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High dimensionless figure-of-merit in nanostructured p-type bulk SiGe alloys GIRI JOSHI, Boston College, HOHYUN LEE, Massachusetts Institute of Technology, XIAOWEI WANG, GOAHUA ZHU, YUCHENG LAN, DEZHI WANG, Boston College, BED POUDEL, GMZ Energy, Inc., MILDRED DRESSELHAUS, GANG CHEN, Massachusetts Institute of Technology, ZHIFENG REN, Boston College — Silicon Germanium (SiGe) alloys have been used for high temperature power generation in thermoelectric generators that provided the onboard electrical power to several US space vehicles. Since their performance is related to dimensionless figure-of-merit (ZT), material scientists have focused their attention on possible improvements in ZT of SiGe alloys through an increase in power factor and decrease in thermal conductivity. We have been pursuing an approach of random nanostructures to reduce the thermal conductivity based on the understanding that the reduction of thermal conductivity is primarily responsible for ZT enhancement in superlatices. We have observed 100% improvement in ZT, compared to the state-of-the-art values, in p-type SiGe nanostructured bulk materials, which comes mainly from decrease in thermal conductivity due to the increase in phonon scattering by defects and grain boundaries in random nanostructures. These bulk materials also possess superior mechanical properties making them more suitable for fabrication and integration into systems which were made by hot pressing of nanopowders prepared by using high energy ball milling.

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