Thermoelectric potential: role of bismuth in $CuSb_{1-x}Bi_xSe_2$ for improved transport properties

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Aims and scope

Submit manuscript

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Abstract

The bismuth (Bi)-substituted $CuSb_{1-x}Bi_xSe_2$ chalcostibites were synthesized using the horizontal Bridgman-Stockbarger technique combined with ball milling, at temperatures ranging from 303 to 650 K. The impact of Bi substitution was observed in the thermoelectric transport properties by substituting Bi (x = 0, 0.2, 0.4, 0.6) resulted in a decreased Seebeck coefficient and higher electrical resistivity compared to the pure $CuSbSe_2$ sample. Notably, the higher substitution level (x = 0.6) showed the enhanced properties compared to the lower levels. The pristine sample exhibited a power factor of 550 $\mu WK^{-2}\ m^{-1}$, while the substituted samples showed the values of 20, 37 and 50 $\mu WK^{-2}\ m^{-1}$, respectively. However, in accordance with the power factor, the pristine compound demonstrated a higher figure of merit (ZT = 0.47) compared to the existing literature values (ZT = 0.21), indicating the superior thermoelectric performance using this synthesis method.