Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Bismuth Nanowires: Synthesis, Microscopy and Transport Properties JASON REPPERT, JIAN HE, MALCOLM SKOVE, BRAD EDWARDS, TERRY TRITT, APPARAO RAO, Clemson University — Thermoelectric materials approaching the atomic level possess unique quantum confinement properties that have generated much interest in recent history. Theoretical investigations have suggested that nanowires with diameters <10 nm will possess a ZT >2. Previously, bismuth nanowires have been successfully synthesized by means of electrochemical deposition, liquid-phase pressure injection, and vapor-phase deposition. Here, we report the synthesis of bismuth nanowires via the pulsed laser deposition method (PLD). Using this approach, we have been successful in producing nanowires ranging in diameters of 10 - 20 nm, with the majority ranging 10 – 12 nm, and lengths 200 - 300 nm. The structure of the as-prepared nanowires was characterized using scanning electron microscopy, high-resolution transmission electron microscopy (HRTEM), scanning transmission electron microscopy, x-ray diffraction and electron diffraction. The HRTEM images of the bismuth nanowires show a crystalline Bi core that is wrapped in an amorphous oxide layer. The lattice spacing of planes parallel to the length of the Bi core was found to be 0.328 nm, corresponding to the (012) planes of Bi. Temperature dependent thermopower measurements obtained from our narrow diameter Bi nanowires will be presented.

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Date submitted: 29 Nov 2006 Electronic form version 1.4