High Performance p- and n-type GeTe Based TE Materials and Devices

1. High Thermoelectric Figure of Merit in GeTe by Complementary Co-doping of Bi and In

- In-doping in GeTe enhances the $S$ value via Resonance Level Formation

Mott equation

$$\alpha(E) \propto \rho(E) \sigma(E)$$

$$\sigma(E)$$ is proportional to the density of states (DOS) at $E$.

- Bi-doping minimizes $k_f$ of GeTe by introducing point defects and nano-structuring.

2. Realization of n-type GeTe Thermoelectrics: Electronic Structure Modulation by AgBiSe$_2$ Alloying

- Increasing contribution of Bi-p orbitals to the Conduction Band-edge explains n-type conduction.

3. Low Thermal Conductivity and High TE Performance in GeTe-GeSe-GeS Ternary System

- Pseudo-binary vs. pseudo-ternary

Low ZT

Outcome

Strategies

- Carrier concentration optimization
- Extensive point defect scattering
- Nano-structuring
- Valence band convergence
- Resonance level
- Synergistic approach

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Thank You