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SPEAKER SERIES

PRESENTS

Dynamic Semiconductor Junctions Based Electric Generators

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Friday, August 27, 10:00 am
Room: Zoom*
https://uofh.zoom.us/j/845619943?pwd=QlZvYUV6M2dxNDkvNWxBd3F2YzdJZz09
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LECTURE ABSTRACT

In this talk, I shall discuss mechanical to electric power conversion through dynamic semiconductor junctions formed with a pair of semiconducting or/and metallic electrodes which possess distinct chemical potentials. When the two electrodes are brought in contact, electrons could diffuse from the high into the low chemical potential electrode. Once the two electrodes are being separated, the diffused electrons are then discharged to the external circuit and flow back to the high chemical potential electrode, converting the mechanical power to electrical power. In addition, a direct current is generated in the direction of the built-in electric field in the dynamic p-n junction across the contacted surfaces if one electrode is slid on the other, flowing from the p-semiconductor through the external circuit to the n-semiconductor. The generated currents and voltages are studied through sliding speeds, accelerations, contacting forces, operation temperatures and the geometries of the top electrode. The direct current generation can be attributed to electron-hole pairs generated at the two sliding surfaces, which are then swept out the dynamic junction by the built-in electric field. (Acknowledg-ements: This project is financially supported by MOE AcRF Tier1 (2018-T1-005-001), MOE AcRF Tier2 (2018-T2-2-005) and A*STAR AME IRG Grant SERC A1983c0027, Singapore.)

SPEAKER BIOSKETCH

Qing Zhang is a Professor at Centre of Micro-/Nano-electronics, School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore. His main research interests cover the electronic properties and applications of carbon based materials and other low dimensional electronic materials, energy storage devices and energy harvesting devices, etc.

Prof Qing Zhang and his team were one of the early groups who studied electron and heat transport in carbon nanotubes (CNTs). They found that heat transport in the CNTs is dominated by phonons, rather than electron transport. They have been studying the influences of metal/CNT contacts, adsorbed molecules and functional chemical agents on electron transport in CNTs since 1998 and have successfully demonstrated a variety of CNT electronic devices, including CNT logic gates, CNT OLED drivers, CNT flexible logic gates, CNT bio/chemical sensors, optical configurable CNT and ITO complementary logic gates, etc. They have made a significant contribution to enhance the stability of high specific capacity of carbon based anodes for Li-ion batteries. In 2014, they demonstrated high performance flexible Li-ion batteries with flexible coaxial Ni/PVDF nanofiber network and carbon fiber network. In 2017, Prof Zhang and his team successfully developed a unique electric generator with intermittently contacted p- and n-type doped semiconductor as the electrodes, in which both conduction and displacement current are generated. This is the first generator that possesses this characteristic.

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