CATHODIC PROCESSES IN SOLUTIONS OF Fe(II) METHANOSULPHONATE

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In the repair and machine-building industry, galvanic coatings are applied in the following ways: galvanising, copper plating, tinning, chrome plating, nickel plating, ironing and deposition of a large number of alloys. Ironing has a number of significant advantages. Compared to chromium plating, these include lower electrolyte toxicity, high process speed, high current output, high coating thickness, lower coating stresses, and less coating flooding. Compared to nickel plating, zinc plating and copper plating, it has high roughness and wear resistance of coatings.

To substantiate the required concentration of iron (II) methanesulfonate in electrolytes and determine the technological parameters of the electrochemical plating process based on aqueous solutions of methanesulfonic acid, the kinetics of combined cathodic processes in the concentration range of 0.5...2.0 mol·dm^{-3} of iron (II) were studied. Thus, an increase in the concentration of iron (II) methanesulfonate leads to a decrease in the cathodic potential. This indicates an increase in the concentration of Fe^{2+} in the cathode layer. This has a positive effect on the course of the target process - iron reduction and inhibits the side process - hydrogen production.

Hydrogen release, which is combined with Fe^{2+} reduction, leads to watering of both the coating and the substrate. In turn, this causes the coating to become brittle and impairs its adhesion to the substrate. This is a significant problem.

For each concentration of Fe^{2+}, the current densities were determined, according to which the cathodic process is limited by the electrochemical stage - the reduction of Fe^{2+}. To assess the effect of combined hydrogen production on the cathode process, the volt-ampere characteristics of the cathode process in a solution of 0.5 mol·dm^{-3} iron (II) methanesulfonate on a copper electrode were studied. The Tafele plot of iron release on a copper cathode is characterised by a low overvoltage of about 80 mV and a wide range of current densities - from 0.004 to 0.1 A/cm^2. Similar indicators for the steel cathode in the studied electrolyte were: overvoltage - about 120 mV, current density range - from 0.001 to 0.01 A/cm^2. These results indicate a significant negative effect of the combined hydrogen release reaction on the precipitation of iron from the methanesulfone electrolyte.

The expediency of using 2 mol·dm^{-3} of iron (II) methanesulfonate for further research on the development of technological indicators of iron electroplating was established. It is this concentration of iron (II) methane sulfonate that allows for maximum inhibition of the combined cathodic process - hydrogen production.