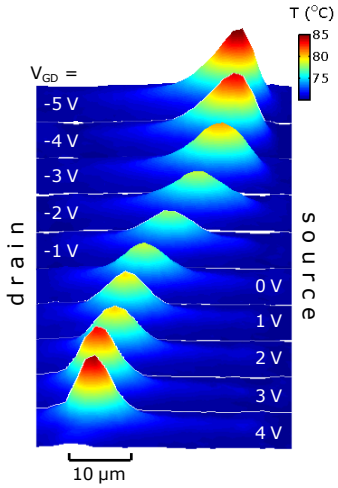
NANOHOUR

Wednesday, September 7, 2011 3:00 pm
Beckman Institute - Room 3269

Self-Heating Effect on Current Saturation in Graphene Transistors

Sharnali Islam, Electrical and Computer Engineering
Graduate Student with Professor Eric Pop

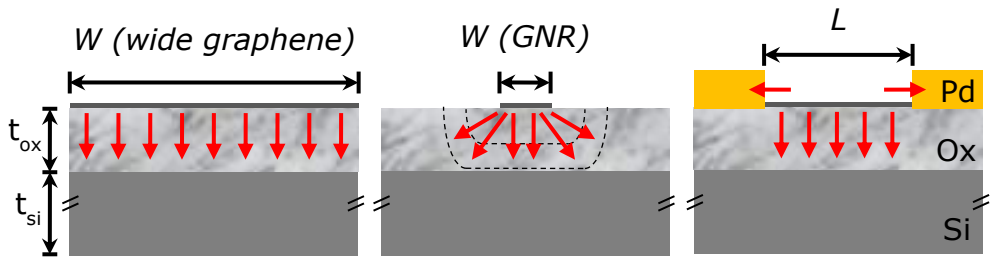


Graphene shows potential as a new material for electronics because of its high intrinsic mobility and high thermal conductivity. However, Joule self-heating remains a concern for graphene-on-insulator (GOI) devices. We use simulations calibrated against experimental data to examine the trends of performance degradation caused by self-heating as a function of insulator (SiO_2) thickness. We find that localized hot spots are electrostatically formed, and that average and peak device temperatures scale differently, which is significant for long-term reliability. We also examine the effect of self-heating on current degradation, and determine the thermal time constant of GOI devices under realistic operating conditions.

Thermally-Limited Current Carrying Ability of Graphene Nanoribbons

Albert Liao, Electrical and Computer Engineering
Graduate Student with Professor Eric Pop

We investigate high-field transport in graphene nanoribbons (GNRs) on SiO_2, up to breakdown. The maximum current density is limited by self-heating, but can reach >3 mA/μm for GNRs ~15 nm wide. Comparison with larger, micron-sized graphene devices reveals that narrow GNRs benefit from 3D heat spreading into the SiO_2, which enables their higher current density. GNRs also benefit from lateral heat flow to the contacts in short devices (< ~0.3 μm), which allows extraction of a median GNR thermal conductivity (TC), ~80 $Wm^{-1}K^{-1}$ at 20 ^oC across our samples, dominated by phonons. The TC of GNRs is an order of magnitude lower than that of micron-sized graphene on SiO_2, suggesting strong roles of edge and defect scattering, and the importance of thermal dissipation in small GNR devices.



Coffee and cookies will be served
http://nanohour.beckman.illinois.edu