Enhancing Figure of Merit in *n*-type PbTe : Defect Evolution Approaching Low Thermal Conductivity

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The PbTe-based alloys are outstanding intermediate-temperature thermoelectric materials, which suits practical TE application. Years of hard work chasing high-performance PbTe via doping, it comes to realize that the breakthroughs for *n*-type PbTe are less impressive, which limits the overall conversion efficiency of a PbTe-based TE device. To surmount dilemma, the electron-donor Gallium is incorporated into the PbTe, which tunes the electron carrier concentration through generateing the additional impurity traps within the bandgap. Furthermore, the κ_L exhibits a significantly decreasing tendency, accompanying with the defect evolution that varies from a dislocation loop to nanoprecipitation with increasing Ga content. The footmark for the κ_L reduction can be probed by an equilibrium phase diagram, which opens a new avenue for locating the high-zT TE materials. The synergy approach of carrier optimization and defect engineering rejuvenate the well-established TE materials and boost their performance even beyond existing records.