Silicon Nanomembranes for Phononics

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Abstract

Heat dissipation in nanoelectronics devices, optimization of thermoelectric generators and development of optomechanical couplers, among others, call for understanding the behaviour of phonons in low dimensional structures. Silicon nanomembranes provide a tool to investigate experimentally the confinement of acoustic phonons and the effects on phonon dispersion and phonon propagation. [1-5] Microelectronics fabrication processes enable realisation of large area ultra-thin membranes with thickness down to a few nanometres and with well controlled strain and doping.
In this talk we will discuss the challenges in the fabrication of the silicon membranes and show results of the effects arising from the acoustic phonon confinement.

References

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Figures

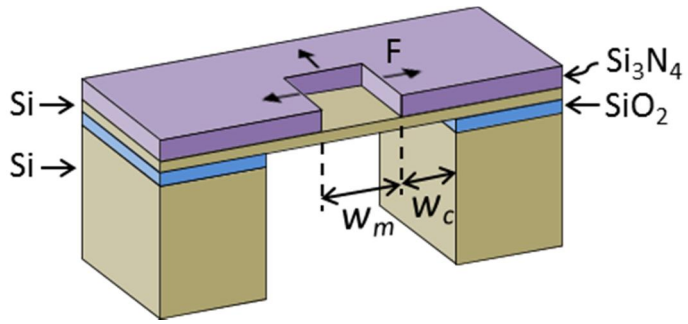

Figure 1. Schematics of a free-standing silicon membrane fabricated from a SOI wafer. The silicon nitride layer on top of the Si membrane is used to tune the strain in the membrane.

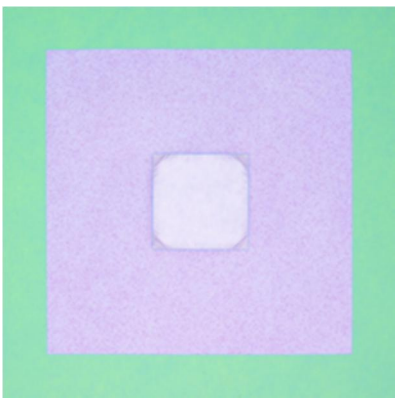

Figure 2. Top view optical image of a 6 nm thick membrane with 0.3 % tensile strain. The cross-sectional structure is shown in Fig. 1.