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Profiling the Local Seebeck Coefficient of InAs-GaAs Quantum Dots Using Scanning Thermoelectric Microscopy YEN-HSIANG LIN, JENNA WALRATH, Univirsity of Michigan, SIMON HUANG, Univ of Michigan - Ann Arbor, RACHEL GOLDMAN, Univirsity of Michigan — Thermoelectric (TE) devices offer a method of recovering waste heat through solid state conversion of heat to electricity. However, the typical efficiencies of TE devices are 5-10% which constitutes a barrier to wide spread use. There have recently been a number of reports of an increase in the bulk thermopower due to nanostructuring. In addition to our recent report of enhanced thermopower for GaAs embedded with indium nanocrystals [1], a theoretical study by Mahan and Sofo suggested that the best thermoelectric materials have a delta function density of states [2]. Quantum dots fit ideally into such a picture. To date, the influence of nanostructuring on the electronic LDOS and thermopower has been studied using spatially averaged measurements; a nanoscale investigation of the effects of nanostructures on thermopower has yet to be presented. To investigate the link between dimensionality and TE properties, we are examining structures ranging from QDs to bulk-like layers, comparing SThEM measurements of the local Seebeck coefficient, S, with STS measurements of the local density of states (LDOS). STM, STS, and SThEM performed on InAs quantum dots (QDs) grown on GaAs. SThEM reveals enhanced S-values near the QD edge; STS reveals band-bending at the QD/GaAs interface, suggesting that the S enhancement is due to interfacial charge accumulation.

[1] M. V. Warren, et. al, J. Appl. Phys. 114, 043704 (2013).
[2] Mahan and Sofo. Proc. Natl. Acad. Sci. USA 93:7436(1996).

Yen-Hsiang Lin
Univirsity of Michigan

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