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Transient Electrical and Thermal Characterization of InGaAlAs Thin Films with embedded ErAs Nanoparticles. TELA FAVALORO, University of California, Santa Cruz School of Electrical Engineering, RAJEEV SINGH, JAMES CHRISTOFFERSON, YOUNES EZZAHRI, ZHIXI BIAN, ALI SHAKOURI, GEHONG ZENG, JE-HYEOUNG BAHK, JOHN BOWERS, HONG LU, ARTHUR GOSSARD — We developed a system for accurate high-temperature characterization of thermoelectric materials and devices. This system can be used for electrical measurements of thermoelectric properties and contains an integrated optical thermoreflectance imaging system is integrated into the thermostat for analysis of sample surface temperature profile resulting from the Peltier effect, Joule heating or external thermal excitation within the sample. Transient electrical and thermal measurements are useful to extract material diffusivity of each layer. We have performed high temperature transient analyses and thermal imaging of thin film devices optimized for direct figure of merit detection in the cross-plane direction. These devices consist of 25 micron thick samples of InGaAlAs films with embedded ErAs nanoparticles. Using the transient Harman technique, we determine the cross-plane figure of merit and electrical conductivity. Thermal imaging is used to ensure current injection uniformity across the device and to extract the Seebeck coefficient and thermal conductivity of the material. The experimental results and theoretical analysis are given.

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