Parameters of electrolysis of zinc sulfate solutions

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Abstract

The purpose of the work was to calculate the exchange currents, the total differential capacity according to the previously developed equations for the electrolysis of sulfate solutions of zinc in the presence of various surfactants on a solid electrode. Electrochemical studies were carried out on a sulfate electrolyte containing 0.005, 0.0125 and 0.025 mol/l $ZnSO_4$ in a background 0.5 mol/l solution of Na_2SO_4. Some studies were performed using electrolytes of composition: 0.25 mol/l $ZnSO_4$; 0.25 and 0.75 mol/l $ZnSO_4$ + 18 and 54 g/l H_2SO_4. In the electrochemical cell flocculants were dosed in the form of an aqueous solution with a concentration of 2.5 g/l in an amount of 25-50 mg/l. The dosage of flocculants corresponded to their consumption in the hydrometallurgical cycle. Lignosulfonate was added in an amount of 80 mg/l. Galvanostatic studies and the removal of polarization curves in a dynamic regime were carried out on the potentiostat *PotentiostatP-30Jcom. Elins Electrochemical Instruments»,* using a three-electrode cell. The working electrode (cathode) is made of Z0A zinc with the area of 0.35 cm^2, the auxiliary (anode) is made of platinum plate with the area of 0.20 cm^2, the reference electrode is chlorine silver.

The exchange current was calculated from galvanostatic measurements, building the Tafel semi logarithmic dependences of the polarization change on the logarithm of the current density at the initial instant of time. In this case, the calculations were based on a section of an inclined straight line with a correlation coefficient (R^2) greater than 0.99. In the region of low deviations in the potential from the equilibrium calculation of the exchange currents, it was estimated from micro-polarization measurements in the overvoltage region of less than 5÷15 mV. The total polarization capacitance was calculated by the equation, assigning a linearly varying voltage to the electrode at a sweep rate of 100 mV/s and recording the dependence of the current on the electrode potential in the initial fractions of the seconds of the process.

As a result of the work performed, it was shown that additives of flocculants reduce the total polarization capacity in the entire range of zinc content in the background electrolyte of sodium sulfate, in contrast to the additions of lignosulfonate due to the higher molecular weight of the flocculants. At the same time, molecules of organic substances are relatively large in size, and their adsorption leads to an increase in the distance between the capacitor plates in the double layer and thereby increases the polarization capacity.

It is noted that the exchange current and the total polarization capacitance are increases substantially under conditions of intense mixing. The calculations of the currents of exchange by different methods have shown in most cases a high convergence. Using the example of electrolysis of zinc sulfate solutions with lignosulfonate additives, it was shown that the exchange current decreases with increasing surfactant of addition, and with increasing concentration of zinc, the exchange current and total polarization capacity are increases.

The performed investigations was made it possible to obtain new data of the exchange currents and the polarization capacity of zinc electrolysis on a solid electrode in the presence of various surfactants.

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