Aalto University

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Thermal relaxation in nanodevices at sub-kelvin temperatures

Title of the dissertation	Experiments on thermal relaxation of copper films for nano-calorimetry K uparifilmien energiarelaksaatiokokeita nanokalorimetrian tarpeisiin
Contents of the dissertation	It is well known that when an object with relatively high temperature is brought into contact with a cold thermal reservoir, its energy is released to the reservoir by the thermal flow across the contact interface. For instance, for an externally heated metallic film on a dielectric substrate (thermal reservoir), at room temperature, the energy relaxation of the film is governed by the thermal boundary resistance between the film and the substrate, which is essentially determined by the thermal coupling of phonons (lattice vibrations) on both sides of the interface. At low temperatures, the thermal relaxation process of metallic films becomes complex due to decoupling of film electrons from its lattice vibrations. In this dissertation, we investigate the thermal relaxation process of evaporated metallic films on a silicon substrate. Experiments are carried out at temperatures closed to the absolute zero and on metallic films of thickness in the nanometer scale. We investigate the thermal relaxation of electrons in metallic films at both steady-state and dynamic conditions. Our experimental results are crucial for the understanding of thermal relaxation in nanodevices and for improving the performance of low temperature detectors utilizing thermal effects.
Field of the dissertation	engineering physics
Doctoral candidate	Libin Wang, M.Sc. (Tech.)
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