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Optimization of Dimensionless Figure of Merit in Oxide Thin Film Thermoelectrics[1] DANIEL OSBORNE, SCOTT HUXTABLE, Virginia Tech, ASHUTOSH TIWARI, University of Utah, JEREMIAH ABIADE, Virginia Tech — The ability of uniquely functional thermoelectric materials to convert waste heat directly into electricity is critical considering the global energy economy. Profitable, energy-efficient thermoelectrics possess thermoelectric figures of merit ZT $\geq$ 1. We examined the effect of metal nanoparticle – oxide film interfaces on the thermal conductivity κ and Seebeck coefficient S in bilayer and multilayer thin film oxide thermoelectrics in an effort to improve the dimensionless figure of merit ZT. Since a thermoelectric's figure of merit ZT is directly proportional to S/κ, reducing κ and increasing S are key strategies to optimize ZT. We reduced κ by phonon scattering due to the inclusion of metal nanoparticles in the bulk of the thermoelectric thin film, and increased S due to energy-dependent electron scattering at the metal - oxide interfaces. Doped strontium titanate (STO) thin film/Au nanoparticle composites were synthesized by alternate ablation of Au and Nb-doped STO targets during pulsed laser deposition. Characterization of the thermoelectric films involve XRD, XPS, and TEM analyses, Seebeck coefficient measurements, and also measurements of the thermal conductivity via time-domain thermoreflectance. The measured thermal conductivities and Seebeck coefficients of the thin films shows a strong dependence on the nanoscale interfaces of the films.

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Daniel Osborne
Virginia Tech

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