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Infrared imaging of power dissipation in graphene field effect transistors MYUNG-HO BAE BAE, ZHUN-YONG ONG, DAVID ESTRADA, ERIC POP, Micro & Nanotechnology Laboratory, Dept. of Electrical & Computer Engineering, and Beckman Institute, University of Illinois at Urbana-Champaign — We have employed thermal infrared microscopy to image temperature distributions in monolayer and bilayer graphene transistors under high bias. The hot spot position is sensitive to device electrostatics, corresponding to the location of minimum charge density in unipolar transport, and to that of charge neutrality in ambipolar operation. The hot spot shape carries information of spatial variations in charge density of devices. By comparison with a self-consistent electrical-thermal model, the imaged temperature profiles are correlated with power dissipation, carrier distributions, and electric fields within such devices, providing rich insight into their operation and energy relaxation physics. For instance, the combined approach reveals that low-field mobility is limited by impurity scattering, while velocity saturation is set by substrate phonon scattering in our samples. These results also open up the possibility of thermal imaging as a more general non-invasive tool for examining transport and energy dissipation in novel devices.

Myung-Ho Bae Bae
University of Illinois at Urbana-Champaign

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