The phonon and thermal properties of a ladder nanostructure

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Abstract
In this paper, we study the phonon thermal properties of a ladder nanostructure in harmonic approximation. We present a model consisting of two infinite chains with different masses. Then, we investigate the effect of different masses on the phonon spectrum. Moreover, as a specific case, in the absence of the second neighbor interaction, we calculate the phonon density of states/modes. Finally, we consider the thermal conductivity of the system. The results show that the phonon spectrum shifts down to the lower frequencies by increasing the masses. Furthermore, a frequency gap appears in the phonon spectrum. By increasing the springs constants, the thermal conductance decreases.

Keywords: ladder nanostructure; phonon spectrum; density of states/modes; thermal conductance; transfer matrix

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