DOUBLE MICROTHERMOCOUPLE MADE ON THE BASIS OF Bi2Te3 MICROWIRES FOR BIOMEDICAL RESEARCH

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Development of the technology for manufacturing miniature device for microscopy investigation of various biological objects with the possibility of changing their temperature in the direction of its increase and decrease is important. Due to very good thermoelectric performance at room temperature the BiTe microwires in glass coating for constructing this device were selected. Most frequently for materials of *n*-type conductivity the alloys $Bi_2Te_{3-x}Se_x$($x=0.1\div1$) are utilized. As thermoelectric material of *p*-type conductivity, the alloys $(Bi_2Te_3)_{1-x}(Sb_2Te_3)_x$ commonly used. According to investigations of thermopower of the microwires in a glass coating, core materials for the *n* and *p* branches of the thermocouple on basis of topological insulators Bi2Te3 with the value of the thermopower in the temperature range 200 - 300 K equal to 100 - 300 μV/K have been found.[1] We have chosen for *n*-type branch the alloy Bi_2Te_2Se and for *p*-type branch the alloy $(Bi_2Te_3)_{0.25}(Sb_2Te_3)_{0.75}$. The technology of making these thermocouples using chemical deposition of Ni on the one ends and electrochemical deposition of Cu for making thermoelectric junction on the another ends were developed. Our device consists of two thermocouples – one thermocouple using the Peltier effect working as cooler or heater (depend on the dirction of current through it), and second thermocouple working as temperature sensor. Schematic drawing of double thermocouple and experimental sample are shown in Fig. 1.

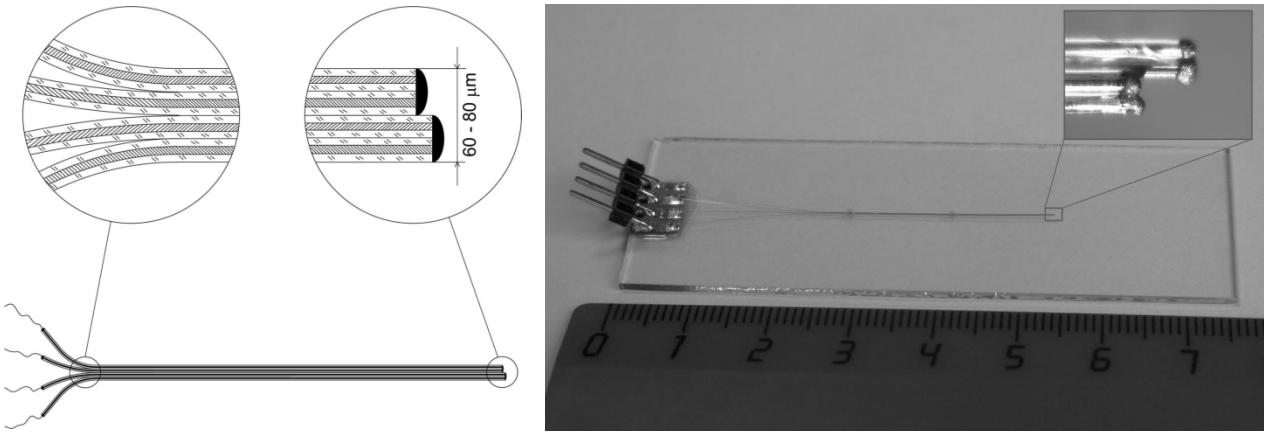

Fig. 1. (Left) Schematic drawing of the double thermocouple. It consists of two thermocouples made from n- and p-types Bi_2Te_3 microwires in glass coating. (Right) Experimental sample of the double thermocouple mounted on a glass substrate which is commonly used in optical microscopy.

This double thermocouple allows us in the single cycle:

- high accuracy temperature measurements of the small objects (individual cells) without destroying it;
- changing the temperature (cooling or heating) of the small objects for the cytological studies.

This work was supported by STCU project #5373 and US National Science Foundation PREM.

[1] L.A. Konopko, A.A. Nikolaeva, T.E. Huber, and D.F. Meglei, pss (a) (2014), accepted for publication.