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SELENIUM RECTIFIERS AND METHOD OF MANUFACTURING THE SAME

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This invention relates to selenium rectifiers and more particularly to a process for the production of selenium rectifiers which can be formed and operated at higher voltages than known rectifiers with the same value of the rectified current for the same heat dissipation and which possess a higher reversing or blocking resistance without increasing the direct resistance.

In accordance with the known process for manufacturing selenium rectifiers, a metal base or disk is sand-blasted or shot-blasted and is then covered with a metallic deposit, such as nickel. A thin coating of selenium is applied over the nickel surface in conjunction with additional substances, such as halogen compounds. The rectifier at this stage is then heat treated to produce the desired condition of the selenium and is subsequently subjected to the fumes of selenium anhydride either in the presence or in the absence of water vapor. The usual counter electrode is then applied to the so-treated rectifier base or disk in the form of a low melting point alloy of known composition. The rectifier is next subjected to electroforming, in which suitable electrical potentials, which may be A. C., D. C. or pulsed, are applied in such manner that the counter electrode constitutes the anode.

This known process produces rectifier disks which cannot be employed with high voltages. They are also characterized by having a relatively low reverse or blocking resistance as compared with the direct resistance from the counter electrode to the selenium. While rectifiers made in accordance with the known procedure just described will withstand potentials of about 18–20 volts, this constitutes their practical maximum and therefore these rectifiers are not adapted for uses requiring the application of higher voltages, because, when such higher voltages are applied, the rectifiers break down. Some efforts have been made to improve this situation but such tend to increase the direct resistance along with any increases produced in the reverse or blocking resistance. It has been proposed, for example, to apply a layer of insulating organic material between the selenium and the counter electrode and, while such is of some advantage for certain purposes, it has not solved the problem here involved and does not produce rectifiers with the characteristics sought by applicants.

It is, accordingly, an object of the present invention to manufacture rectifiers in such manner that they will withstand higher potentials than known rectifiers without increasing the direct resistance of such rectifiers.

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Another object of the invention resides in the application to a known rectifier of a simple acyclic or aliphatic aldehyde prior to the application of the counter electrode thereto.

Another object of the invention resides in manufacturing rectifiers by a procedure which includes the application of an aliphatic aldehyde RCHO, wherein R is hydrogen or a lower alkyl group, to the rectifier subsequent to the selenium anhydride fuming and prior to the application thereto of the counter electrode so as to produce a rectifier which has a higher reverse or blocking resistance than known rectifiers but a direct resistance which is of the same order or even lower than that of known rectifiers.

In accordance with this invention the known manufacturing procedure for producing rectifiers, as above described, is interrupted subsequent to the selenium anhydride fuming and just before the counter electrode is applied. Thus, after the step of subjecting the selenium coating to the fumes of selenium anhydride, which can be either in the presence or in the absence of water vapor as above mentioned, the rectifier is treated with an acyclic or aliphatic aldehyde RCHO, wherein R is either hydrogen or a lower alkyl group, and, in particular, with formaldehyde or acetaldehyde. The treatment may be carried out in various specific ways, such as by applying the aldehyde to the selenium coating by means of a brush or by dipping the rectifier in an aqueous and/or alcoholic solution of the aldehyde or in pure fluid aldehyde. We prefer, however, to treat the rectifier with the aldehyde by subjecting the rectifier to the vapors of the aldehyde which have been produced by heating the aldehyde to a suitable temperature depending upon whether it is in pure form or in aqueous and/or alcoholic solution and when in solution form the temperature will vary somewhat depending upon the concentration of such solution. We have found that a very satisfactory solution for applying the aldehyde to the rectifier consists of Formol, which is a readily available commercial solution of formaldehyde in water and methanol.

The invention will be more fully appreciated from the following specific example, which is presented as illustrative without constituting a limitation upon the invention.

Example

Rectifier disks obtained by the known procedure above set forth up to and including the heat treating steps are subjected to the fumes of selenium anhydride for a period of time rang-

ing from about 1–10 seconds and are then subjected to the vapors of a heated aqueous solution of formaldehyde of any suitable or convenient concentration for a length of time which depends upon the concentration of the solution and its temperature and which is a specific case is a 30% solution heated to a temperature of 40° C. Under these conditions it has been found that a treatment of about 1–10 seconds is fully satisfactory and accomplishes the objects and advantages herein set forth. After the aldehyde treatment just described, the rectifier disks are then covered with the counter electrode and electroformed at potentials up to about 35 volts.

Such rectifiers will readily withstand in normal operation an alternating voltage R. M. S. of 30 volts and show in the reverse direction a materially higher resistance than rectifiers not treated with an aliphatic aldehyde in accordance with this invention. This increase in the reverse resistance is evidenced by the fact that the temperature reached after an extended length of time under a potential of 30 volts is the same as the temperature reached by rectifiers made by known procedures and subjected to a potential of only R. M. S. 18 volts. Rectifiers made in accordance with this invention will withstand potentials up to 30–40 volts, which is of the order of twice the voltage which the said known rectifiers can withstand and, in addition, our new rectifiers show higher reverse or blocking resistance than known rectifiers without increasing the direct resistance, which latter remains of the same order or is even reduced. The advantages of the invention will thus be clearly understood and appreciated.

While the invention has been particularly described in connection with the use of formaldehyde as the acyclic or aliphatic aldehyde, our invention is not limited to the use of this particular aldehyde which, however, has produced excellent results in actual practice. Other acyclic or aliphatic aldehydes and particularly a lower aliphatic aldehyde, such as acetaldehyde, may equally well be employed. Aldehydes embraced by the invention are defined as those acyclic or aliphatic aldehydes which respond to the general formula RCHO, wherein R is selected from the group consisting of hydrogen and lower alkyl radicals.

We claim:

1. A method of manufacturing a selenium rectifier which comprises treating such rectifier with selenium anhydride and thereafter with an acyclic aldehyde RCHO, wherein R is selected from the group consisting of hydrogen and a lower alkyl radical, prior to the application of a counter electrode to such rectifier.

2. A method of manufacturing a selenium rectifier which comprises treating such rectifier with selenium anhydride and thereafter with an acyclic aldehyde RCHO, wherein R is a lower alkyl group, prior to the application of a counter electrode to such rectifier.

3. A method of manufacturing a selenium rectifier which comprises treating such rectifier with selenium anhydride and thereafter with formaldehyde prior to the application of a counter electrode to such rectifier.

4. A method of manufacturing a selenium rectifier which comprises treating such rectifier with selenium anhydride and thereafter with acetaldehyde prior to the application of a counter electrode to such rectifier.

5. A method of manufacturing a selenium rectifier which comprises treating the selenium coating of such rectifier with selenium anhydride and thereafter with formaldehyde for a period of time ranging from about one to ten seconds subsequent to the usual heat treatment of the selenium coating and prior to the application of the usual counter electrode to the selenium coating.

6. A method of manufacturing a selenium rectifier which comprises treating such rectifier with selenium anhydride and thereafter with an acyclic aldehyde RCHO, wherein R is selected from the group consisting of hydrogen and a lower alkyl radical, prior to the application of a counter electrode to such rectifier by subjecting the selenium coating of the rectifier to contact with said aldehyde.

7. A method of manufacturing a selenium rectifier which comprises treating such rectifier with selenium anhydride and thereafter with an acyclic aldehyde RCHO, wherein R is selected from the group of consisting of hydrogen and a lower alkyl radical, prior to the application to such rectifier of the usual counter electrode by subjecting the selenium coating of such rectifier to the vapors from a heated aqueous solution of such aldehyde for a period of time ranging from about one to ten seconds.

8. In a process for the manufacture of rectifiers, the step which consists in subjecting a rectifier disk after a layer of selenium has been applied thereto and said layer has been fumed with selenium anhydride but before the application of a counter electrode, to the vapors of a formaldehyde solution, having a concentration of about 30%, heated to a temperature of about 40° C. for a period of time ranging from about one to ten seconds.

9. In a process for the manufacture of rectifiers, the step which consists in subjecting a rectifier disk after a layer of selenium has been applied thereto and said layer has been fumed with selenium anhydride but before the application of a counter electrode, to the fumes of selenium anhydride and then to the vapors of a formaldehyde solution, having a concentration of about 30%, heated to a temperature of about 40° C. for a period of time ranging from about one to ten seconds.

10. A selenium rectifier comprising a metal disk, a metallic deposit on one surface of such disk, a formaldehyde-treated selenium anhydride fumed selenium coating on said metallic deposit and a counter electrode on said selenium coating, said rectifier being characterized by the capacity to withstand a potential of 30–40 volts and by a relatively high reverse resistance in conjunction with a normal direct resistance.

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No references cited.