EXPERIMENT 6:Observation of the V-I characteristic of a diode

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1 Aim of experiment

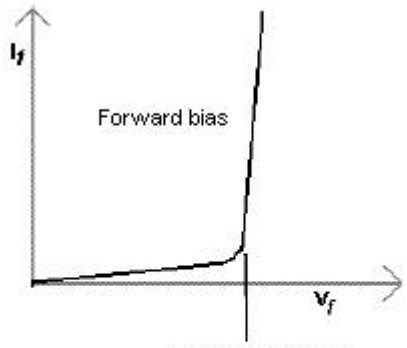
We try to see the Voltage-Current realtion in Diodes by applying a voltage across it and measuring the corressponding current flowing through it

2 Apparatus required

a)A diode
b)A DC voltage supplier
c)Bread board
d)100Ω resistor
e)2 multimeter for measuring current and voltage
f)Connecting wires

3 Theory of experiment

The diode is a device formed from a junction of n-type and p-type semiconductor material. The lead connected to the p-type material is called the anode and the lead connected to the n-type material is the cathode. In general, the cathode of a diode is marked by a solid line on the diode.The primary function of the diode is rectification. When it is forward biased (the higher potential is connected to the anode lead), it will pass current. When it is reversed biased (the higher potential is connected to the cathode lead), current flow is blocked.A general curve looks like this:



V vs I graph for a diode

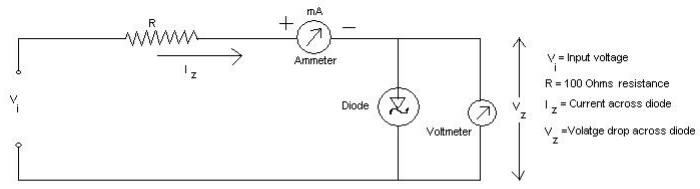
In the forward-bias region the V-I relationship is described as follows:

$$I = I_s(e^{\frac{V}{nV_T}} - 1)$$

In the above equation, I is the forward current, V is the forward voltage, It is the saturation current, and $V_T = kT/q$ is the thermal voltage. Initially, the V vs I graph is linear but then after reaching breakdown, it becomes exponential.

4 Procedure

First, complete a circuit as shown below with a 100Ω resistor and an variable DC input voltage source.



Circuit for observing V-I characteristioc of diode

We first note the point where the ammeter starts deflecting. We note this point and gradually increase the input voltage and take the corressponding current readings. We have to take many readings till the input voltage is

about 30V. On plotting an V vs I curve, we will get a clear picture of the diode characteristic. Now, we change the direction of voltage that is being applied. Then, we can get the readings in reverse bias. These readings on plotting will be linear.

5 Claculations

5.1 Readings for forward bias

S.No	Voltage(V)	Current(mA)
1	0.283	0
2	0.347	0.001
3	0.370	0.001
4	0.395	0.005
5	0.425	0.009
6	0.435	0.012
7	0.445	0.018
8	0.467	0.047
9	0.485	0.060
10	0.496	0.082
11	0.503	0.101
12	0.517	0.145
13	0.525	0.175
14	0.527	0.181
15	0.538	0.246
16	0.544	0.306
17	0.555	0.412
18	0.563	0.509
19	0.573	0.646
20	0.575	0.693
21	0.585	0.822
22	0.592	0.979
23	0.598	1.112
24	0.605	1.335
25	0.618	1.805
26	0.623	2.007
27	0.630	2.392
28	0.646	3.4
29	0.653	3.9
30	0.658	4.3
31	0.665	5.3
32	0.672	6.7
33	0.677	7.6
34	0.680	8.0

5.2 Measurement in reverse bias

S.No	Voltage(V)	Current(μA)
1	0.90	0
2	1.60	0.001
3	2.07	0.002
4	3.78	0.003
5	4.94	0.004
6	5.95	0.005
7	7.27	0.006
8	8.01	0.007
9	9.32	0.008
10	9.84	0.009
11	10.34	0.010
12	11.94	0.011
13	12.77	0.012
14	13.93	0.013
15	15.11	0.014
16	16.32	0.015
17	17.03	0.016
18	17.81	0.017
19	18.56	0.018
20	19.35	0.019

6 Results

We plot the readings on a V vs I curve and the two graphs look as follows:
Forward bias graph:

Reverse bias graph

7 Discussion

•If, we just reverse the diode to measure the I-V characteristics, the sudden change might destroy the diode.
•The diode should not be short-circuited. That will allow a flow of huge current which might destroy the diode.
•Current must not pass through it for a very long time. It will then increase the depletion region and develop a fluctuating resistance.