Supplementary Information

Improved thermoelectric power factor and conversion efficiency of perovskite barium stannate

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To examine the practical application of $n$-type doped BaSnO$_3$ in thermoelectric devices, four different $p$-type popular thermoelectric materials including BiCuSeO, Si–Ge alloy, PbTe based compounds and half-Heusler FeNbSb are selected to assemble with $n$-type doped BaSnO$_3$ to form the high temperature thermoelectric modulus.$^{1-4}$ It is worthy to note that the disparity compatibility factor of $n$-type doped BaSnO$_3$ is matched with that of the four $p$-type samples to assemble the thermoelectric modules over the considered operating temperature range (300 K to 1200 K), as shown in Fig. S1(a). With $T_c$ fixes at 300 K and $T_h$ varies from 400 K to 1200 K, the thermoelectric couples compromising $n$-type BaSnO$_3$ and $p$-type thermoelectric materials can be assembled. The ideal conversion efficiency is simulated and the results are plotted in Fig. S1(b). The couple between $n$-type doped BaSnO$_3$ and $p$-type doped FeNbSb exhibits the optimal conversion efficiency. Under the condition of temperature difference is 900 K (hot/cold-side temperature of 1200 K/300 K), the module produces a maximum efficiency of 9.7%, which is even higher than that of commercial thermoelectric modules base on bulk Bi$_2$Te$_3$.$^5$ The high conversion efficiency is ascribed to excellent thermoelectric performance as well as the thermal stability of these two samples at high temperature.
Fig. S1 (a) Compatibility factor of $n$-type BaSnO$_3$ and four $p$-type thermoelectric segments. (b) The ideal maximum efficiency of four types of thermoelectric couples assembled by $n$-type BaSnO$_3$ and $p$-type BiCuSeO, Si–Ge alloy, PbTe based sample and Hf-doped FeNbSb.

References:


