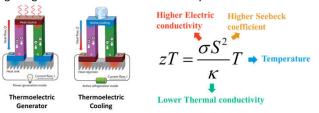


Enhanced Thermoelectric Performance of Zintl-phase NaCdSb via Carrier Excitation Suppression Kejia Liu and Yue Chen

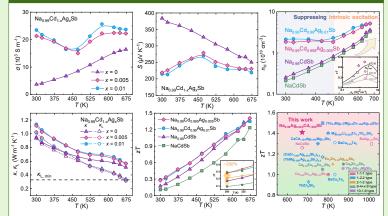
Department of Mechanical Engineering

Introduction

- * Zintl phases are a class of intermetallic compounds that have complex structures and low lattice thermal conductivities, promising for thermoelectric applications.
- Recently, Zintl-phase NaCdSb compound has been studied for its extraordinary TE performance^[1]. However, the low-temperature carrier concentration significantly deviates from the optimal value, greatly limiting its thermoelectric efficiency.
- In this study, a stepwise strategy is employed to enhance the TE performance of the NaCdSb-based Zintl phase. The NaCdSb-based single-leg device has also been successfully fabricated.



Suppressing the Intrinsic Carrier Excitation



- Ag doping further increases the carrier concentration, suppressing the intrinsic excitation temperature to 473 K, with minor effect on the lattice thermal conductivity^[2].
- As a result, zT_{max} ~1.41 at 673 K and zT_{avg} ~ 0.81 from 300 K to 673 K are achieved in Na_{0.99}Cd_{0.995}Ag_{0.005}Sb.

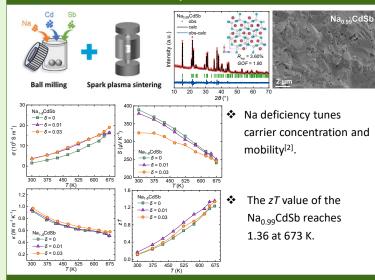
Conclusions

- * sodium deficiency and silver $Na_{0.99}Ag_{0.005}Cd_{0.995}Sb$ achieves a zT value of 1.41 at 673 K, with an average zT of 0.81 over the temperature range of 300 K to 673 K.
- * Motivated by the superior zT, a NaCdSb-based single-leg device has been successfully fabricated, showing a conversion efficiency of about 7% at a temperature difference of 373 K.

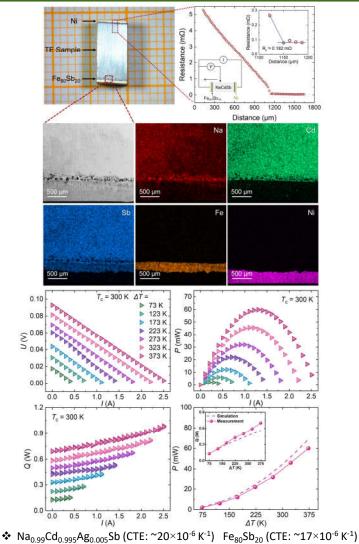
Reference

- [1] K Guo et al. Angew. Chem. Int. Ed., 2023, 62, e202212515.
- [2] K Liu et al. Adv. Funct. Mater., 2025, 35, 2419145.

Fabrication and Optimization of NaCdSb



Single-leg Fabrication and Performance Testing



- ❖ NaCdSb-based single-leg: $\eta_{\rm max}$ ~7% at $T_{\rm h}$ = 673 K (ΔT ~ 373 K)^[2]