EPSRC CENTRE FOR DOCTORAL TRAINING
NEW AND SUSTAINABLE
PHOTOVOLTAICS

Lab 2 : Capacitance-Voltage

Aim:

The DSSC system offers a convenient solution for more advanced characterisation of solar cells. It was designed to look at dye-sensitized cells, but can also be used with other devices. With a small AC perturbation to a scanned voltage, we can alter the depletion width and probe the carrier concentration throughout the absorber layer. Using this information, we can understand the internal structure of the junction and, for example, see the effect of processing conditions on available carriers and the back-contact.

Tasks:

1. Make sure you have completed a risk assessment for this lab.
2. Mount the provided cell into the holder and connect the wires CE/RE1 -> back contact, WE/RE2 -> front contact.
3. Use the J-V program to measure a J-V curve for the cell to check it has been connected up correctly, if not double check connections or try a different cell.
4. Use the C-V program to measure the C-V response of the cell.
5. Make sure the graph is showing |C| vs. V and output the data.

Questions:

1. What is the equation for calculating the carrier density from C-V data. The formula should be in cm^{-3}, watch your units!
2. From a straight-line fit to the depletion region of your C-V curve, calculate the carrier concentration and built-in voltage of the device (relative permittivity for CdTe = 10.36).
3. What is the equation for apparent depletion width?
4. Create a depth density profile for the device from the C-V data. Limit your graph to $|V| < 0.5$ V to avoid the influence of large currents.