National Conference on Emerging Trends in Engineering, Science, Management and Humanities (NCETESMH – 2020)
27th September, 2020

CERTIFICATE NO : NCETESMH /2020/ C0920617

A STUDY OF STRATEGIES TO DESIGN THE MATERIAL AND IMPROVE THE THERMOELECTRIC PROPERTIES

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ABSTRACT

In order to obtain high zT, it is essential to find a material which possesses high Seebeck coefficient value along with low electrical resistivity. However, both the parameters depend simultaneously on the Fermi level EF, i.e., the increase in the Seebeck coefficient simultaneously increases electric resistivity. EF is a function of carrier concentration, effective mass and temperature. Hence maintaining the optimum carrier concentration gives rise to a moderate value of S, ρ and C. Various ways are considered to improve the zT. Achieving optimum carrier concentration by means of substitution or alloying, increase of band degeneracy by tuning the band structure, low energy carrier filtering from nano-inclusions, selective scattering of phonons by nano-structuring, preventing bipolar conduction through enhanced band gap are the important techniques explored to enhance the PF and reduce the C. L is reduced by creating disorder in the unit cell through point defects and rattling reduces lattice thermal conductivity significantly by scattering the phonons. However, the materials with complex crystal structure, large unit cell inherently show low lattice thermal conductivity.