43. Operation of an Electron-multiplier.

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An electron-multiplier which contained thirteen electrodes was constructed by us. One or more electrons emerging from the first electrode under the action of radioactive rays or other ionizing particles are amplified to a measurable number by the ejection of secondary electrons at the successive electrode surfaces.

In order to use this multiplier as a counting apparatus for individual particles, the thermionic emission at the first electrode being necessary to be avoided as possible, the electrodes need to be made of the metal with a high work function. For this reason we adopted beryllium-copper alloy (Be 2 % +Cu 98 %), which has a work function of 4 eV and the thermionic emission at the room temperature is negligible. The secondary emission ratio of this alloy was about 2, but this value could be raised to 3～5 by the heat treatment at 500°～700° for about 30 minutes in good vacuum (10^{-3}～10^{-4} mm Hg). After this procedure we could expose the surface of the alloy without any serious deterioration. Each electrode, made of the alloy sheet (0.2 mm thick), was mounted between two mica sheets in proper geometry, which is very suitable for focusing the ejected secondary electrons on the next electrode successfully.

After a whole apparatus was evacuated up to 1×10^{-5} mm Hg by the use of two diffusion pumps with a liquid air trap, negative high voltage of 2000～5000 V (i. e. 200～500 V per stage) was applied. The electrons multiplied 10^4～10^5 times were caught at the collector, which was a nickel wire 0.5 mm in diameter, and caused the potential drop at the top grid of the linear amplifier.

The counting rate for a given particle increased as the voltage per stage was raised up to 500 V, but when the voltage was increased beyond 350 V, the background noise increased very rapidly. The counting efficiency of this multiplier for γ-rays was about 10 % of Geiger-müller counter's; while for α-particles the efficiency seemed to be 100 %. Determination of efficiencies for β-particles or other ionizing particles is now in progress.

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44. Electron Bombardment Conductivity of (BaSr) O. (II)

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In the previous report we found that, when (BaSr) O was bombarded by electrons from ThW emitter, the resistance v. s. applied accelerating voltage curve shows the trough at some accelerating voltage. By the rough estimation of the intrinsic kinetic energy of incident electron, it seems reasonable that the appearance of the trough is due to thd excitation of the electrons from the impurity level to the conduction band.

In order to confirm this fact we repeated the same dxperiment concerning (BaSr)O emitter instead of ThW. We have found also in this case that the resistance change curve shows the same behaviour i. e. the curve shows minimum at about 0.2 volt and then increases up to the value for non-bombardment with increasing applied voltage. Above 0.7 volt the resistance does not change by the bombardment of electrons.

In order to calculate accurately the intrinsic kinetic energy of incident electron, which causes the trough, from the observed value of applied voltage, 0.2 volt, we must take into account various correcting terms, (such as contact potential difference between the sample and the emitter, and its variation by some reasons, and initial velocity distribution of incident electrons and charging up the sample surface and so on). These estimations are now in progress.

To explain the question why the resistance does not change above 0.7 volt, we observed the resistance and the secondary emission against the applied accelerating voltage simultaneously. Then we found the closely-related agreement between the behaviour of the curves of resistance and the secondary emission. It seems, therefore, that qualitatively the impurity level plays an important role for the secondary emission from (BaSr)O.

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45. On the Characteristics of Ionization Chamber with Screen-Grid. (I)

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In the experiment when a large-sized or high pressure ionization chamber are filled with electronegative gases, difficulties arise in attaining the voltage saturation. The characteristics of ionization chamber with screen-grid were studied, both theoretically and experimentally, to overcome these difficulties. The essential advantage of this chamber is that the voltage required is proportional th the depth instead of the square of it as in the case without the grid.

The causes of the inhomogeneity of the pulse heights i. e. the inperfection of the shielding effect of the grid and the rate of ions captured by the grid were analysed theoretically. The validity of the theory was acertained experimentally with several chamders having different shieldings.