High Thermoelectric Performance of AgSbTe2-x-ySexSy Materials by Phase Stabilization

ID# 2021-5391

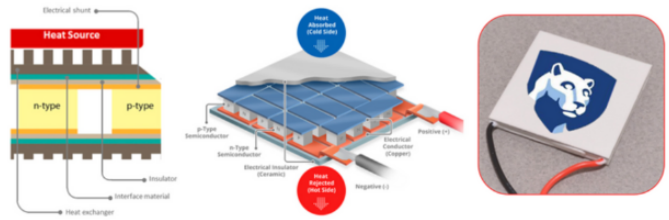

Figure 1. Example of a AgSbTe1.85S0.15 device and power generation performance

Technology Summary

Novel samples of AgSbTe2-x-ySexSy resulted in two orders-of-magnitude improvement in the carrier density. The carrier concentration and mobility of the doped sample showed stable and minor variation over the temperature range (3000 K to 673 K). The doped materials retain a relatively high Seebeck coefficient, which contributes to a power factor as high as 2.0 mW m-1K-2 at 673 K, with a maximum Figure of Merit (ZT) value as high as 2.3 when y = 0.15. This ZT value is 310% higher than that of the undoped sample and is one of the highest reported in the literature to date.

Application & Market Utility

Thermoelectric harvests waste heat through solid state technologies that have no moving parts/gears and no sound. Commercial materials have a ZT at 1 and an overall efficiency of at 6%. This invention raised the level to about 2 with an efficiency between 15-20%, which are competitive with other thermogenerators. These lighter, solid-state, bulk semiconductor pieces can be diced and machined and are stable for hours at 400oC in an inert atmosphere. The DC electricity requires no converter and may enable portable and decentralized power generation.

Next Steps

Since ZT directly relates to thermal to electrical energy conversion. These materials have potential utility for the design and development of highly efficient solid state thermoelectric generators for waste heat recovery.

TECHNOLOGY READINESS LEVEL 4

Seeking

Licensing | Research

Keywords

- Thermoelectric materials
- Thermoelectric applications

Researchers

Bed Poudel
Research Professor
Website

Yu Zhang
Postdoctoral Scholar

Shashank Priya
Associate Vice President for Research and Professor of Materials Science and Engineering
Originating College
College of Earth & Mineral Sciences

Office of Technology Management Contact
Matthew Smith
mds126@psu.edu
(814) 863-1122