RESEARCH CORROSION RESISTANCE OF SHS COATINGS IN SULFATE SOLUTIONS

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The technology of obtaining coatings in the conditions of self-propagating high-temperature synthesis (SHS), combined with chemical transport reactions, is devoid of these shortcomings and provides high (up to 95 %) stability of processing results. Sampling of the mother liquor of the sulfate department was performed. The choice of this environment is due to its high corrosion activity and propensity to provoke local types of corrosion damage.

The composition of the mother liquor is as follows: sulfuric acid – 3÷4 % of the mass; ammonium sulfate – 380÷458 g/l; chlorides – 1.8÷2.5 g/l; rhodanide – 0.1÷0.3 g/l; pyridine bases – 12÷15 g/l.

Laboratory electrochemical measurement of corrosion activity, which consists in removing potentiostatic curves, was used to monitor the corrosion activity of working solutions. Corrosion activity was determined by electrochemical method, based on potentiostat EP-20A, automatically controlled by a computer program. Measurements were performed in a glass three-electrode cell with separated electrodes with free access of oxygen to the cell. Values at the electrode potentials were measured relative to the saturated chloride of the silver electrode E^{o} = –0.222 V. As an auxiliary electrode used a platinum plate, the working electrode was a sample of steel. The corrosion current was determined from the analysis of polarization curves, the transmission relationship between the electrode potential of the steel electrode and the dissolution current density of steel during polarization from an external source of direct electric current. The corrosion current density is proportional to the corrosion rate of the metal in the test medium, which was determined by extrapolating the Tafel sections on the obtained polarization curves to the value of the free corrosion potential.

Samples of the studied materials were installed in the most aggressive environments of the sulfate department. The test was performed in a saturator. It follows from the voltammetry that the protective coatings inhibit both the anode and cathode corrosion process. At a potential of +0.1 V, the maximum anode dissolution current is observed, which decreases to a potential of +0.8 V and a current of 0.8 mA/sm^2 (aluminotitan coatings in 15 % aqueous sulfuric acid solution). The corrosion rate calculated from voltammograms is $22\cdot10^{-6}\div55\cdot10^{-5}$A/sm^2.

References

1. Nesterenko S.V., Troshin V.M., Bannikov L.P., Karchakova V.V. Improving the corrosion resistance of steel and alloys in coal-tar processing // Coke and Chemistry. 2016. – Vol. 59. – No. 10. – P. 389–395.