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METHOD OF ELECTROLYTICALLY PRODUCING ZINC OF HIGH PURITY

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5 Claims. (Cl. 204—119)

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This invention relates to a method of electrolytically refining zinc, particularly zinc produced by an electrolytic process, to obtain zinc of high purity.

Zinc of extremely high purity is of great importance in a number of fields and particularly in the production of die cast zinc articles. The purer is the zinc used, particularly as to the lead content, the better are the castings. As an example of the strict requirements as to zinc purity it may be mentioned that the British Ministry of Supply will not permit die casters supply war equipment to use zinc of a lower quality than the following:

	Per cent
Zn	99.99 min.
Pb	0.003 max.
Cd	0.003 max.

Total impurities including Pb and Cd 0.01% max.
Impurities other than Pb, Cd, Fe, and Cu traces only.

When zinc is refined electrolytically, using zinc sulphate solution as the electrolyte and an anode of quite impure zinc, the refined zinc has a considerably lowered content of impurities, particularly of lead, but is still not of really high purity. The difficulty is that if an attempt is made further to refine this zinc electrolytically very little result is obtained because as the zinc in the anodes becomes purer the refining action decreases. It is thus impossible by methods now known to produce zinc of really high purity by electrolytic methods exclusively.

According to the present invention these disadvantages are overcome and zinc of an exceedingly high degree of purity may be produced by a method of which the essential feature consists in adding cresylic acid and pine oil to a zinc sulphate electrolyte in a state of substantial equilibrium neutrality.

As used throughout this specification and claims, "a zinc sulphate solution in a state of equilibrium neutrality" means a zinc sulphate solution having the same hydrogen ion concentration as one which has been in contact with an excess of zinc oxide or roasted zinc ore until equilibrium is established. The pH of a zinc sulphate solution in a state of equilibrium neutrality depends on the temperature and concentration of the solution and also on the amounts and nature of addition agents which it contains. Over a

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range of concentrations of from 80 to 150 grams per litre of zinc in the solution, the pH value at equilibrium neutrality lies generally between 5.1 and 5.5 as determined by the glass electrode. The zinc sulphate electrolyte used need not be in a state of strict equilibrium neutrality but must be substantially in that state, i. e. its pH, as determined by the glass electrode, should not differ by more than .2 from its pH at equilibrium neutrality under the same conditions of temperature, concentration, etc. The more nearly it is in a state of strict equilibrium neutrality the better. In order to obtain a smooth, coherent plate the electrolyte should contain about 90 grams or more of zinc per litre.

The concentration of cresylic acid and pine oil in the electrolyte may vary within fairly wide limits but should not exceed that which will dissolve in the solution, since excess cresylic acid tends to burn the zinc deposit, while excess pine oil will reduce the current efficiency. The quantity of the reagents will in practice be adjusted having regard on the one hand to their cost and on the other hand to the purity and quality of the plate desired. An initial concentration of from 0.2 to 1 gram of cresylic acid and from 0.15 to 0.3 gram of pine oil per litre of electrolyte has been found satisfactory, with subsequent additions at the rate of 5.8 pounds of cresylic acid and 2.6 pounds of pine oil per ton of zinc deposited. Such subsequent additions may be larger or smaller than these specific amounts, varying according to circumstances between about 2 and 10 pounds of cresylic acid and up to 6.5 pounds of pine oil per ton of zinc deposited, though they are preferably restricted to not over about 8.0 pounds of cresylic acid and 5 pounds of pine oil per ton of zinc deposited.

A typical analysis of the electrolyte is as follows in grams per litre: Zinc 106.7, cresylic acid 1.0, pine oil 0.17, Cu 0.00070, Cd 0.00022, Pb 0.00045, Co 0.0020, besides other elements commonly found in electrolytic zinc plant solutions.

The method is preferably carried out with comparatively low current densities of not over about 25 amperes per square foot of cathode. While refining is being carried out, film or slime often forms on the anode and falls from the latter to the bottom of the cell. This slime should not be allowed to touch the cathode as it contains rela-

tively high proportions of impurities from which the zinc is to be freed. The electrolyte is accordingly kept substantially quiescent, only sufficient circulation being allowed to ensure a proper mixture of all its constituents.

The results obtained by the method of the invention are indicated by the following typical analysis, in which the first column of figures relates to zinc before treatment by the method of the invention using cresylic acid and pine oil and the second column to zinc after such treatment:

	Before treatment	After treatment
	Per cent	*Per cent*
Lead	0.0021	0.00020
Copper	0.0015	0.00023
Cadmium	0.0005	0.00018
Iron	0.0002	Trace

The consumption of cresylic acid and pine oil in this test was 8 pounds and 6.4 pounds respectively per ton of zinc deposited.

This application is a continuation-in-part of our prior application Serial No. 446,658, filed June 11, 1942, which has become abandoned.

We claim:

1. The method of electrolytically producing zinc of high purity from a zinc sulphate electrolyte containing at least one of the impurities lead, copper, cadmium and iron, which comprises adjusting the pH of the electrolyte to a state of substantial equilibrium neutrality, said neutrality being a pH of 5.1 to 5.5, adding cresylic acid and pine oil to the electrolyte in amounts sufficient to reduce the amount of said impurities and not more than will dissolve in the electrolyte, and passing electric current from an impure zinc anode to a cathode through said electrolyte containing said cresylic acid and pine oil to deposit said zinc of high purity.

2. The method according to claim 1, which comprises maintaining the electrolyte substantially quiescent during operation.

3. The method according to claim 1, in which the density of the current is not over about 25 amperes per square foot of cathode.

4. The method according to claim 1, in which the amount of cresylic acid added to the electrolyte is between 2 and 10 pounds per ton of zinc deposited and the amount of pine oil added is up to 6.5 pounds per ton of zinc deposited.

5. The method according to claim 1, in which the amount of cresylic acid added to the electrolyte is about 5.8 pounds per ton of zinc deposited and the amount of pine oil added is about 2.6 pounds per ton of zinc deposited.

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