of R-C type was used. As materials for the metal wires used in the experimental research, pairs of materials with different electrical properties were chosen: electrotechnical copper - nickel; electrotechnical copper - carbon steel; electrotechnical copper - nichrome; electrotechnical copper – constantan; carbon steel - constantan. The diameters of the metal wires are between 0.3 and 1 mm.

Results

The technological regimes and equipment required for the micro-welding of components made of materials of various natures were established. The technology for developing devices based on the conversion of thermal energy into electrical energy was successfully implemented. The functional characteristics of the converters, as well as the feasibility of operating the devices and their active elements, were determined.

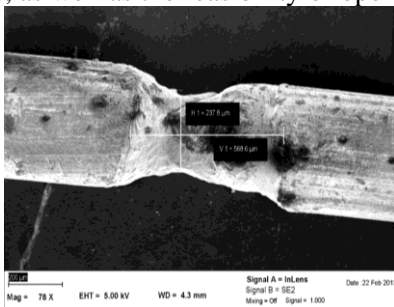


Figure 1. SEM of welded wires.

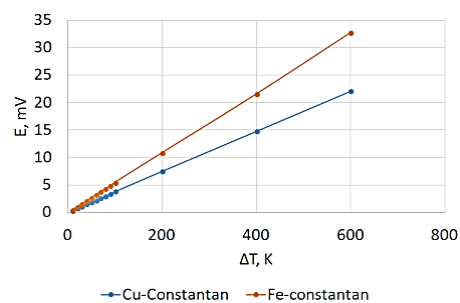


Figure 2. Thermo-voltaic characteristics.

Conclusions and Implications

The developed technology allows the construction of devices for converting thermal energy into electrical energy. The use of energy-saving technologies, such as pulsed electrical discharge machining, leads to a decrease in the production costs of devices.

Keywords: converter, energy conversion, metal wire, microwelding, pulsed electric discharge machining

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