PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

MOHAMED BOUDIAF UNIVERSITY - M'SILA

FACULTY OF SCIENCE

PHYSICS DEPARTMENT

OPTION: Energy Physics and Renewable Energies

DOMAIN: Material Sciences

FIELD: Physics

1st Year Master

Energy Physics and Renewable Energies

Practical Work N°: 01

Photovoltaic Panels

Academic year : 2023/2024

1- Objectives

The aim of the PV Table is to study the factors that affect the performance and efficiency of photovoltaic cells. We therefore carried out 5 experiments in which we were able to:

- Identify the main characteristics and parameters of photovoltaic cells.

- Determine the influence of illumination on the performance of photovoltaic panels.

- The influence of angles of incidence and azimuth on the performance of photovoltaic cells.

- study the influence of connections on open-circuit voltage and short-circuit current.

2- Measuring instruments used

In order to determine the thermal and electrical performance of the photovoltaic solar collector, whose dimensions and geometric characteristics are shown in the table, a number of essential parameters must be measured. To do this, we used the instruments listed below:

1-Thermometer to measure temperature.

2-Current and voltage (I-V) measurement equipment for the PV module.

3-Variable resistor.

3- Method of carrying out the experimental process

The experimental bench for the study consists of fixed PV systems, composed of a PV module with the system terminals applied to the electrical circuit in the figure. This system was installed to have the same orientation, south facing at zero azimuths with a module tilt of 35° south (which approximates the latitude of the location).

4- Current-Voltage characteristic of a photovoltaic cell

The electrical power delivered by a photovoltaic cell is the product of the voltage and the current it generates.

- These two quantities, current and voltage, depend both on the electrical properties of the cell and on the electrical charge at its terminals.

- The electrical properties of the cell are summarised in a graph called the current-voltage characteristic.

5- Current-Voltage characteristic short-circuit current (I_{CC})

- This is the current flowing through the photovoltaic cell when it is short-circuited, i.e. when the + pole is connected to the - pole (the voltage at its terminals is then zero).

- The power supplied by the cell $P = U \times I$ is zero.

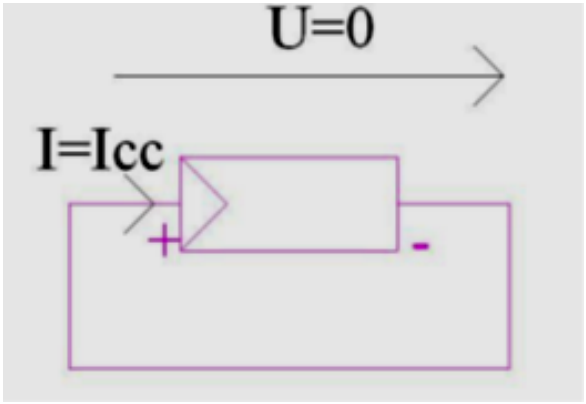

Figure 1. Short-circuit current **(I_{CC})**

6- Current-Voltage characteristic open circuit voltage (U_{CO})

- This is the voltage at the terminals of the cell when it is in open circuit, i.e. when the + and - poles are electrically isolated from any other electrical circuit (the current flowing through it is then zero).

- In this case, the power supplied by the cell $P = U \times I$ is zero.

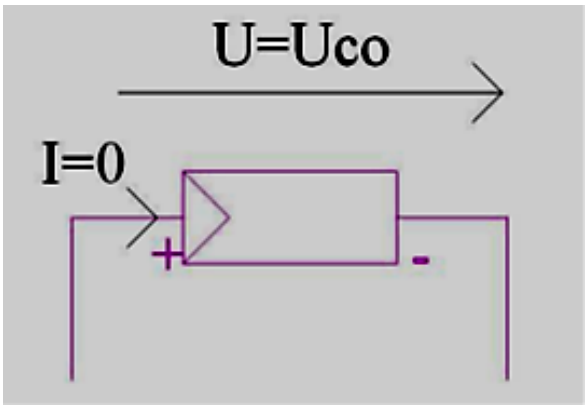

Figure 2. Open circuit voltage (U_{CO})

7- Characteristics of a PV cell

A photovoltaic cell can be characterised by 4 main parameters

- The short-circuit current, (*Icc*)

- The open-circuit voltage, (*Uco*)

- The maximum power current, (I_{MPP})

- The maximum power voltage noted, (U_{MPP})

These parameters depend on:

- Illumination level

- Cell temperature

8- Choosing a photovoltaic panel

A photovoltaic panel is a combination of several PV modules. For a PV system, it represents the source of energy to be supplied, which in turn feeds the rest of the components in the photovoltaic process (chopper, inverter, battery, load, etc.). The choice of a photovoltaic panel was crucial, as power from a single cell or even a single module is not enough to meet the needs of our PV system.

Find:

- No-load voltage in V
- The short-circuit current *Icc* in (*mA*)
- The maximum power *Pmpp* in (*W*)
- The current corresponding to the optimum power value *Impp* in (*mA*)
- The voltage corresponding to the optimum power value *Umpp* in (*V*)

Draw a diagram of the series and parallel connection of the 2 voltaic panels using the ammeter and voltmeter and fill in the following tables:

Times	Voltage (*V*)	Intensity (*A*)	Power (*W*)
t = …….mn			
t = …….mn			
t = …….mn			
t = …….mn			
t = …….mn			
t = …….mn			
t = …….mn			
t = …….mn			
t = …….mn			

Questions:

- Draw the current curve as a function of time.
- Draw the voltage curve as a function of time.
- Plot the current versus voltage curve.
- Plot the power versus voltage curve.
- Interpret these curves
- Draw a conclusion?