High Perfection Bulk and Film Thermoelectrics Based on PbTe Doped by In

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Energy harvesting has been proposed as a promising method of supplying electric power to autonomous sensor network devices and mobile electrical instruments due to the possibility of obtaining electric power from unemployed environmental energy, such as heat, light, and vibrations. It was found that micro-generators for energy harvesting are more useful than standard electrical batteries. Lead telluride alloys are the first materials investigated and commercialized from micro- to macro-generators with electrical power up to few hundreds watt, however, their full potential for thermoelectricity has only recently been revealed to be greater than commonly believed. The maximal value of the thermoelectric figure of merit Z, as a function of electron density, is attained only for the specific location of the Fermi level E_F relatively to the conduction band edge E_C. A systematic study of structural, microstructural, and thermoelectric properties of bulk and film PbTe doped with indium is presented. The bulk samples were prepared using spark plasma sintering technique. The films with high efficiency of energy conversion were fabricated using a flash evaporation method on the polyimide substrate. A systematic study of thermoelectric properties (Seebeck coefficient, electrical and thermal conductivity) over a wide temperature range for $Pb_{1-x}In_xTe$ bulk and film samples has been performed.

Keywords: thermoelectrical materials, PbTe semiconductor, indium doping, thermoelectric figure of merit Z.

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