March. 2020

IV Characterization of Solar Cells using Elite-EDC

Introduction

Identifying electrical properties and performance of solar cells is important to researchers and manufacturers who contribute to improving the cell efficiency and energy conversion. Current-voltage (I-V) characterization of solar cells is a generic method to verify the performance of cells, which provides several important parameters, including short-circuit current (I_{sc}), open-circuit voltage (V_{oc}), max power (P_{max}= I_{max} × V_{max}), current of max power (I_{max}), voltage of max power (V_{max}), fill factor (FF), energy conversion efficiency (η), series resistance (R_s) and shunt resistance (R_{sh}). Figure 1 shows a typical I-V curve of solar cell in the dark or illuminated environments. The short-circuit current (I_{sc}) is the current through a solar cell when the voltage across the cell is zero (short circuited, V=0). When the current through the cell is zero (I=0), the related voltage here is referred to as the open-circuit voltage (V_{oc}), which is the maximum voltage of the cell. The max power point (V_{max}, I_{max}) indicates the maximum power generated by solar cells.

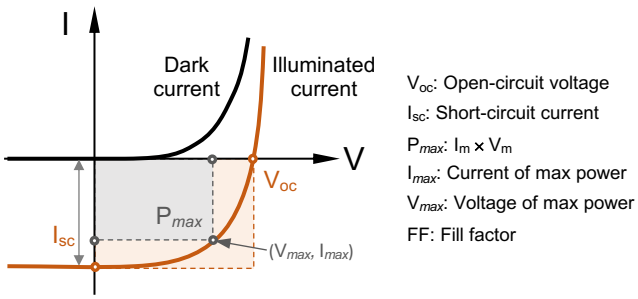

Figure 1. Dark and illuminated I-V curves of a solar cell.

Experimental setup

Figure 2 shows the equivalent circuit of using Elite-EDC for I-V characterization of solar cells

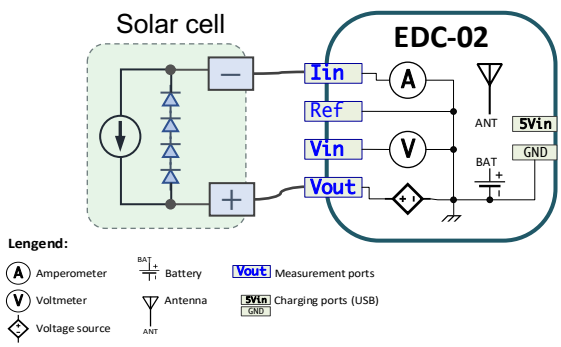

Figure 2. Equivalent circuit of an Elite-EDC connect to a solar cell for I-V characterization.

To measure the IV characteristics of solar cells, Elite-EDC is set up to generate a sweep voltage source on solar cells and record the relationship between current and voltage. Figure 3 shows how to connect the test solar cell to an Elite-EDC.

- Connect positive (+) terminal of solar cells to Elite-Vin and -V_{out}
- Connect negative (-) terminal to Elite-I_{in}
- Choose I-V curve mode on the UI page, set up parameter and record data.

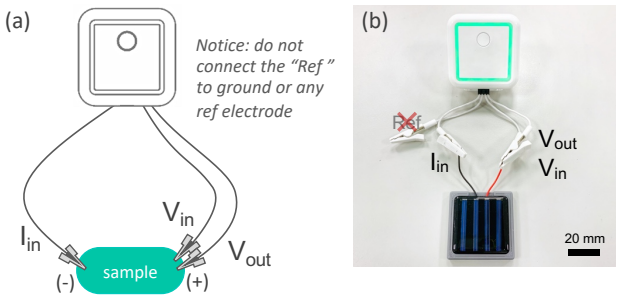

Figure 3. Schematic illustration (a) and photograph (b) of measuring I-V characteristics of solar cells using Elite-EDC. (solar cell part No: 109985, Centenary).

Results

Figure 4 shows the result of dark and light I-V curves of solar cells. This plot is post-processed with Excel to combine two scans.

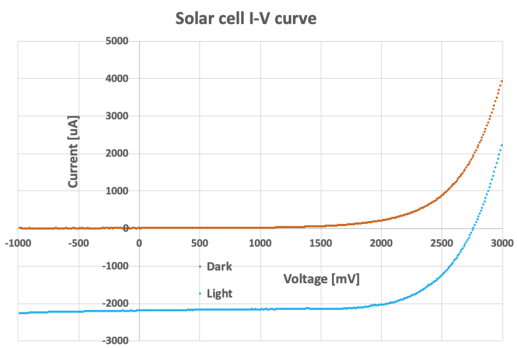

Figure 4. Dark (orange) and light (blue) I-V curves of a solar cell using Elite-EDC.

Specification of Elite-EDC-02	
Voltage range	-5 ~ +5 V
Current range	-15 ~ +15 mA
Voltage step size	0.2 ~ 100 mV
Current resolution	~ nA
Step time	2, 1, 0.5 sec
Sample rate	up to 100 Hz
Accuracy	1%