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### **Recent Advances in Thermoelectric Energy Conversion and Refrigeration Materials**

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Recently, there has been an ever-increasing research effort on thermoelectric nanocomposite materials. Composites using a mixture of bulk thermoelectric materials with nanoparticles incorporated within the bulk are of specific interest. One of the main goals is to have additional design or tuning parameters for materials (such as dimensionality) in order to manipulate and control the phonon scattering mechanisms, without significantly deteriorating the electrical transport properties. The ability to decouple the electron and phonon scattering mechanisms is very important in the development of higher efficiency thermoelectric (TE) materials, wherein the figure of merit,  $ZT$ , can be greater than unity. New opportunities are being explored in order to improve existing TE materials and significantly increase  $ZT$ . The role of phonons may be one of the most important parameters to understand in these novel materials. A review of recent results in low dimensional and nanocomposite TE materials from several research groups, including my own, will be presented. In addition, a perspective of the potential impact that thermoelectric energy conversion technologies might have on the overall global energy picture will be discussed.