L.12: Development of LabVIEW based automation of photoconductivity experiments

Composites of photonic materials such as conducting polymers and nanomaterials are widely used in developing organic optoelectronic devices e.g. photovoltaic devices. Amongst various experimental methods used for characterizing the optoelectronic properties of these materials the photoconductivity measurement are widely employed to obtain efficiency of photogeneration, carrier mobilities etc. It involves measurement of photocurrent dependence on various parameters like incident photon energy, intensity of illumination, temperature etc. Precise measurement of photocurrent on routine basis therefore requires coordinated operation of various instruments involved, real time data acquisition, data analysis etc. For these reasons automation of the photoconductivity experiment was carried out in Organic Photonic Materials Lab of Laser Material Processing Division.

We have developed a Graphical User Interface (GUI) automation software, for interfacing of various instruments in the photoconductivity experiment to a personal computer through General Purpose Interface Bus (GPIB). Fig. L.12.1 shows block diagram for the automation of various instruments used.

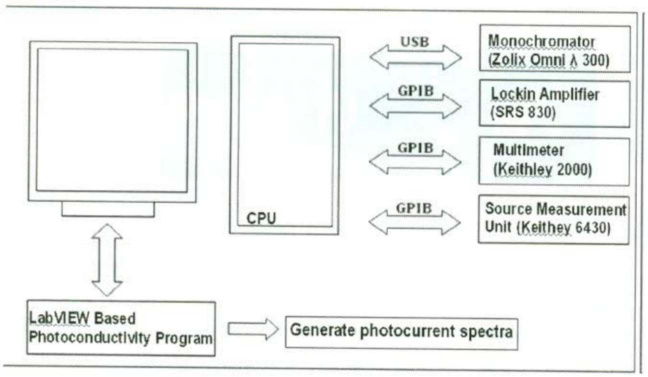

Fig. L.12.1: Block diagram for automated photoconductivity measurement setup.

Fig. L.12.2 shows the Graphical User Interface (GUI) of the LabView program. The GUI can plot the data received from the lock-in amplifier/SMU against wavelength in real time and save the data, after sufficient averaging, from all the instruments for later analysis. Proper error handling of various settings of the instruments has been implemented in the software for the safety of sophisticated instruments. The developed photoconductivity set up is first tested by recording the photoresponse of a standard Silicon photodiode, which is also shown in Fig. L.12.2.

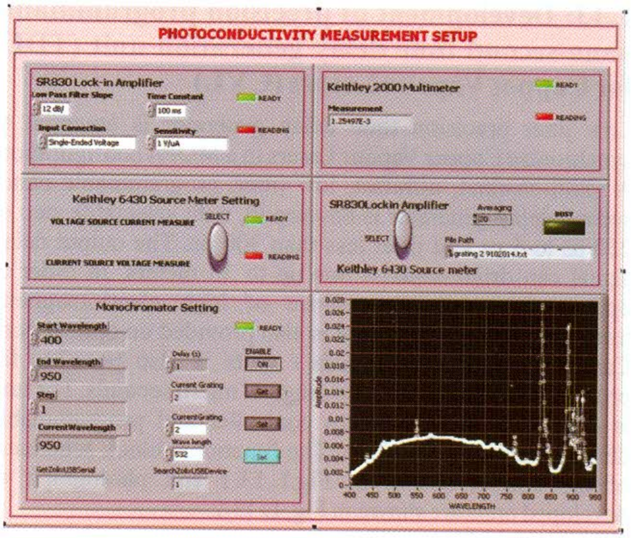

Fig. L.12.2: GUI of LabVIEW program.

The set-up is further tested for its intended application of recording the photocurrent spectra of conjugated polymers. Fig. L.12.3 shows the room temperature photocurrent spectra of diode made using MDMO-PPV polymer (ITO/MDMO-PPV/Al) and excited through semi-transparent electrodes.

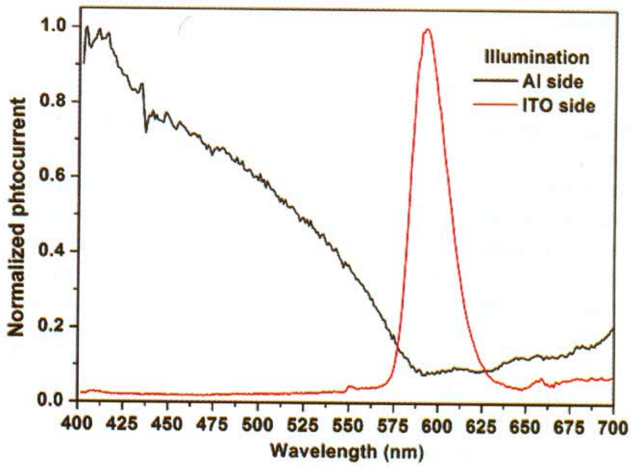

Fig. L.12.3: Photocurrent response of MDMO- PPV diode under reverse bias.

Variation in the photocurrent spectra when illuminated from two electrode sides is due to the difference in hole and electron mobility in MDMO-PPV. Further investigations are in progress to get more insight.

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