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The Effect of Bi/Sb ratio on Maximum ZT in Nanostructured p-type $\mathbf{Bi_xSb_{2-x}Te_3}$ Alloys YI MA, BO YU, BED POUDEL, YUCHENG LAN, JIAN YANG, ZHIFENG REN, Physics Dept., Boston College, QING HAO, GANG CHEN, Department of Mechanical, Massachusetts Institute of Technology — Alloy nanoparticles $Bi_xSb_{2-x}Te_3$ (x = 0.2, 0.3, 0.4, 0.5 and 0.6) were synthesized from bismuth, antimony, and tellurium and compacted into nanostructured bulk samples with full density. The thermoelectric properties were measured in the temperature range of 25 to 250°C. We showed that a maximum dimensionless figure-of-merit (ZT) reached 1.27 at about 100°C for $Bi_{0.4}Sb_{1.6}Te_3$(x = 0.4), a significant improvement over the state-of-the-art p-type Bi_2Te_3 alloys. It is demonstrated that the enhanced ZT mainly comes from a reduced thermal conductivity due to the increased phonon scattering due to the nano size of the grains. Also, the ZT peaks shift from low temperature to high temperature with the decreasing of x, which indicates the less Bi content would benefit the potential power generation application while the more Bi content materials could be used as a potential cooling device. This new route of enhancing ZT value can be applied to other materials.

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