Abstract Submitted
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Ultra-low thermal conductivity in silicon membranes by surface oxidation and alloying DAVIDE DONADIO, University of California Davis, SHIYUN XIONG, Max Planck Institute for Polymer Research, SANGHAMITRA NEOGI, University of Colorado Boulder, DANIELE SELLI, University of Milano Bicocca — A detailed understanding of the relation between microscopic structure and phonon propagation at the nanoscale is essential to design nanomaterials with desired phononic and thermal properties. Here we show that native oxide layers that spontaneously grow at the surfaces of ultra thin silicon membranes effectively hamper the mean free path long wavelength phonons through surface resonances that hybridize with propagating modes. This mechanism can be combined with mass scattering in SiGe alloyed membranes to hinder heat carriers over the whole spectrum of frequencies, thus resulting in extremely low thermal conductivity, up to 100 times lower than the bulk.

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