Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Effect of Alkyl Ligand Size on Thermoelectric Properties of Gold Nanocrystal Arrays WILLIAM CHANG, BORIS RUSS, UC Berkeley, JEFFREY URBAN, Lawrence Berkeley National Lab, RACHEL SEGALMAN, UC Berkeley — Traditional thermoelectric materials suffer from low efficiencies due to inverse coupling of the Seebeck coefficient and electrical conductivity, which limits the power factor. Decoupling of these two physical properties represents an exciting opportunity, and has previously been demonstrated in molecular junctions. Using molecular junction design principles for guidance, we designed gold nanocrystal arrays with varying alkyl linkers. We demonstrate that the conductivity of these nanocrystal arrays follows a conventional tunneling model, where the length between nanoparticles dictates conductance. Interestingly, the Seebeck coefficients are not explained by single molecule tunneling junction theory. Metal ligand charge transfer theory, in conjunction with optical spectroscopy, is used to explain thin film charge transport. We compare these macroscale thin film transport properties to single molecule electronic transmission measurements reported in previous studies. This result will lend further insight into how molecular junctions and nanocrystal arrays can be integrated for materials with higher power factors.

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Date submitted: 15 Nov 2013 Electronic form version 1.4