Thermal Conductivity Reduction in p-type $Si_{80}Ge_{20}$ Alloys due to Ultrafine BN Particulates

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ABSTRACT

The key to improving the figure of merit, Z, of $Si_{80}Ge_{20}$ thermoelectric alloys in the temperature range of 300-1000 C is to reduce the thermal conductivity. Models predict that adding 40-100Å ultra-fine inert particulates that act as phonon scattering centers should increase Z by 20 to 40 percent. A novel spark erosion method was used to produce ultra fine SiGe powders as well as BN scattering centers. Samples hot-pressed from these powders had thermal conductivities up to 50 percent below that for the hot-pressed standard p-type SiGe material. These observed reductions resulted in only slightly (about 10 percent) improved figures of merit because of an increase in the electrical resistivity. This increase in resistivity was found to be direction dependent and reasons for that will be discussed.