CARBON STEEL CORROSION KINETIC in SODIUM CHLORIDE DYNAMIC SOLUTIONS SURROUNDINGS INCLUDING APPLICATION to the GALVANOCHEMICAL PROCESS

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INTRODUCTION

Metal corrosion is the driving force for galvanochemical process [1]. This a relatively new method, also called galvanocoagulation, based on producing reagents such as ferrous and ferric ions from corrosion of carbon steel. Galvanocoagulation is intended for industrial treatment of wastes.

Apparatus for this process contains a horizontal revolving cylinder filled with corroding material. The main reaction for this process is steel corrosion accompanied by oxygen reduction. To accelerate this heterogeneous process some other "indifferent" (non-corrosive with large active for oxygen reduction area) materials are added. They can be coke, titanium, stainless steel or any similar materials.

Inside the revolving reaction cylinder are mixing ribs arranged in so-called "cataract motion" mixing pattern for solids. As a result, corrosion of carbon steel takes place mostly under oxygen depolarization with vigorously moving and mixing environment.

Galvanochemical process is based on working large amount of forming, self-connected and disconnected voltaic and electrolysis cells. Kinetics of the steel corrosion governs the process of waste water decontamination, and directly affects it velocity, selectivity and other technical parameters. In [2…4] mathematical models of corrosion rate was created and investigated.

The main goal of this work was detail investigation kinetic of steel corrosion in sodium chloride solutions which modeling environment of the galvanochemical operation.

EXPERIMENTAL

Experiments were performed on a laboratory model and in more detail described in [2, 3]. Chemicals were "pure" quality grade, and used as received. All calculations, including mathematical models building and analysis were performed by Microsoft Office Excel software.

RESULTS AND DISCUSSION

Influence of all factors (reaction cylinder revolving rate and number of mixing ribs, amounts of corroded and "indifferent" materials and it size, as well as solution's volume, pH and concentration, temperature and duration of process) on the corrosion rate were developed as linear logarithm or square equations similar to [2…4].

$$Ln\ K = A_0 + SUM\ (A_x * Ln\ F_x) \qquad (1)$$

$$K = A_0 + (A_i * F_x + A_j * F_x^2) \qquad (2)$$

Where: K – corrosion rate; F – experimental factor; A – constant.

Both equations were estimated as well as for all factors as for statistically significant (level of confidence more than 5%) factors. Results of all mathematical models were close to the experimental data. Analysis of equation (2) gave possibility found some extremes, which is important for the galvanochemical operation evaluation and optimization.

On the base of experimental data some formal kinetic constants of rate–determining reactions were calculated and compared with the literature data.

REFERENCES

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