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Potassium resonant doping in $Bi_{92.5}Sb_{7.5}$ material HUAIZHOU ZHAO, MANI POKHAREL, CYRIL OPEIL, Department of Physics, Boston College, GANG CHEN, Department of Mechanical Engineering, Massachusetts Institute of Technology, ZHIFENG REN, Department of Physics, Boston College, REN'S LAB AT BOSTON COLLEGE COLLABORATION, GANG CHEN'S LAB AT MIT COLLABORATION — $Bi_{1-x}Sb_x$ alloy material is a narrow band semiconductor when x is in the range of 0.07 – 0.4. The energy gap reaches a maximum value of 0.014 eV in the composition range of x = 0.15 to 0.2. Thermoelectric properties on this material have been investigated for half a century due to the promising cooling applications. However, the low efficiency originating from the medium thermoelectric Power Factor (PF) prohibited this material from real applications. Here, we demonstrated that by potassium doping, both the Seebeck Coefficient and electrical conductivity can be enhanced by 25% for the ingot samples for a broad temperature range. Further more, by combining with our nano grain size approach, thermal conductivity of ingot sample was reduced by 20%, this lead to the figure of merit ZT increase of 50% comparing to ingot counterpart. The potassium resonant doping was accounted for the PF enhancement for ingot $Bi_{92.5}Sb_{7.5}$ sample. We also find that the resonant doping can be realized for nano composite samples through parameters optimization.

Huaizhou Zhao
Department of Physics, Boston College

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