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Editorial

Nanomaterials for Thermoelectrics

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The production and use of fossil fuels raise environmental concerns. A global movement toward the generation of renewable energy is therefore underway to help meet increased energy needs. Among various green energy technologies, thermoelectric power generation has attracted increasing attention. Thermoelectric generation refers to the direct conversion of waste heat into useful electricity. Because of a nonpolluting and renewable technique, it is a suitable candidate for future energy conversion. High electrical conductivity, low thermal conductivity, and the high Seebeck coefficient are required for thermoelectric materials. However, it is difficult to control these factors individually because thermal conductivity is generally proportional to electrical conductivity. One way to disrupt this relationship is to control the microstructure on a nanoscale. By adopting a new design concept of phonon-glass electron-crystal, nanostructure could be adopted to optimize thermoelectric figure of merit. The goal of this special issue was to exhibit recent developments in the nanomaterials for application in thermoelectrics, so as to plot a picture of (1) the current state of the field and (2) the opportunities for future research related to nanomaterials for thermoelectrics.

A total of 10 articles are presented in the current issue and they are all research papers. They involve nanocomposite formation for thermoelectrics, nanoparticle dispersion in thermoelectric matrix, minimization of lattice thermal conductivity by formation of dense pore structure, mesoporous structured thermoelectrics, and microstructural control of thermoelectric materials. The effects of porosity, doping, mechanical deformation, and microstructure on the thermoelectric properties were discussed.

We are pleased to see the progress in a relation between microstructural control and the properties of thermoelectric materials. We hope that this special issue will contribute to the enhancement of the thermoelectric properties, economically feasible thermoelectric device technologies, and also their wide use.

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