

## ANODE PROCESSES IN THE ELECTROCHEMICAL SYNTHESIS OF PERACETIC ACID

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Peracetic acid (PAA) is an organic peroxyacid that is widely used as a disinfectant and sterilizing agent in medicine and the food industry; as a pasteurizer in breweries and wineries; as a bleaching agent in pulp and paper and textile production; in the chemical industry for the synthesis of epoxy compounds.

The electrolytes were prepared from concentrated acetic and sulfuric acids. Polarization measurements were performed using an MTech SPG-500S potentiostat in an electrochemical cell at a temperature of 291...295 K. The working surface of the platinum electrode was polished, and the back and end sides were insulated with a polymer coating. The platinum anode had an oxide film formed on the working surface. The auxiliary electrode is platinum. The reference electrode is silver chloride.

The electrolysis of aqueous acetic acid solutions involves the following combined processes:



The processes of electrochemical formation of hydrogen peroxide and PAA are combined or even related. The range of potentials for electrochemical synthesis of hydrogen peroxide coincides with the potentials for electrochemical formation PAA ( $E_{\text{CH}_3\text{COOH}/\text{CH}_3\text{COOOH}} = 1,689 \text{ B}$ ).

The adsorption of acetic acid and promoters of peroxy-group formation was studied by the method of charging curves on the surface of the Pt/PtO electrode.

The results revealed that the potential shift to the electropositive region leads to a continuous increase in the adsorption of acetic acid along with an increase in the charge of the platinum surface. A continuous increase in the adsorption of  $\text{Cl}^-$ ,  $\text{Br}^-$ , and  $\text{I}^-$  ions with increasing surface charge of platinum is established upon shifting the electrode potential toward the electropositive region. It was observed that the adsorption of  $\text{CNS}^-$  ions on the potential has a maximum at  $\approx 1.85 \text{ V}$ . A further decrease in the adsorption of  $\text{CNS}^-$  ions is associated with a stronger adsorption of their oxidation product,  $\text{CN}^-$ . The anions were found to influence the electrode surface in the following order:  $\text{CNS}^- > \text{Cl}^- > \text{Br}^- > \text{I}^-$ . For the electrochemical synthesis of peracetic acid, it is advisable to use  $\text{Cl}^-$ ,  $\text{Br}^-$ , and  $\text{I}^-$  additives, as they increase the current yield of the target product compared to the starting solution. The most effective of them is  $\text{Cl}^-$ , since the current efficiency of the PAA was 17.8 %.

The  $\text{CNS}^-$  additive was not effective as a promoter, which is explained by the low stability of  $\text{CNS}^-$  ions on the surface of the platinum electrode in the region of high anode current densities.

The process of electrochemical formation of PAA proceeds through the stage of adsorption of acetic acid on the surface of the Pt/PtO electrode. A scheme of the stage of adsorption of acetic acid at the electrode-electrolyte interface is proposed.