Graphene: Thermal Properties and Applications

Serap Yiğen
Department of Physics, Izmir Institute of Technology

Abstract:

Graphene, a two-dimensional (2D) crystal made up of carbon atoms, has attracted tremendous attention owing to its exceptional electronic quality, mechanical strength and transparent optical nature. The isolation of single-layer graphene was a groundbreaking discovery which opened up opportunities to explore relativistic-like electrons in simple bench-top experiments, and develop real world applications in electronics and opto-electronics. Heat transport studies serve as a powerful tool to explore electronic and phononic properties of graphene as well as their interactions. The electronic thermal conductivity measurements in particular can describe how energy is transported by the charge carriers in graphene, and how these carriers lose their energy via diffusion and interactions with phonons and impurities. Understanding these interactions can shed light on electron-phonon scatterings, thermal relaxation processes, and the electron cooling mechanisms in graphene. We developed a method to experimentally isolate the electronic thermal conductivity in suspended graphene transistors using two-point DC electron transport measurements. The first part of this seminar will describe how the electronic thermal conductivity in graphene was extracted as a function of electron temperature and carrier density. In the second part, I will discuss some results and progress from an ongoing project in which graphene will be integrated as transparent electrodes into layered oxide thin films in order to fabricate a custom designed optoelectronic device. The oxide thin films have been grown by using a state-of-the-art Pulsed Electron Deposition (PED) method. The structural, morphological, electrical and optoelectronic characterizations of the deposited films and graphene will be presented.