Electronic Supplementary Material (ESI) for RSC Advances.

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_2Te_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.

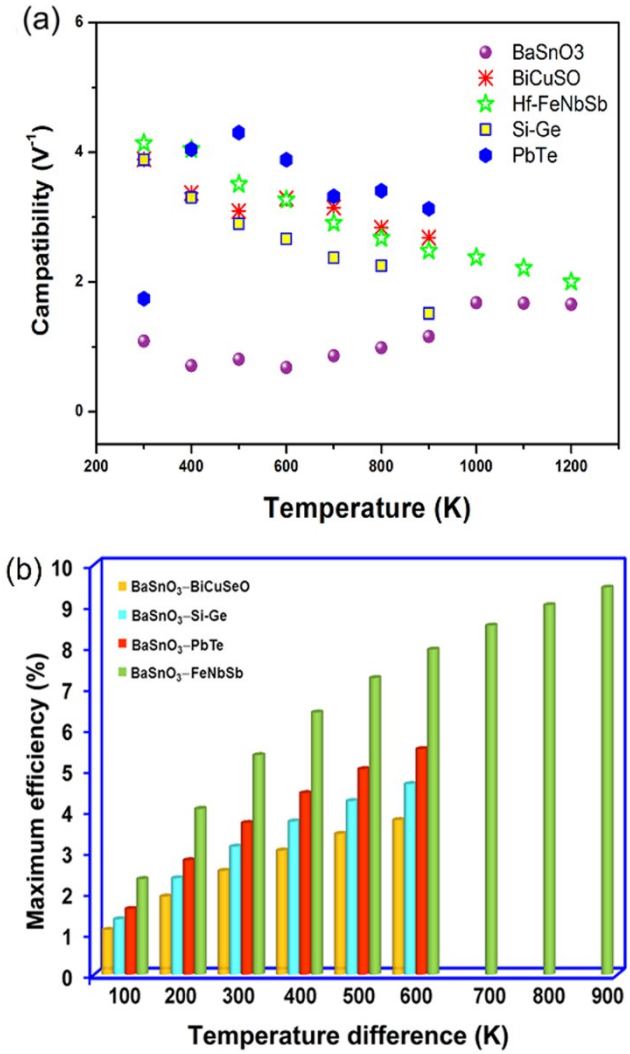

Fig. S1 (a) Compatibility factor of *n*-type $BaSnO_3$ and four *p*-type thermoelectric segments. (b) The ideal maximum efficiency of four types of thermoelectric couples assembled by *n*-type $BaSnO_3$ and *p*-type BiCuSeO, Si–Ge alloy, PbTe based sample and Hf-doped FeNbSb.

References:

1. L. D. Zhao, J. Q. He, D. Berardan, Y. H. Lin, J. F. Li, C. W. Nan and N. Dragoe, *Energy Environ. Sci.*, 2014, **7**, 2900–2924.
2. G. Bb Joshi, H. Lee, Y. Lan, X. Wang, G. Zhu, D. Wang, G. Chen, *Nano Lett.*, 2015, **8**, 4670–674.
3. Y. Z. Pei, A. LaLonde, S. Iwanaga, G. J. Snyder, *Energy Environ. Sci.*, 2011, **4**,

2085–2089.

4. C. G. Fu, S. Q. Bai, Y. T. Liu, Y. S. Tang, L. D. Chen, X. B. Zhao, T. J. Zhu, *Nat. Commun.*, 2015, **6**, 8144.
5. G. J. Snyder, J. R. Lim, C. K. Huang, *Nat. Mater.*, 2003, **2**, 528–531.