Nanoscale Thermoelectrics—·

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Thermoelectric materials extend from semiconductors via metalloids to oxides. Decisive factors for the efficiency of the thermoelectrics are a high Seebeck coefficient, also known as the thermoelectric power, a high electrical and at the same time a low thermal conductivity. Here the classical physics has imposed laws which do not allow an independent optimization of these properties.

Modern high ZT materials manage to trick nature to a certain degree: they use different nanoscale configuration in which the inner structure of the material restricts the mobility of the phonons, and hence the thermal conductivity, (phonon blocking) while not obstructing or even promoting that of the electrons (electron transmitting).

Nanoscale materials are regarded thus as especially promising. They are manufactured by different techniques, for example, by superlattices, quantum well structures, nanowires, coherent precipitates, spinodal decomposition, embedding inert nanoparticles in a macroscopic matrix. Also special processes like melt-spinning and subsequent densification with spark plasma sintering will be used.
Materials under research are on the one hand well known classical ones like V_2VI_3, IV-VI and SiGe-alloys on the other hand promising so called high temperature materials like Mg-silicides, Half-Heuslers or scutterudites or even oxides. A survey about recent concepts and results for nanoscale thermoelectric materials will be presented.

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