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Bi_2Te_3 for room temperature thermoelectric applications

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Thermoelectric energy conversion is a promising technology. A number of materials have been used with different dopants and varying compositions to achieve better performance. In case of thermoelectric materials performance is measured by a dimensionless parameter ZT, which is called figure of merit. Maximum figure of merit achieved till date is less than 3. All materials used to build thermoelectric devices are temperature specific. Bismuth Telluride is one of very few materials for room temperature applications [1].

Bismuth telluride samples are synthesized and characterized for thermoelectric performance. Solid state reaction method is used for synthesis in which Bi and Te powders were vacuum sealed into a quartz tube ampoule then heated at 600°C. Obtained crystalline ingots were hand grounded into powder. This powder was then cold pressed into 10mm discs. These disc samples were subjected to thermoelectric measurements. LFA-1000 instrument was used for thermal conductivity measurement and LSR-3 for measuring seebeck coefficient and electrical resistivity.

As bismuth telluride is a low temperature material, its thermoelectric properties are measured for up to 420K. As can be seen from the Figure 1a, total thermal conductivity is increasing with temperature. Figure 1b is showing power factor Vs temperature. Figure 1c is showing ZT Vs temperature, maximum ZT achieved is 0.75 at 420K.

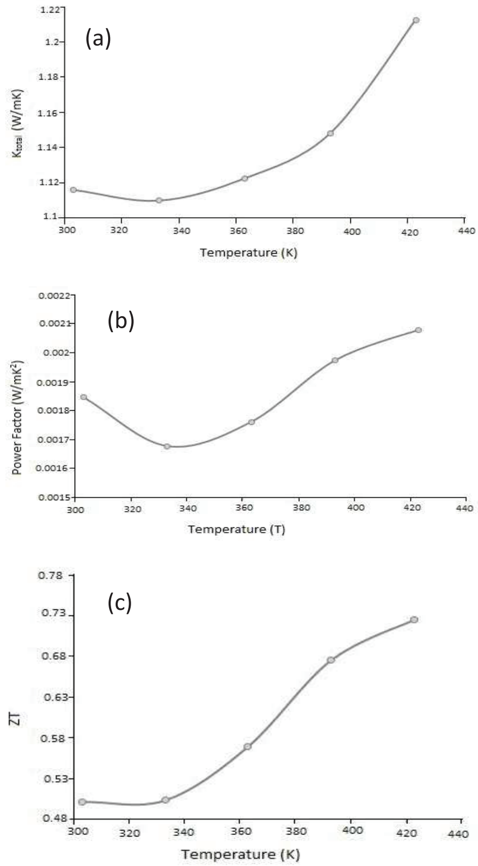

Figure 1: (a) Ttotal thermal conductivity (b) Power factor and (c) ZT Vs temperature

Reference

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