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Improvement of Thermoelectric Cooling with Inhomogeneous Thermal Conductivity JUN ZHOU, TINGYU LU, BAOWEN LI, Tongji Univ, CENTER FOR PHONONICS AND THERMAL ENERGY SCIENCE TEAM — Thermal rectifier with inhomogeneous thermal conductivity has been theoretically proposed [Li, Wang, and Casati, Phys. Rev. Lett. **93**, 184301 (2004); Segal and Nitzan, Phys. Rev. Lett. **94**, 034301 (2005); Terraneo, Peyrard, and Casati, Phys. Rev. Lett. 88, 094302 (2002)] and been experimentally observed in carbon and boron-nitride nanotubes which are mass-loaded externally and inhomogeneously with heavy molecules [Chang et al., Science **314**, 1121 (2006)]. We theoretically investigate the thermal rectification effect on the thermoelectric cooling process with linearly changed spatial dependent thermal conductivity. We find that the dissipation of Joule heat generated in such thermoelectric devices could be inhomogeneous that is very different from the convention thermoelectric devices. Such inhomogeneity of heat dissipation could enhance the heat absorption at the cold end in cooling and therefore enhance the cooling power. The energy conversion efficiency can also be modified with a redefined thermoelectric figure-of-merit ZT. Our finding is believed to be useful for high performance of thermoelectric devices in the future.

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