Experiment 2

Recording the characteristic curve of a solar module

Solar cells convert sunlight to electricity. To use the solar cells in technical applications, they are combined in a series connection so as to achieve a higher operating voltage. In addition to the voltage, the series connection of the cells also increases the power of a solar module. The cell surface defines the level of the possible current flowing in case of a corresponding irradiation. The combination of several cells is called solar module. There are crystalline and amorphous cells, with the crystalline cells divided further in mono- and multi-crystalline.

Just as the behaviour of a diode, the behaviour of a solar module can be described by a UI characteristic curve.

2.1 Experimental procedure with ST 14 module stand mono-crystalline

In this experiment, the characteristic curve of a solar module is to be recorded. Please use the **ST 14 module stand** in connection with panel **ST 01** for this. Connect the module to the rear side of the panel using the jack plug. The current and voltage measurement is performed with separate measuring devices.
Before starting the measurements, set the halogen lamp to maximum using the dimmer. Adjust the lamp in such a way that the maximum possible short-circuit current (approx. 300mA - amperemeter directly at the output sockets of the module) is flowing. **To do this, the short circuit plug must be plugged to panel ST01.** To obtain as high a short-circuit current as possible, select the “summer setting” of the module rack (top swivel arm inside, orientation of the module South, tilt angle approx. 30^{o}). Ensure that the module surface is irradiated as evenly as possible.
You can now record the characteristic curve of the module using the resistor and beginning with the short circuit. From 14V onward, select the voltage values yourself.

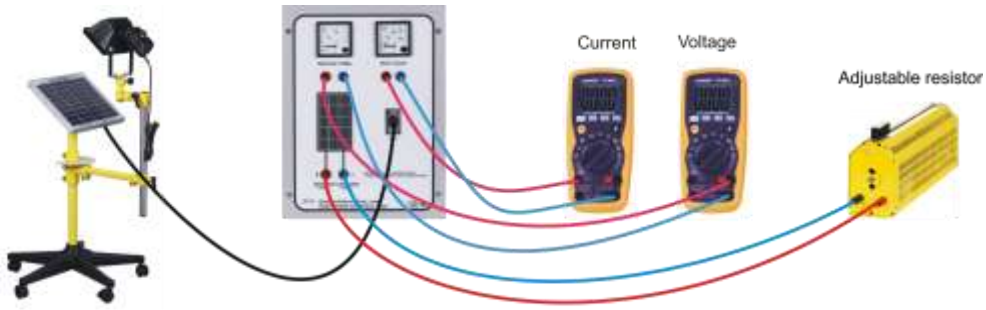
Attention

Attention! In longer operation, the lamp can get hot. There is a risk of burns. Switch the lamp off when it is not in use.

Please make this experiment very quickly so as to prevent the module from getting warmer too fast. Cause heating of the solar modules the measuring values will change. To minimize the influence of temperature it is necessary to heat the solar module with the halogen bulb up to 35° before starting the experiment.

Set the specified voltage values using the sliding resistor and register the current values measured in the table. From 14V onward, select the voltage values yourself. Calculate the corresponding power from the line of value pairs. First transfer the value pairs for current and voltage to the diagram prepared for this purpose. Then complete the diagram by registering the characteristic curve.

Panels and devices used:



ST 01 solar module connector indoor
ST 14 module stand
ST 20 RW adjustable resistor 325 Ohm / 1.2 A
ST 24 multimeter (V automatical scale)
ST 24 multimeter (10 A value)

U_S (Volt)	0	5	10	12	14							
I_S (mA)												
P_S (W)												

Table 2.1: Measured values of a characteristic curve of the module mono.

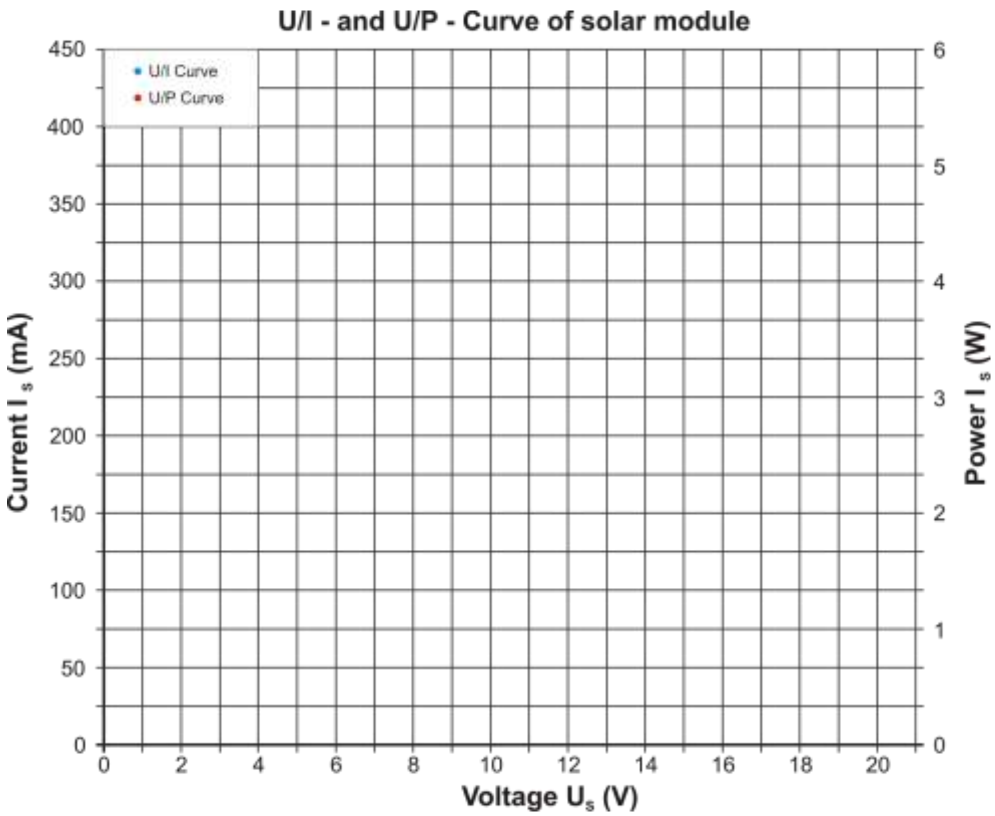


Diagram 2.1: UI and UP characteristic curve of a solar module mono

Question 1: Which type of cell is used in the module that was measured?

Solution:

mono-crystalline multi-crystalline amorphous

Question 2: Use the two characteristic curves to determine the values for current and voltage occurring in the ideal operation point of the module (slight deviations possible).

Solution:

Voltage: Current: Power:

Question 3: What is the percentage of the measured no-load voltage in relation to the ideal operation point of the module (slight deviations possible)?

Solution:

....

(slight deviations possible)