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Numerical study of heat flow and electron-phonon coupling in nanowires JASON MATTHEWS, ERIC HOFFMANN, University of Oregon, Eugene, OR, HENRIK NILSSON, LARS SAMUELSON, Lund University, Sweden, HEINER LINKE, University of Oregon, Eugene, OR — The strength of electron-phonon (e-ph) interaction in one-dimensional systems is an important mechanism that controls heat flow generated by Joule heating, e.g. in nanowires. Here we use finite element modeling to study the effects of e-ph interactions on the electron temperature profile within a heterostructure nanowire. In recent experiments, we have measured the electron temperatures in the vicinity of a double-barrier quantum dot embedded in a nanowire. We find a significant electron temperature rise in the non-heated (drain) end of the nanowire near the dot. Such a temperature rise is unexpected due to electrons seeing the dot as both electrically and thermally insulating. It is suspected that this temperature rise is due to heat bypassing the quantum dot via phonons, which in turn heat electrons in the nanowire drain by means of e-ph interaction. Our modeling results are in agreement with measured electronic temperatures, suggesting that these measurements could be used to determine the strength of e-ph interaction.

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