

Electron Emission and Transport at Graphene-based Interface and Devices

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Abstract: Electron emission plays a crucial important role in the development of micro/nanoelectronics. The physics picture behind different emission process depends on the electronic band structure of materials and excitation approach (e.g. heat, electric field and light). Graphene is a two-dimensional wonderful material, completely different from conventional materials used in micro/nanoelectronic devices. In this thesis presentation, we attempt to reveal the new physics of electron emission and transport from graphene-based interface and explore its applications in energy conversion and photodetection.

To begin with, we first discuss the novel thermionic emission law from graphene, which is then used to modify the conventional Schottky diode equation to subsequently have a new understanding of carrier transport across graphene-semiconductor Schottky junction. Based on newly discovered thermionic emission physics, we will explore the performance of a van der Waals heterostructure thermionic energy converter against conventional thermoelectric converter and find out the theoretical performance limit of telecom-wavelength graphene-semiconductor photodetector.

Speaker Bio: Liang Shijun joined the Singapore University of Technology and Design (SUTD) as RA on February 2012, later became a PhD candidate in Engineering Product Development (EPD) under the SUTD President's Graduate Fellowship in September 2013. He is currently under the supervision of Prof. Lay Kee Ang. He has so far published more than 15 papers during Ph.D studies, and won some awards such as keynote speaker at International Vacuum Electronics Conference (2013), Young Scientist Award at International Vacuum Nanoelectronics Conference (2015). IEEE Nuclear Plasma Science Society Postgraduate Fellowship Award (2016), FIRST Industry Workshop Outstanding Graduate Research Awards (2016) and FIRST Industry Workshop Company Competition Award (2017) and so on. His research interest focuses on Electrical transport, energy conversion, photodetection based on two-dimensional materials and other emerging materials like topological insulator and Weyl semimetals, and so on.

