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Low thermal conductivity and hydrothermal synthesis of bismuth telluride alloys and n-type cobalt skutterudites

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Thermoelectric materials require low thermal conductivity for attaining high ZT of dimensionless figure of merit. It is a common practice now to reduce the lattice thermal conductivity through scattering heat-carrying phonons at interfaces by introducing nanoparticles in the matrix. Hydrothermal methods to synthesize bismuth telluride alloys and n-type cobalt skutterudite are adopted. The resulting powders are cold pressed and sintered in an evacuated ampoule. A remarkable low thermal conductivity of 0.41 $Wm^{-1}K^{-1}$ and hence a ZT of 1.65 can be attained for $Bi_{0.45}Sb_{1.55}Te_{3-\delta}$ at 290 K. Hydrothermal synthesis of pristine n-type CoSb3 provides a rapid and low temperature fabrication route and low thermal conductivity of 1.33 $Wm^{-1}K^{-1}$ as compared to lengthy annealing and reaction at high temperature using solid state reaction. The thermal conductivity reported for $CoSb_3$ synthesized from solid state reaction methods falls in the range of 3 and 10 $Wm^{-1}K^{-1}$ at room temperature.

Biography

Chia-Jyi Liu received his PhD from The Johns Hopkins University. He is the distinguished Professor of National Changhua University of Education. He has published more than 100 papers in international journals and serves as an editorial board member in condensed matter physics of The Scientific World Journal and hosts a research topic “Nanostructured thermoelectric composites” with Frontiers in Chemistry.

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