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MANUFACTURE OF ALTERNATING ELECTRIC CURRENT RECTIFIERS

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6 Claims. (Cl. 175—366)

1

This invention relates to the manufacture of alternating electric current rectifiers of the dry surface contact type comprising a body of metal having a compound of the metal formed directly thereon and more particularly to rectifiers of the copper oxide type.

Important desirable qualities in rectifiers of the type to which the invention relates are that the resistance in the forward direction should be as low as possible while the resistance in the reverse direction should be as high as possible and that these resistances more particularly the resistance in the reverse direction should be stable and not liable to appreciable creep or continuous change under an applied voltage.

In the usual process for the production of copper oxide rectifiers copper blanks are heated in an oxidizing atmosphere at a temperature for example of approximately 1000° C. and are thereafter quenched or cooled either directly or after a further heat treatment at a lower temperature of, for example, approximately 500° C.

This process is found to give generally satisfactory results in the case of blanks composed of copper having certain characteristics as regards degree of purity or the presence of certain impurities but it is found in practice that any disadvantageous results of these characteristics particularly arise during the initial stages of oxidation while the copper blanks are at a relatively low temperature and that if the oxidation can be prevented or reduced until the blanks have attained practically the normal temperature of oxidation, the rectifier elements produced are to a large extent satisfactory as regards the desirable qualities above indicated regardless of the characteristics of the copper of which the blanks are composed.

According to the invention this result is achieved by heating the copper blanks to approximately the normal temperature of oxidation in an atmosphere consisting wholly or mainly of steam prior to the actual oxidation treatment in air or other oxidising agent.

By this preliminary treatment not only are certain variations in the characteristics of the copper rendered relatively unimportant but the creep in the reverse resistance above referred to is substantially reduced from that ordinarily found in rectifier elements produced from copper hitherto regarded as satisfactory in this respect.

In carrying the invention into practice the copper blanks are introduced into a furnace having a temperature of approximately 1025° C. The internal atmosphere of this furnace is composed wholly or mainly of steam originally introduced from a boiler at a pressure of approximately 15 lb. per sq. in. and after a period of approximately 3 minutes (when the copper blanks will have attained the furnace temperature) the steam is removed in any suitable manner and replaced by atmospheric air. The oxidation in this atmosphere is allowed to proceed for a period of approximately four minutes and the blanks are then transferred to another furnace containing atmospheric air and operated at a temperature of approximately 530° C. The blanks remain in this furnace for approximately 10 minutes and are then removed and quenched in the usual manner.

2

In some cases it is found to be advantageous to carry out the preliminary heat treatment in an atmosphere composed of steam with a small proportion (for example 10%) of air and the composition of this atmosphere to give the best results must be determined by trial although it may be possible to ascertain this from a preliminary test or knowledge of the composition or degree of purity of the copper of which the blanks are composed.

In a particular case in which the copper employed gave unsatisfactory results by the process hitherto used, the blanks subjected to the process of the invention possessed a reverse resistance about 25% higher than that of blanks produced from a much better sample of copper by the process hitherto employed while the reverse creep after 24 hours was only about one quarter of that of blanks produced from the better sample of copper by this latter process.

The invention is evidently not limited to the particular conditions of heat treatment above specified by way of example.

Having thus described our invention, what we claim is:

1. A process for the manufacture of alternating current rectifiers of the copper oxide type comprising the step of heating copper blanks prior to oxidation to approximately the normal oxidation temperature in a steam laden atmosphere.

2. A process for the manufacture of alternating current rectifiers of the copper oxide type comprising the step of heating copper blanks prior to oxidation to approximately the normal oxidation temperature in an atmosphere which is composed wholly of steam.

3. A process for the manufacture of alternating current rectifiers of the copper oxide type comprising the step of heating copper blanks prior

to oxidation to approximately the normal oxidation temperature in an atmosphere which contains at least 90% of steam.

4. A process for the manufacture of alternating current rectifiers of the copper oxide type comprising the steps of introducing copper blanks into a furnace having a temperature of approximately 1025° C. and a steam containing atmosphere, and replacing the said atmosphere by atmospheric air after a period of time sufficient for the said blanks to attain the furnace temperature.

5. A process for the manufacture of alternating current rectifiers of the copper oxide type, comprising the steps of heating copper blanks in a steam-laden atmosphere to the temperature of oxidation, and replacing the said atmosphere by atmospheric air after a period of time sufficient for said blanks to attain said temperature of oxidation.

6. A process for the manufacture of alternating current rectifiers of the copper oxide type, comprising the steps of heating copper blanks first in a steam-laden atmosphere to the temperature of oxidation and then continuing said heating in atmospheric air.

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No references cited.