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Signatures of 1D Electron Subbands in the Thermoelectric Properties of InAs Nanowire XUAN GAO, YUAN TIAN, JESSE KINDER, DONG LIANG, MICHAEL MACDONALD, RICHARD QIU, Dept of Physics, Case Western Reserve University, MOHAMMED SAKR, Faculty of Science, Alexandria University, Egypt, HONGJUN GAO, Institute of Physics,Chinese Academy of Sciences, Beijing — We report electrical conductance and thermopower measurements on InAs nanowires synthesized by chemical vapor deposition. Gate modulation of the thermopower of individual InAs nanowires with diameter around 20nm is obtained over $T = 40$ to 300K. At low temperatures (less than c.a.100K), oscillations in the thermopower and power factor concomitant with the stepwise conductance increases are observed as the gate voltage shifts the chemical potential of electrons in InAs nanowire through quasi-one-dimensional (1D) sub-bands. This work experimentally shows the possibility to modulate semiconductor nanowire's thermoelectric properties through the peaked 1D density of states in the diffusive transport regime, a long-sought goal in nanostructured thermoelectrics research. Moreover, we point out the importance of scattering (or disorder) induced energy level broadening in smearing out the 1D confinement enhanced thermoelectric power factor at practical temperatures (e.g. 300K). The authors acknowledge NSF CAREER Award (DMR-1151534), ACS PRF (48800-DNI10) and the NSF of China for support of this research.

Xuan Gao
Dept of Physics, Case Western Reserve University

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