Theory model report

Politics

Lab Report: Internal Resistance of a Battery

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Abstract

This purpose of this lab is to demonstrate the effect of internal resistance of a household battery on circuits and to measure the power transfer through it. The battery is connected in series with a rheostat that acts as a variable resistor. The value of resistance is varied across the available rheostat range. The voltage at the output is measured across rheostat and its effect on the charge depletion of battery is analyzed. The hypothesis of the experiment is that as the current flowing through the load increases with decrease in resistance, the battery tends to lose more charge and hence load voltage drops significantly. We will get less voltage from battery than its theoretically rated voltage referred to as Electromotive Force (EMF). The actual voltage the terminal of load is called terminal voltage.

The internal resistance of the battery is the function of many variables such as aging and state of charge. This lab report will demonstrate the effect of variation in load current on battery’s voltage. Since internal resistance of the battery is in series with the source, the current provided by the battery will pass through it. When load is not present, the current will not pass through internal resistance and the output voltage will be the same as the theoretical rating of the battery. This voltage is called no load voltage, open circuit voltage or simply the Electromotive Force (EMF) .

As the load current increases the voltage drop across the internal resistance of the battery will rise and correspondingly, it will eat the charge of the

battery. The voltage drop across internal resistance is of no use from application point of view and it is a serious burden on the health of battery. Therefore, it is recommended not to discharge large current from battery to enhance its life.

Limitations

The limitations of the experiment done in this lab are:

The load resistance value may not be precise

The value of calculated current and related parameters may not be accurate.

Experimental Procedure

The following experimental setup is employed for performing the lab:

The values of equipment used in this experiment are:

9 volt battery

89 ohm rheostat

1-Ohm, 20-Watt resistors

Switch

Multimeter

Clips and wires

The equations used in carrying out analysis are:

$V= \epsilon - IR$

$P= VI$

Where " V" is the terminal voltage across load, " ϵ" is the EMF of the battery, " I" is the load current, " R" is the internal resistance of the battery, " P" is the power dissipated across the resistor.

The following procedure is adopted for accomplishing the tasks of this lab.

EMF of the battery is measured first of all.

Using multimeter, find the maximum value of rheostat resistance.

Setup the experiment as shown in the figure above. Make sure that the switch is closed for brief instants for taking all measurements.

Record the current and voltage a number of times by varying rheostat resistance.

Use ceramic resistors instead of rheostat and again find the load current and terminal voltages.

Find the short circuit current of the battery by disconnecting all the loads and leaving only ammeter and voltmeter in the circuit.

Sources of Error

Inaccuracy of multimeter

Chattering of switch contacts

Summary of Results

The results of the experiment are summarized below:

The graph of voltage versus load current is plotted below:

The slope of the line gives the internal resistance of the battery. The percentage error is calculated as follows:

| Vactual-VusedVactual|×100

| 2. 14-2. 2812. 14|×100= 6. 5%

Similarly, the percentage error in the measurement of EMF is found below:

The percentage error in the measurement of short-circuit current is found below:

The graph of current versus power is plotted below:

At the point of maximum power, the percentage difference between rheostat and internal resistance is calculated as follows:

Discussion of Results and Conclusions

The terminal voltage decreases with increase in load current

The power increases as the function of load current.

The results of the experiment match with our hypothesis.

Answer to Questions:

Had there been ordinary resistors used they wouldn’t have been able to sustain large current and would have been damaged.

The battery was heated due to the current drawn from it. This heat comes from copper losses across the internal resistance of the battery.

As the load current increased, the terminal voltages kept reducing and at the end, we ere left with only a little voltage at the end.

The power supplied is maximum when load resistance exactly matches the internal resistance of the battery.

References

Spellman, F. R. a. B. R. M., 2012. The Science of Renewable Energy. s. l.: CRC Press.