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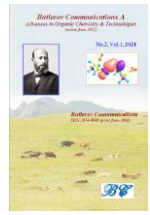

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Cementation of cobalt and nickel in zinc sulfate solutions

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Abstract

In zinc plants, to obtain cathode metal, solutions sent to electrolysis are deeply purified from impurities. The reduction of cobalt and nickel cations and their removal from solutions to concentrations less than 0.3 and 0.1 mg/l, respectively, makes it possible to sufficiently purify solutions from other chemical of elements harmful to zinc electrolysis. For the experiments, solutions of cobalt and nickel were prepared in the distilled water. Purification was carried out at pH = 4.3-4.5 (pH was maintained by continuous introduction of sulfuric acid solution) at a temperature of 80 ºC. Antimony and copper additives were 5 and 50 mg/l, respectively. The initial content of cobalt and nickel in solutions was 10 mg/l. Cleaning duration – 0.5-2 hours. The studies used zinc dust of fraction less than 0.063 mm in an amount of 2.5 g/l. To obtain the required zinc concentration, heptahydrate zinc sulfate ($ZnSO_4 \cdot 7H_2O$) of chemically pure grade was introduced into the initial solution. The pH value was continuously recorded on a SevenMulti 47-k laboratory device with a pH module and UEP (f. Mettler Toledo Gmbh).

Cementation cleaning was carried out in three modes:

- with the introduction of activating additives of copper and antimony, as well as zinc sulfate, up to 150 g/l;
- with the addition of copper and antimony activating compounds to the solution in the absence of zinc sulfate in the solution;
- carrying out carburizing without the addition of copper and antimony, as well as zinc sulfate.

It is shown that at the initial stages of the process (0.5 hour) the rate of cementation of cobalt from an aqueous solution without introducing zinc sulfate is lower. For the duration of the process from 0.5 to 1.5 hours, the greatest depth of solution purification from cobalt and nickel is achieved when the zinc content in the solution is 50 g/l. After 2 hours of the process, for cobalt, in contrast to nickel, the minimum reverse dissolution of

the cement metal occurs in a solution with a zinc content of 100 g/l, and for nickel – 50 g/l of zinc.

It is noted that the activating additives of copper and antimony introduced into the initial solution accelerate not only the process of cementation of impurities, but also the reduction of hydrogen. Moreover, with nickel, the acceleration effect is higher than with cobalt. With an increase in the zinc content in the solution at the given cementation conditions, the consumption of zinc metal for the hydrogen reduction reaction decreased. This fact corresponds to Le Chatelier's principle: with an increase in the concentration of zinc in solution, the rate of the reverse reaction of the interaction of zinc sulfate with hydrogen increases.

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