High thermoelectric performance at low temperature of p-$Bi_{1.8}Sb_{0.2}Te_{3.0}$ grown by the gradient freeze method from Te-rich melt

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Abstract: The structural and low-temperature thermoelectric properties were investigated in the temperature range from 4.2 to 300 K of $Bi_{1.8}Sb_{0.2}Te_{3.0}$ grown by the gradient freeze method from Te-rich melt of $Bi_{1.8}Sb_{0.2}Te_{3.0+\delta}$. The composition profile was determined by electron probe microanalysis (EPMA) measurement to be homogeneous in the center part of the single crystalline ingots. An excess of Te is segregated at the top of the ingots. A high thermoelectric performance was achieved at low temperature in the p-type samples. The largest value of the Seebeck coefficient α of > 500 μVK^{-1} was obtained at 200 K for $\delta = 0.259$ to give ZT = 1.1. The optimum carrier concentration was determined to be $n = 1.6 \times 10^{19}$ cm^{-3} for the highest thermoelectric performance.

Author Keywords: Crystal growth; Electronic transport; Semiconductors; Thermoelectricity; X-ray diffraction

Index Keywords: Carrier concentration; Carrier mobility; Crystal structure; Electric conductivity; Seebeck effect; Semiconductor materials; Solid solutions; Tellurium; X ray diffraction analysis; Electron probe microanalysis (EPMA); Thermoelectric efficiency; Bismuth alloys

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