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LIQUID TREATMENT OF CONTACT SURFACES FOR COPPER OXIDE RECTIFIERS

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1 Claim. (Cl. 134—2)

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My invention relates to dry contact rectifiers and, in particular, relates to methods of making good electrical contact to the oxide surface of copper oxide rectifiers.

As is disclosed in Grondahl Patent No. 1,640,335, the junction between mother copper and a cuprous oxide layer formed thereon constitutes a very effective current rectifier, but commercial employment of such rectifiers has emphasized the problem of making electrical contact to the outer surface of the cuprous oxide which shall have a relatively low resistance to current flow in the normally conductive direction and in which the value of the voltage drop due to current flow shall be relatively constant during the life period of the rectifier. Various methods of making electrical contact to the oxide surface have been proposed, for example, lightly abrading the oxide surface by means of a sand blast or the like and superposing thereon a thin layer of silver, gold or other metal by evaporation and condensation.

However, when the sand-blasting method is used on rectifiers, particularly for relatively high voltage service, it is found that the disturbance to the delicate inter-face between the oxide and the copper is likely to render the rectifiers susceptible to electrical breakdown.

In accordance with my present invention, I avoid the difficulties from abrading the oxide surface before deposition of the metallic layer by various other types of treatment.

One object of my invention is, accordingly, to produce an improved method of making electrical contact to the oxide surface of copper oxide rectifiers.

Another object of my invention is to provide a method of forming contact layers of evaporated or sprayed metal on the oxide surface of copper oxide rectifiers which avoids damage to the rectifier by employment of abrasion or the like prior to such metallic deposition.

Still another object of my invention is to provide an improved method of preparing the oxide surface of copper oxide rectifiers for deposition of a metallic contact layer.

Other objects of my invention will become apparent upon reading the following description of processes embodying the principles of my invention.

In order to prepare copper oxide rectifiers for the use of my process, they are first oxidized in an atmosphere containing oxygen at a temperature not far below their melting point; and subsequently annealed at a temperature of the

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order of 500 to 600 degrees for a period of the order of 15 minutes and then cooled either in air or water to room temperature. This treatment leaves a layer of cuprous oxide adjacent to the copper and superposed on such layer a coating of black cupric oxide. The latter is preferably removed by etching for 2 minutes in 2% sulfuric acid at 80° C., followed by a quick dip in concentrated nitric acid and a subsequent rinse in tap water and drying.

The oxide surfaces so prepared are then dipped for a period of from one to five minutes in a mixture of ammonium hydroxide of specific gravity 0.9015 with water, the ammonium hydroxide being from 12½% to 100% of the mixture.

In accordance with another form of my invention, the oxide surface may be dipped in a solution containing equal parts of ammonium hydroxide, specific gravity 0.9015, and hydrogen peroxide, such immersion being continued from one-quarter of a minute to six minutes.

In accordance with another embodiment of my invention, cuprous-oxide surfaces, prepared as above described, are mounted on a rotatable spindle and a piece of soft white felt is held against the surface during the rotation.

In accordance with still another embodiment of my invention, the rotating oxide surface above described is held against thin felt on which very fine carbon black, such as is used in the preparation of colloidal graphite materials, had been rubbed.

In still another modification of my invention, the felt used to rub the rotating oxide surface was previously dipped into a water suspension of colloidal graphite known in the trade as "Aquadag."

In accordance with still another modification of my invention, "Aquadag" was applied as a heavy coat to the washer and thereafter washed off with water.

After employing any of the above-mentioned modifications of my invention, evaporated silver was deposited on the surface of the treated copper oxide by placing the unit in an evacuated container in which a body of silver was heated to the point where it sublimed.

I tested rectifier units coated with a conducting layer in accordance with each of the above-described methods to determine whether they were affected during a long active life by humidity or moisture and found that their resistance in the conductive direction was substantially invariable over periods up to 500 hours. In this

and other respects, they were fully as satisfactory as rectifier units in which the oxide surface was sand-blasted before deposition of the metal contact layer, and showed a materially lower lossage due to electrical break-down and short circuiting under quantity production.

I claim as my invention:

The method of preparing a contact surface for copper oxide rectifiers which comprises treating the oxidized surfaces of the copper for from one-quarter of a minute to six minutes in a solution comprising equal parts of ammonium hydroxide of specific gravity 0.9015 and hydrogen peroxide.

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The following references are of record in the file of this patent:

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