METHOD OF PRODUCING SELENIUM RECTIFIERS OR THE LIKE

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My invention relates to dry plate rectifiers or like devices such as light-sensitive cells of the type wherein a semi-conductor layer composed of a material such as selenium or a selenium compound is deposited by a vaporization process on a carrier electrode. The object of the invention is to provide an improved device of the above type and an improved method of forming the semi-conductor layer on the carrier electrode.

Conventional cells of the selenium type for rectifiers or light-sensitive devices comprise a carrier electrode having thereon a semi-conductor layer of selenium or selenium compound, and a counterelectrode in contact with the semi-conductor layer. Heretofore the semi-conductor layer has been commonly produced by a mechanical application of the selenium or selenium compound to the carrier electrode, for example by melting of the semi-conductor material upon the electrode and flowing the material thereof to form a layer of the required thickness. It has been suggested to produce the semi-conductor layer, for cells of the selenium type for example, by exposing the carrier electrode to the vapor of a semi-conductor material in a high vacuum. Semi-conductor layers produced by the latter or similar vaporization methods are characterized by a more uniform construction and greater degree of efficiency as compared with layers produced by the mechanical methods such as the above-mentioned fusion of the semi-conductor material to the carrier electrode. Light metals, or metal alloys, for example metals or alloys of the group comprising aluminum, magnesium and beryllium, have proved to be particularly advantageous and efficient materials for the carrier electrode when the vaporization method of forming the semi-conductor layer is employed.

The vaporization method has had the disadvantage, however, that the carrier electrode must be maintained at a temperature at which the semi-conductor material has a low vapor pressure. Thus a condition, not easily controlled, of the semi-conductor material ensues in which the material may be at a given instant either in process of being condensed or of being vaporized, and the thinness and structure of the semi-conductor layer obtainable are so greatly dependent on the temperature of the carrier electrode and on the vapor pressure of the semi-conductor emerging from the vaporization apparatus that these characteristics of the semi-conductor layer can not, arbitrarily, under this latter condition, be properly determined. In the use of the vaporization process other difficulties are encountered, and a loss of material occurs, due to the fact that the pumps, which serve to maintain the vacuum, draw off a portion of the vaporized semi-conductor material.

In accordance with my invention these disadvantages are obviated by a vaporization method wherein the depositing of the semi-conductor layer on the carrier electrode in a vacuum is avoided. Further, a plurality of materials for forming the semi-conductor layer are vaporized simultaneously and intermixed.

My invention will be better understood from the following description when considered in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

Referring to the drawing, Figs. 1 and 2 illustrate rectifier cells in which, in accordance with my invention, a semi-conductor layer is mounted between a carrier electrode and a counterelectrode.

In Fig. 1 the rectifier cell or element includes a carrier electrode 1, a semi-conductor layer 2, and a counterelectrode 3. The semi-conductor layer is deposited on the carrier electrode by exposing the carrier electrode to the vapor of a semi-conductor material, as usual in the vaporization process. In accordance with the present invention, however, the vaporizing of the semi-conductor material and the exposing of the carrier electrode 1 to the vapor of the material, for forming the semi-conductor layer 2, on the carrier electrode, take place in an atmosphere of a neutral gas. Nitrogen and the rare gases, helium, neon, argon, krypton, and xenon have proved suitable.

In accordance with the method of the present invention the thickness and structure of the semi-conductor layer can be better controlled than by former methods; by varying the pressure of the neutral gas and the temperature of the carrier electrode within wide limits, adjustment can be made for any special condition arising from the revaporization of the semi-conductor material.

The method in accordance with my invention can further be improved by employing a directed stream of the neutral gas, thus hindering the revaporization of the semi-conductor material which is being deposited onto the carrier electrode. The gas current is preferably caused to flow directly against the carrier electrode, so that the losses of material become small. Pre-heating of the current of neutral gas has proved to be of advantage.

The method according to the present invention...
makes it possible that a plurality of semiconductor materials may be simultaneously vaporized and intermixed without difficulty, the semiconductor layers thus obtained proving very efficient in many cases. The production of such compound layers has been difficult heretofore by reason of the varying gas pressure of the components in the course of evaporation in a high vacuum, whereas the presence of a neutral gas, as provided by my present invention, considerably improves and simplifies the method of production of the semiconductor layer. By the use of the neutral gas, and by carefully directing the gas stream against the carrier electrode, efficient mixing of the components of the semiconductor material is assured. I have found that a mixture of selenium and iodine, as illustrated in Figs. 1 and 2, is particularly advantageous.

When employing the method of the present invention it is, further, expedient to operate at a pressure of the neutral gas which is higher than the external pressure, i.e., at a pressure higher than one atmosphere, the neutral gas then preventing access of air to the carrier electrode, upon which the semiconductor layer is being deposited. By this means, further, an especially favorable condition is possible and preferably utilized for developing the semiconductor layer, viz., the maintaining of the carrier electrode, upon which the layer is being deposited, at a temperature of over 210°C.

In Fig. 2 the semiconductor layer 2 is composed, as in Fig. 1, of a mixture of selenium and iodine. The carrier electrode 4, however, is composed of a metal or alloy of the group comprising aluminum, magnesium, and beryllium. The semiconductor layer is deposited on the carrier electrode in the same manner as hereabove described in connection with the cell or element illustrated in Fig. 1.

It has been set forth herein that light metals or alloys are suitable as materials for the carrier electrode. It will be readily understood, however, that other well known materials such as iron or nickel may be utilized for this purpose in practising my present invention.

My invention has been described herein in particular embodiments for purposes of illustration. It is to be understood, however, that the invention is susceptible of various changes and modifications, and that by the appended claims I intend to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. The method of producing an element for a dry plate device, said element comprising a carrier electrode composed of a material of the group comprising aluminum, magnesium, and beryllium and alloys of said metals, which includes exposing said electrode to a mixture of selenium vapor and iodine vapor in the presence of a chemically neutral gas.

2. The method of producing an element for a dry plate device, said element comprising a carrier electrode, which includes forming a vapor of a semiconductor material, forming a current of preheated, chemically inactive gas, and blowing said vapor against said carrier electrode by said current of gas, to form a layer of said semiconductor material on said electrode.

3. The method of producing an element for a dry plate device, said element comprising a carrier electrode, which includes exposing said electrode to the vapor of a semiconductor material in the presence of a chemically neutral gas, said gas being at a pressure higher than atmosphere, and maintaining said carrier electrode at a temperature sufficiently low to cause said vapor to condense thereon to form a solid semiconductor layer thereon.

4. An element for a dry plate device, including a carrier electrode, and a semiconductor layer on said electrode composed of a mixture of selenium and iodine.

5. An element for a dry plate device, including a carrier electrode composed of a material of the group comprising aluminum, magnesium, and beryllium and a semiconductor layer on said electrode composed of a mixture of selenium and iodine.

6. An element for a dry plate device, including a carrier electrode composed of a material of the group comprising aluminum, magnesium, and beryllium, and a semiconductor layer on said electrode composed of a mixture of selenium and iodine.

7. The method of producing an element for a dry plate device, including a carrier electrode composed of a material of the group comprising aluminum, magnesium, and beryllium and alloys of said metals, which includes exposing said electrode to a mixture of selenium vapor and iodine vapor in the presence of a chemically neutral gas.

8. An element for a dry plate rectifier or the like, including a carrier electrode, and a semiconductor layer on said electrode composed of a mixture of selenium and iodine.

9. An element for a dry plate rectifier or the like, including a carrier electrode composed of a material of the group comprising aluminum, magnesium, and beryllium and alloys of said metals, and a semiconductor layer on said electrode composed of a mixture of selenium and iodine.

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