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CONDITIONING OF GRAPHITE ELECTRODES AND PRODUCT OF SAME

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The subject of this invention is the conditioning for service of graphite electrodes such as used in electrolytic cells of the type generating caustic soda and hydrogen at the cathode, and chlorine at the anode. This invention further relates to the electrodes eminently adapted for service resulting from such conditioning.

It is the custom to use graphite as the material of construction of the anodes in various types of electrolytic cells, for instance, in the Allen-Moore and the LeSueur cells employed for electrolyzing sodium chloride solutions. One of the prime desiderata in such cells is that the graphite electrodes have a long useful life, as it is a matter of considerable expense and inconvenience to dismantle the cells for the installation of new electrodes.

After many years of trial and experimentation, I have discovered that before the graphite electrodes are put to use it is highly advantageous to impregnate them with a drying oil, and more especially linseed oil, containing added so-called driers, and to convert the drying oil and driers in situ in the electrodes into oxidation products which have practically no tendency to ooze from the electrodes when they exert their electrolyzing function under the action of the electric current. This oxidation may be accomplished conveniently and inexpensively by ageing or seasoning the impregnated electrodes in the air for a long period of time before being used. The driers which I employ are preferably the usual commercial lead and manganese compounds of unsaturated fatty acids, and more specifically the lead and manganese linoleates. Inasmuch as such driers are not available on the market in chemically pure form, they are used as commercially produced by the reaction of lead or manganese oxide on a drying oil, and so contain glycerine, which is formed by the reaction, and residual drying oil.

A specific procedure for conditioning electrodes in accordance with the principles of my invention, and which has been found to give highly satisfactory results, is carried out as follows. Linseed oil (e. g., of the commercial, boiled variety) as it comes in barrels is dumped into a treating tank to form a soaking bath, and 5 gallons of commercial lead and manganese drier is added for every barrel (50 gallons) of linseed oil in the bath. The bath is preferably then heated to about 150° to 160° F., as by a steam-heating coil at the bottom of the tank. A suitable basket or rack provided with hooks for hanging on the walls of the tank may be conveniently used for handling a batch of the electrodes; and a basket or rack full of electrodes may be suspended from the tank walls, with the electrodes completely immersed in the bath. The electrodes are permitted to remain immersed for hours, say, sixteen hours or more, in the bath, which is preferably maintained at about 150° to 160° F. throughout the immersion period. The basket or rack of electrodes is then raised out of the bath and excess oil is allowed to drain therefrom into the bath.

As a result of this procedure, the electrodes are impregnated with oil and drier, which set or oxidize very quickly upon exposure to the air. In fact, the oil has such pronounced setting tendency that a thick coating of oxidized oil of jelly-like consistency quickly accumulates on the walls of the treating tank and on the submersing basket or rack. This accumulation may be dissolved in fresh linseed oil added to the bath to replace that taken up by a batch of electrodes, whereupon more drier may be added to the bath in amount to maintain therein the desired ratio of drier to linseed oil.

I have observed that when the impregnated electrodes were put to service only after a short period of exposure to the air, the oil oozed therefrom, contaminated the caustic soda solution produced in the cells, and caused undue foaming when the caustic soda solution was concentrated in the evaporators. More serious than this, however, such electrodes were not longer-lived than the usual untreated electrodes.

In accordance with the present invention, the foregoing difficulties are obviated and a long useful life imparted to the impregnated electrodes by subjecting them to seasoning or ageing in the atmosphere for a long

period of time, for instance, for at least about six months or so. After such ageing, the oxidation products of the oil and driers are present in the electrodes in an oxidized state substantially free from oozing tendencies when the electrodes are put to electrolyzing service; and the serviceable life of the electrodes is surprisingly increased.

The commercial importance of my invention will be readily appreciated from data obtained in the operation of cells of standard makes. Thus, whereas untreated graphite anodes in Le Sueur cells operated at standard amperage withstand constant service for only two years, anodes of the same kind treated in accordance with the present invention last from six to eight years in similar service. By employing anodes conditioned in accordance with the present invention, I have determined that the consumption of graphite anodes may be reduced to as low as 4 pounds per ton of caustic soda produced from a consumption of 17½ pounds in the case of untreated similar anodes. The saving in cost of graphite anodes alone (about 16 cents per pound, installed in the cells) in a plant producing thousands of tons of caustic soda per year is thus a very significant one, let alone the annoyance and loss of capacity incident to dismantling the cells for the installation of new electrodes.

I am aware of the fact that it has been proposed to impregnate graphite electrodes with various kinds of oil. Indeed, I experimented for a number of years with a large variety of oils, but obtained varying and indifferent results. It may be of interest to note that pure boiled linseed oil effected but little improvement upon the electrodes, and further that, as already indicated, even a linseed oil containing driers gave rise to troubles until I discovered that it was essential to age the impregnated electrodes in the air for a long period of time. Among these troubles may further be mentioned that the oil exuding from the anodes had a tendency to collect on and to clog the diaphragms (usually made of asbestos paper), thereby necessitating the additional expense and inconvenience of renewing the diaphragms.

I am using the expression "graphite electrodes" in the specification and in the appended claims in its comprehensive sense, to include electrodes of various sizes and configurations, for instance, those in the form of slabs or plates and those of circular or other cross-sections. The specific example of procedure hereinbefore given was carried out with the use of the plate form of electrode manufactured by the Acheson Graphite Company and comprising pressed graphite in a more or less porous condition. While I cannot advance the exact reason why graphite electrodes, and more particularly the graphite anodes used in electrolyzing a sodium chloride solution, are consumed in use, my explanation is that sodium chloride migrates into the pores immediately below the surfaces of the anodes, and that local reaction slowly takes place with the anode material. This results in erosion on the anode surface, particles of graphite tending to break off as their bond with the body portion of the anode is loosened. The highly satisfactory results secured after applying my conditioning process are attributable, first, to the fact that substantially all the pores of the anodes are filled and closed with linseed oil, and, second, to the fact that the linseed oil is in thoroughly or substantially completely oxidized condition,—so much so that the graphite structure is hard, flintlike, and highly resistant to erosion by the liberation of chlorine gas adjacent thereto. Whether or not my explanation is correct, it is a fact that by following the teaching herein given, graphite electrodes may be made to withstand the customary conditions of continuous use in electrolyzing sodium chloride solutions for a much longer period of time than was heretofore possible.

What I claim is:

1. A graphite electrode impregnated with oxidation products of a drying oil and a drier and aged for at least about six months while exposed to the atmosphere, whereby said products are present in substantially completely oxidized and hardened state substantially free from oozing tendencies when said electrode is put to electrolyzing service.

2. A graphite electrode impregnated with oxidation products of linseed oil and a drier and aged for at least about six months while exposed to the atmosphere, whereby said products are present in substantially completely oxidized and hardened state substantially free from oozing tendencies when said electrode is put to electrolyzing service.

3. A graphite electrode impregnated with oxidation products of a drying oil and manganese and lead driers and aged for at least about six months while exposed to the atmosphere, whereby said products are present in substantially completely oxidized and hardened state substantially free from oozing tendencies when said electrode is put to electrolyzing service.

4. A graphite electrode impregnated with oxidation products of linseed oil and manganese and lead driers and aged for at least about six months while exposed to the atmosphere, whereby said products are present in substantially completely oxidized and hardened state substantially free from oozing tendencies when said electrode is put to electrolyzing service.

5. A process which comprises impregnating graphite electrodes with linseed oil and a drier, and then ageing the impregnated

electrodes while exposed to the atmosphere for at least about six months.

6. A process which comprises maintaining graphite electrodes immersed in a bath of heated linseed oil containing added manganese and lead driers for a substantial period of time, removing the electrodes from the bath, and then ageing them while exposed to the atmosphere for a period of at least about six months.

In testimony whereof I have affixed my signature.

CHARLES B. BARTON.