

Abstract Submitted
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Measured and Calculated Properties of *n*- and *p*-type PbTe-Based Materials for High-Performance Thermoelectrics¹ C. VINEIS, T. HARMAN, S. CALAWA, M. WALSH, R. REEDER, W. GOODHUE, MIT Lincoln Laboratory — Recent advances in PbTe and other material systems for thermoelectric applications are based on nanostructuring, with a specific goal of substantially reducing lattice thermal conductivity while maintaining good electrical properties. Our work has focused on developing PbTe/PbSe_{1-x}Te_x ($x \sim 0.02-0.04$) nanodot superlattices (NDSLs) for improved thermoelectric performance. In this presentation we will compare the electrical and thermal properties of *n*- and *p*-type NDSLs to baseline homogeneous PbTe, and also compare the electrical data to calculations performed using the Boltzmann transport equation with the relaxation time approximation. Compared to PbTe at the same carrier concentration, NDSL samples generally have reduced mobilities ($\sim 25-35\%$), the same Seebeck coefficients, and substantially reduced ($\sim 4-6x$) lattice thermal conductivities, resulting in a large increase in ZT . Specifically, a 300-K in-plane power factor of $\geq 25 \mu\text{W}/\text{cm-K}^2$ has been repeatedly achieved for both *n*- and *p*-NDSLs, while the cross-plane lattice thermal conductivity has been measured as $\sim 0.35-0.4 \text{ W}/\text{m-K}$ using various techniques. We will also present recent power generation results where $9.9 \text{ W}/\text{cm}^2$ was obtained from a 1 mm^2 , $100\text{-}\mu\text{m}$ -thick stand-alone *n*-NDSL thermoelement, at a ΔT of 202 K.

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