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MAKING PER-SALTS BY ELECTROLYSIS

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For the anodic electrolytic manufacture of persalts heretofore a choice could only be made among two groups of metals being suitable to be used as material for cathodes.

(1) One group of such materials covers metals which are not affected by the electrolyte, but catalytically decompose the electrolyte owing to which the yield is reduced. Examples of such metals are platinum, gold and chromium if used in acid solutions, or silver, nickel and iron if used in neutral or alkaline solutions.

(2) A second group of metals such as aluminum, tin or zinc in a neutral or alkaline solution, or silver, nickel, copper and iron in an acid solution, do not catalytically decompose the electrolyte, but they possess the drawback that they are corroded during electrolysis.

Hence one objection to the use of either of such groups of metals as the cathode, is that there is produced, not the pure per-salt, but a mixture thereof with metal compounds, requiring purification or separation. Another objection is the need of periodically providing new cathodes, which adds to the cost of the process.

It has now been found that both of the defects above mentioned may be overcome, by using as cathodes, certain alloys, at least one of the components of which have itself catalytic properties to cause decomposition of the per-salts. Such alloys may for example consist of two or more of the following metals: nickel, chromium, iron, silver, aluminum and tin. In some cases also alloys may be taken all of the components of which possess such properties (namely those of the first group above given). So using the alloys just mentioned the above stated drawbacks can be removed which is a technical and economical progress.

Example I.—A saturated solution of potassium carbonate is electrolyzed at a temperature not over 0° C.

As anode, sheet platinum is used, and as the cathode, a V_2A steel sheet. V_2A steel is manufactured by Krupp (the well known German works), and its approximate composition is: carbon 0.25%, chromium 20%, nickel 7%, the remainder being iron. Both for the anode and for the cathode a current density of 1 amp/cm² is applied. The tension is 8 volts. The electrochemical reactions lead to the formation of potassium percarbonate which is precipitated out, as soon as the limit of solubility is reached.

Example II.—The electrolysis is carried out with a solution nearly saturated with ammonium phosphate, adding ammonium fluoride and ammonium chromate and takes place at 0° C., between a platinum anode and a cathode consisting of an alloy of 91% silver and 9% aluminum. The current density is 0.01 amp/cm². Ammonium perphosphate is produced.

Example III.—The V_2A steel cathode used in the process as described in Example I is substituted by a cathode consisting of an alloy of 67% nickel and 33% tin. With this alloy (which is cheap) very satisfactory results are secured.

Example IV.—A saturated solution of sodium carbonate and borax is electrolyzed at 0° C., between a platinum anode and a cathode of V_2A steel. The anodic current density is 0.2 amp/cm²; the cathodic current density is 1 amp/cm²; the tension in the cell is about 8 volts. The yield as to the perborate is 50–60% of the theoretical (based on amount of current used) and it precipitates out as soon as the concentration reaches 6 gr./L.

The alloys above stated are examples only, given for the purpose of illustration and in no sense limiting the scope of the invention.

As to the proportions of the several constituents of the alloys, these can be substantially varied, but the proportions stated above are very satisfactory.

Good results have been secured with a good many alloys of a metal (or several metals) of the first mentioned group (platinum, gold, nickel, iron and silver) with one or more metals of the second mentioned group (aluminum, tin and zinc) and also with alloys of two or more of the metals of the first mentioned group, without any metal of the second group.

As will be apparent from the examples, the current density may vary between wide limits. The current densities given in the examples (where not otherwise stated) refer to amperes per square centimeter of cathode surface.

I claim:—

1. In the process of producing persalts by anodic oxidation of an alkali metal salt of at least one acid selected from the group consisting of carbonic, phosphoric and boric, the herein described step of applying a cathode made of a steel consisting largely of iron, nickel and chromium.

2. A process which comprises forming persalts by anodic oxidation of an alkali metal salt in the presence of a cathode consisting essentially of an alloy containing a plurality of metals selected from the herein described group consisting of nickel, chromium and iron.

3. A process which comprises forming perborates and percarbonates by anodic oxidation in the presence of a cathode consisting essentially of an alloy steel consisting largely of iron, nickel and chromium.

4. Process for preparing perborates and percarbonates comprising forming perborates and percarbonates by anodic oxidation in the presence of a cathode consisting essentially of an alloy containing a metal selected from those having catalytic properties to cause decomposition of the said persalts formed and a metal selected from those which are corroded during electrolysis.

5. A process which comprises forming persalts by anodic oxidation of an alkali metal salt in the presence of a cathode consisting essentially of an alloy of at least one metal selected from those having catalytic properties to cause decomposition of the said persalts formed and a metal selected from those which are corroded during electrolysis.

6. The process of producing persalts which comprises electrolyzing an alkali metal salt, including ammonium salts, of at least one acid selected from the group consisting of carbonic, phosphoric and boric acids and utilizing in the said electrolysis a cathode consisting essentially of an alloy comprising at least two metals, at least one of which is selected from the group consisting of nickel, iron and silver and another of which is selected from the group consisting of aluminum, tin and zinc.

7. The process of producing persalts which comprises electrolyzing an alkali metal salt including ammonium salts of at least one acid selected from the group consisting of carbonic, phosphoric and boric acids and utilizing in said electrolysis a cathode consisting essentially of an alloy comprising at least two metals, at least one of which is selected from the group consisting of platinum, gold and chromium and another of which is selected from the group consisting of silver, nickel, copper and iron.

8. The process of producing persalts which comprises electrolyzing a salt of an acid of which persalts are capable of being formed and utilizing in said electrolysis a cathode consisting essentially of an alloy selected from the following group of alloys: V_2A, silver-aluminum alloy and nickel-tin alloy.

9. The process of producing persalts which comprises electrolyzing a salt of an acid of which persalts are capable of being formed and utilizing in said electrolysis a cathode consisting essentially of V_2A steel.

10. The process of producing persalts which comprises electrolyzing an alkali metal salt, including ammonium salts, of an acid of which persalts are capable of being formed and utilizing in said electrolysis a cathode consisting essentially of an alloy comprising at least two metals, one of which is substantially unaffected by the electrolyte used in the electrolysis but which catalytically decomposes the electrolyte, and the other of which is corroded by the electrolyte but which does not catalytically decompose the electrolyte.

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