Nanostructures for Phononics

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Thermal management has become an important field due to increasing importance of thermal properties in devices with reduced dimensions [1]. Confinement of acoustic phonons was experimentally demonstrated in freestanding silicon membranes in early 2000 [2], and this finding has led to a number of papers in which the effect of dimensions on the behaviour of phonons has been investigated. In thin membranes the velocity of phonons slows down [3] and the dispersion can be further affected by strain [4,5], and especially the surface structuring has a significant effect on the thermal conductivity [6]. The reduced thermal conductivity enhances considerably the thermoelectric properties of silicon and enables realisation of new types of thermal detectors [7]. Nanostructured silicon also opens new possibilities in optomechanics due to enhanced nonlinearity of the material [8]. In this talk, we will discuss some of the main outcomes in the field of nanophononics and the future prospects.

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