Research project and supervisory team

Supervisory Team	Prof. Jim Greer; Dr. Jing Wang
Short introduction & description of research project	Nowadays, there are typically between a half dozen to two dozen sensors performing different tasks in a smartphone, allowing information from the external world to be converted to digital information for processing and decision making. Often information from a large number of sensor nodes in a network is transmitted to a central computing infrastructure such as the 'cloud' or a locally dispersed computing infrastructure (the 'fog'). Different such networks become connected and interact, forming the 'Internet of Things' (IoT). The focus for this PhD project is on chemical sensing. For example, the requirements for gas sensors, in addition to sensitivity and selectivity, are increasingly being placed on design simplicity, a wide operating temperature range, ease for integration into an electronics module, and flexibility. The key to meeting these requirements is the development of high-performance gas sensing materials. 2-dimensional (2D) structures have demonstrated a number of attractive properties that are beneficial to gas sensing, including the versatile and tuneable electronic/optoelectronic properties, a rich surface chemistry, and good electrical conductivity. Understanding the gas-solid interaction and the subsequent signal transduction pathways is essential for improving the performance of existing sensing materials and searching for newer and more advanced material options. In this project, the reactivity of differing gas species with inorganic 0D (quantum dots) and 2D materials, thin films and nanowires will be investigated from a combination of physical and chemical characterisation techniques. A particular focus of the studies will be to characterise surface coverage or absorption for various gases and relate these to changes in electrical conduction across the sensor material. The physical and chemical characterisation studies will be closely supported by a part of the team undertaking electronic structure calculations to determine changes upon gas absorption and to relate to the measurements to determine the underlying mechanisms for chemical sensing with low dimensional structures.
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