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Enhancing transport properties of Bi_2Te_3-xSex alloys via doping for thermoelectric power generation applications

Omer Meroz and Yaniv Gelbstein
Ben-Gurion University of the Negev, Israel

While trying to find new alternative energy resources, new technological developments must be made to bring the society one step closer to a cleaner environment. The rising awareness of the global warming effect as well as the steady decline in the quantity of current resources and subsequently the climb in their price drive the search for improving current energy usage and finding new energy resources. Thermoelectric devices take thermal heat, either directly from solar energy or as a byproduct of fuel burn and transform it to electricity. The performance of thermoelectric devices is assessed by the dimensionless figure of merit ZT of the material, defined as $ZT=\alpha^2\sigma T/\kappa$, where α, σ,κ and T are the Seebeck coefficient, the electrical and thermal conductivities and the absolute temperature, respectively. The thermal conductivity is a combination of thermal conductivity via electrons, Ke and via phonons, κl. The main difficulty in improvement of the efficiency of a thermoelectric device is due to the complex relation between σ, α and κ. Improving the performance of thermoelectric materials is usually done either by improving the power factor, $\alpha^2\sigma$ or by applying phonon scattering methods in order to lower the thermal conductivity. Bismuth-telluride-based alloys are of great importance not only as the best thermoelectric materials with the maximal ZT values close to unity near room temperature but also due to the potential for further performance improvement. In this study $Bi_2Te_{3-x}Se_x$ compositions were electronically optimized by various CHI_3 doping levels, preferred alignment of the crystallographic orientation and lattice thermal conductivity minimization. The synthesis route included rocking furnace melting, energetic ball milling and hot pressing under optimal conditions for enhancement of the thermoelectric figure of merit, ZT commonly applied in low temperature power generation applications. The transport properties in perpendicular to the pressing direction were examined.

Biography

Omer Meroz is student at Ben-Gurion University of the Negev, Israel. Her research experience includes various programs, contributions and participation in different countries for diverse fields of study. She is a recipient of many awards and grants for his valuable contributions and discoveries in major area of research. Her research interests lie in Major areas of Study. She is committed to highest standards of excellence and it proves through her work and experience.

omer.meroz@gmail.com

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