Study of the crystallization and dopants effect on the semiconducting thermoelectric compounds with \((\text{Bi}_{0.25} \text{Sb}_{0.75})_2\text{Te}_3\) formula

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Abstract: The \((\text{Bi}_{0.25} \text{Sb}_{0.75})_2\text{Te}_3\) compound is a p-type thermoelectric semiconductor for application in thermoelectric cooling systems. To fabricate this single crystal, required elements, Bi, Sb and Te with 5N purity melted in quartz capsule at \(10^{-6}\) torr pressure and rapidly quenched to room temperature. The sample crystallized by zone melting method with the rate of 8 mm per an hour at 700 °C and for heat stress relieving annealed at 370 °C. In this presentation; crystal growth process and effect of dopants on improving the thermoelectric property of crystals will be reported. Structural studies by XRD show the expected phases formed in single phase. Scanning electron microscopy (SEM) was used to characterize the quality of the crystal growth. Maximum figure of merit \(Z = 3.15 \times 10^{-3} \text{ K}^{-1}\) in optimum condition was obtained.

Keywords: Crystal Growth, thermoelectric Semiconductor, Figure of merit, Scanning Electron Microscopy.