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Thermoelectric properties of FeSi and Related Alloys: Evidence for Strong Electron-Phonon Coupling BRIAN SALES, OLIVIER DELAIRE, MICHAEL MCGUIRE, ANDREW MAY, Oak Ridge National Laboratory — The effects of various transition metal dopants on the electrical and thermal transport properties of $Fe_{1-x}M_xSi$ alloys (M= Co, Ir, Os) are reported. The thermoelectric figure of merit ZT is improved from 0.007 at 60 K for pure FeSi to ZT = 0.08 at 100 K for 4% Ir doping. A comparison of the thermal conductivity data among Os, Ir and Co doped alloys indicates strong electron-phonon coupling in this compound. The common approximation of dividing the total thermal conductivity into electronic and lattice components ($\kappa_{Total} = \kappa_{electronic} + \kappa_{lattice}$) fails spectacularly for these alloys. The effects of nanostructuring on thermoelectric properties of $Fe_{0.96}Ir_{0.04}Si$ alloys are also reported. The thermal conductivity can be lowered by about 50% with little or no effect on the electrical resistivity or Seebeck coefficient. This results in $ZT_{max} = 0.125$ at 100 K, still about a factor of five too low for solid-state refrigeration applications. Research sponsored by the Materials Science and Engineering Division, Office of Basic Energy Sciences, U.S. DOE.

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