学术讲座

同济大学 TONGJI UNIVERSITY

物理科学与工程学院
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地点： 第一实验楼423室

Ballisticity and Coherence in Thermal NanoPhononics

报告摘要:

The ballisticity of thermal phonons is a well-accepted mechanism but remains difficult to prove. We propose to experimentally investigate such a behavior in silicon short Nanowires [1] and Phononic Crystals [2] uncovering size and temperature ranges when ballisticity appears.
Original strategies to break ballisticity by using nanocoatings [3] or etching techniques (black silicon) [4] will then be presented when applied to silicon nanomembranes.
Finally, a new type of thermally resistive mechanism based on the combination of disorder and coherence will be demonstrated in 2-Dimensional heterostructures. A detailed analysis of the thermal phonon spectra will indeed prove the existence of localization due to interface diffusion [5].

[1] Anufriev, R., Gluchko, S., Volz, S., & NOMURA, M., “Probing ballistic thermal conduction in segmented silicon nanowires”, Nanoscale, 11(28), 13407-13414. http://doi.org/10.1039/C9NR03863A, (2019)
[2] Sergei Gluchko, Roman Anufriev, Ryoto Yanagisawa, Sebastian Volz and Masahiro Nomura, “On the reduction and rectification of thermal conduction using phononic crystals with pacman-shaped holes”, Appl. Phys. Lett. 114, 023102 (2019); doi: 10.1063/1.5079931
[3] George, A., Yanagisawa, R., Anufriev, R., He, J., Yoshie, N., Tsujii, N., et al. (2019).Thermoelectric Enhancement of Silicon Membranes by Ultrathin Amorphous Films. ACS Applied Materials & Interfaces, 1–5. http://doi.org/10.1021/acsami.8b21003.
[4] X. Huang, S. Gluchko, R. Anufriev, S. Volz and M. Nomura, “Thermal Conductivity Reduction in Silicon Thin Film with Nanocones”, ACS Applied Materials & Interfaces, 11, 37, 34394-34398, (2019)
[5] Y Ni, H Zhang, S Hu, H Wang, S Volz, S Xiong, “Interface diffusion-induced phonon localization in two-dimensional lateral heterostructures”, International Journal of Heat and Mass Transfer 144, 118608, (2019)