ANALYSIS OF A POSSIBLE REDUCTION IN ENERGY CONSUMPTION IN WATER ELECTROLYSIS REACTION

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Abstract. *It was experimentally observed that the electrolysis reaction continues a short period of time - time to relax* τ_c *- after the cell power supply is interrupted. This paper presents an analysis of transient phenomena occurring and pr opose technical solutions.*

Keywords: reaction of the electrolysis, the anode, cathode, recombination.
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1. INTRODUCTION

In the light of previous studies we calculated that for one mole of water electrolysis requires a quantity of electric energy

$$\Delta G = W_{el.} = 328{,}1646 kJ$$

and the cost of the energy produced by burning H_2 and O_2 in stoichiometric proportions resulting from the reaction of electrolysis is 1.13 to 1,264 times higher than the price of electric power used for electrolysis. Moreover, through electrolysis of a kilogram of water 5 kwh electricity are consumed to obtain about 14000 kJ quantity of heat. At about the same price of 1 kg of fuel is obtained so about three times less energy.

2. ELECTRON EXCHANGE IN ELECTROLYSIS PROCESS

Anode: Oxidation: $2H_2O_{(l)} \rightarrow O_{2(g)} + 4H^+_{(aq)} + 4e^-$ (1)

Cathode: reduction: $2H_2O_{(l)} + 2e^- \rightarrow H_{2(g)} + 2OH^-_{(aq)}$ (2)

To maintain equal the number of free electrons in the solution must have the reduction reaction (2) is multiplied by a factor of 2, then:

Cathode: reduction: $2H_2O_{(l)} + 4e^- \rightarrow 2H_{2(g)} + 4OH^-_{(aq)}$ (3)

Conclusion

In order to keep the number of electrons in equilibrium, the reaction of the cathode has to be twice as high as the anode reaction.

By adding the reactions (1) and (3):

$$6H_2O_{(l)} + 4e^- \rightarrow 2H_{2(g)} + O_{2(g)} + 4H_2O_{(l)} + 4e^-$$

Reducing the identical terms on both sides of the arrow is obtained:

$$2H_2O_{(l)} \rightarrow 2H_{2(g)} + O_{2(g)}$$

During the electrolysis reaction:

- ions: $H^+_{(aq)}$ generated at the anode migrates to the cathode, where :

$$H_+ + e^- \rightarrow H_0 \qquad (5)$$

$$H_0 + H_0 \xrightarrow{leg.\text{cov}\,alenta} H_{2(g)},$$

when the H^+ ions take $2e^-$ of the cathode.

- ions: OH^- generated at the cathode migrate to the anode, where:

$$OH_{(aq)}^- \rightarrow OH_0 + e^-$$

$$OH_0 + OH_0 + 2e^- \rightarrow 1/2\, O_2 + H_2O$$

or

$$4OH_0 + 4e^- \rightarrow O_2 + 2H_2O \qquad (6)$$

3. ANALISIS OF THE TRANSIENT PROCESS

The transport of ions through the electrolyte (electrical conductivity of order II) is carried out under the influence of the electric field between the anode and cathode.

a) We consider this transitional process:

Suppose that disconnect the anode (+) of the power supply and the cathode stay connected.

Thus OH^- ions can not donate additional electron anode delay, The cathode being still connected to the power source, so loaded with negative charge, Can give an electron from $H^-_{(aq)}$ ion which becomes the $H_{(aq)}$ and recombine with another $H_{(aq)}$ becomes $H_{2(g)}$.

Such a period of time since hydrogen is generated at the cathode and the electrolyte is charged with OH^- ion in excess.

b) we continue the process in two ways, the cathode remaining connected to the negative pole of the power source:

b_1) connect the anode of the power supply for a short time. $H^+_{(aq)}$ ions in the electrolyte are generated, while not to reach the anode, and then recombine with the ions OH^-
existing in the electrolyte, forming H O_2 :

$$H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2 O \qquad (4)$$

b_2) connect the anode of the power supply for a long time. H^+ ions are generated so that:

- some of them recombine with OH^- ions, the effect of relation (4)
- the remaining arrive to the cathode reaction takes place (5)

Interpretation

The cathode may further be coupled at a high voltage source (possibly electrostatic), and the anode may be coupled sequentially in a short period of time at the DC power supply.

b_3) if the two electrodes of the electrolytic cell are fed sequentially - one by one - to an electrical signal, it is possible to cause electrolysis reaction, but without the power consumption because:

- there are intervals during which both electrodes are coupled together;
- where each electrode is connected to power, he is electric potential and theoretically should fulfill the functions described above.

4. CONCLUSIONS AND EXPERIMENTAL POSSIBILITIES

Following the analysis of the transient process the experimental possibilities are the following:

1). Obtaining the product of electrolysis in condition cathode (or anode delay) are permanently connected at the power supply, and the anode (or cathode) is applied repetitive signal, experimentally determined frequency.

2). Sequential application of an electrical signal, between the two electrodes so that the electrolytic cell electric current does not flow. Here, the potential applied to the electrodes which enables the exchange of electrical charges in the electrolyte ions.

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