Laboratory work № 3.43

Studying of two-electrode lamp

Instruments and equipment: model of the facility.

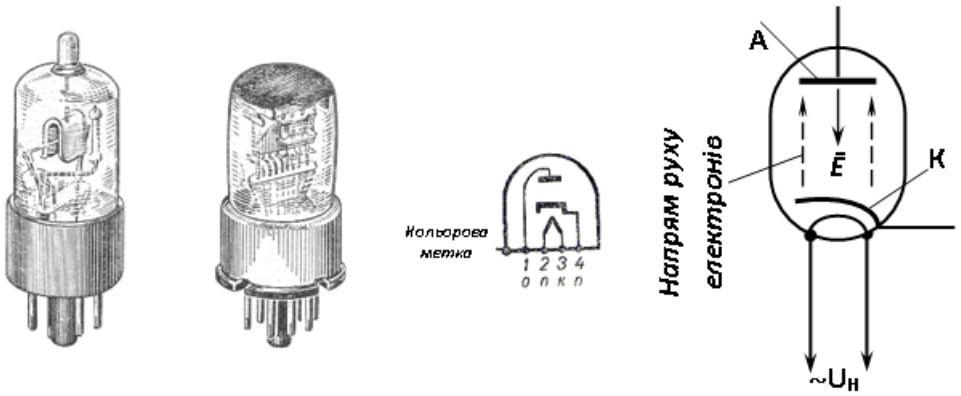
Purpose: 1) to measure the temperature characteristics of the diode; 2) to measure the anode of the diode characteristics.

Description of the facility and theoretical information

The phenomenon of thermionic emission is the emission of electrons by hot metals. During the chaotic motion of inside the metal, some electrons get some more kinetic energy than the work of electrons removing from the metal.

These electrons emit from the metal and form an electronic cloud around i. Emission of electrons increases with increasing the temperature of the metal.

If the cathode of vacuum tube will be made of incandescent metal (which means that he serves negative potential) and apply the positive potential to the anode, the thermionic current will flow through the tube. This two-electrode vacuum tube is called as a diode (Figure 1). The electric field between the cathode K and anode A picks the electrons to A, so electron cloud dissipates and conditions for further emission of electrons from the metal will be formed.



(Figure 1).

If between the cathode and anode create an electric field so that the positive pole of the battery was connected to the anode, the negative (cathode) and milliammeter, which are switched in series with the diode, it will show a current (Fig. 2). If cathode is cold, then it will be any current in the circuit, when the voltage will be supplied to the anode. This is because rather rarefied gas inside the diode (vacuum) contains any charged particles. In such a condition the electrical conductivity of the diode is zero.

The current dependence of the voltage (anode or the volt-ampere characteristics of the diode) is non-linear, i.e. Ohm's law for the vacuum diode isn`t performed. When by the increasing the anode voltage, the current (at the $T_{cathode}$ = const) reaches its maximum, it is called the saturation current.

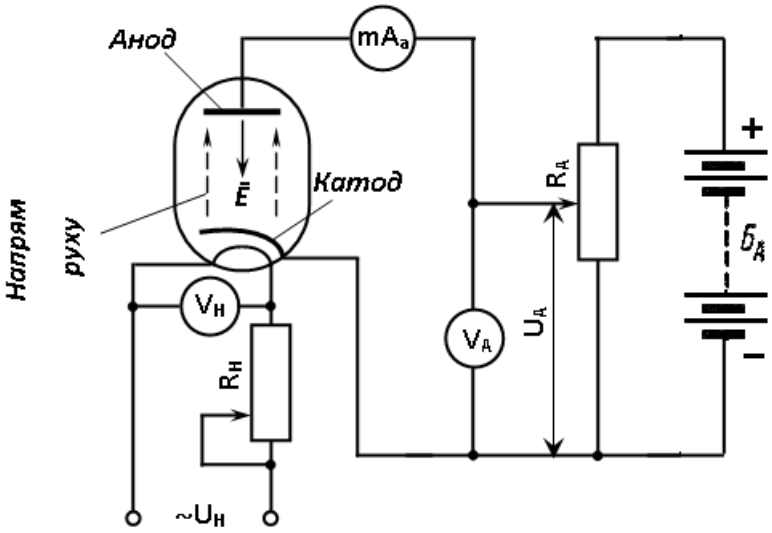
Measurements

I. Measurement of diode temperature characteristics

Temperature increases with the cathode incandescent voltage $\mathbf{U_i}$, so we will study the anode current $\mathbf{I_a}$ dependence of voltage on the cathode incandescent filament $\mathbf{U_i}$.

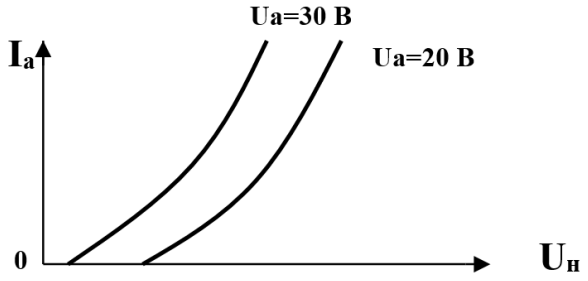
$$I_a = f(U_i)$$

1. Assemble the scheme according to Fig. 2.



(Figure 2).

2. By potentiometer set the anode voltage 20 V.
3. Use the incandescent rheostat R_i to change voltage U_i over 0.2 V, each time identifying the constant current value I_a.
4. The results of measurements enter in Table 1.
5. Repeat items 3, 4 for U_a = 30 V.
6. According to the table to build dependence $I_a = f(U_i)$ with U_a = 20V and 30V. Both curves are constructed in a same coordinate system (Fig. 3).



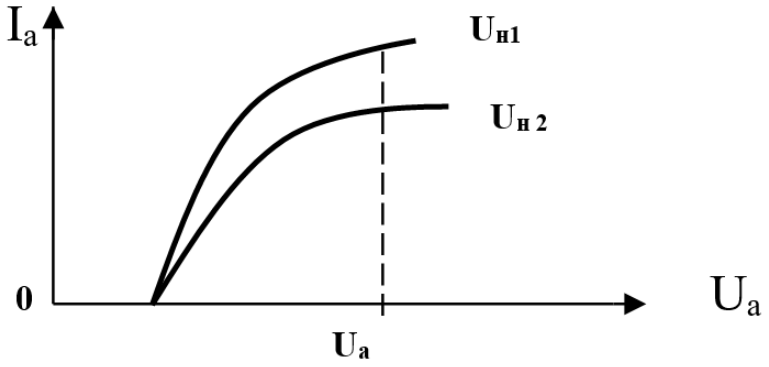
(Figure 3).

II. Measurement of anode characteristics

1. To Measure the anode characteristics we need to use the previous scheme (Fig. 2).
2. Set incandescent voltage U_{i1}.

3. Increasing each time anode voltage U_i by 5 V, measure the anode current I_a.
4. The results of measurements enter to Table 2.
5. Repeat points 3 and 4 for U_{i2}.
6. According to the table to build dependence $I_a = f(U_a)$ with U_{i1} and U_{i2}.

Both curves are constructed in a same coordinate system (Fig. 4).



(Figure 4).

Tab.1

№	*Ua = 20 B*		*Ua = 30 B*	
	U_i	I_a	U_i	I_a
1				
…				
10				

Tab.2

№	*Ui =*		*Ui =*	
	U_a	I_a	U_a	I_a
1				
…				
10				

Control tasks

1. What determines the current saturation?
2. Why for electron tubes required high vacuum?