Basal Plane Thermal Conductivity of Thin Germanane Layers

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Germanane (GeH), a two-dimensional material comprised of thin layers of sp^3- bonded hydrogen-terminated Germanium, has recently been synthesized. It has been predicted to have high electron mobility, and a band gap suitable for use in electronics. Just like silicon nanoelectric devices, the performance and reliability of novel electronic devices made from GeH can degrade with increasing local device temperature that sensitively depend on its thermal properties, which are largely unknown. The thermal conductivity of thin GeH layers was measured using suspended micro-devices with integrated heaters and thermometers. The thermal contact resistance of the GeH samples suspended on the measurement devices was determined from the measured thermal resistance values of samples with different suspended lengths. The room-temperature thermal conductivity of the GeH samples was observed to be 0.6-1.0 $Wm^{-1}K^{-1}$. This low thermal conductivity is attributed to phonon scattering by defects and grain boundaries in the layered materials, including scattering caused by dangling bonds associated with missing Hydrogen atoms between adjacent layers.

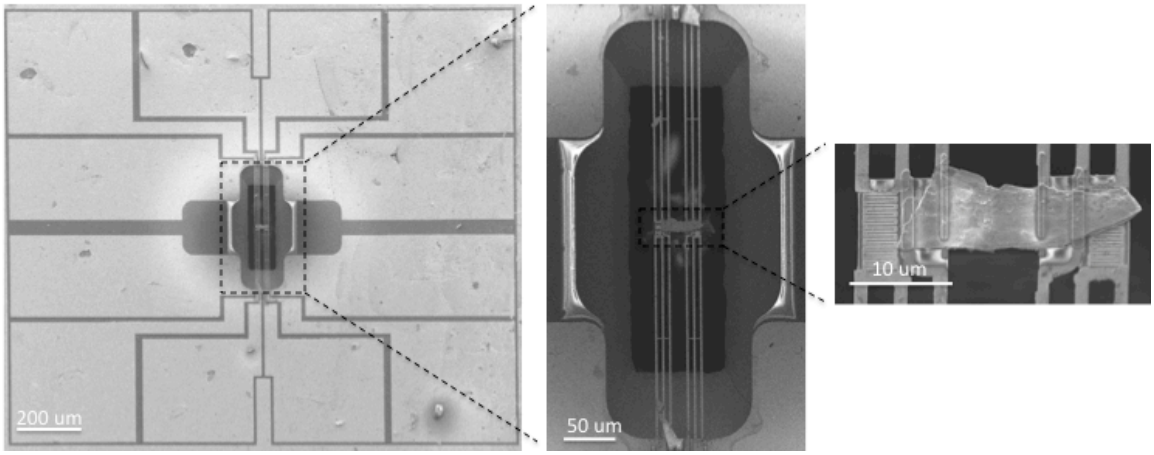

Figure: SEM image of a GeH sample on a microheating device