Supporting Information

Core-shell nanostructures introduce multiple potential barriers to enhance energy filtering for the improvement of thermoelectric properties of SnTe

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Results and Discussion:

In our work, the Lorenz number is obtained based on the two band model:

$$\mathrm{L}_{lh}=\left(\frac{\kappa_B}{e}\right)^2\left[\frac{{}^2F_{-2}^1(\eta,\alpha)}{{}^0F_{-2}^1(\eta,\alpha)}-\left(\frac{{}^1F_{-2}^1(\eta,\alpha)}{{}^0F_{-2}^1(\eta,\alpha)}\right)^2\right], \quad (1)$$

and

$$\mathrm{L}_{hh}=\left(\frac{\kappa_B}{e}\right)^2\left[\frac{{}^2F_{-2}^1(\eta-\Delta\nu,0)}{{}^0F_{-2}^1(\eta-\Delta\nu,0)}-\left(\frac{{}^1F_{-2}^1(\eta-\Delta\nu,0)}{{}^0F_{-2}^1(\eta-\Delta\nu,0)}\right)^2\right], \quad (2)$$

In the equations above the integral ${}^nF_l^m$ is defined by

$${}^nF_l^m=\int_0^\infty -\frac{\partial f}{\partial\varepsilon}\varepsilon^n\left(\varepsilon+\alpha\varepsilon^2\right)^m\left[\left(1+2\alpha\varepsilon\right)^2+2\right]^{\frac{l}{2}}d\varepsilon,$$

where L_{lh} is the L of light-hole band, L_{hh} is the L of heavy-hole band, η is the reduced chemical potential calculated by $\eta = E_f/k_BT$, α is the nonparabolic parameter obtained by $\alpha = k_BT/E_g$, and ${}^nF_l^m$ is the generalized Fermi function. For the second valence band, we set α = 0 and replace η with $\eta-\Delta\nu$ in these equations, where $\Delta\nu = \Delta E/k_BT$, ΔE is the energy difference between the first and second valence band. The total L of the system can be expressed:

$$L_{total} = \left(\delta_{lh} L_{lh} + \delta_{hh} L_{hh}\right) / \left(\delta_{lh} + \delta_{hh}\right). \quad (3)$$

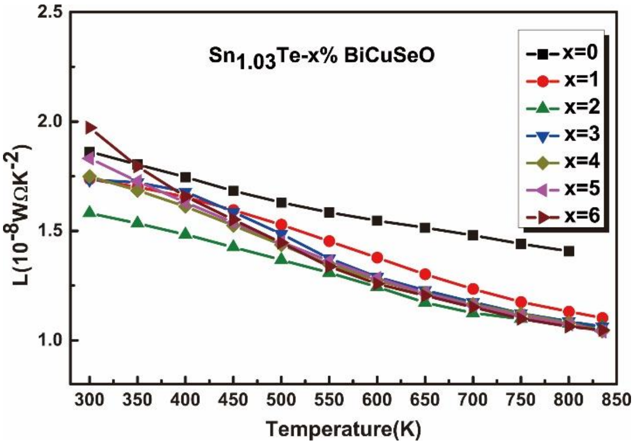

Figure S1. Lorenz numbers as a function of temperature for $Sn_{1.03}Te$-x% BiCuSeO.