Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Electrical Characterization of a Hybrid 1D-0D System of Quantum Dot Chains[1] THOMAS REMBERT, VASYL KUNETS, GREGORY SALAMO, Institute for Nanoscience & Engineering, University of Arkansas — Recent developments in the area of material science and nanotechnology open new horizons to fabricate novel artificial materials with the possibility to engineer the electron and phonon material properties. Our objective is to create structures with high electrical conductivity and low thermal conductivity. The outcome will allow efficient transfer of thermal energy into the electrical output. Early theoretical and experimental research indicates that one-dimensional (1D) quantum wires and zero-dimensional (0D) quantum dots can be used to fabricate very efficient thermoelectric devices. This project focuses on the development of artificial material systems, called quantum dot chains, where 1D states, which are important for high electrical conductivity, coexist with 0D states, causing efficient acoustic phonon scattering, reducing the thermal conductivity. The samples are InGaAs/GaAs grown using an MBE technique of strain-induced self-assembly. Current analysis of our results shows anisotropies of temperature-dependent measurements of sheet resistance and electron mobility, along with physical characterization via AFM scans. Continued studies of electron and phonon physics in this system will help determine the potential for chains of quantum dots in thermoelectric applications.

[1]Supported by the Arkansas Department of Higher Education and NSF EPSCoR, VICTER Project (No. EPS1003970).

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Date submitted: 20 Nov 2011 Electronic form version 1.4