

The behaviors of output efficiency of n-type and p-type Bi₂Te₃ thermoelectric cell rod with difference of leg height

Abstract

The objectives of this study were to study the output efficiency of n-type and p-type Bi₂Te₃ thermoelectric materials (ingot) for applying as a thermoelectric generator (TEG). The phase analysis of Bi₂Te₃ was performed by X-ray diffraction (XRD). The results indicated that most diffraction peaks of the XRD patterns of Bi₂Te₃ sample present a rhombohedral Bi₂Te₃ structure. The scanning electron microscopy (SEM) was investigated bulk Bi₂Te₃ samples revealed their surface morphology after polishing. This result can be seen in these figures that the high homogeneity of all bulk samples resulted in a highly dense microstructure. The density value of bulk Bi₂Te₃ was approximately 98%. Before measurement, both n-type and p-type Bi₂Te₃ were cut as cell rod about 0.5 * 0.5 * 2 cm and the silver paint was paint at both surfaces as the electrode. For investigation of the output efficiency, the temperature at hot surface was set at 100 °C. The temperature differences (ΔT) were found that the ΔT of n-type Bi₂Te₃ thermoelectric cell rod was observed at about 60 °C. Moreover, a voltage and a current of n-type Bi₂Te₃ thermoelectric cell rod were observed at about 9.1 mV and 1.75 μ A, respectively. However, good output efficiency was observed in the p-type Bi₂Te₃ thermoelectric cell rod with ΔT of about 65 °C and a voltage and current were observed about 12.8 mV and 4.32 μ A, respectively. Notably, the good output efficiency of p-type Bi₂Te₃ is higher than n-type Bi₂Te₃ because the figure-of-merit (ZT) value of p-type Bi₂Te₃ is higher than n-type Bi₂Te₃. Then the difference of leg height of the p-type Bi₂Te₃ thermoelectric cell rod was investigated. These results indicated that the output efficiency of p-type Bi₂Te₃ thermoelectric cell rod is dependent on the height of p-type Bi₂Te₃ thermoelectric leg.

Keywords: n-type Bi₂Te₃, and p-type Bi₂Te₃, figure-of-merit (ZT), bulk Bi₂Te₃

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