

Abstract Submitted
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Enhancement of Thermoelectric Performance in n-type $\text{PbTe}_{1-y}\text{Se}_y$ by Cr Doping EYOB CHERE, QIAN ZHANG, Univ of Houston, KENNETH MCENANEY, MIT, MENGLIANG YAO, Boston Collage, FENG CAO, Univ of Houston, CYRIL OPEIL, Boston Collage, GANG CHEN, MIT, ZHIFENG REN, Univ of Houston — Lead telluride and its alloys have been extensively studied for medium temperature thermoelectric applications. However, little emphasis has been given to improve the figure-of-merit (ZT) near room temperature. In this investigation, we report a systematic study of Cr doping in $\text{PbTe}_{1-y}\text{Se}_y$ with $y = 0, 0.25, 0.5, 0.75, 0.85,$ and 1. We found the peak ZT temperature increased with increasing concentration of Se. A highest ZT of ~ 0.6 at room temperature in Te-rich $\text{Cr}_{0.015}\text{Pb}_{0.985}\text{Te}_{0.75}\text{Se}_{0.25}$ was obtained due to a lowered thermal conductivity and enhanced power factor resulted from high Seebeck coefficient of about $-220 \mu\text{V K}^{-1}$ and high Hall mobility $\sim 1120 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$ at room temperature. A room temperature ZT of ~ 0.5 and peak ZT of ~ 1 at about 573 K to 673 K is shown by Se-rich sample $\text{Cr}_{0.01}\text{Pb}_{0.99}\text{Te}_{0.25}\text{Se}_{0.75}$. This improvement of the room temperature ZT improved the average ZT over a wide temperature range and could potentially lead to a single leg efficiency of thermoelectric conversion for Te-rich $\text{Cr}_{0.015}\text{Pb}_{0.985}\text{Te}_{0.75}\text{Se}_{0.25}$ up to $\sim 11 \%$ and Se-rich $\text{Cr}_{0.01}\text{Pb}_{0.99}\text{Te}_{0.25}\text{Se}_{0.75}$ up to $\sim 13 \%$ with cold side and hot side temperature at 300 K and 873 K, respectively, if matched with appropriate p-type legs.

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