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Overview of thermoelectric materials and their emerging applications CAMAS KEY, KAREN MARTIROSYAN, University of Texas at Brownsville — Waste heat derived from any heat generating process: radioisotope decay, fuel combustion, solar thermal energy, geothermal energy, waste incineration, nuclear reactor cooling, industrial manufacturing, etc.; can be converted into electricity through the application of thermoelectric materials. The optimal thermoelectric materials exhibit high electronic conductivity in addition to very low thermal conductivity, two physical properties that are often hard to decouple within a material system. Narrow gap semiconductors prove to be the most suitable thermoelectric materials. Thermoelectric performance depends greatly upon phonon scattering over a wide range of phonon modes, analogous to having structures that scatter phonons on many different length scales. The ability to control material structures on the nanoscale helps in this regard and has been shown to reduce thermal conductivity without degrading electrical properties. Here we review characteristics shared by the best thermoelectric materials and focus on new material synthesis approaches to achieve greater thermoelectric performance.

Camas Key
University of Texas Brownsville

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