ANISOTROPIC THERMOELECTRIC GENERATOR MADE FROM LONG Bi MICROWIRE IN GLASS COATING

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There are many reasons we are looking towards alternative energy sources. As a source of heat for thermoelectric generators (the thermoelectric method of thermal energy conversion into electric energy) involves unconventional renewable sources of thermal energy: from solar energy to the heat of human body. Currently, for thermoelectric conversion of heat most widely used approach based on the Seebeck and Peltier effects created at the interface of two materials with different values *S* of the Seebeck coefficient. Another type of thermoelectric converter is the anisotropic thermoelement (AT) using anisotropy of thermoelectric power. AT has some advantages: (a) The thermopower, unlike a conventional thermocouple, is proportional to the temperature gradient $(T_1 - T_2)/h$ instead of the temperature difference $T_1 - T_2$. Thus, decreasing the width *h*, it is possible to increase voltage at the same temperature difference; (b) Voltage *V* is proportional to length *l*; thus, it is possible to increase voltage by increasing the length of the plate. At room temperature we have investigated the transverse thermopower in thin single-crystal bismuth microwires for the purpose of using a microwire of bismuth to design an anisotropic thermoelectric generator. [1] The dependence of the specific transverse thermopower $S_{special} = V_{transv}/(\Delta T*l)$ for Bi microwire on the microwire diameter, schematic of AT generator and experimental sample of the AT generator are shown in Fig. 1

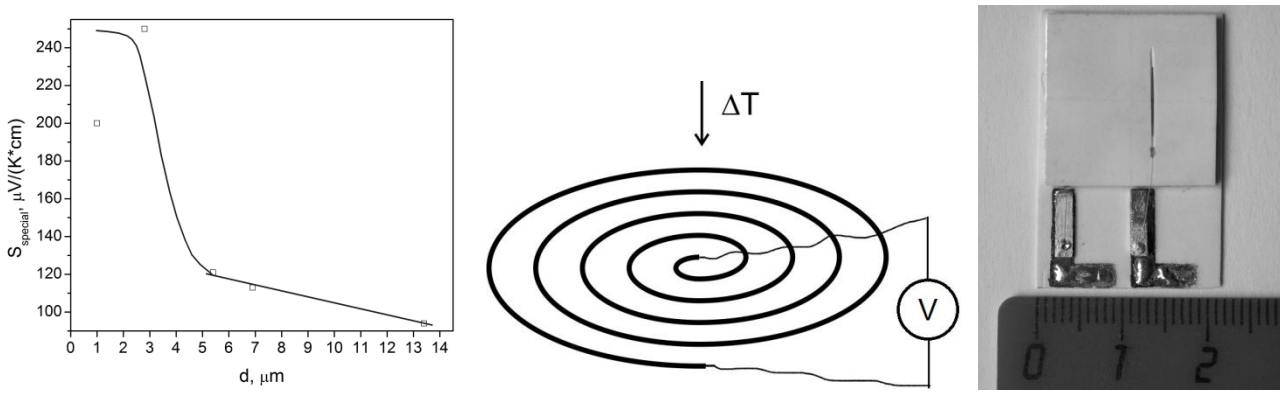

Fig. 1. (Left) The dependence of the specific transverse thermopower for Bi microwire on the microwire diameter; (Middle) Schematic of the anisotropic thermoelectric generator made of long Bi-Sn microwire in glass coating (long microwire coiled into a spiral so that the plane containing the axis C_3 was directed along the gradient T); (Right). Experimental sample of the anisotropic thermoelectric generator made of Bi-Sn microwire (l= 5 m) with outer diameter D= 45 μm and the core diameter d=11 μm

According to our experimental data, to obtain a thermoelectric voltage of 1 V at a transverse temperature gradient of 5 K, the microwire with a diameter of 2 μm and a length of 8 m must be used. The resistance of this microwire will be R = 3 MOhm and the maximum current of that generator will be equal to 0.34×10^{-6} A.

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[1] L.A. Konopko, T.E. Huber, and A.A. Nikolaeva, *AIP Conf. Proc.*, **1449** (2012) 287