CHARACTERIZATION AND ANALYSIS OF SOLAR CELLS USING I_{SC}-V_{OC} AND DARK DIODE CURVES

E. Albers, S. Hubbard, R. Raffaelle, Nano Power Research Laboratories,
eka3484@rit.edu, smhsps@rit.edu, rprsps@rit.edu

The analysis of Dark-Diode curves and I_{sc}-V_{oc} curves can be used to determine and investigate the effects of series resistance, shunt resistance, saturation currents, and diode ideality factors in Solar Cells. A modified Lab View program is used to control a Keithley 2400 SourceMeter, a Sorensen DLM power supply, and a 4-point-measurement probe-station in order to Measure I-V curves, as well as make observations of the cell in both dark and illuminated conditions. A baseline cell, 5 layer Quantum Dot cell, and 10 layer Quantum Dot cell were observed and their curves compared in order to determine a relationship between Quantum Dots and parasitic cell resistances. Further investigations included fitting a two-diode equation to the cells' Dark-Diode curves to account for the different cell behavior in the Recombination/Generation region (low applied voltage), and in the Injection/Diffusion Region (higher applied voltage). Results obtained from curve fitting were analyzed in order to identify the fundamental transport mechanisms in the cell and QD structures. The diode characteristics of the solar cells, as well as the effects of parasitic resistances on cell behavior are investigated in order to discover methods to increase the cells' operating efficiency under both one sun and higher concentration levels.