THESIS DEFENCE

Speaker: Sandeep Kumar (Y9204069)
Title: Spectral response analysis of single layer organic semiconductor devices
Date: 5th September 2017
Time: 2:10 PM to 3:30 PM
Place: Samtel Centre Seminar Room (access from ground level)

Abstract: There has been significant progress in the field of organic electronics in the last two decades primarily motivated by their potential for low cost, low temperature solution processing, compatibility with flexible substrates and being a greener technology compared to inorganic electronics. However, to achieve their full potential, better performance organic electronic devices is imperative, which requires improved characterisation and better understanding of these devices. In this thesis, characterisation techniques of single layer organic semiconductor devices has been developed based on spectral response (SR) measurements in the ultra-violet and near infra-red spectral range.

In the initial part of the thesis, signals of internal photo emission (IPE) from the electrodes to the organic semiconductor layers are analysed to evaluate of the metal-organic semiconductor (MO) barrier for electron and holes – a critical parameter for designing organic semiconductor devices. The IPE signal however is buried in the photo conductive (PC) signals of the photovoltaic active layer in the device. Two methods – (i) comparing SR of devices with different electrodes and (ii) analysis of different device SR under different bias conditions have been proposed and their utility demonstrated. In order to more clearly discern the SR signal, taking ratios of the SR signals under different device bias conditions have been proposed. The ratios technique developed allows a more objective discernment of IPE signal from within the total SR signal.

The symbatic and antibatic nature of the SR with respect to the absorption spectrum of a single layer device is investigated based on basic optoelectronic models. The potential for tune-ability of the SR with device thickness and applied bias has been investigated. This property can find use in optical demodulation systems.

The analysis methods developed in the thesis have been used to study and extract parameters of single layer test devices fabricated with single walled carbon nanotubes as transparent electrodes.