Enhancement of Thermoelectric properties of hole-doped polycrystalline SnSe by alloying Ge

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Thermoelectric (TE) materials offer a potential solution to the global energy crisis in an environmentally friendly way by harvesting waste heat and converting it to electric energy. Single crystal p-type SnSe samples have an extraordinarily high figure of merit (ZT) of ~2.2-2.6 at 923 K. because it has intrinsically ultralow lattice thermal con- ductivity due to highly anharmonic bonding characters. Since single crystal samples consume a lot of time and cost to produce high quality, there is a limit to the practical application of devices. Although polycrystalline samples show lower performance than single crystal samples, they have advantages of machinability and scalability, so they are easy to apply to devices. As a result, improving TE properties of polycrystalline SnSe samples have been one of the most important tasks in TE community.

In this presentation, we report the alloying effect of Ge for polycrystalline SnSe systems to improve their TE performance. At the optimal level, the synergistic role of Ge alloying for enhancement in power factor and reduction in the thermal conductivity enables a significantly high ZT of 1.4 to be achieved at 800 K.