Universidad Carlos III de Madrid

Seminario del Instituto Gregorio Millán

Carbon nanotube-based motor driven by a thermal gradient

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Abstract

We present a model able to reproduce experimental observations and computer simulation results of the movement of two coaxial carbon nanotubes induced by a thermal gradient. The model is formulated in terms of a Langevin equation which includes the friction force, the van der Waals forces between both nanotubes, that depend on their chiralities, and the inhomogeneous temperature distribution which give rise to an inhomogeneous phonon distribution. The random force term is assumed to be related to the fluctuations of the heat current along the inner nanotube and therefore its intensity is proportional to the heat conductivity. The model reproduces the rich variety of possible dynamic behaviors and proves the conjecture that the driving force is the phononic current induced by the thermal gradient. Applications to other nano-electromechanical devices are also analyzed.

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